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Adel
JOURNAL D'ESSAIS DE SEMENCES
JOURNAL OF SEED TESTING
ZEITSCHRIFT FÜR SAMENPRÜFUNG

No. 1

179.
**COMPTE RENDU DU CONGRÈS INTERNATIONAL
D'ESSAIS DE SEMENCES**

DISCUSSIONS AT THE INTERNATIONAL SEED
TESTING CONFERENCE

VERHANDLUNGEN DER INTERNATIONALEN
KONFERENZ FÜR SAMENPRÜFUNG

À / IN

COPENHAGUE (DANEMARK)

6.—10. VI. 1921.

PAR / BY / VON

K. DORPH-PETERSEN
COPENHAGUE.

SELBSTVERLAG DES KONGRESSES.
1922.

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1921

FRØKONTROLLEN

Congrès international d'essais de semences.

International Seed Testing
Conference.

Internationale Konferenz
für Samenprüfung.

Copenhagen, Danemark, 6.-10. VI. 1921.

On Monday, June 6, 1921 at 10:00 A. M. the Third International Seed Testing Conference assembled in the library of the Danish State Seed Testing Station, Fjords Allé 15.

Montag, den 6. Juni 1921, um 10 Uhr vormittags, trat die Dritte Internationale Konferenz für Samenprüfung in der Bibliothek von „Statsfrøkontrollen“ (der dänischen Staats-Samenkontrollanstalt), Fjords Allé 15, zusammen.

Professeur à l'université de Copenhague, Dr. W. Johansen, Président de la Commission de contrôle des semences, opened the meeting and bade all those present welcome in the following words: eröffnete die Konferenz und hieß die Anwesenden mit folgenden Worten willkommen:

Ladies and Gentlemen!

On behalf of the Royal Ministry of Agriculture and the Danish Seed Control Commission, I have the honour of bidding you a hearty welcome here.

In this country we of course use the Danish language; the most natural thing for me would be to address you in Danish — but only the delegates from the other Scandinavian countries would be able to understand me. In countries where the language does not belong to those that are wide spread, it is necessary on an occasion like this to use one of the great languages.

La langue française a été depuis bien longtemps la langue des diplomates qui a remplacé le latin maintenant hors d'usage, chose bien regrettable; l'ido, l'esperanto ou même le fameux volapuk n'ont pas encore pu remplacer le latin bien aimé, supprimé par le zèle nationaliste de tous pays. Si j'avais une mission diplomatique, je ferais de mon mieux pour m'adresser à vous en un français pas trop barbare — mais cette conférence n'a rien à faire avec la diplomatie — au contraire nous sommes réunis dans l'intérêt de nos buts communs.

Deutschland hat das Verdienst, die erste Samenkontrollstation vor 52 Jahren errichtet zu haben. Insofern wäre es mir sehr naheliegend, die deutsche Sprache hier zu benutzen, eine Sprache, mit welcher man in den skandinavischen Ländern, sowie in Holland, recht vertraut ist.

But the same may be said about the English language; when I have the honour of addressing you in English, it is not only because English is the language of very great populations, or because of its relation both to the French, the Scandinavian and German language, but especially because the idea of this conference emanated from English circles. Sir Lawrence Weaver, accompanied by several English gentlemen interested in agricultural questions, visited Denmark the two past summers. Having inspected our Seed Testing Station, Sir Lawrence Weaver proposed to Mr. Dorph-Petersen, the director

of our station, to arrange an international Seed Testing Conference. Mr. Dorph-Petersen adopted the idea, the Danish "Seed Control-Commission" was also highly interested, and the Royal Ministry of Agriculture gave the necessary sanction to the plan. In the meanwhile Sir Lawrence visited Germany and discussed the possibility of arranging the Conference with Professor Dr. A. Voigt in Hamburg who hailed the idea with enthusiasm. Then invitations were sent to all countries.

Mr. Dorph-Petersen has recently visited several of his colleagues in the different countries and, based on his experiences, the particulars of the conference are arranged as you find them indicated in the order of the day.

The following countries were invited to send representatives:

Argentina	1 delegate	Italy	2 delegates
Austria	2 delegates	Japan	2 "
Belgium	2 "	Lettonia	1 delegate
Brazil	1 delegate	New-Zealand	1 "
Canada	1 "	Norway	2 delegates
Denmark	2 delegates	Poland	1 delegate
Finland	1 delegate	Roumania	1 "
France	5 delegates	Servia-Slovenia-Croatia	1 "
Germany	5 "	Spain	2 delegates
Great Britain and Ireland	5 "	Sweden	4 "
Greece	1 delegate	Switzerland	2 "
Holland	2 delegates	Tschecoslovakia	1 delegate
Hungary	1 delegate	United States of America	5 delegates

Not all countries have sent delegates; we regret especially that we must do without delegates from Austria, Italy and from the United States of America. Mr. Dorph-Petersen will communicate to you the names of the delegates, whom we have the pleasure of seeing here.

As usual in International Conferences in this country the addresses and discussions may be carried on in English, French or German.

I must ask the assembly whether it wishes to elect special chairman for the several meetings or if it might prefer the proposal made by the Swedish and English delegations viz. to leave the chairmanship of the whole conference in Danish hands. We are at your service — as you like it — the question can be settled when Mr. Dorph-Petersen has given a detailed account of the plan for the conference.

I repeat heartily my welcome to you, hoping not only that this little conference may be fruitful to international cooperation for the benefit of agriculture and trade, but that each of you personally may feel at home in this country in which you all are regarded as our friends. I herewith have the honour to declare the conference opened.

Professor Johannsen introduced Mr. K. Dorph-Petersen, Director State Seed Testing Station, Copenhagen, who made the following speech:

Honored colleagues and guests!

May I second Professor Johannsens words and bid my esteemed colleagues and the representatives from the various boards and institutions of agriculture a hearty welcome to Denmark and our State Seed Testing Station! It is my earnest hope, that the discussions in which we will take part during the coming week will set fruit that will be of permanent value in our work and benefit international trade with good seed.

When Sir Lawrence Weaver about one year ago on the occasion of his second visit to the Danish State Seed Testing Station and after visiting the well-known institutions in Hamburg and Wageningen wrote to me suggesting that I take steps to assemble an international seed testing conference in Copenhagen, I received the suggestion with great hesitation. Denmark is a small country whose language is only understood here in the

three northern lands, and therefore ill adapted to international discussions. Some years ago, however, an inofficial suggestion that the third international seed testing conference be held here had been made. As you all know the first was held in Hamburg in 1906, and the second in Münster and Wageningen in 1910 on German initiative and in connection with the meetings of the "Vereinigung für angewandte Botanik" in the main on initiative of Professor Dr. A. Voigt in Hamburg.

However the appeal from England was urgent and was seconded by several of our well-known colleagues. As Professor Johannsen has stated, Sir Lawrence Weaver wrote in his first letter that Professor Dr. A. Voigt in Hamburg had expressed great enthusiasm for the idea. I discussed the subject with the State Seed Testing Board, which is appointed by our Ministry of Agriculture and acts as advisory in all matters pertaining to the State Seed Testing Station.

The members of the board agreed with me that the suggestion should be followed, and invitations to a congress of experts comprising a few professionally trained, interested representatives from each country sent out in the hope of assembling a working congress. The plan was adopted not only by the originator but by all the colleagues with whom I have had the privilege of discussing it.

The Ministry of Agriculture gave us its sanction and in the beginning of February this year invitations were sent through the Foreign Office to the countries mentioned by Professor Johannsen.

In March a tentative plan of the congress was sent out. Some countries, the United States for instance, are not allowing themselves to be represented, others accepted the invitation very promptly, still others waited until the last moment which has rendered it difficult to lay final plans.

During April and May I visited the seed testing stations in Germany (München and Hamburg), Switzerland (Zürich), France (Paris), England (London and Cambridge) and Holland (Wageningen) in order to discuss the congress with the directors of the respective institutions. May I take this opportunity of thanking them and Sir Lawrence Weaver for the kind and hospitable reception which was accorded me and for the interesting hours spent at the institutions. Previous to this, due to press of seasonal work and the publication of a book on the work done at the Danish State Seed Testing Station during the past 50 years, I have had but little leisure to devote to the conference. I must therefore beg leniency for defects in the arrangements. Up to date the following countries have asked to be represented (they are named alphabetically in French, and the delegates are named in the order in which their respective governments placed them in the communication to us):

l'Allemagne:

Oberregierungsrat Professor Dr. Hiltner, Direktor der Bayrischen Landesanstalt für Pflanzenbau und Pflanzenschutz, München (nicht eingetroffen).

Professor Dr. A. Voigt, Direktor des Staatsinstituts für angewandte Botanik, Hamburg.

l'Argentine:

Ingenieur-Agronom Juan Carlos Riera (pas arrivé).

la Belgique:

M. Douven, Directeur de la station d'essais de semences à Louvain.

la Canada:

Mr. George H. Clark, State Seed Commissioner, Ottawa.

le Danemark:

Dr. W. Johannsen, Professeur à l'université de Copenhague, Président de la Commission de contrôle de semences.

M. K. Dorph-Petersen, Directeur de la station d'essais de semences de l'état, Copenhague.

la Finlande:

Dr. G. Grotenfeld, Professeur à l'université de Helsingfors (à cause de maladie pas arrivé).

Dr. phil. E. F. Simola, membre du conseil d'agriculture, le bureau d'agriculture, Helsingfors.

la France:

Professeur Léon Bussard, Directeur adjoint de la station d'essais de semences de l'état, Paris.

la Grande Bretagne et l'Irlande:

Sir Lawrence Weaver, Director General Land Department, Ministry of Agriculture and Fisheries, London.

Mr. H. L. French, Secretary General Land Department, Ministry of Agriculture and Fisheries, London.

Mr. C. B. Saunders, Director of the Official Seed Testing Station, London. ✓

Mr. T. Anderson, Director of the Official Seed Testing Station, Edinburgh. ✓

Dr. G. Pethybridge, Director of the Official Seed Testing Station, Dublin (sent communications, not able to be present personally).

la Suisse:

Dr. A. Volkart, Vorstand der landwirtschaftlichen Versuchsanstalt, Örlikon-Zürich.

la Hongrie:

Hofrat Dr. A. v. Degen, Directeur chef de la station d'essais de semences de l'état, Budapest.

la Norvège:

Dr. Y. Buchholz, Directeur de la station de chimie agricole et d'essais de semences de l'état, Christiania.

M. G. Tryti, Sous-directeur de la station d'essais de semences de l'état, Christiania.

les Pays Bas:

M. F. F. Bruijning, Directeur de la station d'essais de semences de l'état, Wageningen.

la Pologne:

Consul Thades Bilinski à Copenhague.

la Roumanie:

M. Jon Enesco, Directeur de la station d'agronomie, Boukharest.

Royaume des Serbes et Croates et Slovènes:

Professeur Nikola Ranojevitch, Directeur de la station d'essais de semences, Belgrade (pas arrivé).

Ingenieur Bogdan Ferlinc, Assistant à la station d'essais de semences, Belgrade.

la Suède:

M. M. Insulander, Directeur général du Bureau royal d'agriculture, Stockholm.

M. v. Zweigbergk, Chef du bureau royal d'agriculture, Stockholm.

M. J. Widén, Directeur de la station de chimie agricole et d'essais de semences, Örebro.

Adjoint A. Vilke, Directeur de la station d'essais de semences, Lund.

M. A. Elofson, Conseiller d'agriculture de l'état, Upsala (Suppléant).

M. Fr. Walldén, Directeur de la station d'essais de semences, Svalöf (comme hôte).

la Tchécoslovaquie:

M. E. Vitek, Directeur de la station d'essais de semences, Prague.

Dr. Chmelar, Directeur de la station d'essais de semences, Brünn (Suppléant).

Besides the official delegates we have this day with us the chief of a department of the Ministry of Foreign Affairs, Mr. Wårum, and the Secretary of the Ministry of Agriculture, Mr. Stahlschmidt, and some of the members of the State Seed Testing Board. On this board are two expert scientists, the chairman, Professor Dr. W. Johannsen, who has been a member the 35 years the board has existed, and the director of the State Experiment Station in Tystofte, Mr. E. Lindhard, two farmers and one substitute, the president of the Royal Danish Agricultural Society, Mr. Chr. Sonne, Mr. Hauch, Member of the Upper House, and Mr. Selchau Hansen, and also two seed-dealers with one substitute, Mr. G. Hage, Mr. A. Höffding and the chairman of the Association of the Danish Seed Dealers, Mr. K. Stallknecht.

Mrs. F. Kølpin Ravn and Miss I. Fogh are present to report the English and German discussions respectively. All we Danes will do everything in our power to assist our honored guests in every way possible.

After visiting the laboratories and various departments of the State Seed Testing Station the delegates are invited to take luncheon here, as guests of the institution.

On the following days the meetings will be held in the Assembly Hall of the Agricultural Board, Vester Boulevard 4, near Raadhusplads, as that locality is more central and there is better room.

With the permission of Sir Lawrence Weaver and Mr. Saunders the meeting to-morrow afternoon will be open to representatives from the Association of the Danish Seed Dealers, whose guests we are to be at supper to-morrow evening at 7 o'clock at Nimbs. Those who expect to be present will kindly sign their names on this list.

On Wednesday, June 8, at 1:30 sharp, a large sight-seeing automobile will be waiting in front of the entrance to the hall, V. Boulevard 4. We will be driven to Lyngby to see the control field of the Seed Testing Station and the Experiment Station there, the Agricultural Museum and other matters of interest, and from there to Skodsborg where the usual table d'hôte will be served. Those desiring to participate in this excursion also are requested to sign their names on the accompanying list. We hope that all the delegates will be able to be present at the dinner given June 9, by the Minister of Agriculture, Mr. Th. Madsen-Mygdal. We request that each delegate who expects to attend, will sign his name on the list. Those wishing to participate in the excursion to the Experiment Station at Tystofte on June 11., are requested to sign their names on the same list. The expenses for this excursion will amount to about 40 Kr. per head.

The object of this conference is to become acquainted with each other and with the methods used at our respective institutions and primarily to attempt to establish cooperation between seed-testing stations in those countries wishing such cooperation established. Methods were discussed at the two former congresses, but no positive results were attained. However we have from the last conference the measure proposed by Professor Schribaux of Paris and Director v. Degen of Budapest. This will be taken up for discussion and, as may be seen from the plan for our meetings, a copy of which has been sent to each delegate at his hotel, on the last day of the congress, Hofrat v. Degen and Director Bussard, acting for Professor Schribaux, will again present these measures. I trust that other delegates will have plans for future cooperation to propose.

In January this year 25 samples of seed of the more important clover, grass and root varieties were sent to different seed-testing stations with the request that they analyse the samples and send their results to us. 23 have thus far responded. The figures showing the purity, the germination-speed and -power and content of pure viable seed, but not real the value found, are given on the lists sent to each delegate. The names of the institutions which have made the tests are not given, but each is designated by an initial. We hope that each of the gentlemen present who is director of an institution which has sent in results of their tests, has received at his hotel a proof copy of the list in which the results found by his institution are underscored. These results are worth careful study. Fortunately they show that as a whole the results found by the seed testing

stations agree within a reasonable latitude. However the analysis results found by some seed testing stations, in the case of certain seed varieties which are difficult to analyze, diverge greatly from those found by others. The last row of figures shows the results found by the Danish Seed Testing Station.

In seed of oats 3.2 % grains which were attacked by the *Oscinis* frit has been subtracted as waste. No other seed testing institution has done this, and as it entails a great deal of work, in the future we will allow these grains to pass as pure seed. The germination test will then show how large is the percentage of seed unable to germinate on account of the above-named attack of the fritfly (*Oscinis* frit).

In making purity determinations of forest seed, *Picea sitkaensis*, some of the seeds tested by us have been submitted to too great a pressure in trying to determine whether they were pure seed or chaff. Our germination power found is therefore too small.

I hope that other institutions as well will be benefited by studying the results. It would be of great interest to us all if the leaders of the institutions which have sent in results would tell us their opinion of the experience gained.

Of course it would be interesting to know from what institutions the various results come, but I have not felt at liberty to publish other names than that of my own station.

I will now very briefly tell you about the Danish State Seed Testing Station. However, as a short English summary of the work done by our institution and a copy of our Rules for Seed Analyses have been distributed to each delegate, and as unfortunately there is no corresponding German translation of the same, I will now use the German language in making my report.

Die dänische Staats-Samenkontrolle.

Über die Wirksamkeit der Staats-Samenkontrolle ist eine Jubiläumsschrift von 160 Seiten herausgegeben worden, da heuer 50 Jahre verflossen sind, seitdem sie errichtet wurde. In dieser Jubiläumsschrift werden Sie eine ziemlich ausführliche Beschreibung der für die Samenkontrolle geltenden Regeln finden, und zwar a) die Untersuchung der Proben, b) die Probeziehung und c) die Vergütung bei Mindergehalten, und weiter über die Geschichte und die benutzten Methoden und Apparate. Ferner sind die Durchschnittsergebnisse der Reinheit und Keimung angeführt sowie der Unkrautgehalt der wichtigeren Samenarten in den Jahren von 1897 bis 1921. Außerdem werden Sie eine Beschreibung der selbstwirkenden Kontrolle finden, der Untersuchung des Samens im Felde und verschiedener anderer Verhältnisse, betreffend die Wirksamkeit der Samenkontrolle, samt einem Bericht über die Samenkontrolle im Auslande. Endlich ist darin auch ein Bericht von Geheimrat Nobbe über die Errichtung und die Wirksamkeit der Samenkontrolle in Tharand und ein englischer Auszug des übrigen Inhalts des Buches enthalten.

Diese Jubiläumsschrift ist den meisten der Anwesenden zugesandt worden. Diejenigen von meinen geehrten Kollegen, die sie noch nicht erhalten haben, bitte ich, sich an mich zu wenden, daß ich sie Ihnen übergeben kann. Ich möchte Sie sowohl auf dieses als auch auf die früher genannten Publikationen in den drei Hauptsprachen im wesentlichen verweisen und Ihnen deshalb hier nur einen kurzen Bericht über die Wirksamkeit als Einleitung zu einer Besichtigung der Anstalt und ihrer Wirksamkeit geben.

Infolge des wachsenden Interesses für Pflanzen- und Samenbau hat die Arbeit der Samenkontrolle in den letzten zwei Jahrzehnten, wie Sie auf der graphischen Tafel sehen können, sehr zugenommen. In jedem der beiden letzten Arbeitsjahre sind ca. 28 000 Proben untersucht worden.

So wie in allen anderen Samenkontrollanstalten wird auch hier die Artechtheit des Samens durch Laboratoriumsuntersuchungen bestimmt und außerdem, sofern es nach dem Aussehen und dem Bau des Samens möglich ist, auch die Sortenechtheit und die Herkunft; weiter wird natürlich auch die Reinheit, die Keimfähigkeit, der Wassergehalt, das Körnergewicht u. s. w. bestimmt. Ich werde nur ganz einzelne Verhältnisse bei diesen Untersuchungen, die nach meiner Kenntnis der Samenkontrolle im Auslande für uns besonders wichtig sind, hervorheben

Zur Hilfe bei der Echtheitsbestimmung haben wir eine Samensammlung von ca. 3000 Nummern. Wir finden dennoch in einzelnen Fällen Arten, die wir früher hier nicht gefunden haben. Bei solchen Bestimmungen haben wir oft Hilfe von dem Professor für Botanik an der landwirtschaftlichen Hochschule, Dr. Ostenfeld, und von den Kollegen Dr. Stebler und Volkart in Zürich und dem Errichter der ersten Samenkontrolle in Schweden, Bureauchef A. Lyttkens, bekommen. Übrigens werden solche Samen, um bestimmt zu werden, in unserem Versuchsgarten bei diesem Gebäude ausgesät. Dieser Garten ist ganz neu angelegt, weil dieses Gebäude erst vor $\frac{3}{4}$ Jahren bezogen worden ist; damals war der Garten nach dem Bau noch ganz in Unordnung, und er ist deshalb auch heute noch bei weitem nicht in Ordnung.

Über die Frage der Sortenechtheitsbestimmungen und die Untersuchung auf Abwesenheit von Krankheiten, die mit dem Saatgut übertragen werden, werde ich auf der Versammlung am Mittwoch näher sprechen.

Die Herkunftsbestimmungen werden hier im wesentlichen nach dem Vorgehen, das Dr. Stebler an dem ersten Samenkontrollkongreß dargelegt hat, und welches wir uns freuen, Dr. Volkart morgen weiter austiefen zu hören, vorgenommen.

Bei der Reinheitsbestimmung benutzen wir hier verhältnismäßig kleine, genau gezogene Durchschnittsproben, die doch so groß sind, daß sie mindestens 1000 Samen von der in Frage stehenden Art enthalten. Bei der Bestimmung des Abfalls sind wir sehr genau. Unser Personal besteht im wesentlichen aus Damen, von denen wir eine mit einem Examen abschließende Schulbildung verlangen. Erst nach einer mehrjährigen Arbeit, wenn die Damen sich als ganz zuverlässig und für die Analysenarbeit geeignet erwiesen haben, werden sie fest angestellt.

Im ganzen ist es von entscheidender Bedeutung für die Arbeit einer Samenkontrolle, daß sowohl die Leitenden, als auch das übrige Personal, eine passende Ausbildung haben, und daß alle ganz zuverlässig sind. Man muß darum bei der Wahl der Gehilfen, und ehe man diese fest angestellt, sehr kritisch sein. Um dieses tun zu können, ist es notwendig, das Personal so entschädigen und auch sonst solche Verhältnisse bieten zu können, daß es Lust hat, bei dieser Arbeit zu bleiben. Nachdem wir 1919 ein neues Besoldungsgesetz und 1920 dieses neue Gebäude bekommen haben, meinen wir, daß wir in diesen Richtungen hier ganz gute Verhältnisse haben.

Die fremden Samenarten werden genau ausgesucht und bestimmt, und die verschiedenen Arten werden angegeben. Von den besonders schädlichen Unkrautsamen, die auf den verteilten Analysenformularen angegeben sind, werden auch die Zahlen in Kilogramm angegeben. Bei der Bestimmung hiervon werden zwei Proben, die ca. 10000 Samen der betreffenden Art enthalten, untersucht. Die Arbeit wird in zwei Reinheitslaboratorien ausgeführt, einem größeren, worin 18 Damen die Arbeit unter der Leitung von Fräulein F. Carstensen, die seit der Zeit Möller-Holst's seit 46 Jahren hier beschäftigt ist, ausführen, und einem kleineren Reinheitslaboratorium, wo 6 Damen unter der Leitung von Fräulein L. Lange arbeiten. Dieses Personal des zweiten Laboratoriums hat jetzt Sommerferien. Sie werden gleich Gelegenheit bekommen, die Arbeit in dem größeren Laboratorium, wo die Einzelheiten bei der Analysierung genauer gezeigt werden können, zu beobachten; unter anderem auch ein bei der Analysierung des Grassamens zuerst vorgenommenes sogenanntes „Dröftning“ (Stäuben).

Bei der Keimungsuntersuchung streben wir danach, dem Samen die bestmöglichen Keimbedingungen zu verschaffen. Die Arbeit wird hier von Fräulein I. Jacobsen geleitet, der Tochter des Herrn Chr. Jacobsen, der im Herbst 1872 die erste Samenhandlung in Dänemark, die untersuchten Feldsamen verkaufte, errichtet hat. Die meisten kleinkörnigen Samenarten: Klee, Gras, Kohl, Möhren und die meisten Garten- und Waldsamenarten, werden auf den Apparaten, die von ihm konstruiert sind, zum Keimen angesetzt. Diese Apparate werden, nachdem sie die Nacht hindurch bei einer Zimmertemperatur von 18°C gehalten worden sind, am Morgen von ca. $9\frac{1}{2}$ bis 1 Uhr elektrisch geheizt, bis die Temperatur im Wasser 36°C und da, wo der Samen liegt, bei den meisten Samenarten, ca. 26°C beträgt.

Bei einzelnen Arten, zum Beispiel Hopfenklee (*Medicago lupulina*), wird das Wasser im Apparat jedoch nur bis 25° C gewärmt, so daß die Temperatur da, wo der Samen liegt, nur auf ca. 22° C steigt. Bei Garantieuntersuchungen werden 6 mal 100 Körner zum Keimen gelegt, bei Orientierungsuntersuchungen nur 3 mal 100 Körner.

Samen der Betafamilie werden zum Keimen in feuchtem Filtrierpapier in Portionen von entweder 12- oder 6mal 50 Knäulen ausgelegt. Sie keimen im Thermostaten bei einer Temperatur, die 18 Stunden 20° und 6 Stunden 30° C beträgt.

Gewöhnlich untersuchen wir nur die Zahl der gekeimten Knäule, wenn es aber verlangt wird, auch die Zahl der Keime im Kilo der Ware. Soll die Untersuchung Bedeutung haben, so muß das Herausnehmen der Keime aus den Knäulen allmählich sehr sorgfältig gemacht werden. Wir geben hier immer das Gewicht von 1000 Knäulen von der Betafamilie an, weil die Keimfähigkeit ja in einem ungefähr gleichen Verhältnis zu dem Körnergewicht steht. Wenn häufig darüber geklagt wird, daß die Keimungsergebnisse von zwei Proben derselben Partie von Beta nicht übereinstimmen, so ist der Grund in der Regel darin zu finden, daß diese Proben nicht sorgfältig genug ausgezogen wurden, was sich in verschiedenem Körnergewicht zeigt.

Das Getreide wird zum Keimen in feuchtem Sand in inwendig glasierten Tonschalen bei Zimmertemperatur (18° C) gelegt. Das Getreide wird nicht mit Sand zugedeckt. Wir legen nur eine Glasplatte über die Schale. Dagegen werden Bohnen, Erbsen, Wicken und dergleichen mit ca. 15 mm Sand bedeckt.

Die Zeit der Keimung ist auf den verteilten Abzügen unserer Regeln angegeben. Die Keimungsenergie, die wir Keimschnelligkeit nennen, wird nach ungefähr einem Drittel der Zeit der Keimung bestimmt. Bei dieser Bestimmung werden die Samenkörner, die nicht auf dem Jacobsenschen Keimapparat gekeimt haben, auf neues Filtrierpapier gelegt, und es wird festgestellt, ob ihre Zahl mit der Zahl der gekeimten und der Zahl der toten Körner in jeder Serie 100 gibt. Die Keimungsenergie wird dem Einsender aufgegeben. Es hat sich nämlich bei gleichzeitigen Untersuchungen der Keimung in der Samenkontrolle und im Felde gezeigt, daß die Proben, die im Felde schlecht keimen, so gut wie immer eine geringe Keimungsenergie haben. Wir raten darum den Verbrauchern immer, vorsichtig zu sein und nicht Samen mit geringer Keimungsenergie zu brauchen. Wenn es verlangt wird, untersuchen wir auch die Keimkraft durch Aussaat in Lehm Boden. Der Samen wird mit ca. 2 cm Erde bedeckt.

Das Körnergewicht, d. h. das Gewicht von 1000 Samenkörnern, wird immer von 3 mal 200 respektive 3mal 100 Samenkörnern bestimmt.

Von den Waldsamen haben wir besonders in den Jahren 1905—15 eine bedeutende Zahl von 60 bis 70 Arten untersucht. Diese Proben sind alle von dem „Skovfrøkontoret“ eingesandt worden. Der Inhaber dieses Instituts, Herr Johannes Rafn, hat eine große Arbeit geleistet, um guten Waldsamen zu verschaffen, wodurch sein Name in der ganzen Welt bekannt geworden ist. Wir haben in unserem Jahresbericht 1914—15 die Durchschnittszahlen der wichtigsten Waldsamenarten aufgegeben, und Herr Rafn hat ein größeres Werk „Untersuchung von Forstsamen 1887—1912“ herausgegeben (auch in englischer Sprache). Die Leiterin des Keimungslaboratoriums, Fräulein Jacobsen, hat mit den Untersuchungen dieses Waldsamens eine nicht geringe Arbeit ausgerichtet.

Die Wassergehaltsbestimmungen werden hier bei ca. 98° C vorgenommen, indem wir zwei parallele Proben 5 Stunden in einem Trockenschrank mit doppelten Wänden, worin kochendes Wasser sich befindet, trocknen. Von den feinkörnigen Samen brauchen wir zu diesen Bestimmungen 2 mal 1 g, von den größeren Samen (Beta, Getreide, Erbsen u. s. w.) 2 mal 5 g. Die letzteren werden vor dem Trocknen gemahlen.

Dr. Heinrich (Rostock) sollte nach dem für den Kongreß ausgearbeiteten Plane ein einleitendes Referat über das „Körnergewicht und den Wassergehalt“ halten. Er ist aber leider verhindert, hierher zu kommen. Es würde indessen sehr interessant sein, nähere Auskünfte über die Wassergehaltsbestimmungen an den verschiedenen Samenkontrollanstalten zu hören. Hier untersuchen wir Proben auf Wassergehalt nur dann, wenn diese

uns in einem geschlossenen, luftdichten Behälter zugesandt werden. Die Einsender können für diesen Gebrauch Blechrohre hier leihen.

Von den Untersuchungsergebnissen der verschiedenen Samenarten der Landwirtschaft werden jedes Jahr Ende der Saison im August oder September, zur Orientierung der Landwirte und Samenhändler, die Durchschnittszahlen der Keimung von allen wichtigen Samenarten von dem verflossenen Jahre und von den letzten zehn Jahren versandt. Solche sind Ihnen verteilt worden. In den letzten Jahren sind auch bedeutende Mengen von Gartensamen untersucht worden; darum wurden in den letzten Jahren im jährlichen Bericht die Durchschnittszahlen von ca. 20 solcher Arten aufgegeben.

Die selbstwirkende (automatische) Kontrolle.

Eine der ersten und für die Samenkontrolle sehr wesentliche Aufgabe ist es immer gewesen, Nachuntersuchungen der Waren, die den Landwirten zur Aussaat geliefert werden, auszuführen.

Es ist indessen eine Tatsache, daß eine solche Kontrolle sehr zerstreut und zufällig wird, solange sie allein auf Grund der wenigen Proben, die die einzelnen Landwirte auf eigene Initiative zur Nachuntersuchung einsenden, ausgeführt werden soll.

Bei der sogenannten „selbstwirkenden Kontrolle“ der dänischen Samenkontrolle, die durch eine freiwillige Übereinkunft zwischen der Staats-Samenkontrolle und einem Teil der Samenfirmen organisiert ist, sind die Nachuntersuchungen so eingerichtet, dass etwa 2 Drittel des Samens, der hier im Lande zur Aussaat benützt wird, der Kontrolle unterworfen ist.

Die Arbeitsmethode der selbstwirkenden Kontrolle ist kurz folgende:

Zwischen der Staats-Samenkontrolle und den Firmen, die sich dieser Kontrolle zu unterwerfen wünschen, wird ein Vertrag abgeschlossen, nach welchem die Firma sich verpflichtet Garantie für Reinheit, Keimfähigkeit und Maximalgehalt von Unkraut in allen Gras-, Klee- und Rübensamen, die sie an die Landwirte, Einkaufsvereine und Detailhändler des Inlandes verkaufen, zu leisten. Die Garantiezahlen müssen sowohl der Staats-Samenkontrolle als auch den Käufern so bald wie möglich aufgegeben werden, spätestens bei der Lieferung des Samens. Eine jede Samenware soll auf den Preislisten und bei der Lieferung mit einer Nummer oder auf andere charakteristische Weise bezeichnet werden, so daß es möglich ist, jede einzelne Lieferung auf eine bestimmte Partie zurückzuführen. Die Firma verpflichtet sich außerdem dazu, die Staats-Samenkontrolle von den sämtlichen Adressen ihrer Kunden zu unterrichten und aufzugeben, welches Quantum jeder Käufer von den einzelnen Samenpartien bekommen hat. Dieses geschieht gewöhnlich so, daß die Firma der Staats-Samenkontrolle Kopien der Fakturen sendet, und zwar fortlaufend so, wie der Samen expediert wird. Die Firma bestätigt endlich in einer Erklärung auf „Treu und Glauben“, daß der Anstalt alle Adressen unmittelbar nach der Expedition der Samenpartien vorgelegt sind. Zur Kontrolle, daß jede gegebene Garantie erfüllt worden ist, verschafft sich und untersucht die Staats-Samenkontrolle im Laufe der Expeditionszeit eine passende Zahl (2—6) Proben von jeder Partie. Wenn die Untersuchungsergebnisse der Proben in einer oder mehreren Beziehungen nicht der für die Partie angegebenen Garantie entspricht, so ist die Firma verpflichtet, Schadenersatz nach den Regeln der Samenkontrolle nicht nur an die Kunden, aus deren Lieferung die Proben genommen wurden, sondern auch an alle übrigen, die von derselben Partie gekauft haben, zu bezahlen. Die Firmen bezahlen die Untersuchungen nach einer etwas reduzierten Taxe; aber sie bezahlen auch einige andere Ausgaben, die mit der Kontrolle verbunden sind, Probenentnahme, die Drucksachen, das Porto u. s. w., nach Rechnung.

Die Proben zur Kontrolle werden auf zwei verschiedene Weisen verschafft, erstens zum Teil dadurch, daß die Staats-Samenkontrolle nach den vorgelegten Adressen eine Zuschrift an einige willkürlich gewählte Käufer richtet und sie ersucht, Proben von einer bestimmten Partie, von der sie gekauft haben, einzusenden. In dem Schreiben wird unter anderem mitgeteilt, daß diese Zuschrift im Einverständnis mit der Firma geschickt wird, und daß die Untersuchung ohne Ausgaben für den Einsender vorgenommen wird. Mit der Aufforderung folgt eine Papiertüte zur Einsendung der Probe; auf der Tüte ist ein kurzer

Auszug der Regeln für die Probenentnahme aufgedruckt. Andere Proben werden verschafft durch Angestellte der Staats-Samenkontrolle, die auf den Lagern der zu kontrollierenden Firmen den Lieferungen, die für die Kunden abgewogen sind, Proben entnehmen. Nachdem die Proben genommen sind, wird der Sack, aus dem die Probe genommen ist, mit der Plombe der Staats-Samenkontrolle plombiert, und der Empfänger wird durch eine Briefkarte unterrichtet, daß der Lieferung eine Probe entnommen worden ist. Gleichzeitig wird angefragt, ob die Plombe der Samenkontrolle beim Empfang unverletzt gewesen sei, und welche Garantiezahlen der Verkäufer ihm aufgegeben habe. Zur Beantwortung dieser Fragen liegt eine frankierte Karte anbei.

Die Firma wird durch gewöhnliche Analysenatteste von den Analysenresultaten nach und nach, wenn diese vorliegen, unterrichtet.

Für die Benachrichtigung der Kunden verfertigt die Staats-Samenkontrolle eine Übersicht der Analysenresultate jeder kontrollierten Firma mit Angabe der Partien, für welche diese ersatzpflichtig ist. Diese Übersicht wird von der Staats-Samenkontrolle an alle Käufer, aus deren Lieferungen Proben untersucht wurden, gesandt, und die Firma ist dazu verpflichtet, sie an alle anderen Käufer zu schicken. Um zu kontrollieren, ob die Firma sowohl diese als auch die Verpflichtung, Ersatz an sämtliche Käufer von ersatzpflichtigen Partien zu leisten, einlöst, sendet die Samenkontrolle an einige nach den Fakturenkopien willkürlich gewählte Käufer eine Fragekarte mit bezahlter Antwort.

Außer durch die schon genannten Übersichten über die Analysenresultate wird ein Resümee dieser in dem Jahresbericht der Staats-Samenkontrolle veröffentlicht.

Zum Schluß muß noch betont werden, daß diese Kontrolle von Seiten der Firmen völlig freiwillig geschieht. Letztes Jahr verkauften 26 Firmen zusammen $5\frac{1}{2}$ Millionen Kilogramm Samen der kontrollierten Arten unter dieser Kontrolle. In Dänemark werden im ganzen ca. $8\frac{1}{2}$ Millionen Kilogramm Samen der erwähnten Art jährlich verbraucht. Heuer sind 31 Firmen und unzweifelhaft auch eine größere Samenmenge als letztes Jahr unter der Kontrolle.

Es ist eine Eigentümlichkeit bei dieser Kontrolle im Gegensatz zu der gesetzlichen, daß die Firmen auf Grund der Konkurrenz sehr interessiert daran sind, daß die Kontrolle so effektiv wie möglich ist. Die Firmen, die am sichersten in der Qualität ihrer Lieferungen sind, wünschen die Kontrolle immer strenger und umfassender, und die anderen müssen dann nachfolgen.

Beispielsweise kann ich anführen, daß der Ersatz nach den Regeln der Staats-Samenkontrolle, die auf Englisch und Deutsch verteilt wurden, für Reinheit und Keimfähigkeit $\frac{M \cdot P}{G}$ ist, wo M der Minderwert in Reinheit oder Keimfähigkeit bedeutet, G die garantierte

Reinheit oder Keimfähigkeit und P der Preis der Ware. Die Organisation, die den größten Umsatz hatte, führte vor einigen Jahren ein, daß sie Ersatz nach der Formel $\frac{(M + \frac{M^2}{10}) \times P}{G}$

leisten wollte. Diese Formel gibt bei größerem Minderwert einen viel größeren Ersatz als die erstgenannte. Bei einem Fehler von 10 % doppelt so viel, bei 20 % viermal so viel und bei 30 % neunmal so viel. Andere Firmen haben aus Konkurrenzgründen die gleiche Bestimmung eingeführt.

Wir sichern durch diese sogenannte „selbstwirkende Kontrolle“ den Landwirten, daß sie bekommen, was ihnen garantiert ist.

Zur Orientierung darüber, was sie verlangen können, werden jährlich im September von der Staats-Samenkontrolle die früher erwähnten Durchschnittszahlen der gewöhnlichen guten Handelswaren ausgesandt. In dem Jahresbericht wird veröffentlicht, wie die Garantiezahlen der einzelnen Firmen diesen entsprochen haben*). Die Firmen konkurrieren deshalb darum, die bestmöglichen Garantiezahlen zu bekommen. Die Kontrolle aber verhindert sie daran, diese höher, als sie den Lieferungen entsprechen, zu setzen, was, bevor die Kontrolle existierte, oft der Fall war.

*) Von 1921/22 an sollen die Firmen auf allen Preis- und Bestellungslisten die Durchschnittszahlen der Staats-Samenkontrolle auführen.

Wir haben hier im Lande kein Gesetz für den Samenhandel, und ich meine, daß wir auf dem Wege der freiwilligen Konkurrenz weiter gekommen sind, indem wir, wie früher erwähnt, ungefähr 2 Drittel des Samens, den die Landwirte brauchen, unter Kontrolle haben. Dies ist mehr, als selbst mit den strengsten Gesetzen erreicht würde.

Professor Johannsen then proposed that the question of chairmanship be brought up.

Sir Lawrence Weaver, Director General Land Department, Ministry of Agriculture and Fisheries, London, and M. M. Insulander, Directeur général du Bureau royal d'agriculture, Stockholm, Suède, moved that Professor Johannsen should act as chairman for the entire Conference with Mr. Dorph-Petersen as vice-chairman; this was passed unanimously.

schlugen Professor Johannsen als Präsident und Direktor Dorph-Petersen als Vizepräsident der Konferenz vor, was einstimmig angenommen wurde.

Professor Johannsen thanked and then stated that an opportunity would be given for the delegates to see the State Seed Testing Station and at 1:00 they would be the guests of the station at luncheon.

After luncheon the delegates were photographed on the steps of the State Seed Testing Station.

At 3:00 the meeting re-opened.

Professor Johannsen introduced Mr. F. F. Bruijning, Director of the State Seed Testing Station, Wageningen, Holland, who expressed the following:

"Mr. Chairman!

The Dutch Government, which I have the honour to represent in this place, has instructed me to tell you, that they are following this Congress with special interest and offer you their best wishes for its success.

With the greatest pleasure I now acquit myself of this instruction which affords me the great privilege of meeting here with you, Mr. Chairman, highly appreciated and renowned as a geneticist far beyond the limits of your native-country, and with you, Gentlemen, who are going to take part in our proceedings. There are many among you with whom bonds of cooperation and mutual appreciation have existed for many years.

May our meeting be characterized by the very special blessing of renewed cooperation and renewed friendship that will give us the best expectations for the future.

Mr. Bruijning thereafter read a paper on:

„General views concerning the international unification of methods of testing seeds in the interest of trade, more especially with regard to the purity of seeds“:

Determination of the purity of seeds is, theoretically speaking, so simple that it would seem that all theory about it is futile. However, an effectual test necessitates some rules, the neglect of which might make it worthless. In the first place testing the purity of seeds must be executed with accuracy and practical knowledge. I need hardly state that these conditions are not always fulfilled. Laboratories are not always well equipped, and some of them lack a sufficient staff, at least one with ample, many-sided, experience. If we propose to lay the foundations of a unification of methods, this must be taken into account. Unification is only practically possible, when it rests on mutual deliberation of establishments possessing the means of meeting their obligations unreservedly and scrupulously. For this reason I fear that several small establishments must be disregarded the

alternative lies between efficiency and renouncement; institutes not able to complete will have to abstain, until conditions change for the better.

Therefore, with the permission of our chairman, I should like to conceive the task of this congress somewhat more broadly, and to lead you through my short discourse to a conclusion which I have reached after many years' experience.

In the first place I must recommend a certain restriction in the selection of establishments to join in unification¹⁾. If not, we are liable to many and various deceptions and consequently the total ruin of our efforts in the interest of international trade. I beg, therefore, to submit to the judgment of the present congress, the stipulation that²⁾ in every state, here represented, at least one establishment shall be designed for what we may call "International Service". Said establishment should be completely equipped in order to meet the highest demands. If this is impossible every make-believe unification should be discarded as worthless, for it would only hurt the interests of the matter in question.

If there is more than one station, the representatives of the States concerned, might make their choice and tender a proposal to their Government on this subject. But I see, Gentlemen, that I am already dwelling upon a topic that would perhaps better be considered in special discussions; yet I should like to make some observations in this connection.

I mention first of all the training of a scientific and technical staff and the somewhat surprising fact that hardly any attention is paid to said training, a fact partly attributable to the fact that the number of scientific men required by the stations is relatively small, so that it is very difficult to induce the Universities to give lectures on seed-testing. Consequently a man who goes in for our profession can only acquire the indispensable professional knowledge in the course of a many years' practice. The question arises: "Could we not do something in this direction?" I believe the answer might be worded as follows³⁾: "It is desirable that scientific co-operators who wish to be appointed later on, should have been employed, for three consecutive months at least, in two well-reputed foreign institutes, and that they should be required to produce a testimonial to this effect". By this measure, both universality and uniformity would be greatly enhanced.

It is necessary to state that the merely technical members of the staff will always receive their training in laboratories, i. e. an exclusively practical training, but I have always felt that the better endowed, the more highly gifted, among them, should have the opportunity of going to some foreign stations. Yet another and more important observation should be made concerning this technical staff. The training of a skilful technical staff requires a couple years' practice at least, if satisfactory results are to be obtained. To this end in Holland the system of female pupils has been adopted, on the understanding that the said pupils shall receive a yearly allowance that enables a young lady of good standing to live on a reasonable footing, in abeyance of her being appointed analyst or assistant-analyst.

In my opinion such a skilful staff ought to be induced to remain on duty with the same laboratory for many years. Consequently an adequate salary is a matter of course. The staff must set to work day by day with alacrity and cheerfulness. They must not be subject to vexing pecuniary troubles which would not only be contrary to the humane principles of modern times, but would also fail to tally with the fact that a monotonous task, demanding a high degree of prolonged accuracy, requires some traits of character which we appreciate in proportion as we grow older. Here I feel myself under an obligation to grateful acknowledge all that my institution owes to the co-operation of several efficient technical assistants, and I am convinced that our efforts are sure to benefit by the acknowledgment of the justice of the claims, I have just brought forward. An efficient and beneficial unification of methods can only be imagined, if there is a sincere co-operation of institutes established on a sound basis, i. e. possessing an efficient staff and an up-to-date equipment.

¹⁾ Concl. 1. ²⁾ Concl. 2. ³⁾ Concl. 3.

After this digression, which may serve as a short introduction throwing some light upon my personal view regarding the possibility of unification of methods, I will now return to a discussion of the several views which may be taken with regard to the purity-test, and their effects upon International Trade.

Ascertainment of purity is founded upon the sifting of the seed to be tested, into "pure" and "impure", the latter being either noxious or harmless. The first question that arises here is: What do the terms "pure" and "impure" imply? In order to obviate confusion which might become inevitable through the accumulation of data, I have brought together in Appendix B all that is to be found on that question in the methods in use at Wageningen, and you will allow me to refer to said Appendix, if necessary. Treating the matter in general we at once observe two essential differences. Waiving details we may say that in determining the germinating power and purity of seed, Wageningen follows the so-called "Continental Method", in contradistinction to our English colleagues, who apply the "English Method", also called the "Irish Method", as it has always found a very vigilant champion in our colleague Mr. Pethybridge. The Irish method is really the older one, and at the start it was used at Wageningen too. 28 years ago I adopted the Continental method for all species of grass-seeds. The apparatus and materials necessary for this investigation, have gradually acquired a satisfactory degree of perfection in our institute. All persons present are aware, that according to the Continental method, many seeds, especially grass-seeds, are at first examined in the usual way by direct light, and afterwards by translucent light, by which method all empty seeds are detected and reckoned as impurities. Only the full seeds are admitted to the determination of the germinating power. According to the Irish method the examination by translucent light is not used and consequently the halfempty and empty seeds are tested for germinating power. This is an essential difference and seemingly an unsurmountable impediment to a unification of methods. The Irish "purity" contains seeds having no caryopses at all and of no use whatever for agriculture. Therefore the valuation of this seed with respect to the purity is too high, but as regards the germinating power the figure is often far too low. Indeed, the Irish figure stated for purity cannot be called right, no more than any Irish figure for germinating power. Moreover, when using the Irish method, the germination beds sometimes presented a far less healthy aspect than the others, which made prudence quite advisable. So we encountered an impediment that seemed to shut off from every approach in the methods of procedure. Indeed I cannot consider an English figure, either for germinating power or for purity, otherwise than as an unsafe basis for international transactions.

However, Gentlemen, this is not a vital question. The chief object of this congress I do not take to be an extensive but fruitless discussion of the merits of either method; for opinions about it may vary. I intend to waive this question altogether and to restrict myself to considering what we might do to conciliate the two parties so as to lead to an easy-moving world-traffic, and to protect the Trade from the difficulties hitherto experienced on account of the stations' being at variance.

Let us, for the time being, observe the following determination of the Trade-Value of grass- and clover-seeds; in the case of these seeds and of most of the others a mediatory proposal may prove to be possible.

Generally speaking the determination of the value of the seed must be founded on numerous factors, and especially so the determination of Trade-Value while several factors are more prominent than in the case of valuing seeds for agriculture. The reverse may be also the case: some factors are of more weight for trade than they are for agriculture. But when comparing two samples of the same qualities of colour and smell, and both of the same variety (approved of, at a field-inspection), the value of the samples will be found comparable when the figures for the use-value have been found. As a rule the figures for real-value are calculated from the figures for the germinating power and the purity, according to the simple formula: $\text{real-value} = \frac{Gp \times P}{100}$. In Holland a long time

ago we went one step further by deducting the percentage of noxious impurity (weeds and suchlike) according to the formula: $\text{real-value} = \frac{Gp \times P}{100} - 3 \times Ni$. Consequently at 98 % Purity, 86 % Germinating power and 2 % Noxious impurity the value is: $\frac{98 \times 86}{100} - 3 \times 2 = 78.28$ or rounded off 78 %. According to the usual calculation it would amount to 84.28, rounded off 84 %. However, when comparing the two methods (English and Continental), we have to use the more ancient calculation of real-value, as it is in use in most countries. The methods for determining the germinating power having changed in the course of time, the desirability of comparing the two procedures becomes more and more striking. The results mentioned in Appendix A have been obtained from various samples. Each sample was examined twice: 1st according to the British Method and 2nd according to the Wageningen or Continental Method. To secure a correct comparison the conditions of germination were made equal in either case; the fundamental difference between the two determinations (each carried out in quadruple), really consisted in proceeding respectively from an Irish purity-test and a Continental test one. The figures stated in Appendix A have been all calculated without a deduction for noxious impurity. It was to be expected that the higher "purity" according to the Irish method would be compensated by a lower germinating power, as numerous other comparisons have pointed in the same direction; but we had not foreseen that the said compensation would be so complete, of course provided the conditions for germination were equal. The comparative examination of the first series (55 cases) showed a difference of less than 5 % in a little more than 78 % of the cases, and consequently remained within the usual allowance of 5 %. In 7 $\frac{1}{4}$ % of the total amount of cases (4 cases) the difference was exactly 5 % and in 14 $\frac{1}{2}$ % more than 5 %. The important deviations however occurred chiefly in case the final figure was such that on mathematical grounds a greater deviation could be expected. I must further observe that striking differences in the health-conditions of the germinating seeds did not appear. In either case the fungosity was but slight one; indeed in our institute it generally did not surpass moderate bounds. In the course of time it has constantly decreased, exception being made for a few kinds of seed.

Before drawing a conclusion from the various data, I will once more briefly state the principal matter. We all have in view a procedure, that will obviate, if possible, the divergences of results between the leading stations. This end can never be attained unless we succeed in finding a fixed standard of value adopted by the several countries and by trade and agriculture. It is impossible to express by one figure either the sale-value or the agricultural-value; but it is highly desirable in behalf of a sound trade between foreign countries, that the trader should have at his disposal an international standard for the valuation of some qualities which cannot be easily or promptly detected, and are yet of very great importance. In this respect the purity of the seed is of no use, as in its determination we are checked by unsurmountable impediments; the same is true of germinating power, as that is deduced from material obtained while determining the purity, and varying accordingly. That's why I will lay no particular stress upon these two qualities, but I prefer to try and find an expedient. As a first conclusion¹⁾ I observe that it is highly desirable that we should choose as value-measure something like real-value, i. e. a real-value obtained by a determination of the germinating power of what in England, according to the Irish method, is called pure seed. If — in the calculation — the threefold percentage of the amount of "noxious impurity" (seed of weeds &c., vide: Appendix B) be deducted as already being done in Holland for a number of years and in accordance with the requirements of Trade and Agriculture, we shall obtain a value-measure, including three value-factors (Germinating power, Purity and Amount of weeds) and one that is founded on a purity-test, speedy, simple and practical in method and con-

¹⁾ Concl. 4.

Concl. 3. After the unification has been enforced, candidates for an appointment as co-operator must produce a documentary evidence stating that they have been employed in two foreign establishments at least and for no less than three consecutive months on either side.

Concl. 4. It is desirable to establish an international value-standard.

Concl. 5. Instead of the term "use-value", the word "grade" should be adopted to denote the international value-measure.

Concl. 6. Reports of "international" analyses shall be worded as briefly and simply as possible, and drawn up in the language of the country as well as in two other European languages.

In connection with the foregoing the question arises which as to the part the international or unified analyses and the inferential analyses will assume in international trade and agriculture. As to international trade, they will soon be of great significance; but — as I said before — traders cannot always do without a normal "continental" determination of purity, nor can the agriculturists, applying themselves to growing seeds for the trade do so. As far as the usual practice of agriculture is concerned, a mere determination of grade will suffice in the majority of cases. Indeed, the grade can serve conveniently for all seeds of agriculture, horticulture and sylviculture, even for the seeds of Beta-species. For that purpose the only thing to take into consideration for the factor of Germinating power, is the percentage of sound seeds or — as the case may be — that of grains, which each will produce at least one germ. At present this is being done at Paris, Copenhagen and Wageningen, and possibly at other institutes too. From an agricultural point of view no objections can be raised to this proceeding. Concerning the determination of the purity the rule will hold that we shall include as purities all particles which a slit-sieve with a 2 m. M. opening let pass, and moreover all parts being not beet root seeds, such as little stem, long bractaea, weeds, &c. (See Appendix B.)

If the ideas I have unfolded here should be adhered to, I propose to lay down new Regulations in which the introduction of the following practicable determinations shall be aimed at:

1. Determination of the grade of seeds.

This determination will be made whenever the applicant did not state particulars the nature of the examination, but has simply solicited "a determination", without any further qualification.

2. A determination of the purity.

If solicited without any further qualification, the Continental method, as practised at Wageningen, has to be followed, observing the particulars more fully discussed in Appendix A. Besides a determination of a more special kind may be solicited by the applicant, e. g.: a determination of the noxious impurity, of the percentage of certain seeds of different species; &c., for which I beg to refer again to Appendix A.

3. Special determinations connected with germinative faculties, such as the percentage of impervious seeds, of the germinating power of seeds having undergone some special preparation, the germinating power of Beta-seeds.

4. An examination of several other qualities of the seeds, besides germinating power and purity, except such as mentioned sub 1—3, qualities, being practically of some importance, such as an inquiry into the origin of the seeds, the grain-weight, the volume-weight, the percentage of dodder seeds, &c. &c.

This list is not a complete one, nor need it be. The thing that matters is to lay stress upon applying the unification-method to the ordinary determinations, on the strength of considerations having been fully expounded here, observant of the fact that, also in future, various other determinations hitherto practised, may be executed at the special request of the applicant, if the directors of the institutes do not object.

Let us now pay attention to a closer consideration of the methods for determining the purity. As a basis for this I may give a more detailed description of the procedure

now practised in Wageningen. As I want to lay the stress of my argument upon unification of methods in behalf of international trading-transactions — this being the most important thing at this moment — I should like to summarize the description of the Wageningen method in the subjoined Appendix B.

APPENDIX A.

Number	Denomination	P. Purity		Ni. Noxious impurity	Hi. Harmless impurity	Gp. Germinating Power		%Gp. × %P. 100	
		C.	I.			C.	I.	C.	I.
1	Smooth-stalked Meadow-Grass (<i>Poa pratensis</i>)	92.8	95.6	2.4	2.8	80	80	74	76
2	"	86.1	96.2	0.6	10.1	78	65	67	63
3	"	76.2	91.8	3.2	15.6	79	69	60	63
4	"	75.5	94.7	0.8	19.2	83	61	63	58
5	Fiorin-Grass (<i>Agrostis alba</i>)	93.6	95.2	1.0	1.6	88	86	82	82
6	"	95.0	95.8	0.6	0.8	92	87	87	83
7	"	62.9	88.7	2.6	25.8	67	59	42	52
8	"	55.2	93.2	1.0	38.0	56	51	31	48
9	Sheep's Fescue (<i>Festuca ovina</i>)	89.7	96.8	0.4	7.1	94	86	84	83
10	"	91.3	97.4	0.2	6.1	84	78	77	76
11	"	46.0	92.0	2.7	46.0	71	32	33	29
12	"	55.1	99.3	0.0	44.2	42	20	23	20
13	Cock's-foot (<i>Dactylis glomerata</i>)	90.5	97.6	0.4	7.1	87	81	79	79
14	"	86.0	90.1	1.9	4.1	93	86	80	77
15	"	90.9	96.5	0.9	5.6	80	70	73	68
16	"	56.2	60.9	0.4	4.7	95	90	53	55
17	Foxtail (<i>Alopecurus pratensis</i>)	85.8	95.1	1.9	9.3	64	58	55	55
18	"	83.7	84.9	1.2	1.2	82	72	69	61
19	"	81.8	93.5	1.4	11.7	36	26	29	24
20	"	59.4	87.6	7.5	28.2	58	28	34	25
21	"	65.9	96.0	0.3	30.1	76	41	50	39
22	Tall Oat-Grass (<i>Arrhenatherum avenaceum</i>)	95.6	98.9	0.1	3.3	86	82	82	81
23	"	72.7	82.5	0.1	9.8	85	71	62	59
24	Perennial Rye-Grass (<i>Lolium perenne</i>)	94.7	95.6	0.1	0.9	96	95	91	91
25	"	99.3	99.5	0.1	0.2	83	84	82	84
26	"	97.8	98.4	0.3	0.6	64	58	63	57
27	"	97.9	98.0	0.7	0.1	43	42	42	41
28	"	87.5	92.3	0.1	4.8	64	62	56	57

The figures for Germinating power of clovers do not include the percentages of impervious seeds ("hard seeds").

C. = Continental Method.

I. = Irish Method.

Number	Denomination	P. Purity		Ni. Noxious impurity	Hi. Harmless impurity	Gp. Germin- ating Power		$\frac{\%Gp. \times \%P.}{100}$	
		C.	I.	C. & I.	I.	C.	I.	C.	I.
29	Westerwoldic. Italian- Rye-Grass (<i>Lolium italicum</i> var. <i>Wester- woldicum</i>)	98.2	98.5	0.1	0.3	98	98	96	97
30	"	81.1	91.8	6.9	10.7	21	16	17	15
31	"	98.4	98.9	0.9	0.5	51	49	50	48
32	"	92.3	95.9	1.7	3.6	55	50	51	48
33	"	86.1	87.3	8.6	1.2	51	51	44	45
34	Timothy-Grass (<i>Phleum pratense</i>)	99.8	99.9	0.02	0.1	97	95	97	95
35	"	85.4	85.7	4.0	0.3	95	92	81	79
36	"	93.3	93.4	3.0	0.1	71	69	66	64
37	"	94.5	94.6	2.7	0.1	65	68	61	64
38	Serradella (<i>Ornithopus sativus</i>)	97.7	98.1	0.6	0.4	95	91	93	89
39	"	94.8	95.4	1.8	0.6	49	46	46	44
40	"	92.3	93.6	3.4	1.3	53	50	49	47
41	"	99.0	99.3	0.2	0.3	72	67	71	67
42	"	87.7	87.9	5.3	0.2	97	96	85	84
43	Red Clover (<i>Trifolium pratense</i>)	98.0	99.5	0.3	1.5	81	81	79	81
44	"	89.2	97.2	0.1	8.0	95	92	85	89
45	"	97.1	98.5	0.9	1.4	59	58	57	57
46	"	83.1	87.5	5.8	4.4	56	63	47	55
47	"	84.1	90.1	4.9	6.0	50	48	42	43
48	White Clover (<i>Trifolium repens</i>)	96.6	97.3	0.5	0.7	98	99	95	96
49	"	88.3	90.9	6.1	2.6	95	92	84	84
50	"	96.7	99.2	0.01	2.5	31	32	30	32
51	"	83.6	85.6	7.4	2.0	46	45	38	39
52	Alsike (<i>Trifolium hybri- dum</i>)	98.2	98.4	0.2	0.2	96	92	94	91
53	"	71.0	73.0	5.7	2.0	86	77	61	56
54	"	94.0	94.5	3.5	0.5	60	55	56	52
55	"	87.9	88.8	7.5	0.9	64	60	56	53

The figures for Germinating power of clovers do not include the percentages of impervious seeds ("hard seeds").

C. = Continental Method.

I. = Irish Method.

APPENDIX B.

The methods for determining the purity of seeds, now in use at Wageningen, and some observations in connection therewith.

General View of the subject.

The term "Purity" includes all genuine and full seeds, which are sound or so slightly damaged that they are likely not to have lost their germinating capacity.

The term "Harmless Impurity" includes:

1. All pure seeds being broken or damaged so as to have probably lost their germinating capacity¹⁾.
2. Seeds of other cultivated plants.
3. Dead seeds, empty glumes of grass-seeds, straws, glumes, earth, sand, residues of seeds and fruits, also of weed-seeds and of parasites which are esteemed incapable of development, and
4. Seeds surely containing some special kinds of parasites, the quantity of which is however liable to speedy changes and which are not of a very noxious nature²⁾.

The term "Noxious Impurity" includes:

1. Seeds of plants being in general or very nearly in general considered as "weeds".
2. Seeds of plants which — though cultivated — may become troublesome in some way or other, or of which the growth is not recommendable, &c., such are f. i. *Aira flexuosa*, *Alopecurus agrestis*, *Anthoxanthum Puelli*, *Avena fatua*, *Brassica*- and *Sinapis*-species, *Bromus*, small-seeded *Vicia*-species, &c.

On the contrary the seeds of *Daucus*, found among grass- and clover seeds, are reckoned to the Noxious Impurity, while originating from proper weeds, notwithstanding *Daucus* is frequently cultivated.

3. *Sclerotia*, seeds of blight and *Tylenchus*. Here it should be observed that for the determination of the "purity" of corn and leguminous plants, a special procedure is practised in case the seeds are infected with some disease. This procedure will be described below.
4. Insects, larvae and insect-eggs, including what has been mentioned sub 3 and 4 (Noxious Impurity).

Details concerning the application of the method.

1. Weighing the quantity to be tested.

The required quantity is to be taken from the sample so as to guarantee that its properties and blend represent the main sample most accurately. For this purpose the sample is carefully blended by means of suitable implements as: spatulas, mixing-basins, &c. The seed after being carefully blended and spread out smoothly must not be shocked or shaken before being weighed; should this happen, the blending and spreading out must be done over again. The weighing consists in scooping little quantities off at least five different places, until the proper quantity has been reached. Its extent depends on the size of the grain and on a rough estimation of the purity, for very pure samples as well as very impure ones allow the quantities to diminish. The grain-size is important, so far as it determines the number of grains, found in the quantity that is to be sifted and this number must not be too small with a view to unavoidable errors. Formerly it was assumed as a principle that the quantity to be tested should contain no less than 5000 or 1000 genuine seeds, but this principle cannot be carried out into practice because the quantity of the samples might become much too large. In Wageningen, in the course of time, the experience has led to the average quantities stated in Appendix D.

2. Parallel-test.

Each determination of purity is made in duplicate (at the least). The average results are calculated in tenths of percents. The sifting of the seed must be done as quickly as possible and possibly without intervals. Loss of material may not occur. The difference between the sum of weights of the pure seed and the impurities, and the weight of the commencing quantity, may not exceed the weight figured out for the loss of water. As the waterpercentage of the seeds will diminish considerably

¹⁾ Slight damages f. i. those of Red-Clover seed — as generally known — don't necessarily cause the loss of germinating capacity. Small cracks or abrasions or little cracks in the seed-lobes without loss of tissue, do not make the seed valueless, resp. impure.

²⁾ Notably the seeds of *Alopecurus pratensis* containing seeds of *Oligotrophus Alopecuri*.

during the sifting, the several parts must be covered with watch-glasses. The loss of weight is checked. To this end it is necessary to determine more or less accurately the percentage of water of the sample, observing however the rule laid down here below sub 3. This will facilitate the determination of losses of weight. If they exceed certain limits, the test must be repeated. As limits we have adopted: 4 % for seeds of which 2 grammes or less are sifted for determination and 2 %, if the quantity exceeds 2 grammes. Two parallel-tests are estimated to cover each another, if the results do not deviate more than 2 % in the case of fine grass-seeds and more than 1 % in all other cases.

3. Previous drying of seeds with a rather high percentage of water.

In order to keep the percentage of water within reasonable bounds, it is necessary to previously dry the samples in case the seeds prove to be insufficiently dry. When the quantities are small and not too moist, it will be sufficient to expose the seed to the air for one or two hours at room-temperature and spread out thinly. If, however, the seeds are very moist, they will have to be dried at a temperature, not exceeding 30° C in a current of air and — eventually — afterwards exposed to the air to become airy.

4. Appliange of translucent light.

All „seeds“ which admit of recognizing the empty seeds by means of translucent light, are examined in this way on the diaphanoscope-tables, in use at my institute. It must be observed that it will not do to assume for convenience sake certain proportionate figures for the percentage of empty seeds in the coherent parts of grass-ears. In many cases they will have to be plucked out and examined separately. In order to secure accurate results, complicated procedures are to be followed, which may be considered by some parties to be rather doctrinaire. An example of them is to be found in Appendix E.

Sieves must not be used in examinations by means of translucent light, unless we are sure that the percentage of empty seeds or impurity will not undergo an alteration.

5. Examination of seeds demanding a modification of the usual method.

Poa trivialis e. g. may contain *Poa compressa*, *Brassica Napus* may be mixed with *Brassica oleracea*, &c. In these cases the species being not easily separable are provisionally reckoned to the pure seed. So the “rough” purity of a mixture of 80 % *Poa trivialis* and 10 % *Poa compressa* and 10 % other impurities, will be 90 %. Of this imperfectly homogeneous “rough pure seed”, 100 seeds are told off and determined carefully one by one. In the report of the given sample, it is stated that the purity amounts to about 90 %, but that there are 10 seeds of *Poa compressa* in every 100 pure seeds. In calculating the “approximate use-value” in this case, we proceed from an “approximate” purity-figure of 90 %. This way of proceeding does not guarantee an accurate percentage, but it will prevent differences in the results, which would otherwise be altogether unavoidable. Only in this manner f. i. is it possible to test *Brassica*-mixtures or some *Beta*-mixtures that might want a complete cultivation on the field.

An analogous method is to be followed for the valuation of the percentage of diseased seeds, which is made at our institute chiefly for corn and leguminous plants. We have now considerable experience in this matter. In many cases we are able to distinguish at sight diseased seeds from sound ones, and we have used our best endeavours to obtain sound “pure seed” for the determination of the germinating power. Much can be done in this respect with a highly trained staff and a good deal of practice. Just these conditions however are apt to lead to dissimilar results, which we should wish now to eliminate if possible. Finally I have come to adopt a very radical precept. In determining the purity of corn or leguminous plants, no attention is paid to the state of health or to the presumable state of health of the seeds, even though they should be recognizable by a practised expert. All the seeds that — apart from the

state of health — can be reckoned to pure seed, are considered as such. Thereupon, again 100 specimens are carefully told off and examined mycologically after germinating. In the report it is stated that the purity is $x\%$ and that of 100 seeds considered as pure, $y\%$ are infected with *Fusarium*, or another disease as the case may be.

6. Partial germinating of seeds. Seeds showing already an initial germination.

Shooting of cereals and other seeds will bring about many difficulties in the examination. If you investigate the effect of shooting upon germinating power (and we did so in a great number of cases) you will often be surprised at the slight damage caused. Consequently, the assertion that all shot seeds has to be reckoned to the impurity is untenable. There is no room here for a description of the several methods for surmounting the difficulties mentioned. Only the observation of a great many cases and much experience scrupulously verified, can show the right way here. The said experience, however, is often found wanting; depending upon it would lead us to a slippery road; learned speculations are of no practical use, but the thing that matters is a figure obtained by methods that can be easily put in practice by every one, so that errors in analyses and divergent results are out of the question. In this way only can unification be effectuated. That is why I came to consider shot corn as purity, except in extreme cases. Whether the seed that contains much shot is really of inferior quality, yes or no, will yet become evident at the determination of the germinating power. Consequently it cannot be right to state only the purity, or only the germinating power, when determining the quality of corn.

Gentlemen, we now are approaching a limit which I must not cross. I did not purpose to write a book on determining the purity of seeds, or on the methods adopted at Wageningen. I only intended to illustrate the latter with some examples. It was another desire that made me travel all the way to fair Copenhagen. I wanted to witness a cordial hand-shake between the many who have to till the same field; I wanted to find mutual fresh co-operation. May this congress be a mean for leading to international collaboration, for opening very widely the international doors.

APPENDIX C.

Form for Certificate for International grading of Seeds.

f. i.

Seed Testing Station for

(Government Station for International grading of Seeds —

Internationale Samenkontrollstation für die Gradbestimmung von Sämereien —

Station internationale pour la graduation des semences).

Sample: *Marked:* *Sealed:*

Muster: *Gemarkt:* *Gesiegelt:*

Echantillon: *Marqué:* *Cacheté:*

Registernummer: *Received:*

Buchnummer: *Empfangen:*

Numéro du registre: *Reçu:*

Fee: *Grade:*

Gebühr: *Grad:*

Frais: *Grade:*

.....
Director.

Direktor.

Directeur.

APPENDIX D.

The quantities to be weighed and sifted for each single determination of the purity, as usual in Wageningen, are running as follows:¹⁾

200 Grammes for all large-seeded species or varieties of *Lupinus*, *Phaseolus*, *Vicia Faba* and *Zea Mais*;

100 Grammes for *Pisum* and less large-seeded species, resp. varieties of *Phaseolus* and of *Vicia Faba*;

50 Grammes for grains of cereals;

25 Grammes for *Beta*, *Cannabis*, *Cucumis*, *Cucurbita*, *Ervum Lens* and *Polygonum Fagopyrum*;

15 Grammes for *Raphanus*, *Scorzonera* and *Spinacia*;

10 Grammes for *Allium*, *Camelina*, *Foeniculum*, *Linum usitatissimum*, *Pinus silvestris* and other tree seeds of equal size and *Trifolium incarnatum*;

5 Grammes for *Anthriscus*, *Anthyllis*, *Arrhenatherum*, *Carum*, *Festuca pratensis*, *Lolium*, *Medicago*, *Melilotus*, *Pastinaca* and *Trifolium pratense*;

3 Grammes for *Anethum*, *Brassica*, *Cichorium*, *Lactuca sativa*, *Lotus corniculatus*, *Lotus tenuifolius*, *Petroselinum*, *Sinapis*, *Spergula* and *Valerianella*;

2 Grammes for *Alopecurus*, *Cynosurus*, *Dactylis*, *Festuca (ovina, duriuscula and rubra)*, *Holcus lanatus* (peeled), *Lotus uliginosus*, *Phleum pratense*, *Portulaca*, *Trifolium hybridum* and *Trifolium repens*;

4 × 1/2 Gramme for *Anthoxanthum* and *Holcus* (rough);

1 Gramme for *Apium*, *Daucus*, *Papaver* &c.;

0,5 Gramme for *Agrostis*, *Avena flavescens* and *Poa*;

0,25 Gramme for *Nicotiana*.

APPENDIX E.

Examination of *Holcus lanatus* (with husk) and of *Anthoxanthum odoratum*.

A quantity of 2 grammes is divided into four equal parts. Each part (consisting of 1/2 gramme) is examined by another assistant, the ordinary method being at first employed (naked caryopses are counted as "pure seed", and "the seed" afterwards examined by means of translucent light from below, empty glumes being counted as harmless impurities). The full "seeds", together with the caryopses which from the outset have formed part of the "seed", are classed as pure seed. In order to get a better control in this examination the seeds are husked, if the caryopses are full, and at the end of each test the following must be weighed:

1. Noxious impurities;
2. Harmless impurities;
3. Naked caryopses;
4. Seeds, full at the outset, but husked during the test.

(No. 3 and 4 are classed as pure seed.)

In testing for germination, only the naked caryopses are taken.

APPENDIX F.

Méthode pour l'Examen des graines de betteraves, actuellement usitée à la Station des Essais des Semences de l'État à Wageningen.

La Prise des Echantillons.

Après avoir écarté les graines sur un baquet à mêler et après les avoir scrupuleusement-mélangées, on en prend ci et là de petites quantités, jusqu'à un total pesant 25 grammes.

¹⁾ Each determination is carried out in duplicate.

L'Examen de la Pureté.

A cet effet on jette 2×25 grammes obtenus de la façon décrite ci-dessus sur un appareil secoueur, actionné par un moteur électrique muni de deux tamis dont les fentes ont une largeur de 2 m. M. On secoue les graines pendant une demi-minute précise.

Tout ce qui passe aux tamis est ramassé et compté parmi les impuretés. Donc les graines d'un diamètre au dessous de 2 m. M. ne sont plus comptées parmi la «semence pure». De temps à autre (si les lots n'ont pas été bien nettoyés) on fera bien de les frotter légèrement entre les deux mains, pour détacher au moins une partie des bractées et des pédoncules adhérents, opération qui n'a de succès qu'avec de la graine bien sèche; dans les échantillons humides les déchets sont résistants et ne se détachent pas aisément; plus tard, à l'examen de la pureté, on éloigne tous les pédoncules (et bractées) adhérents à l'aide d'une pincette. En même temps on éloigne les graines qui ne contiennent aucune semence, pour être comptées parmi les impuretés non nuisibles. En outre, on trie les semences de mauvaises herbes se trouvant entre les graines et on les compte avec les impuretés nuisibles.

L'Examen de la Faculté Germinative.

On part du principe que les 4×100 graines, nécessaires pour la détermination de la faculté germinative, doivent autant que possible représenter proportionnellement toutes les graines se trouvant dans l'échantillon. A cet effet on assemble la graine provenant de deux déterminations de pureté parallèles, et on jette la quantité totale de 45—50 grammes sur un appareil de tamis dont les fentes ont une largeur successivement de 6, 5, $4\frac{1}{2}$, 4, $3\frac{1}{2}$, 3, $2\frac{1}{2}$ et 2 m. M. Les tamis sont soumis pendant 5 minutes à un mouvement oscillatoire compliqué, qui paraît faciliter au plus haut degré le passage des graines aux tamis. Après ce tamisage on compte séparément les graines se trouvant sur chacun des tamis, par conséquent le nombre de toutes les graines qui ont une grosseur de 2 à $2\frac{1}{2}$ 5 à 6 m. M. Ensemble elles constituent le nombre total des graines qui forment la «semence pure», dont on prend les quatre petits échantillons qui doivent servir à la détermination de la faculté germinative. On calcule maintenant au moyen d'un calculateur arithmétique combien de graines il faut prendre dans chaque tamis pour obtenir pour chaque essai parallèle exactement 100 graines formant une moyenne aussi parfaite que possible. Dans le cas où le total de ces graines serait de 99 ou de 101 on ajoute ou on ôte 1 graine à celles qui sont relativement les plus nombreuses. Avant de mettre les 4×100 graines dans les lits à germer, elles sont, après le pesage, exposées à de l'eau courante. Pendant $3\frac{1}{4}$ —4 heures on les lave en cette eau courante, ayant soin de tenir les lots de 100 graines de chaque essai à l'écart des autres lots destinés à la germination. A cet effet on fait usage d'un appareil de lavage et de trempage spécialement construit, lequel permet de laver et de tremper simultanément 56 petites quantités destinées à la germination. Il faut que les quatre lots chacun de 100 graines soient pesés séparément avant le lavage; d'abord pour pouvoir calculer le nombre total des germes par kilo et ensuite, parce que les poids par centaine de graines ne doivent pas différer de plus de 10% du poids moyen de 100 graines, qui a été déduit du poids total et du nombre total des graines se trouvant dans l'ensemble des tamis. Dans le cas où de grandes différences se présenteraient, il faut renouveler la prise des échantillons. On écarte les graines trempées dans des baquets de germination ouverts en zinc; on place ces baquets dans les thermostats. Ces baquets, ouverts et à fond perforé, me donnent plus de satisfaction que les lits à germer à couches de sable. La cause en est probablement que l'apport de l'oxygène est bien mieux réglé que dans les lits à germer à couches de sable, condition à laquelle les graines des betteraves sont très sensibles. L'usage de baquets ouverts à fond perforé, placés à leur tour dans de grands baquets en zinc également pourvus d'un fond perforé, dans des thermostats bien aérés, garantit le plus haut degré d'apport d'oxygène.

Un élément de grande importance pour la germination, c'est le degré d'humidité du lit à germer. Si d'une part on doit empêcher la dessiccation du lit à germer, d'autre par l'apport d'un excédent d'eau, ne fût ce qu'une quantité minime, doit être

rigoureusement évité. En mettant les graines dans les baquets, on arrose chaque lit à germer de la même quantité d'eau à l'aide de petits gobelets, gradués spécialement fabriqués pour l'humectation des lits à germer avec une quantité d'eau déterminée. Lors de l'inspection quotidienne le degré d'humidité de chaque baquet est contrôlé et chaque baquet est arrosé, selon le besoin, par des employés expérimentés. La germination a lieu à des températures qui varient régulièrement entre :

18—20° C (pendant 18 heures) et

29—30° C (pendant 6 heures).

L'intermittence des températures se fait de deux manières :

- a. Les baquets restent dans leur thermostat ; l'intermittence des températures se fait par la baisse et la hausse de la température, moyennant l'embrayage et le débrayage automatiques d'un brûleur auxiliaire, à l'aide de deux régulateurs et d'un mouvement d'horlogerie.
- b. Périodiquement les grands baquets, qui renferment les petits baquets à graines, sont transférés en d'autres thermostats qui ont la température désirée, soit plus haute, soit plus basse. On inspecte les graines germantes les 3^{ième}, 5^{ième}, 10^{ième} et 16^{ième} jours ; on écarte les graines qui ont poussé des germes, ou bien on les tient à l'écart après avoir éliminé les germes, dans le cas où l'on désire savoir le nombre total des germes par centaine ou par kilo de graines. Nous satisfaisons encore actuellement aux demandes spéciales faites à ce sujet. Du reste dans les cas normaux on calcule la faculté germinative exclusivement comme le pourcentage des graines fécondes, c'est à dire on la déduit du pourcentage de graines fécondes, produisant chacune en soi un germe au moins.

Professor Johannsen thanked Director Bruijning, and the subject was opened for discussion.

Director Bruijning replied that this is a question for international co-operation.

Professor Johannsen suggested that the word "grade" might be substituted for "agricultural value" used in old times.

Approves of Mr. Bruijning's definition :

$$\text{Grade} = \frac{\text{Purity} \times \text{Germinating power}}{100} \div 3 \times \text{percentage of weeds.}$$

M. Léon Bussard, Directeur adjoint de la station d'essais de semences, Paris, demande qu'on donne une définition du terme «mauvaises herbes». D'après la loi américaine les semences peuvent contenir jusqu'à 3 % de «mauvaises herbes».

Sir Lawrence Weaver expressed pleasure in Mr. Bruijning's paper, and referred to the differences between the so-called "Continental" and "Irish" methods. From August 1, 1921 the Irish method will go out of use in England and Scotland, but will continue in Ireland. New regulations will be established in England and Scotland.

Sir Lawrence Weaver emphasized a point mentioned in Mr. Bruijning's paper, i. e. the desirability of sending members of the staffs of seed testing stations to foreign stations to learn methods. At present two members from the English State Seed Testing Station are here in Copenhagen at the Danish State Seed Testing Station. However financial difficulties are to be overcome. Is exchange feasible? All countries are suffering from lack of funds and lack of lodgings. The matter is important and must be kept in mind.

Mr. Bruijning stated that there is no absolute standard in the different countries for the term "grade", but he considered the definition used in this paper the best.

Suggested that a committee be appointed to discuss the question of "noxious seed".

Professor Dr. A. Voigt, Direktor des Staatsinstituts für angewandte Botanik, Hamburg:

„Der Einführung eines neutralen Wortes für $\frac{\text{Reinheit} \times \text{Keimfähigkeit}}{100}$

stimme ich zu. Wir sollten ferner den Kampf gegen das Unkraut intensiver aufnehmen durch Aufhöhung der gefundenen Prozente, wie es in Dänemark bereits geschieht. Für jedes Prozent Unkraut mehr als garantiert werden 15 % des Preises als Ersatz bezahlt“.

Hofrat Dr. Arpad v. Degen, Oberdirektor der königlich ungarischen Samenkontrollstation in Budapest:

Approved Mr. Bruijning's definition of the term "grade". "The introduction of this term is — as it also was the case with regard to the designation "intrinsic value" — a matter of agreement. The strict judgment of the weed seeds is an advantage; the fight against the weeds is one of the most important problems of the seed control; but it is a question whether the weed seeds are not too strictly judged by the term "grade". It is by the purity determination already once subtracted. According to this proposal it is still further 3 times subtracted. It is difficult to introduce the term into a country where the term is regulated by law (in Hungary for inst.). New regulations would be necessary, but these will surely be passed. How commerce will accept the new term, is a question. This is a subject for international discussion and settlement”.

„Ich halte den Vorschlag Direktor Bruijnings bezüglich Einführung der Bezeichnung „Grad“ für annehmbar. Seine Einführung wäre — wie dies ja auch bei der Bezeichnung „Gebrauchswert“ der Fall war — Sache des Übereinkommens, das vorerst zustande gebracht werden müßte. Ich erkenne den Vorteil, den die strenge Beurteilung der Unkrautsamen mit sich bringt; der Kampf gegen das Unkraut ist ja eine der wichtigsten Aufgaben der Samenkontrolle. Es fragt sich aber, ob in der Formel „Grad“ die Unkrautsamen nicht zu streng beurteilt werden. Sie werden nämlich bei der Reinheitsbestimmung schon einmal abgezogen, nun sollen sie dem Vorschlage nach noch dreimal abgezogen werden. Eine weitere Frage ist es auch, wie der Handel sich zu dem Begriff „Grad“ stellen wird. Ferner würden Schwierigkeiten überall da erwachsen, wo — wie z. B. in Ungarn — alle diese Bezeichnungen gesetzlich festgelegt sind.

Es müßten also diese gesetzlichen Bestimmungen abgeändert

werden, wozu aber nötigenfalls die betreffenden Regierungen ihre Zustimmung sicher nicht versagen werden“.

Mr. George H. Clark, Seed Commissioner, Ottawa, Canada, expressed his pleasure in Mr. Bruijning's paper. As president of the Association of Official Seed Analysts of North America he represented both the United States of America and Canada. This association holds annual meetings. The general policy is to test grass seeds according to the Continental method. The seed-merchants of North America favor this. However it is believed by many in the United States and Canada who sow by machine (bulk) that it is better to use the Irish method. Percentage of germinable seeds is to include all in the bulk. All staple commodities, such as cereal grains, dairy products, meat &c., are sold on basis of grade according to a fixed standard of quality. This does away with many difficulties. The Canadian Seed Control Act which has been in force for 10 years is very satisfactory. Grade is fixed as Extra No. 1, No. 1, No. 2, No. 3 and "rejected". This includes the general quality of the seed. When a selection of special seed is required this name is added to the grade, for inst. Irish No. 1 Red clover. Hoped that Europe will adopt "grade" as basis for quality as it is better than "germinating power".

Dr. Y. Buchholz, Directeur chef de la station d'essais de semences de l'état, Christiania,

did not wish to oppose the term "grade", but the word suggested a mathematical formula. According to the pure seed it is still easy, but when also the weed is to be taken into consideration it is more difficult, because the weed not only is different injurious for the different species, but also at the different times. It seems gratuitous to subtract the figure 3 times the weed seed. The question is difficult, unless

$$\text{grade} = \frac{\text{Germinating power} \times \text{Purity}}{100}$$

A more definite formula is difficult to fix.

„Ich will nicht Stellung gegen das Wort „Grad“ nehmen. Man denkt jedoch bei „Grad“ an einen bestimmten Teil eines Maßes. Einen passenden Ausdruck zu finden wird schwierig sein. Mit den reinen Samen ist es noch einfach; wenn aber das Unkraut mitberücksichtigt werden soll, wird es schwieriger. Das Unkraut ist nicht allein verschieden schädlich nach den verschiedenen Arten, sondern auch zu verschiedenen Zeiten. Die Zahl 3 (oder irgendeine andere Zahl) mal Prozente Unkraut in Abzug zu bringen, scheint deshalb ganz willkürlich, und ich halte prinzipiell auf die einfache Formel:

$$\frac{\text{Reinheit} \times \text{Keimfähigkeit}}{100}$$

auch für den Fall, daß der Ausdruck „Grad“ eingeführt wird“.

Mr. Dorph-Petersen stated that the matter should be referred to a committee, and asked if "grade" means the intrinsic value. Asked further why the figure stating the percentage of weight of weed-seeds was just multiplied with 3.

Professor Dr. A. Voigt asked Mr. Clark what he meant by "grade".

Mr. Clark:

"All seed of red clover, timothy and alsike must be sold under 1st, 2nd, 3rd grade and "rejected". This is established by a committee.

Tentative Draft of Standard Grades Red Clover Seeds — Canadian.

(Prepared to conform to the British seed control regulations. Statement of percentages, are only suggestive.)

Extra No. 1. Export Red Clover seed shall be mature, sound, plump, of good colour dry and sweet, well cleaned and graded, free from the noxious weed seeds prescribed by the British Ministry of Agriculture and contain not less than 99% pure and 95% germinable seeds.

No. 1. Export Red Clover seed shall be mature, sound, plump, of good colour, dry and sweet, well cleaned and graded, free from dodder, contain not less than 98% pure red clover seed, not more than one tenth of one per cent by number of the other noxious weed seeds prescribed by the British Ministry of Agriculture, and not less than 93% germinable seed.

No. 2. Export Red Clover seed shall be reasonably mature, sound, well cleaned, of medium colour, dry and sweet, free from dodder, contain not less than 92% pure red clover and 97% pure red clover, alsike, timothy, and other useful seeds, not more than one-fifth of one per cent by number of the other noxious weed seeds prescribed by the British Ministry of Agriculture, and not less than 90% germinable seeds.

No. 3. Export Red Clover seed shall be reasonably mature, sound, cleaned, dry and sweet, contain not less than 87% pure red clover and 95% pure red clover, alsike, timothy, and other useful seeds, free from dodder, not more than one half of one per cent by number of the other noxious weed seeds prescribed by the British Ministry of Agriculture, and not less than 85% germinable seeds.

"Red Clover Mixture" shall be the designation of any mixture in which red clover seed predominates, and any certificate of grade issued therefore shall include a statement of the kinds and the per cent of each kind of clover and grass seeds which compose more than 5% of the mixture, and shall in all other respects conform to the defined standards of quality for No. 1, No. 2, and No. 3 grades provided for "Export Red Clover Seed".

Exporters will conform to any definition of noxious seed passed by this congress if only something can be passed".

Mr. Dorph-Petersen:

"The terms "sound", "sweet" &c. must be defined accurately. What are they reduced to figures? The Danish State Seed Testing Station deals only with such".

Mr. J. Widén, Directeur de la station de chimie agricole et d'essais de semences, Örebro, Suède,

agreed with Mr. Bruijning that it is important to appoint a committee to discuss "grade". However we were not yet sufficiently advanced to decide on the numerical insignia for the terms used in defining "grade".

„Ich meine, wie Direktor Bruijning, es wäre gut, einen Einheitsbegriff für den Wert des Samens einzuführen. Wir sind nur nicht so weit gekommen, daß wir den Wert in einer Zahl festlegen können. Wenn man

den Prozentsatz des Unkrautes mit 3 multipliziert, so kann dies nicht immer richtig sein. Unkraut ist sehr verschieden schädlich. In einem staatsplombierten Rotklee darf in Schweden bis 1% unschädliches Unkrautsein; wenn es aber schädlich ist, dürfen nicht mehr als höchstens 500 Körner im Kilogramm der Ware (ca. 0,1 %) sein“.

Mr. C. B. Saunders, Director Chief Office, Official Seed Testing Station, London, wished to say a few words in regard to the payment of the staff. At present the Treasuries of most countries do not appear to look on seed testing as skilled work. The result is that salaries are too low and the work tends to become a “blind alley” occupation. In regard to Appendix A of Mr. Bruijning's paper — “purity tests on grasses and clovers” — we have found that in the British Isles we were wrong in Continental eyes in our tests of grasses, but we thought our method agreed with the Continental method for testing clover. How were the Irish tests on clovers referred to by Mr. Bruijning made? On August 1, 1921 new regulations will come into effect. In these the percentage of germination in mangolds and beets will be computed on the percentage of germinated clusters.

On page 5, appendix to Mr. Bruijning's paper is a discussion of partial germination of seed, — “sprouted” or “shot” seed. Does a sprouted seed count as an impurity?

Sprouted seed was listed as an impurity in the British seed regulations passed 3 weeks ago.

Mr. Dorph-Petersen declared that in Denmark, Sweden and Norway sprouted seed is considered dead; also in Germany.

Dr. A. Volkart, Direktor der Samenuntersuchungs- und Versuchsanstalt in Oerlikon-Zürich, Schweiz:

“The question of sprouted seed is a complicated one. It varies for various seeds. Oak seeds often go into trade already sprouted. These however are always of good germination. This is often true of other large seeds. In small seeds sprouted seeds are worthless. In grading clover and grasses, attention should also be paid to the provenience of the seed. The fine Italian Red Clover for instance would certainly always be graded first class, though it is not a good seed

„Die ausgekeimten Samen können nicht immer zum Unreinen gerechnet werden. Eicheln z. B., die in den Handel kommen, sind fast immer ausgekeimt und keimen doch noch ganz gut. Dasselbe ist oft der Fall mit andern großkörnigen Samen. Bei den feinkörnigen Samen sind dagegen die ausgekeimten Samen meist wertlos. Das amerikanische Verfahren der Gradierung der Saaten ist sehr beachtenswert; wenn es aber auch in Europa eingeführt werden sollte, so müßten wir unbedingt die Herkunft

for the greatest part of Central Europe.

der Saat mitberücksichtigen. Italienischer Rotklee z. B. würde wohl fast immer als „1st. Grade“ beurteilt werden, obschon er für den größten Teil des mittleren Europas ganz ungeeignet ist“.

Mr. T. Anderson, Director of the Official Seed Testing Station, Edinburgh, Scotland, wished to say a few words about grading applied to Scotland. Rye-grass, timothy and cereals only are grown for seed. The question of grade must there be considered from the point of view of the buyer. When the general practice of stating the results of analyses was adopted seeds were tested according to the Continental system. If the purity was too low it was not stated; germination only was declared. This misled the buyers. In Great Britain merchants used seed analysis chiefly for purposes of advertisement. They have now, however, adopted government seed-control.

It is impossible to go beyond a figure stating pure germinating seed which has any international significance. The seed control stations in each country must define the further terms. Noxious seeds vary. Dodder for inst. is not of importance in Scotland; elsewhere it is common.

Proposal to be put before the Seed Testing Conference at Copenhagen 1921.

The ultimate object of seed analysis is to ensure that the farmer receives a true and easily understood description of the seed which he purchases.

The present method of describing seeds in terms of the results of analyses of purity and germination is not intelligible to the general farming public because the percentage of germination does not refer to the whole sample but only to the portions left after the impurities have been removed.

Agricultural seeds are generally sold by weight and the buyer is entitled to know what percentage of the weight which he buys has the capacity to produce the species of plant which he desires.

The figure which expresses this information is that which indicates the percentage of pure germinating seed viz.

$$\frac{\text{purity \%} \times \text{germination \%}}{100}$$

The estimate obtained by means of this formula is the nearest approximation possible to the percentage weight which a sample contains of germinating seed of the species examined.

Submission is therefore made to the Conference that it should be adopted as a general practice of Seed Testing Stations to emphasize, in reports of analyses, the percentage of pure germinating seed, to the suppression of the result of the experiment on the germination of the pure seed.

Alternatively it is submitted that the percentage of pure germinating seed should be reported as the sole figure expressing the value of the seed as ascertained by analysis, and should be accompanied by separate statements of the percentage of impurity, and of the percentage of non-germinating seeds or portions of the seed or its accessory parts which normally occur in samples, the percentage weight of ungerminated seeds being estimated in the same way as the percentage of pure germinating seed.

*Example.***Trifolium pratense.**

Present Form of Report.		Proposed Form of Report.	
Purity	91.5 %	Pure germinating seed	56.0 %
Useful seeds	2.6 %	Hard seeds	26.0 %
Weed seeds	0.9 %	Broken and Dead seeds	13.5 %
Sand, broken seeds, foreign matter	5.0 %	Impurity (including)	4.5 %
	<hr/> 100.0 %	Useful seeds	2.6 %
Germination	61.0 %	Weed seeds	0.9 %
Hard seeds	28.0 %	Sand, foreign matter ...	1.0 %
Pure germinating seed	68.6 %		<hr/> 100.0 %

There is an objection to be made to conclusion 3, page 8 in Mr. Bruijning's article. It should be altered to read: "One or more members of the senior staffs proposing to come into the Seed Testing Union should come to a foreign station for 3 or 4 months".

Mr. Bruijning agreed that this is better than nothing, but preferred his own suggestion. — It was selected to multiply the content of weed seed with 3 because this figure seemed reasonable.

Professor Johannsen:

"The meeting is now adjourned until 9:30 A. M. June 7, when it will assemble in the Assembly Hall of the Agricultural Union, Vester Boulevard 4, where the meetings will be held hereafter".

„Die Sitzung ist für heute geschlossen. Wir werden uns morgen, Dienstag, den 7. Juni, um 9 1/2 Uhr in „Landbrugsraadets“, Versammlungssaal, Vester Boulevard 4, wo die künftigen Sitzungen abgehalten werden, versammeln.“

7. Juin 1921.

Professor Johannsen

called the meeting to order and welcomed Mr. Bogdan Ferlinc, the colleague from Servia, Slovenia and Croatia, after which he gave the floor to Dr. Volkart.

eröffnete die Sitzung und hieß Bogdan Ferlinc, den Kollegen von Serbien, Slovenien und Kroatien, willkommen, wonach er das Wort Dr. Volkart erteilte.

Dr. Volkart

read a paper on the following subject: "The determination of the origin of agricultural seeds".

hielt einen Vortrag über folgenden Stoff:

„Die Herkunftbestimmung der Saaten.“

Von

Dr. A. Volkart, Direktor der Samenuntersuchungs- und Versuchsanstalt Oerlikon-Zürich.

„Mein Amtsvorgänger, Herr Dr. Stebler, hat auf der ersten internationalen Konferenz von Vorständen der Samenuntersuchungsanstalten in Hamburg im September 1906 einen Vortrag über die Herkunftbestimmungen der Saaten gehalten. Er hat damals Verzeichnisse der Unkrautsamen, die für die Bestimmung der Herkunft eines Saatgutes maßgebend sind, und die zum größeren Teil in Zürich bestimmt worden waren, vorgeführt und dabei

die besonders häufigen und charakteristischen hervorgehoben. Sie dürfen nun von mir nicht erwarten, daß ich diese Verzeichnisse heute ergänze und die einzelnen Arten näher bespreche; ich möchte vielmehr heute zwei Fragen näher untersuchen:

1. ob es nicht notwendig sei, bei den Herkunftsbestimmungen neben den eigentlichen bestimmenden Arten auch allen übrigen Unkrautsamen mehr Beachtung zu schenken als bisher, und
2. ob nicht zu den Herkunftsbestimmungen eines Saatgutes alle seine Merkmale, nicht bloß die Unkrautsamen, herbeigezogen werden sollten.

Es ist möglich, daß durch die Ausführungen von Herrn Dr. Stebler der Eindruck erweckt worden ist, daß wir in Zürich bei den Herkunftsbestimmungen fast ausschließlich auf diejenigen Unkrautsamen abstellen, die nur in einer bestimmten Provenienz vorkommen, die also für diese charakteristisch sind, und die wir hier als **Leitarten** bezeichnen wollen. Wir haben aber auch seit jeher bei diesen Untersuchungen den übrigen Arten, den **Begleit-samen**, alle Aufmerksamkeit geschenkt, indem bei jeder Bestimmung alle vorkommenden Arten notiert wurden. Man kommt so zu einem Gesamtbilde der Unkrautflora einer Saat, das den gefundenen Leitarten erst den richtigen Rahmen gibt, und das Gewicht dieser Leitarten und damit die Sicherheit der Herkunftsbestimmung erhöht. Die gleiche Beobachtung wird wohl auch an anderen Anstalten gemacht worden sein, und doch wird nicht geleugnet werden können, daß man bisher diese Begleitarten gegenüber den eigentlichen provenienzbestimmenden Arten etwas zu sehr vernachlässigt hat, und daß sie uns die Herkunftsbestimmungen fühlbar erleichtern könnten, wenn wir uns durch methodische Untersuchungen größere Klarheit über ihr Auftreten verschaffen würden, wenn wir namentlich versuchen würden, einen Einblick in die Bedingungen zu erhalten, die ihr Auftreten regeln. Hierüber wissen wir noch sehr wenig. Wir können nur annehmen, daß es abhängig ist

1. vom Zeitpunkt des Reifens der Hauptart,
2. von ihrer Pflege und Nutzung,
3. von der Art ihrer Reinigung,
4. vom Boden des Ursprungsgebietes,
5. von seinem Klima.

Je später die in Frage kommende Samenart reift, um so mehr Begleitarten vermögen mit ihr Schritt zu halten und gleichzeitig mit ihr Samen zu reifen, ein Umstand, der ja auch zur Bestimmung der Echtheit herangezogen werden kann, z. B. bei der Unterscheidung von *Poa pratensis* und *Poa compressa* nach dem Vorkommen von Timothesamen. Später reifende Sorten und Abarten einer Kulturpflanze werden deshalb stets auch eine etwas anders zusammengesetzte Unkrautflora besitzen als früher reifende. Wichtig ist natürlich auch, ob die Samengewinnung vom ersten oder zweiten Schnitt erfolgt. Es ist bekannt, daß beim Rotklee im mittleren und östlichen Europa stets der zweite Schnitt zur Samengewinnung verwendet wird, während andernorts auch vom ersten Schnitt Samen gewonnen werden.

Daß Nutzung und Pflege der Samenkultur einen großen Einfluß auf den Unkraut-samengehalt eines Saatgutes hat, leuchtet ohne weiteres ein. Ebenso wird die Reinigung eine Verschiebung der beigemengten Unkrautsamen bedingen, wenn diese Veränderung auch tatsächlich nicht so stark ist, wie man wohl von vornherein annehmen möchte.

Sehr zu beachten ist natürlich auch der Einfluß des Bodens. Man darf nie vergessen, daß Arten wie *Medicago sativa* und *lupulina*, *Atriplex patulum*, *Silene inflata*, *Sinapis arvensis*, *Centaurea jacea* und *Matricaria inodora*, *Ranunculus acer*, *Daucus carota*, *Anagallis arvensis*, *Sherardia arvensis* kalkhaltigen, absorptiv gesättigten Boden bevorzugen, und daß, wenn diese Arten in starkem Maße in einem Saatgut auftreten, darin neben dem Einfluß des Klimas auch der des Bodens zum Ausdruck kommt. Dagegen sind die meisten Trifolien, auch *Lotus* und namentlich *Anthyllis*, sodann *Vicia hirsuta*, die beiden *Holcus*-arten, die *Rumex*-arten aus den Gruppen der *Acetosae* und *Acetosellae*, *Brunella*, *Anthemis arvensis* nicht so anspruchsvoll an den Kalkgehalt des Bodens; sie kommen auch auf absorptiv

ungesättigten Bodenarten, auf Boden, der also zur Säurebildung neigt, vor, und wenn wir daher die erste Gruppe zum Beispiel vorherrschend in französischem Rotklee, die zweite in böhmischer Saat finden, so spricht sich darin nicht allein das Klima, sondern auch der Einfluß des Bodens aus, der in den französischen Produktionsgebieten vorherrschend kalkreich ist, während er in Böhmen aus kalkarmem Urgestein hervorgegangen ist. In gleicher Weise können in der Unkrautflora einer Saat Einflüsse des Feuchtigkeitsgehaltes und der Dispersität des Bodens, die ja beide miteinander zusammenhängen, zum Ausdruck kommen. Boden geringer Dispersität, also Sandboden, nährt eine ganz andere Unkrautflora als Boden hoher Dispersität (schwerer, feuchter Tonboden). Wenn wir z. B. *Poa trivialis* in einer Saat finden, so wird das immer ein Fingerzeig sein, daß die betreffende Saat auf schwerem feuchtem Boden gewachsen ist.

Weitaus am wichtigsten aber ist doch der Einfluß des Klimas auf das Auftreten der Unkräuter, und damit ist eben die Möglichkeit der Beurteilung der Provenienz auch aus Unkrautsamen zu geben, die mehr oder weniger kosmopolitisch sind, die also nicht wie die eigentlichen Leitarten ein engbegrenztes Verbreitungsgebiet besitzen.

Zunächst muß ich nun die Frage besprechen, warum die Leitarten, die eigentlichen Provenienzunkräuter, sich außerhalb ihres Ursprungslandes in den Kleefeldern und in den übrigen Kulturen in der Regel nicht entwickeln, und warum sie, verschleppt, meist nur auf sogenanntem Ödland, d. h. auf steinigem, vegetationsarmem Lande, vorkommen. Wir haben früher schon (im XXII. Jahresberichte der Schweiz. Samenuntersuchungs- und Versuchsanstalt 1898/99, S. 37) darauf aufmerksam gemacht, daß sich dies für die amerikanischen Arten sehr leicht daraus erkläre, daß diese Arten spät blühen und spät Samen reifen, und daß es ihnen daher ganz unmöglich sei, bei uns gleichzeitig mit dem Klee oder mit einem unserer Hauptgräser reife Samen zu entwickeln. Wir ernteten von ihnen in unseren Versuchsfeldern erst ausgangs September, meist aber erst im Oktober reife Samen. Zudem handelt es sich ja in der Regel um einjährige Gewächse. Werden sie mit dem Klee geschnitten, so entwickeln sich die meisten nicht mehr. Amerikanische Leitarten wird man daher nur ausnahmsweise, d. h. nur unter für sie besonders günstigen Bedingungen, in Europa auf Kleefeldern antreffen. Daß sie bei uns gleichzeitig mit dem Kleesamen reifen, ist höchstens für *Plantago Rugelii* zu erwarten, von den andern eigentlich amerikanischen Arten nicht.

Etwas anders verhalten sich die südlichen Arten. Sie treten auch im engern Mitteleuropa in Kleefeldern hie und da auf. Man trifft in trockenen Jahren hie und da Luzernefelder, in denen *Centaurea solstitialis*, *Ammi majus* und namentlich *Helminthia* zu finden sind. Dies ist aber nur dann der Fall, wenn der Bestand lückig ist, wenn also die fremde Art genügend Luft und Licht zur Entwicklung findet, und es besteht auch ein Unterschied insofern, als *Helminthia* offenbar leichter zur Entwicklung kommt, als die beiden andern. Für eine Art mit den Eigenschaften des *Arthrobotrys*, das ja eine der wichtigsten Leitarten für die Erkennung der französischen und italienischen Saaten ist, scheint eine Entwicklung in nördlichen Gegenden überhaupt ausgeschlossen zu sein. Andere südliche Arten können sich dagegen, wie gesagt, auch in nördlichen Breiten in den Kulturen gelegentlich bis zur Samenreife entwickeln. Gewöhnlich aber tritt dies nicht ein. Die Samen, die mit fremdländischem Saatgut zur Aussaat kommen, werden zwar keimen, aber sie können in ihrer Entwicklung mit dem Klee nicht Schritt halten und werden so von ihm unterdrückt. Es wiederholt sich hier die gleiche Erscheinung, die wir in der landwirtschaftlichen Praxis so oft beobachten. So schadet ja z. B. der Ackersenf nur im Sommergetreide, aus dem einzigen Grunde, weil er erst im Frühjahr keimt. Im Wintergetreide keimt er zwar im Frühjahr auch, vermag aber nicht mehr zur rechten Entwicklung zu kommen, weil er vom Wintergetreide beschattet und unterdrückt wird. Im Sommergetreide dagegen findet er, bis dieses zum Schossen kommt, Zeit zur Stärkung, sodaß er hier blüht und fruchtet. Gleiches muß auch der Fall sein mit den südlichen Unkräutern; sie kommen zwar zum Keimen, entwickeln sich aber infolge ihres Wärmebedürfnisses langsamer und werden so von der rascher wachsenden Hauptart unterdrückt. Nur in lückigen Beständen vermögen sie sich zu entwickeln. Deshalb werden sie sich dort nicht weiter ausbreiten; sie bleiben Ephemerophyten.

Was nun die osteuropäischen Unkräuter anbetrifft, so sollte man die leichte Akklimatisierung der *Silene dichotoma*, die sich ja als ursprünglich osteuropäische Pflanze binnen kurzer Zeit über große Gebiete Mitteleuropas ausgebreitet hat, nicht verallgemeinern. Gewöhnlich zeichnen sich die Unkräuter kontinentalen Ursprungs dadurch aus, daß sie erst bei hoher Bodentemperatur keimen (dies gilt auch für nordamerikanische einjährige Arten). Die Folge davon ist, daß, wenn sie bei uns zu keimen beginnen, die übrigen Pflanzen und namentlich der Klee sich schon stark entwickelt haben, und es ihnen in der Folge an Licht und Bodenraum gebricht. Sie werden unterdrückt. Sie sind eben angepaßt an kontinentale Verhältnisse, wo der Übergang von der kalten zu der warmen Jahreszeit viel rascher erfolgt, und wo deshalb die Vegetation mit einem Male erwacht. Hier vermögen sie sich auch in Kulturen zu halten, in unserm gemäßigten Klima dagegen nicht. Ganz so leicht ist es daher auch den Unkräutern des kontinentalen Klimas nicht, sich in gemäßigtem Klima in Kulturen einzubürgern.

Bei allem ist übrigens noch eins nicht zu übersehen: In unserm gemäßigten Klima entwickeln sich Klee und Gräser viel stärker, als in kontinentalen und warmen Erdstrichen. Sie werden namentlich umso stärker und üppiger, je feuchter das Klima ist. Das erschwert das Aufkommen einjähriger Arten, die sich jedes Jahr vom Samen zur fruchtenden Pflanze entwickeln müssen.

In den Rotkleeproben, deren Untersuchungsergebnis später zu besprechen sein wird, fand sich nach der Dauer geordnet folgende Zahl von Unkrautarten:

	Frankreich		Rotklee aus der Tschechoslovakei		der Schweiz	
	Arten	%	Arten	%	Arten	%
Einjährige Unkräuter	25	39,1	18	47,3	14	27,4
Überwinternd einjährige Unkräuter	7	10,9	5	13,2	8	15,7
Zweijährige Unkräuter	7	10,9	5	13,2	3	5,9
Ausdauernde Unkräuter	25	39,1	10	26,3	26	51,0
	64		38		51	

Von den drei Produktionsgebieten hat die Schweiz das kühlsste und feuchteste Klima und daher am meisten ausdauernde Arten. Auch das ist ein Grund, der es vielen Unkräutern kontinentalen oder südlichen Ursprungs unmöglich macht, in gemäßigtem Klima in Kulturen aufzutreten.

Was hier nun aber für die eigentlichen provenienzbestimmenden Leitarten gesagt wurde, gilt auch mit Einschränkungen für die Begleitsamen. Es zeigt zwar ihr größeres Verbreitungsgebiet, daß sie an das Klima keine so bestimmten, scharfumrissenen Anforderungen stellen wie jene, daß aber doch ausgesprochene Unterschiede vorhanden sind, liegt auf der Hand, und diese Unterschiede sollten zugunsten der Provenienzbestimmungen beachtet werden.

Es gibt unter den Begleitarten bestimmte Arten, die wärmebedürftiger sind und deshalb im kühlen Klima mit andern Gewächsen nicht so gut zu konkurrieren vermögen. Sie treten deshalb hier nicht so häufig auf, sodaß sich ein quantitativer Unterschied feststellen läßt. Zu diesen Arten gehört z. B. *Verbena officinalis*, *Teucrium botrys*, *Malvaarten*, *Bupleurum rotundifolium*, vielleicht auch *Lotus* und *Cichorium*. Ebenso gibt es Arten, die überwinternd einjährig sind und dabei wohl den Winter des gemäßigten, nicht aber den strengen des kontinentalen Klimas gut auszuhalten vermögen. Das beste Beispiel dafür ist *Alopecurus agrestis*, ein Gras, das zwar auch im Frühjahr ausgesät zur Blütenbildung gelangt (das sich also nicht verhält wie das Wintergetreide), das aber keine Keimruhe besitzt und deshalb kurz nach der Reife schon im Herbst keimt. Im Osten fällt es dem strengen Winter zum Opfer. *Alopecurus agrestis* ist nach den Angaben von Celakowsky, Beck von Managetta, Hackel (in Halasey und Braun), Neilreich und andern schon im Gebiete der ehemaligen österreichisch-ungarischen Monarchie ein unbeständiges Gewächs. Etwas anders verhalten sich dagegen die gleichfalls überwinternd einjährigen *Valerianella*-Arten, die eine tiefere Keimruhe besitzen, und deshalb oft erst im Frühjahr

keimen, die monocyclischen Geranien und die Bromusarten aus der Gruppe der Zeo- und Stenobromus.

Ausgesprochene kontinentale Unkräuter sind die Panicumarten aus den Sektionen Miliaria, Digitaria, Echinochloa und Setaria, die alle spät keimen und deshalb ausgezeichnete Kennzeichen für östliche und amerikanische Herkunft sind, so namentlich Panicum lineare, sanguinale, crus galli und Setaria glauca.

Ich halte also dafür, daß eine aufmerksame und eingehende Prüfung der Begleitsamen auf ihre Verbreitung, und zwar unter Berücksichtigung der Mengenverhältnisse, in der die verschiedenen Arten auftreten, sicher viele Tatsachen ans Licht fördern würden, durch die die Beurteilung nach den eigentlichen Leitsamen ergänzt und befestigt würde. Ich werde später auf einige kleinere, allerdings in ihren Ergebnissen nicht ganz befriedigende Versuche in dieser Richtung noch zu sprechen kommen.

Nun zur zweiten der eingangs gestellten Fragen, nämlich, ob nicht zur Herkunftsbestimmung eines Saatgutes alle seine Merkmale, nicht bloß die Unkrautsamen, herbeigezogen werden müssen. Als solche Merkmale kommen in Betracht: andere Beimengungen mineralischen und tierischen Ursprungs, das Tausendkorngewicht, die Farbe, die chemische Zusammensetzung u. s. w.

Die dem Saatgut beigemengten Erde- und Gesteinsteilchen hat man wohl immer zur Provenienzbestimmung mit herangezogen, so namentlich die Schwarzerde als Kennzeichen südrussischer Saaten. Die Schwarzerde- oder Tschernosemböden, bestehend aus absorptiv gesättigtem, also nicht saurem Humus, haben aber in Europa ein größeres Verbreitungsgebiet. Sie treten auch auf der Balkanhalbinsel und in Ungarn, vereinzelt selbst in Deutschland auf, immerhin nicht so ausgesprochen wie gerade in Südrußland. Da diese Schwarzerdeböden klimatisch bedingt sind (sie entstehen nur in Gebieten mit weniger als 500 mm Niederschlägen), so bilden sie ein gutes Kennzeichen für Rotklee und andere Saaten, die auf sehr trockenem Boden gewachsen sind, was sich übrigens stets auch durch die Unkrautflora ohne weiteres ergeben wird. Einen ähnlichen Fall haben wir mit der Roterde, einer Übergangsform zu den tropischen Lateritböden. Roterde entsteht, wenn infolge hoher Temperatur und genügender Niederschläge Kieselsäure und Elektrolyte ausgewaschen werden, womit eine Anreicherung des Bodens an Aluminium- und Eisenhydroxyd und damit Rotfärbung zustande kommt. Roterden haben wir in weiter Ausdehnung namentlich in Südfrankreich, in der Languedoc, und es sollte somit möglich sein, an der Roterdebeimengung die Luzerne aus der Gegend von Nîmes u. s. f. von der echten Provencer Luzerne, die im Gegensatz dazu Kalksteinchen enthält, zu unterscheiden. An manchen Anstalten will man auch den böhmischen Rotklee an der Beimengung kleiner, glimmerhaltiger Gesteinsstückchen erkennen.

An Beimengungen tierischen Ursprungs haben wir die Muschelbruchstücke zu erwähnen, die sich in südfranzösischer Luzerne vorfinden und von der Düngung der Luzernfelder mit vom Meere ausgeworfenen Algenmassen herrühren. Sie sind ein Kennzeichen für Saatgut, das aus der Nähe des Meeres stammt. Gegenwärtig wird diese Düngung hauptsächlich im Departement Var durchgeführt.

Sodann haben wir schon früher (Beste Futterpflanzen I, 4. Aufl. 1913, S. 174) darauf hingewiesen, daß auch die kleinen Schnecken, die sich im Esparsettesamen vorfinden, gute Provenienzbestimmungsmittel sind. Es liegt uns bei der Esparsette hauptsächlich daran, die südfranzösische Herkunft sicher festzustellen, da diese Saat sich dadurch auszeichnet, daß sie zwar schon im ersten Jahr zur Blüte kommt, nachher aber sehr rasch verschwindet. Wir haben dabei als gute Leitart namentlich die *Helix acuta* ausfindig gemacht. Es war uns früher stets möglich, südfranzösische Saat an dieser Schnecke, die sich in großen Proben stets vorfand, sicher zu erkennen. Seither reinigen aber die Samenhändler die Esparsette viel schärfer und entfernen damit auch die letzten Reste dieser *Helix*. Ganz gelingt ihnen die Verwischung der Herkunft allerdings nicht. Man findet immer noch gewisse Arten vor, allerdings nur in Jugendformen, die schwer zu bestimmen sind. So scheint *Helix ericetorum* ein gutes Kennzeichen für westeuropäische, *Helix obvia*

dagegen für osteuropäische Esparsette zu sein. Allerdings sagen uns die Conchyliologen, daß gerade die *Helix obvia* mit Esparsettesaatgut verschleppt werde, und infolgedessen sich ihr Verbreitungsgebiet in letzter Zeit stark nach Westen ausbreitet habe.

Als weiteres zu berücksichtigendes Merkmal, das zur Feststellung der Herkunft beitragen kann, ist das Tausendkorngewicht zu nennen. Die verschiedenen Provenienzen haben meist ein sehr verschiedenes Tausendkorngewicht. Europäisches Timothe ist immer bedeutend schwerer als amerikanisches. Beim Rotklee erwies sich nach unsern Untersuchungen die deutsche Provenienz als die schwerste, die nordamerikanische und italienische als die leichteste Herkunft. Es ist selbstverständlich, daß die Reinigung einen gewissen Einfluß auf das Tausendkorngewicht hat. Wir wissen aber vom Getreide, daß dieser Einfluß die individuellen Unterschiede zwischen den verschiedenen Arten nicht verwischen kann. Jede Reinigung muß ja wirtschaftlich sein; sie darf also nicht zu viel Abfall erzeugen, und sie kann deshalb die Unterschiede im Korngewicht nicht zum Verschwinden bringen. Selbstverständlich schwankt das Tausendkorngewicht im einzelnen innerhalb einer Provenienz sehr stark; es wird bei jeder Provenienz einzelne Saaten geben, die sich so stark vom Mittel entfernen, daß sie auch innerhalb der Variationsbreite einer andern Provenienz liegen. Die Bestimmung des Tausendkorngewichts kann also für sich allein nicht ausschlaggebend sein, wohl aber im Vereine mit andern Merkmalen einen wertvollen Anhaltspunkt zur Bestimmung der Provenienz geben. Das Tausendkorngewicht wird aber auch bei den verschiedenen Provenienzen stärker oder schwächer schwanken, und es ist deshalb nötig, daß man nicht bloß die Mittelzahl, sondern auch das Maß dieser Schwankung, also die mittlere Abweichung, angibt. Das Tausendkorngewicht wird stark vom Klima beeinflusst. Klimate mit langer, warmer Vegetationszeit bringen höhere Tausendkorngewichte hervor, als solche, in denen sie durch Sommerdürre frühzeitig abgeschlossen wird. Deshalb haben amerikanische, Kontinental- und südliche Saaten im allgemeinen ein kleineres Tausendkorngewicht als solche aus gemäßigtem Klima. Dabei dürfen wir jedoch die Unterschiede nicht allein auf Rechnung der Standortseinflüsse an sich setzen; sie erweisen sich bis zu einem gewissen Grade als erblich.

Sodann kann bei der Feststellung der Provenienz auch die Samenfarbe Verwendung finden, besonders beim Rotklee. Die verschiedenen Herkunftte haben deutlich verschiedene Farben; sie sind bald mehr gelb, bald mehr violett gefärbt. Wir haben versucht, diese Unterschiede für die verschiedenen Provenienzen zahlenmäßig festzustellen, indem wir die Körner in gelbe, vorherrschend gelbe, gescheckte, vorherrschend violette und violette trennten. Dabei stellten wir fest, daß beim italienischen und beim schweizerischen Rotklee das Gelb am stärksten vorherrscht. Sie weisen 41,2 und 40,7 % gelbe Körner auf (Mittel von je 10 Proben), während der französische Rotklee am wenigsten, nur 21,2 % gelbe Körner aufweist. Es bestehen also recht erhebliche Unterschiede, die ganz gut zahlenmäßig erfaßt werden können. Die Samenfarbe ist beim Rotklee wie bekannt erblich bedingt, hängt also nicht vom Standorte ab.

Auch die chemische Zusammensetzung kann für verschiedene Herkunftte verschieden sein; so hat Geo. H. Pethybridge kürzlich, gestützt auf Untersuchungen von H. E. und E. F. Armstrong und E. Horton, nachgewiesen, daß wilder englischer Weißklee ein Blausäure absaltendes Glycosid enthält, das dem gewöhnlichen Weißklee des Handels fehlt. Es läßt sich hierdurch englischer Weißklee schon als Keimling von dem gewöhnlichen Weißklee des Handels mit leichter Mühe unterscheiden. Ich habe diese Untersuchung für schweizerischen Weißklee nachgeprüft und gefunden, daß auch wildwachsender schweizerischer Weißklee Blausäure entwickelt, und daß in der Tat die osteuropäischen Weißklee-provenienzen nichts davon absalteten.

Es gibt selbstverständlich noch weitere Merkmale, die geeignet sind, bei der Provenienzbestimmung aushilfsweise beigezogen zu werden. So wurde schon die Länge und Breite des Kleesamens, die Präzipitinreaktion dazu benützt. Ich möchte nun aber zunächst einmal die Ergebnisse einiger kleinerer Voruntersuchungen, die ich zur Erläuterung des von mir Gesagten durchgeführt habe, besprechen.

Um einen Anhaltspunkt darüber zu erhalten, ob die Bestimmung der Begleitsamen einer Samenart nach Zahl und Art tatsächlich zur Charakterisierung und Erkennung einer Herkunft beitragen kann, habe ich je acht Proben von Rotklee aus dem mittleren Frankreich, aus der Tschechoslovakei und aus der Schweiz auf alle in ihnen enthaltenen Samen untersucht. Die Ergebnisse sind nachstehend auszugsweise wiedergegeben. Die Übersichten umfassen nicht alle Arten. Unkrautsamen, die, wie *Plantago lanceolata*, in allen drei Provenienzen in gleich starkem Maße vorkommen, und ferner Arten, die nur ganz sporadisch auftreten, sind weggelassen. Provenienzbestimmende Leitarten sind fettgedruckt:

Zahl und Art der Unkrautsamen in Rotklee aus Mittelfrankreich.

8 Proben von je 100 g.

Art	I	II	III	IV	V	VI	VII	VIII
<i>Lolium italicum</i>	4	183	16	2	1	15	3	5
<i>Rumex obtusifolius</i>	—	1	1	1	1	1	—	3
„ <i>acetosella</i>	11	—	5	4	2	—	1	3
<i>Polygonum aviculare</i>	—	2	—	—	—	—	—	—
<i>Chenopodium album</i>	—	—	—	—	—	1	—	—
<i>Silene inflata</i>	—	3	23	4	—	—	11	3
<i>Lepidium campestre</i>	—	—	—	—	1	—	—	—
<i>Ranunculus acer</i>	—	—	1	—	—	—	1	—
<i>Trifolium hybridum</i>	23	9	7	—	—	1	—	9
„ <i>repens</i>	12	—	—	—	—	—	—	—
<i>Medicago sativa</i>	—	11	270	54	54	60	53	340
„ <i>lupulina</i>	1	36	29	15	15	6	17	37
<i>Lotus corniculatus</i>	4	2	2	1	1	2	1	3
<i>Anthyllus vulneraria</i>	—	—	—	2	2	7	3	—
<i>Arthrolobium scorpioides</i>	—	—	3	—	—	—	1	1
<i>Daucus carota</i>	23	265	279	164	11	117	139	202
<i>Carum segetum</i>	—	13	2	—	—	—	—	2
<i>Verbena officinalis</i>	5	—	4	—	—	—	—	8
<i>Brunella vulgaris</i>	5	1	3	1	—	—	—	1
<i>Teucrium botrys</i>	—	—	7	—	1	—	5	1
<i>Sherardia arvensis</i>	—	1	3	1	—	1	7	2
<i>Cephalaria transilvanica</i>	—	—	8	—	—	—	—	4
<i>Thrinicia hirta</i>	—	3	1	1	—	1	—	1
<i>Cichorium intybus</i>	—	5	124	5	—	1	2	92
<i>Helminthia echinoides</i>	—	—	13	—	—	—	—	8
Tausendkorngewicht mg....	1820	1964	1610	1642	1946	1750	1794	1648

Mittel: mg 1772 $\pm$ 44,87.

Unkrautsamen in Rotklee aus der Tschechoslovakei.

Art	I	II	III	IV	V	VI	VII	VIII
<i>Setaria glauca</i>	1	2	—	—	—	—	—	—
<i>Rumex obtusifolius</i>	11	2	1	9	1	2	3	2
„ <i>acetosella</i>	12	—	3	29	60	1	2	1
<i>Polygonum aviculare</i>	1	4	1	1	7	—	—	1
<i>Chenopodium album</i>	3	5	1	2	—	—	4	1
<i>Silene inflata</i>	3	—	—	2	—	—	—	1

Art	I	II	III	IV	V	VI	VII	VIII
<i>Silena dichotoma</i>	—	13	—	—	—	—	—	—
<i>Lepidium campestre</i>	2	—	—	—	—	—	—	—
<i>Coronilla varia</i>	—	—	—	1	1	—	—	—
<i>Trifolium hybridum</i>	105	4	4	34	—	21	154	12
„ <i>repens</i>	6	—	2	1	3	—	11	1
<i>Medicago sativa</i>	3	37	12	—	—	—	—	2
„ <i>lupulina</i>	3	2	1	10	4	2	—	5
<i>Lotus corniculatus</i>	—	—	—	1	—	1	—	—
<i>Anthyllis vulneraria</i>	6	4	—	9	8	—	—	4
<i>Daucus carota</i>	4	4	1	10	124	—	4	—
<i>Myosotis intermedia</i>	—	—	—	—	1	—	—	—
<i>Galium aparine</i>	7	—	—	—	—	2	7	2
„ <i>mollugo</i>	3	—	—	—	—	—	—	—
<i>Sherardia arvensis</i>	13	4	3	—	—	1	—	1
Tausendkorngewicht mg...	1866	1910	1884	1924	1756	1942	1904	1868

Mittel: mg 1882 $\pm$ 18,9.

Unkrautsamen in schweizerischem Rotklee.

Art	I	II	III	IV	V	VI	VII	VIII
<i>Lolium italicum</i>	10	—	—	—	34	185	21	3
<i>Luzula campestris</i>	—	8	—	1	—	—	—	—
<i>Setaria viridis</i>	—	—	—	—	—	—	—	1
<i>Rumex obtusifolius</i>	30	35	4	—	11	68	27	5
„ <i>acetosella</i>	—	—	—	—	—	1	—	3
<i>Polygonum aviculare</i>	3	3	—	—	—	—	—	1
<i>Chenopodium album</i>	—	36	—	—	—	10	—	—
<i>Silene inflata</i>	—	—	—	—	—	—	—	—
<i>Ranunculus acer</i>	—	1	—	3	—	—	—	—
<i>Trifolium hybridum</i>	—	—	—	1	3	3	—	—
„ <i>repens</i>	—	20	—	3	5	150	—	9
<i>Medicago sativa</i>	—	—	—	—	2	—	—	—
„ <i>lupulina</i>	—	1	—	1	—	—	—	—
<i>Lotus corniculatus</i>	—	—	—	—	1	—	1	—
<i>Daucus carota</i>	—	—	1	5	—	2	—	50
<i>Myosotis intermedia</i>	—	4	—	3	—	—	—	—
<i>Brunella vulgaris</i>	—	85	—	4	1	—	12	4
<i>Galium mollugo</i>	—	6	1	—	—	2	—	2
<i>Leucanthemum vulgare</i>	—	—	—	7	—	11	—	—
Tausendkorngewicht mg...	1748	1738	1618	1860	1940	1916	1772	1952

Mittel: mg 1818 $\pm$ 39,4.

Zunächst sei aus den Ergebnissen der Erhebungen hervorgehoben, daß durch die vorliegenden Bestimmungen ein Unterschied im Tausendkorngewicht nicht nachgewiesen worden ist. Denn die Differenzen der Mittelzahlen der drei Herkünfte und ihre mittleren Fehler betragen in Milligramm:

Französisch-tschechoslovakisch	mg 110 $\pm$ 48,4,
Französisch-schweizerisch	„ 36 $\pm$ 59,7,
Tschechoslovakisch-schweizerisch	„ 64 $\pm$ 43,4.

Die Unterschiede sind also im Verhältnis zu ihrem mittleren Fehler viel zu klein. Es ist nicht ausgeschlossen, daß eine größere Zahl von Bestimmungen einen tatsächlichen Unterschied zutage fördern würde. Allein praktische Bedeutung wird ein solcher Unterschied kaum je erlangen, namentlich wenn man berücksichtigt, daß dieses Gewicht auch von der Jahreswitterung beeinflusst werden kann. Dagegen kann gegenüber anderen Provenienzen ein praktisch verwendbarer Unterschied bestehen, und es ist deshalb notwendig, bei jeder Provenienz das Tausendkorngewicht, und zwar in verschiedenen Jahrgängen an einer hinreichend großen Zahl von Proben zu ermitteln.

Was dagegen die Unkrautsamen anbetrifft, so ist der Übersicht leicht zu entnehmen, daß die mittelfranzösischen Saaten, außer durch verschiedene Leitarten (*Arthrolobium*, *Carum segetum*, *Cephalaria*, *Thrinicia*, *Helminthia*) charakterisiert sind durch starkes Auftreten von *Lolium italicum*, *Medicago sativa* und *lupulina*, *Cichorium intybus* und durch accessorisches von *Verbena*, *Teucrium botrys*. Ferner ist die tschechoslovakische Saat durch *Setaria glauca*, *Silene dichotoma*, *Coronilla*, *Galium aparine* und stärkeres Auftreten von *Chenopodium album*, *Rumex acetosella* und *Trifolium hybridum* gekennzeichnet. Der schweizerische Rotklee läßt sich fast nur erkennen durch die Abwesenheit aller klimatisch kennzeichnenden Arten und das häufige Vorkommen von *Brunella* und *Rumex obtusifolius*.

Als Ergänzung untersuchte ich in gleicher Weise 7 Proben *Timotheegras* amerikanischer, 6 europäischer und 1 zweifelhafter Herkunft. Auch hier mußten die bloß sporadisch auftretenden Arten weggelassen werden. Außer dem Tausendkorngewicht wurde auch der Prozentsatz entspelzter Samen bestimmt. (Tab. S. 41.)

Im Gegensatz zum Rotklee ergibt hier sowohl das Tausendkorngewicht als auch der Prozentsatz entspelzter Samen sicher nachgewiesene Unterschiede. Es beträgt im Mittel:

	Amerikanische	Europäische	
	Herkunft:	Herkunft:	Differenz:
Tausendkorngewicht mg:	367 ± 14,12	439 ± 8,98	72 ± 16,74
Entspelzte Früchte mg:	39,5 ± 5,94	10,6 ± 2,41	28,8 ± 6,14

Im übrigen lassen sich mit einer Ausnahme alle Proben sowohl durch Leitarten (von denen *Myosotis intermedia* und *Valerianella dentata* in Nordamerika nicht vorkommen) als auch durch die Begleitarten erkennen. Die amerikanische Provenienz kennzeichnet sich außer durch die eigentlichen Leitarten durch starkes Vorkommen von *Poa pratensis* und ferner durch das Vorkommen von *Lepidium ruderales*, *Potentilla norvegica*, *Anthemis cotula*, die europäische durch folgende in großer Zahl auftretende Arten: *Brunella vulgaris*, *Anthemis arvensis*, *Chrysanthemum inodorum*, *Lampsana communis* und *Viola tricolor*.

Die letzte Probe läßt sich leicht als Gemisch beider Provenienzen erkennen. Bei der dritten Probe sind überhaupt keine Leitarten vorhanden, und auch die Begleitsamen genügen nicht zur Bestimmung. Dagegen weist sie das Tausendkorngewicht zur amerikanischen Provenienz. Der Prozentsatz entspelzter Samen nimmt eine Mittelstellung ein. Hier genügen die untersuchten Merkmale nicht zur Herkunftsbestimmung.

Wie Sie sehen, ist es jedenfalls möglich auf diesem Wege, durch eine statistische Behandlung der Unkrautsamen und durch Beziehung anderer Merkmale uns die Bestimmung der Herkunft zu erleichtern. Ich bin also der Ansicht, wir sollten für jedes Unkraut in jeder einzelnen Provenienz einen Häufigkeitsindex feststellen, der gleichzeitig auch die Schwankung im Auftreten durch Beifügung der mittleren Abweichung oder des Variationskoeffizienten angibt. Wenn wir dann bei den Herkunftsbestimmungen an Hand der Leitarten zu keinem abgeschlossenen Urteil kommen, dann müssen wir auch die übrigen Begleitsamen in Betracht ziehen und die Häufigkeit ihres Auftretens, wenn nötig, zahlenmäßig genau feststellen und mit den Indices vergleichen. Außerdem aber werden das Tausendkorngewicht zu bestimmen, die Farbe eingehend zu beurteilen und alle andern Beimengungen mit in Betracht zu ziehen sein. Auf diese Weise werden wir sicher in den meisten Fällen zu einem zuverlässigen Urteil kommen. Ich meine natürlich nicht, daß bei jeder Provenienzbestimmung in dieser genauen Weise vorgegangen werden sollte, aber es werden doch

Zahl und Art der Unkrautsamen in amerikanischem (Probe I—VII) und europäischem (Probe VIII—XV) Timothe.
(Proben von 30 g.)

Art	Amerika							Europa							XVI	
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV		XV
1. <i>Agrostis alba</i> L.	207	33	22	418	68	25	24	49	9	145	11	91	—	10	149	594
2. <i>Poa pratensis</i> L.	46	31	—	21	2	2	6	—	—	—	4	2	—	—	—	57
3. " <i>compressa</i> L.	—	4	1	63	172	10	—	13	16	6	4	3	12	6	4	19
4. " <i>trivialis</i> L.	—	—	—	—	—	—	—	7	7	3	6	13	21	24	4	2
5. " <i>memoralis</i> L.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	13
6. " <i>annua</i> L.	—	—	—	—	—	—	—	3	4	—	4	3	3	3	—	—
7. <i>Aira caespitosa</i> L.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7
8. <i>Panicum capillare</i> L.	2	—	—	9	—	—	—	—	—	—	—	—	—	—	—	—
9. " <i>dichotomum</i> L.	—	—	—	—	8	1	—	—	—	—	—	—	—	—	—	2
10. <i>Lepidium rudera</i> le L.	3	—	—	10	—	—	4	—	—	—	—	—	—	—	—	2
11. " <i>virginicum</i> L.	4	1	—	3	8	—	3	—	—	—	—	—	—	—	—	—
12. <i>Potentilla norvegica</i> L.	178	7	—	354	8	2	16	—	—	—	—	—	—	—	—	—
13. <i>Verbena stricta</i> Vent.	6	—	—	3	—	1	1	—	—	—	—	—	—	—	—	2
14. <i>Rudbeckia hirta</i> L.	3	3	—	4	1	—	3	—	—	—	—	—	—	—	—	1
15. <i>Plantago Rugelii</i> Dens.	183	12	—	84	88	9	43	—	—	—	—	—	—	—	—	14
16. " <i>major</i> L.	6	—	—	9	—	—	—	—	—	4	—	—	3	—	6	2
17. <i>Brunella vulgaris</i> L.	—	—	—	—	1	—	2	139	83	72	81	45	126	24	186	—
18. <i>Anthemis arvensis</i> L.	—	—	—	—	—	—	—	2769	1140	2011	2094	1478	5081	1009	372	30
19. " <i>cotula</i> L.	3	3	—	—	—	—	—	—	—	—	—	—	—	—	—	3
20. <i>Chrysanthemum inodorum</i> L.	—	—	—	—	—	—	—	16	106	54	9	69	46	148	2	37
21. <i>Lampsana communis</i> L.	—	—	—	—	—	—	—	138	319	120	81	318	276	103	120	—
22. <i>Myosotis intermedia</i> Lk.	—	—	—	—	—	—	—	906	310	546	1067	462	450	351	161	3
23. <i>Viola tricolor</i> L.	—	—	—	—	—	—	—	211	78	244	187	167	251	186	18	4
24. <i>Valerianella dentata</i> Poll.	—	—	—	—	—	—	—	10	25	4	12	5	42	4	—	—
Tausendkorngewicht in mg	282	276	382	374	366	378	411	448	464	424	444	450	446	458	379	402
Prozentsatz unbespelzter Samen ...	58,4	53,6	16,8	49,8	23,7	49,0	24,9	9,0	16,6	3,6	10,0	17,2	13,0	9,0	6,8	6,8

jedem von uns gelegentlich Fälle vorliegen, wo alles aufgewendet werden muß, um ein sicheres Urteil über die Herkunft einer Saat zu erhalten.

Um aber in dieser Weise vorgehen zu können, müssen wir zuerst die nötige Grundlage schaffen. Nun lese ich in einer Abhandlung von Oberstein (Landw. Jahrbücher 51, 1918, p. 456), daß vor dem Kriege durch die Pariser Samenkontrollstation größere Muster von Rotkleesaat verschiedener französischer Produktionsgebiete in absolut sicherer Originalsaat an die deutschen Versuchsstationen hätten versandt werden sollen, zur Vornahme von Anbauversuchen in Deutschland und Belgien und namentlich auch zur Durchführung einer genauen Analyse dieser Provenienzmuster zur Gewinnung ausreichenden, grundlegenden Materials für den Ausbau der Herkunftsbestimmungen, namentlich um die Unterscheidung zwischen nord- und südfranzösischer Provenienz zu fördern und zu sichern.

Der Krieg wird die Ausführung dieses Planes verhindert haben. Wir sollten ihn aber wieder aufgreifen und wenigstens den zweiten Teil, die genaue Untersuchung des Saatgutes auf etwas breiterer Grundlage durchführen. Die Grundlage muß umfassender sein,

1. weil die Untersuchung sich nicht bloß auf die französischen Provenienzen beschränken sollte, sondern alle Länder umfassen muß,
2. weil aus jedem Produktionsgebiete nicht bloß eine Probe, sondern eine größere Anzahl untersucht werden sollten, da nur dann die Schwankungen, die in jedem Merkmale vorkommen können, d. h. seine Variationsbreite, in richtiger Weise erfaßt wird.

Dabei ist es aber durchaus wünschenswert, daß diese Untersuchungen nach einheitlichem Plane vorgenommen werden, so daß die Ergebnisse später unter sich vergleichbar sind. Sie hätten sich nur auf diejenigen Merkmale zu erstrecken, die für die Erkennung der Provenienz wichtig sind.

Am dringlichsten ist die sichere Erkennung der Provenienz beim Rotklee. Die Untersuchung hätte sich hier zu befassen mit:

1. der genauen Feststellung aller Unkrautsamen nach Zahl und Art in Proben von bestimmter stets gleicher Größe,
2. der Feststellung der übrigen Beimengungen nach bestimmten Vorschlägen,
3. der Ermittlung des Tausendkorngewichtes,
4. der Feststellung der Farbe nach einem bestimmten Schema.

Ich würde es von großem Vorteil halten, wenn unsere Konferenz sich auf die Inangriffnahme dieser Untersuchung und auf bestimmte Vorschriften für ihre Durchführung einigen könnte. Jede Anstalt hätte die Rotkleeprovenienzen ihres Gebiets allein oder unter Beiziehung einer weiteren Anstalt zu untersuchen. So kämen wir zu einem Standardbuch für die Provenienzen, das uns die Durchführung der Herkunftsbestimmungen ganz ungemein erleichtern würde. Ich bin sicher, daß wir auf diesem Wege auch eine ganze Reihe neuer Leitarten für die Provenienzbestimmung kennen lernten. Dabei möchte ich eines ganz besonders hervorheben: wie wichtig und notwendig es ist, die Unkrautsamen nicht bloß nach dem Samen zu bestimmen, sondern die Bestimmungen soviel wie möglich durch Kulturversuche nachzuprüfen. Man kann sich bei diesen Bestimmungen außerordentlich leicht täuschen.

Ich halte dafür, daß die Wichtigkeit der Provenienzbestimmungen es rechtfertigt, daß wir die von mir vorgeschlagenen Untersuchungen vornehmen. Es ist ja nicht zu verkennen, daß mit dem Fortschreiten der Züchtung der Futterpflanzen die Provenienzbestimmung etwas an Wert einbüßen muß. Wenn aber sorgfältig gezüchtet werden soll, dann werden namentlich die Fremdbefruchter, also z. B. Rotklee, jahrelange Bearbeitung erfordern, wenn von ihnen einigermaßen konstante und praktisch wertvolle Stämme erzielt werden sollen. Jeder Stamm muß ja in jeder Generation wieder auf seinen Ertrag geprüft werden, weil er als Heterozygot beständig spaltet. Die Züchtungen werden also nicht sobald die Provenienzen verdrängen. Auch die Plombierungen, die manche Staaten einführen, entheben uns nicht der Notwendigkeit, die Herkunft auch ohne Plombe erkennen zu können. Denn oft ist der Kulturwert der Saaten der verschiedenen Produktionsgebiete innerhalb eines Landes sehr ungleich, und vor jeder nachträglichen Vermischung und Fälschung der Herkunft schützt uns auch die Plombe nicht.

Wenn bisher die Provenienzbestimmungen zu den schwierigeren Aufgaben der Samenkontrolle gehörten, so hat das seinen Grund darin, daß uns eben die sichere Grundlage deren Schaffung ich jetzt vorschlage, dafür fehlte. Die Herkunftsbestimmungen sind so wichtig, daß es sich wohl lohnt, in gemeinsamer Arbeit die notwendigen Erhebungen zu machen. Nur durch Zusammenwirken ist es möglich, das notwendige authentische Material zusammenzubringen. Eine einzelne Anstalt vermag das nicht.

Dabei soll es aber nicht unsere Aufgabe sein, den Kulturwert der verschiedenen Provenienzen zu bestimmen und zu beurteilen. Dies soll eine Angelegenheit für sich sein, und es läßt sich ja tatsächlich ein allgemeines Urteil niemals fällen, weil der Kulturwert der gleichen Herkunft für verschiedene Länder sehr verschieden sein kann. Wir hätten uns nur auf die Erkennung der Provenienzen zu beschränken. Erst wenn durch unsere Untersuchungen einmal eine sichere und umfassende Grundlage gelegt ist, wird es möglich sein, eine Zusammenfassung und Einteilung der Provenienzen vorzunehmen.“

The determination of the origin of agricultural seeds.

Summary.

1. In determining the provenience, the leading species of weed seeds, which have a geographical distribution limited to one country, will always be of the greatest importance. Besides these leading species it will be necessary in the future to pay greater attention to the accessory species which have a wider geographical area; the accuracy of the determination can be increased, if the number of each of these accessory species, which is contained in a sample, is noted. The valuation of a weed-seed for determination of the origin must be based upon an exact knowledge of its habits of life.
2. Furthermore, in order to ascertain its origin, all existing characteristics of the seed should be noted, such as other admixtures (earth, little stones, shells &c.), the thousand-grain-weight, colour, chemical composition.
3. It is desirable that every seed-testing-office submits a sufficient number of samples of the seeds grown in its country to a minute examination, based on a uniform plan (statistical determination of the different species of weed-seeds, of the weight of thousand grain, colour &c.). The identity of each species of weed-seed should be determined by a cultivation trial as often as possible.
4. On the strenght of these examinations, and the results of the trials for determining the agricultural value of the different origins of a given forage plant, it must be possible to classify and distinguish the seeds according to their provenience in a way which takes their agricultural value into consideration.

Professor Johannsen:

thanked Dr. Volkart and expressed „Ich danke Ihnen sehr für diesen the hope, that his suggestion might ausgezeichneten Vortrag und hoffe, have good influence. daß die wichtigen Gedanken guten Erfolg haben werden.“

M. Bussard:

„Je me plais à rendre hommage à la maîtrise avec laquelle M. Volkart a exposé la question de la détermination de la provenance des semences. Cette question est de première importance pour le commerce et l'utilisation des semences dans les différents pays.

En France, nous sommes placés dans une situation qui nous permet d'en apprécier toute la valeur. Sous le rapport du climat, notre pays peut être pratiquement partagé en deux régions distinctes, l'une au nord de la Loire, l'autre au sud de ce fleuve. Par leurs caractères le Poitou et la Vendée, comme aussi la zone montagneuse du Plateau Central, se rattachent à la région septentrionale. M. Volkart a fait une distinction légitime entre les semences fourragères (trèfle des prés, luzerne, esparcette) du nord et celles du midi de la France. Ces dernières sont dépréciées pour l'emploi dans les contrées du nord de l'Europe et dans celles de l'Europe centrale à climat rigoureux.

Mais il faut se montrer très prudent dans les conclusions à tirer, au sujet de la provenance, de la présence, dans un échantillon de semences, de telle ou telle graine étrangère. Les échanges de semences constamment pratiqués d'une région à l'autre, ont disséminé partout les graines d'espèces spontanées et seules les espèces absolument réfractaires à l'acclimatement dans une région ne s'y rencontrent pas. De plus les semences du commerce sont souvent des mélanges de différentes provenances.

En 1913, à la suite des difficultés rencontrées par nos marchands grainiers pour l'exportation des trèfles français, la station de Paris a réuni et examiné plusieurs centaines d'échantillons de semence de ces trèfles, de provenance bien authentique, fournis non par le commerce, qui n'offre pas de garanties certaines à cet égard, mais par des cultivateurs des divers points du territoire. L'enquête ainsi faite a démontré que *Helminthia echinoides*, dont la présence des graines était alors considérée comme indiquant une provenance méridionale, se rencontre en réalité à peu près partout en France, aussi bien dans le nord même que dans la région parisienne, où elle croît et mûrit très facilement; elle est, tout le fois, plus abondante dans le Midi. Dans les trèfles du midi de la France figurent communément aussi des graines d'*Arthrolobium scorpioides*, *Picris stricta*, *Torilis nodosa*, *Rubus* sp. Aucune de ces espèces, rencontrée seule, ne suffit à caractériser la provenance des semences qui la renferment; ce qu'il faut considérer à cet égard, c'est la présence simultanée de plusieurs d'entr'elles, et aussi leur abondance. Les autres indices, tirés de la nature des matières inertes: pierres, coquillages, etc. et des caractères mêmes de la semence: forme, dimensions, couleur, et surtout poids relatif, ne sont pas négligeables, mais de moindre valeur.

Il serait désirable que, pour les semences qui font l'objet d'un commerce international et dont il importe d'établir la provenance, une enquête fût faite avec le concours des stations du pays d'origine, pour déterminer les indices nettement caractéristiques de celle-ci.

Dr. v. Degen:

proposed

1. that in each country (resp. parts) which is taken into consideration concerning the question of provenance the species and quantity of the weed-seeds present in the original seed must be determined after a certain plan,
2. that the conference should appoint one seed testing station, Zürich, whose duty it will be to study all indications of provenance,
3. that the conference should raise funds to finance the publication of the results.

„Ich habe auf dem ersten Samenkontrollkongreß in Hamburg den Antrag gestellt, die Züricher Samenkontrollanstalt als Sammelstelle für Provenienzfragen zu bezeichnen. Dieser Antrag wurde angenommen, leider aber nicht durchgeführt. Ich erlaube mir im Anschluß an den Vortrag vorzuschlagen:

1. daß in jedem Lande resp. Gebiete, das in bezug auf „Provenienz“ in Betracht kommt, nach einem bestimmten Plan an ursprünglichen Samen die Art und Menge der darin vorkommenden Unkraut samen festgestellt werden¹⁾,
2. daß eine Station, und zwar die Züricher, mit der Sammlung und Bearbeitung aller die Provenienz

¹⁾ Da die Bestimmung aller Unkrautsamen nötig ist, und dies oft keine leichte Sache ist, wäre auch bei der Bestimmung der Samen in zweifelhaften Fällen die Hilfe der Züricher Station anzurufen. (Nachträglicher Zusatz des Antragstellers.)

betreffenden Feststellungen beauftragt werde,

3. daß der Kongreß Mittel und Wege finden möge, um die Ergebnisse auch veröffentlichen zu können.

Provenienzen zu unterscheiden ist sehr schwer. In Ungarn wird oft Jahre hindurch zu wenig Rotklee samen geerntet; wir müssen dann fremde Samen importieren und bekommen auf diese Weise fremde Unkrautsamen in unseren Klee. Dann werden vom Handel, der größere Mengen egalisierte Ware braucht, oft verschiedene Provenienzen vermischt. Die Sammlung der Muster zur Zusammenstellung der Provenienztabelle muß also in zwei Teile geteilt werden, und zwar 1) in ursprüngliche Samen und 2) in die Handelsware der betreffenden Gebiete. Wir haben zwar noch Teile in unserem Lande, wo ursprünglicher, von fremder Beimischung freier Klee gebaut wird; diese Ware kommt aber kaum oder nur in geringer Menge in den Handel.

In den Zeiten vor dem Kriege wurde bei uns viel italienischer Klee angebaut. Die in den wärmeren, trockneren Teilen Ungarns geernteten Kleesamen enthalten mehr oder weniger Grobseide, die nicht vollständig aus dem Samen entfernt werden kann; solche Waren wurden dann — um den strengen Anforderungen der ungarischen Plombe zu genügen — mit der reineren ausländischen Saat vermischt, so daß vor dem Kriege die ungarische Rotklee-Handelsware zumeist aus $\frac{2}{3}$ italienischen und $\frac{1}{3}$ ungarischen Kleesamen bestand.

Ein Vorteil des Krieges war nun, daß wir seit 1914 keinen ausländischen Kleesamen mehr bekommen haben, sodaß unser Rotklee also wieder „rein“ geworden ist. Während des Krieges wurden dann in einzelnen Jahren bedeutende Mengen von Rotklee samen nach Deutschland exportiert, die alle durch unsere Hände gegangen sind. Wir haben diese Gelegenheit benützt, um die in den zuverlässig in Ungarn geernteten Samen vorfindlichen Unkrautsamen der Art und Menge nach festzustellen, sodaß wir nun über eine ungarische Provenienztabelle bereits verfügen.

Was die Provenienzunkräuter anbetrifft, so muß ich bemerken, daß sich einige charakteristische südliche Unkrautsamen, z. B. *Helminthia echinoides*, in einer bemerkenswerten Weise in Südungarn angesiedelt haben. Sie können darum nicht mehr unbedingt für die französische Herkunft bestimmend angesehen werden. Diese Arten reifen ihre Samen nördlich bis Budapest. Nach dem ungarischen Gesetz sind die Händler verpflichtet, die Provenienz eines Samens anzugeben, sofern mit dieser gewisse Eigenschaften der Samen einhergehen.

Sollte der Kongreß meinen Vorschlag betreffend die Zusammenstellung der Provenienztabelle annehmen, so wäre auch die Art und Weise festzustellen, wie diese Tabellen zusammengestellt und veröffentlicht werden sollen.“

Professor Johannsen gave a synopsis of v. Degens speech in English.

Mr. Anderson and Mr. Saunders were in favour of the propositions.

Dr. Buchholz

said that Norway had not given her delegate the right to bind the state on economic questions.

bemerkte, daß seine Regierung ihn nicht dazu ermächtigt habe, Beschlüssen zuzustimmen, die finanzielle Folgen für sie haben; er meinte aber, daß alle Länder mit dem Vorschlage Dr. v. Degens einverstanden sein werden.

Dr. Volkart

suggested that v. Degen's second proposal be amended to read that a committee consisting of 3 members be appointed.

wünschte, daß eine Kommission von 3 Mitgliedern für die Bearbeitung der Frage der Herkunftsbestimmungen gewählt wird.

Professor Dr. A. Voigt

would prefer a committee of 5 members:

1. Switzerland, 2. Scandinavia,
3. France or England, 4. East (Hungary, Serbien, Czeko - Slovakia)
5. America.

schlug 5 Mitglieder vor, und daß darin vertreten sind:

1. Die Schweiz (Zürich), 2. Skandinavien, 3. Frankreich oder England, 4. Ungarn, Serbien oder die Tschechoslovakei, 5. Amerika.

Mr. Saunders preferred no committee. It was better to let Zürich work alone. Spoke in behalf of his colleagues from Scotland and trusted Dr. Volkart wholly in this question of provenience.

Mr. Dorph-Petersen

agreed with Mr. Saunders.

war einig mit Mr. Saunders.

Es wäre notwendig, sich große und echte Proben von allen Ländern zu verschaffen. Wir müssen diese verschaffen, nicht der Handel.

Mr. Anderson asked whether if Dr. Volkart is appointed he will be the central authority on this matter and act as referee in any dispute. Would his decisions be final?

Professor Johannsen: "It is not a judicial position. The station at Zürich will only gather material. It will be an institution for study."

Adjunkt A. Vilke, Direktor der Samenkontrollstation in Lund, Schweden: „Ich bin ganz einverstanden mit dem Vorschlage. Ich habe konstatiert, daß Mischungen gemacht werden, so daß die Kennzeichen von einer Saat in einer anderen Saat auftreten. Man muß auch untersuchen, ob die Handelswaren mit den originalen Proben übereinstimmen.“

Mr. Dorph-Petersen stated that Dr. Volkart would have the right to ask for help from other stations which would be given.

Professor Johannsen:

„v. Degen's second proposition is to be voted upon.“

Passed unanimously.

„Hofrat v. Degen's third proposition cannot be settled by the conference, but we hope that each delegate will make clear to his respective government, how necessary financial support in this matter is“.

„Wir stimmen über den zweiten Vorschlag von Hofrat v. Degen ab.“

Dieser wird angenommen, und Dr. A. Volkart wird einstimmig mit der Durchführung beauftragt.

„Der dritte Vorschlag von Hofrat v. Degen kann erst später, wenn die Delegierten mit ihren Regierungen verhandelt haben, erledigt werden“.

Dr. Buchholz: „Ich erlaube mir, die Aufmerksamkeit auf die Bedeutung hinzuleiten, die es hat, daß man auch, so weit es möglich ist, feststellt, wie Samen, der vom Ausland eingeführt wird, sich im Einfuhrland verändert, daß man sich nicht allein damit begnügt, die verschiedenen Unkräuter, die diesen begleiten, zu kennen, sondern daß man auch die Kräuter der geernteten Produkte nach ein, zwei oder mehreren Jahren wieder untersucht, so daß man zu wissen bekommt, wie das Unkraut sich in andern Ländern einbürgert. Dieses wird die Sicherheit der Herkunftsbestimmung stützen.“

Dr. Volkart:

„Es ist sehr erfreulich, vom Kollegen Bussard zu hören, daß die Pariser Anstalt bereits 400 sicher bestimmte Proben Rotklee aus den verschiedenen französischen Produktionsgebieten in der von mir vorgeschlagenen Weise untersucht hat, und es wird sehr wertvoll sein, wenn dieses Material, wie auch dasjenige von Dr. A. v. Degen über ungarischen Rotklee, allen Anstalten zugänglich gemacht wird. Den Einfluß des Wassergehaltes auf das Tausendkorngewicht schätze ich nicht so hoch ein wie Dr. v. Degen, namentlich wenn es sich um Proben handelt, die einige Zeit im geheizten Untersuchungslokal gestanden haben. Es kann sich dann nur um Unterschiede von wenigen Prozenten handeln, die das Tausendkorngewicht für unseren Zweck nicht erheblich beeinflussen können.“

Lassen Sie mich aber Ihnen vor allem aufrichtig danken für das Zutrauen, das Sie unserer Anstalt dadurch erwiesen haben, daß Sie sie als Zentralstelle für Herkunftbestimmungen bezeichneten. Ich fasse unsere Aufgabe in dieser Richtung selbstverständlich nicht so auf, daß wir die Proben von den verschiedenen Anstalten sammeln und selbst untersuchen werden, sondern wir werden nur die notwendige Anleitung für die Untersuchung nach einheitlichem Plane geben und die einzelnen Anstalten soviel wie möglich in ihren Untersuchungen unterstützen. Ferner werden wir dafür zu sorgen haben, daß sie in einer Art publiziert werden, daß sie allen Anstalten zugänglich sein werden. Hierfür sollte aber ein Publikationsorgan zur Verfügung stehen, und es wäre sehr zu wünschen, wenn hierfür, wie dies jetzt vorgeschlagen wird, die Mitteilungen des internationalen landwirtschaftlichen Institutes in Rom offenstehen würden.“

Professor Dr. A. Voigt: „Aus den Ausführungen Dr. v. Degens könnte geschlossen werden, daß der Beschluß des ersten Samenkontrollkongresses nicht ausgeführt worden sei. Ich muß aber erklären, daß man von den

Jahren 1906—1921 sieben Jahre abziehen muß, und daß die Grundlagen eigentlich geschaffen sind.

Zweitens will ich bemerken, daß unsere Floristen mehr zu diesen Arbeiten zugezogen werden sollten.“

Professor Johannsen

agreed with Professor Voigt. It was very important that botanists in the different countries should take up the question of provenience for further study. This is being done in Denmark. Investigations are now being made on the influence of soil on weeds especially with regard to the influence of the concentration of hydrogenions in the soil.

war einig mit Professor Voigt. Es ist sehr wichtig, daß die Floristen in den verschiedenen Ländern die Frage der Verbreitung der Provenienzenkräuter für weitere Studien aufnehmen. Dies ist schon der Fall in Dänemark. Untersuchungen werden jetzt über den Einfluß des Bodens auf das Vorkommen der Unkräuter gemacht, besonders mit Rücksicht auf die Wasserstoff-Ionenkonzentration des Bodens.

Direktor Widén: „Ich möchte wissen, ob die Meinung ist, daß die Samenkontrollstationen die Arbeit selbst machen sollen, in welchem Falle es wünschenswert wäre, wenn Dr. Volkart den Plan für die Untersuchungen ausarbeitet. Wenn die Untersuchungen Wert haben sollen, muß man Proben von echten Samen jedes Landes haben, d. h. nachweislich seit vielen Jahren auf demselben Gute angebaute. In dem Plan müßte sodann vorgeschrieben werden, daß beim Tausendkorngewicht die Feuchtigkeit der Ware berücksichtigt werden muß. Wenn eine Rotkleeware mit einem Wassergehalt von 19 bis 20 % für vier bis fünf Tage auf einen trockenen Boden ausgebreitet wird, sinkt der Wassergehalt in den vier bis fünf Tagen auf 8 bis 9 %.“

Herr E. Vitek, Direktor der Samenkontrollstation in Prag, Tschechoslovakei: „Ich muß darauf aufmerksam machen, daß die Tschechoslovakei jetzt aus drei Ländern besteht. *Setaria glauca* ist nicht charakteristisch für böhmischen Rotkleesamen, weil sie in diesem nicht vorkommt, ist aber typisch für die slovakischen Kleesamen. Darum muß man in der Tschechoslovakeiischen Republik zwischen den Saaten, die aus Böhmen inkl. Mähren und denjenigen, die aus der Slowakei stammen, und in welchen Grobseide häufig vorkommt, unterscheiden. Aus diesen Gründen müssen die Rotkleesamen sowohl von Böhmen inkl. Mähren als auch von der Slowakei plombiert und signiert werden, und zwar als echt böhmische, seidefreie Ware oder merkantile, grobseidefreie Ware. Die Ware, welche aus der Slowakei stammt, wird als solche bezeichnet, auch dann, wenn sie grobseidefrei ist.“

Professor Johannsen:

“The meeting is adjourned until 2 : 00.”

P. M. 2 : 00.

„Die Sitzung ist bis um 2 Uhr geschlossen.“

2 Uhr nachmittags.

Professor Johannsen

opened the meeting. Welcomed the Italian Minister Signor Aloisi and Consul Thades Bilinski from Poland. Communicated that members of the Danish Seed Dealers Association were present as guests with the sanction of Sir Lawrence Weaver. Welcomed them and thereafter introduced Sir Lawrence Weaver.

eröffnete die Sitzung; er hieß den italienischen Minister, Signor Aloisi, und Konsul Thades Bilinski von Polen willkommen und teilte mit, daß Mitglieder des dänischen Samenhändlervereins als Gäste, mit Erlaubnis von Sir Lawrence Weaver, anwesend waren. Hieß diese willkommen und erteilte das Wort an Sir Lawrence Weaver.

Sir Lawrence Weaver:

"The Seeds Act 1920 and the National Institute of Agricultural Botany."

By Sir Lawrence Weaver, K. B. E., F. S. A.

Director General, Land Department: Ministry of Agriculture and Fisheries.

"Before I embark on the two subjects with which Mr. Dorph-Petersen has asked me to deal, I must make an apology to the eminent assembly of agricultural scientists who form this International Conference on Seed Control. It is hardly too much to say that I am here under false pretences because I am neither an agriculturist nor a scientist, but an administrator. Qui s'excuse s'accuse, but my presence here must be excused because my official position, like my two subjects (a) legal control of the seed industry in Great Britain, and (b) the new Institute of Agricultural Botany, is a product of the war.

I must also ask your indulgence for enlarging my subject beyond the technique of seed control and dealing with matters of policy and administration. These questions are, however, germane to the matters under review, as the new development of seed testing in England will be associated with other aspects of seed improvement. This apparent confusion of function may seem novel to many of you, but it is based on experience gained during the hard testing time of the last four years. English Institutions are often constructed on lines which may offend logical instincts but they are generally found to work well in practice.

The tragedy of August 1914 found the Board of Agriculture and Fisheries for England and Wales (since raised to the rank of a Ministry) a comparatively small department of the State. The imperative need for a great increase in the area of arable land in the United Kingdom resulted in the creation of the Food Production Department, linked with the Board of Agriculture but practically independent of it. Into that Department I was thrown by the fortunes of war in April 1917, and placed in control of Farmers' Supplies, seeds, fertilisers and the like. The new department worked in close connection with the Board of Agriculture for Scotland and the Department of Agriculture for Ireland, both of them independent of each other and of the English Board and under the Ministers responsible for Scottish and Irish affairs respectively. I found that whereas the English Board had not concerned itself with the Agricultural Seed Industry in any official way, the Irish Department had secured the passing of the Weeds and Agricultural Seeds (Ireland) Act in 1909, which applied only to that part of the United Kingdom. At the same time an Official Seed Testing Station was set up in Dublin, now presided over by my brilliant colleague Dr. Pethybridge. In 1914 the Scottish Board established a Seed Testing Station in Edinburgh, of which my able friend Mr. Anderson is Director, but it was only for voluntary use by farmers and seed merchants. No form of legal supervision was established, until the Testing of seeds Order was issued.

The summer of 1917 saw the creation of a rigid control of British Agricultural

effort in all directions. Orders were issued compelling farmers to plough grassland and to grow such crops as the local committees decided were best, the prices of fertilisers were fixed, men unfitted for the fighting line were organized in agricultural battalions, a women's Land Army was recruited, and farming generally was controlled in the national interest.

I soon found that an adequate supply of seed was matter for anxiety and measures were taken to secure it. My scientific colleagues however, were no less anxious to ensure that in a time of such stress farmers should be furnished only with pure seed of proper germination and two steps were accordingly taken. An Official Seed Testing Station for England and Wales was opened under the direction of Mr. Stapledon, since appointed Professor of Agricultural Botany at the University College of Wales, and a Testing of Seeds Order was issued under War Emergency Powers. Both the new Station and the Order date from November 14th 1917, but the Order did not begin to operate until January 1st 1918. The broad idea of this first Order was not to fix standards of germination and purity, but to compel the seed merchants to declare the percentages of the seeds they sold and leave the farmer to satisfy himself that the percentages were satisfactory.

The experience of the working of the Order during the first five months of 1917 led to a revised Order being put into force on 1st July 1918, in which standard germinations were scheduled for cereals, peas, beans, and the most important vegetables. This Order applied to Scotland and Ireland as well as to England and Wales, and the results of control were found to be so eminently beneficial to our agriculture that in 1920 its general provisions were incorporated in a Real-Bill applying to England, Wales and Scotland, which became law on August 16th 1920 but will not come into operation until August 1st 1921, until which date the Emergency Testing of Seeds Order will remain in force. Owing to political changes in Ireland, that part of the United Kingdom has not adopted the new Act, but continues to administer their Act of 1909, but all sales of Irish seed to England and Scotland are governed by the new Act of 1920. The new Act of Parliament is an exceedingly flexible instrument and has some novel features. It empowers the Agricultural Departments (a) to prescribe the particulars which a seller of seeds must deliver to the buyer of them; (b) to compel sellers to test seeds which are for sale either at one of the three Official Seed Testing Stations (in England, Scotland and Ireland) or at a private Station licensed by the Government; (c) to forbid altogether the sale of seeds which contain more than a prescribed percentage of certain injurious weeds.

All details as to the sorts of seeds to be controlled in these ways are the subject of Regulations issued by the Departments of Agriculture which can be altered and extended from time to time, but it is provided that all interests concerned shall be consulted by the Departments. This brings me to one of the most interesting features in the new system of seed control which we have established.

When in 1917 I began to take steps in this direction the Department set up two Advisory Committees, one on Cereal Seeds and the other on all other Agricultural Seeds, on which sat representatives of the three Departments and of all sections of the Seed Trade. To these Committees were remitted all the Government's proposals as to control and it is to their patriotic and large minded deliberations that we owe a system of control that is at once valuable to agriculture and workable in practice. I should like to add that when, as has been inevitable, restrictions and regulations were under discussion which threw burdens upon the trade involving additional work in all branches of their undertakings and often rendering unsaleable seed of mediocre quality which would readily have been sold if no control existed, the public spirit of our trade advisers was never on the side of undue relaxation of the control proposed. I am satisfied that it would have been impossible in an individualistic country like Great Britain, to have imposed upon the trade a system which is more far reaching than any in force in the world, if we had not convinced them by free argument at innumerable meetings that a strict measure of control will be in the long run an advantage rather than a hindrance to well organized and honourably conducted business undertakings.

Let me here say a word on nomenclature. "When we use the word "control" in connection with seeds we mean the exercise of the Government's legal powers to regulate the sale of seeds. When we refer only to the examination of seeds in order to establish their qualities of germination and purity we do not speak of "seed control" but simply of "seed testing".

My colleague Mr. Saunders will deal with the technical details of the regulations in force and those about to be issued, the methods employed in the official Testing Stations and the system of licensing private Testing Stations under the Act, and I will therefore pass to the other aspects of English Seed policy bound up with the National Institute of Agricultural Botany.

I must remind you that I was in 1917 an ignoramus and am still only an amateur in all these matters, but my past career as a journalist has given me a lively interest in the printed word. I therefore, at the time I was busy with the new Official Testing Station and our first Seeds Order, studied with great interest an article which appeared in the *Journal of the Board of Agriculture* in February 1917 on the plant breeding activities of Professor Biffen, Director of the Plant Breeding Institute of Cambridge University, to whose achievement and inspiration British Agriculture owes an incalculable debt. This article went on to describe the work begun at Svalöf in 1886 which has resulted in the splendid organisation which we now know. I was fired with the ambition to set up in England a similar system of improving the plants of the farm. The main difficulty which confronted me was the special character of the seed industry in Great Britain, which differentiated it entirely from conditions in Sweden. The British seedsman has deserved well of agriculture by developing new and improved varieties on commercial lines which yet owe a good deal to the scientific spirit. Svalöf represents a dual organisation, half purely scientific and half purely commercial, which would have suited ill our British conditions. The visitor to Svalöf observes that side by side, working together in perfect harmony, there are a scientific institute, supported in the main by Government grants, and a commercial undertaking farming on a very large scale and selling seed direct to the farmer in competition with other seedsmen. That the General Swedish Seed Company recognizes its obligation to its scientific neighbour is clear from the fact that it contributes to the Institute's funds a considerable proportion of its profits, but it remains a commercial concern with shareholders to be considered and trade competitors to be faced.

I felt it would be unjust, if not impossible, to set up a parallel organisation in England. The Plant Breeding Institute of Cambridge works, like Dr. Nilsson's Institute at Svalöf, on purely scientific problems, and had hitherto distributed its products in a rather haphazard way for lack of a suitable organisation. Incidentally, such financial profits as might reasonably have accrued on the distribution of such notable new varieties as "Little Joss" and "Yeoman" went into private rather than public pockets. Any proposal to hand over the products of a State supported Institute to a purely commercial organisation which would make them an occasion for private profit, would have caused a not unjustifiable outcry.

It seemed to me obvious that the need existed for some new type of organisation which would distribute new varieties to the farmer after exhaustive trials had been made, employing any profits made by the undertaking on further work of the same kind. On the other hand it was most desirable to enlist the sympathies and active co-operation of the seed trade. I therefore designed the National Institute of Agricultural Botany to meet the situation.

Shortly after the opening of the Official Seed Testing Station for England and Wales a memorandum on the new proposals was written by myself and supported by letters from the then President of the Board of Agriculture, Lord Ernle, and other eminent agriculturists. I received from private friends donations in land and money amounting to over £ 25,000, and then laid my memorandum before my Seeds Advisory Committee, and the three Seed Trade Associations. These Associations answered the appeal nobly, subscribing altogether about

£ 23,000. Before, therefore, the Institute was formally founded in January 1918, I had secured in money and land subscriptions amounting to about £ 48,000 and a grant by the Government of an amount which gave the Institute a total capital of about £ 94,000.

The Institute is therefore a semi-official body of a new type, which owes its being, and will owe driving power hereafter, to a combination of many interests and many types of benefactors. This collaboration is represented in the composition of the Council of twenty one governing the Institute's affairs, over which I have the honour to preside. Three members are nominated by the Ministry of Agriculture, two by the University of Cambridge, one by the University of Oxford, four by Trade Associations, two by Farmers' Associations, and others are co-opted from among scientific agriculturists, such as Mr. Beaven the great barley expert, and Dr. Salaman whose researches in plant genetics have given him a reputation extending far beyond the English field.

It was arranged that the new Institute should take over from the Ministry of Agriculture the management of the Official Seed Testing Station for England and Wales. This will be done so soon as the fine new building we are erecting on a site of about 35 acres at Cambridge is completed, I hope in August next. The plans I now submit show, I think, that in accommodation and facilities we shall be behind no Station in the world. Even with the limited facilities hitherto at our disposal at the English Station, housed temporarily, we can claim to have achieved something. The operation of the Testing of Seeds Order has stimulated British agriculturists to a clear perception of the advantages deriving from seed control. The statistics of tests for the past five seasons are as follows.

	England and Wales.	Scotland.	Ireland.	Total.
1916/17	—	850	6,089	6,939.
1917/18	7,744	5,382	12,487	25,613.
1918/19	23,604	8,554	8,560	40,718.
1919/20	22,903	9,451	7,403	39,757.
1920/21	22,098	9,183	2,767	34,748.

(to end of April only)

During the last four seasons the official stations of the United Kingdom have carried out in all over 140,000 tests, and the work at the English and Scottish Stations still increases rapidly and is likely to develop to a greater extent next year.

At the English Station the samples sent in during the current season are 1,200 more in number than during the same period of last season. Scotland similarly shows an increase of 276 samples.

An interesting feature of the organisation of the new Station at Cambridge is the provision made for its staff. A Military Charity of which I am Treasurer is building fourteen houses adjoining the Institute. These will be occupied by the widows of British Officers who fell in the war and by permanently disabled Officers. Those who are able, and in any case their daughters will have an opportunity of employment in the Seed Testing Station.

The Chief Executive Officer of the Institute is Mr. Parker lately one of Professor Biffen's assistants, who will control what I may call our "Svalöf" activities, and the technical charge of the Official Station is in the hands of my colleague Mr. Saunders who succeeded Professor Stapledon in 1919.

I can only make brief reference to another important function of the Institute which deals with the danger to the British, potato crop occasioned by the disease synchitrium endobioticum. This can be met, as far as our present knowledge goes, only by creating a wide series of varieties of potatoes immune to the disease, and this is being done with increasing success by our plant breeders. The tests for immunity which have an important relation to the Ministry's legal control of the disease, are of great importance and have hitherto been carried out directly by the Ministry. This duty, however, like that of Official Seed Testing has now been devolved on the Institute, which has acquired for the purpose

a farm at Ormskirk in Lancashire, destined to be a Mecca for all who are interested in combating a serious menace to the potato industry all over the world.

I desire to make quite clear what are the functions of the Institute. It is designed to bring into one organisation, I might almost say, under one roof, all activities for the improvement of agricultural seed legal control only excepted. While closely linked with the Ministry of Agriculture and looking to it for financial aid in carrying on the important work entrusted to it, its constitution is semi-official and not purely official. It is not concerned with the administration of the Seeds Act which remains wholly the duty of the Ministry. It is not a policeman of agriculturists but their guide, counsellor and friend. Under its auspices the Official Seed Testing Station whose activities will be supervised by a Committee consisting of eminent economic botanists and other agricultural scientists, supported by two leaders of the seed trade and presided over by Sir Daniel Hall, the Chief Scientific Adviser to the Ministry, will be the impartial arbiter in all technical matters arising out of the administration of the Seeds Act. In the comprehensive trials leading up to the distribution of new varieties of plants of the farm which are evolved by the Plant Breeding Institutes of our Universities and by private research workers, it will have the advice and co-operation of the Seed Industry which sees in the Institute an Organisation designed to promote its highest interests.

I hope the Conference will believe that I lay before it the constitution and policy of the Institute in a spirit of modesty, even if I am optimistic as to its future achievements. I recognize that its various departments are infants who cannot compare with the manhood of the great established institutions such as the Seed Control Station of Denmark presided over so brilliantly by my esteemed friend Mr. Dorph-Petersen, or with the marvellous organisation of Svalöf to which I pay profound homage.

England has been a late starter in the field where all those whom I address have achieved successes acclaimed the world over, but I am assured that our efforts will be watched with sympathy by all of you. The great science of agriculture, upon which ultimately depends the prosperity and happiness of all our peoples, knows no frontiers, and my colleagues and I are assured that we may appeal to you for advice and assistance in our new enterprise, with the certainty that your answer will be charged with universal goodwill.

“The Seeds Act” (Loi des Semences) 1920 et l’Institut National de Botanique Agricole.

Par Sir Lawrence Weaver, K. B. E., F. S. A.

Director General, Land Department: Ministry of Agriculture and Fisheries.

Avant d’aborder sur les deux sujets que M. le Directeur Dorph-Petersen m’a prié de traiter, je dois des excuses aux honorables d’agronomes qui font partie de cette Conférence Internationale sur le contrôle des semences. Je pourrais presque dire que je me présente ici sous de fausses couleurs, puisque je ne suis ni scientifique ni agriculteur, mais tout simplement un administrateur. Qui s’excuse s’accuse, mais ma présence ici doit être pardonnée, parce que ma position officielle est un produit de la guerre, ainsi que mes deux sujets; (1) Le contrôle légal de l’industrie des graines en Grande Bretagne, et (2) Le nouvel Institut de Botanique Agricole.

Je dois demander aussi votre indulgence, si j’étends mon sujet au delà de la technique du contrôle des graines et si je touche aux affaires de politique et d’administration. Ces questions sont cependant alliées directement aux matières que je vais passer en revue vu que le nouveau développement de l’épreuve des graines en Angleterre sera associé à tous les autres aspects du perfectionnement des graines. Ce mélange de fonctionnements pourrait sembler nouveau à quelques uns parmi vous, mais il se base sur l’expérience gagnée dans les durs temps d’épreuve de ces quatre dernières années. Les instituts anglais sont souvent construits d’une façon qui fait offense aux instincts logiques, mais en général on trouve qu’en pratique ils marchent bien.

La tragédie du mois d'Août de 1914 a trouvé le »Board of Agriculture and Fisheries« de l'Angleterre et du pays de Galles (élevé plus récemment au rang de »Ministry«) un département de l'Etat assez petit. La nécessité absolue d'une grande augmentation des terres labourables dans le Royaume Uni a eu pour résultat la création du »Food Production Department« allié au »Board of Agriculture« mais presque indépendant. C'est à ce service que je fus conduit au mois d'avril 1917 par les circonstances résultant de la guerre et que je fus placé à la tête de la section des approvisionnements agricoles des graines, des engrais, etc.

Le nouveau département a toujours travaillé en liaison avec le »Board of Agriculture for Scotland« et le »Department of Agriculture for Ireland«, tous les deux indépendants l'un de l'autre et du département anglais, et dirigés par des ministres responsables pour les affaires écossaises ou irlandaises.

J'ai trouvé que tandis que le département anglais n'avait pris officiellement aucun intérêt aux affaires de l'industrie des graines agricoles, le département irlandais avait réussi à rendre loi le »Weeds and Agricultural Seeds (Ireland) Act« en 1909 mais, il s'appliquait seulement à l'Irlande.

En même temps un laboratoire officiel pour l'épreuve des semences fut fondé à Dublin. Mon collègue illustre Dr. Pethybridge en est maintenant le président. En 1914 un laboratoire semblable fut établi par le département écossais à Edinburgh; mon habile ami M. Anderson en est Directeur; mais c'était seulement pour les essais volontaires des cultivateurs et des marchands. Il n'y existait aucune surveillance légale jusqu'à l'apparition du »Testing of Seeds Order«.

Pendant l'été de l'année 1917 on vit se créer un contrôle rigoureux sur tous les efforts agricoles. Des décrets furent émis rendant obligatoire pour les agriculteurs de labourer les pâturages et de faire croître les récoltes les plus convenables suivant la décision des comités locaux; les prix des engrais furent fixés; les reformés furent organisés en bataillons agricoles; une armée agricole de femmes fut créée et l'agriculture en général fut contrôlée dans l'intérêt de la nation.

Un approvisionnement suffisant en semences devint bientôt une cause d'inquiétude et on prit des mesures pour l'assurer. Mes collègues scientifiques étaient non moins désireux d'assurer que dans un temps de tel besoin on ne fournirait aux cultivateurs que des graines pures et de germination complète, et par conséquent nous prîmes deux précautions.

Un laboratoire officiel pour l'épreuve des semences fut établi sous la direction de M. Stapledon, qui est depuis devenu Professeur de Botanique Agricole à University College du Pays de Galles, et le »Testing of Seeds Order« fut émis sous les »War Emergency Powers«.

Tous les deux, le laboratoire et la loi datent du quatorze novembre 1917, mais, le décret n'a commencé à opérer qu'au premier janvier 1918.

L'idée général du décret n'était pas de fixer un taux de germination et de pureté, mais d'obliger les marchands de graines à déclarer les pourcentages des graines qu'ils vendaient, et de permettre au cultivateur de déterminer si les pourcentages étaient satisfaisants.

L'expérience faite pendant les premiers cinq mois de 1918 des effets de ce décret amena un nouveau décret celui du premier juillet 1918, auquel les degrés définitifs de germination furent annexés pour les céréales, les pois, les haricots, et les légumes les plus importants.

Cet ordre s'appliqua à l'Ecosse et à l'Irlande aussi bien qu'à l'Angleterre et au pays de Galles, et les résultats du contrôle se sont montrés tellement salutaires pour notre agriculture qu'en 1920 les dispositions générales de cet ordre ont servi de base pour un projet de loi pour l'Angleterre, l'Ecosse et le pays de Galles, lequel projet fut ratifié le seize août 1920. Les conditions pourtant n'en seront mises à exécution qu'au premier août 1921, et jusqu'à cette date le »Emergency Testing of Seeds Order« restera en vigueur. A cause des

changements politiques en Irlande, la nouvelle loi n'a pas été adoptée dans cette partie du Royaume Uni, qui continue à appliquer la loi de 1909, mais toutes les ventes de graines irlandaises en Angleterre et en Ecosse sont soumises à la nouvelle loi de 1920. La nouvelle loi est un agent très flexible et renferme plusieurs traits nouveaux. Il autorise les départements d'Agriculture (a) à prescrire les détails qu'un marchand de graines doit donner à l'acheteur; (b) à rendre obligatoire l'épreuve des semences en vente par une des trois Stations officielles (en Angleterre, en Ecosse ou en Irlande) ou par quelque laboratoire privé autorisé par le Gouvernement; (c) à interdire absolument la vente des graines qui contiennent plus qu'un pourcentage prescrit de certaines herbes nuisibles.

Tous les détails des espèces de graines qui doivent être contrôlées selon ces prévisions sont le sujet d'ordonnances promulguées par les Départements d'Agriculture, lesquelles peuvent être changées et augmentées de temps en temps, mais il est entendu que toutes les sections intéressées seront consultées par les Départements. Cette considération me mène à une des parties les plus intéressantes du nouveau système du contrôle des semences que nous avons établi.

Lorsque, en l'année 1917, je me suis dirigé vers ce but, le Département a fondé deux comités de conseil, l'un pour les graines de céréales et l'autre pour toutes les autres graines agricoles. Ces comités furent composés de représentants des trois départements et de toutes les sections de l'industrie des graines. A ces comités fut soumis tout ce que le Gouvernement proposait concernant le contrôle, et c'est à leurs délibérations patriotiques et d'esprit large que nous devons un système de contrôle qui est théoriquement et pratiquement de la plus grande valeur pour l'agriculture.

Je voudrais ajouter que l'esprit public des représentants du commerce ne fut jamais du côté d'un trop grand relâchement du contrôle proposé même aux moments inévitables ou l'on était forcé de considérer des restrictions aux règlements dont les effets surchargerait l'industrie d'un travail additionnel qui seferait sentir dans chaque section de ses affaires, et qui auraient souvent l'effet de rendre invendables les semences de qualité médiocre dont la vente aurait été facile si le contrôle n'avait pas existé.

Quant à moi, je suis persuadé que dans un pays individualiste comme la Grande Bretagne il aurait été impossible d'imposer aux membres de l'industrie un système, plus rigoureux qu'il n'en existe au monde, si nous ne les avions pas convaincus, par des discussions libres à de maintes assemblées, qu'un rigide système de contrôle serait à la longue plutôt un avantage qu'un empêchement pour une entreprise bien organisée et dirigée d'une manière honorable. Permettez moi d'interpoler ici quelques mots pour attirer votre attention sur deux termes dont je me suis servi. Quand nous employons le mot «contrôle» par rapport aux semences nous voulons dire l'exercice des pouvoirs légaux du gouvernement à en régler la vente. Quand nous parlons seulement de l'essai des semences pour établir le degré de leur germination et de leur pureté nous ne disons pas le «contrôle des semences» mais simplement «l'épreuve des semences».

Mon collègue, M. Saunders, va vous renseigner sur les détails techniques des règlements déjà en vigueur et sur ceux qui seront émis sous peu, ainsi que sur méthodes employées dans les laboratoires, et les conditions auxquelles les laboratoires privés sont autorisés par le Département; je vous présenterai donc certains autres points de vue du plan pour le contrôle des graines en Angleterre qui font partie des fonctions de l'Institut National de Botanique Agricole.

Il faut vous rappeler qu'en 1917 j'étais tout à fait ignorant de toutes ces affaires et que, même à présent, je suis simplement amateur. Mon ancienne carrière de journaliste a pourtant donné un vif intérêt pour tout ce qui est imprimé. C'est donc avec grand intérêt, au moment où j'étais occupé du nouveau laboratoire officiel et du premier «Seeds Order», que j'ai étudié un article dans le Journal du «Board of Agriculture» de février 1917 sur les travaux de Professeur Biffen, Directeur de l'Institut pour la Propagation des Plantes à Cambridge, à qui l'agriculture anglaise doit une dette incalculable pour son inspiration et son achèvement. Dans cet article on a décrit aussi l'ouvrage commencé.

à Svalöf en 1886, qui a pour résultat la merveilleuse organisation que nous connaissons à présent. Je fus saisi de l'ambition d'établir en Angleterre un pareil système pour l'amélioration des plantes agricoles. Ma plus grande difficulté se trouvait dans le caractère spécial de l'industrie des graines en Grande Bretagne qui la rendait tout à fait différente des conditions en Suède. Le grainier anglais a de justes titres aux remerciements de l'agriculture pour avoir développé des variétés nouvelles et perfectionnées d'une manière commerciale mais ce développement, cependant, doit beaucoup à un esprit scientifique. Svalöf est une organisation double, moitié scientifique et moitié commerciale, qui n'aurait guère convenu aux conditions anglaises. Le visiteur à Svalöf peut remarquer côte à côte, travaillant en parfaite harmonie, un institut scientifique supporté en grande partie par le gouvernement; et une entreprise commerciale faisant la culture en grand et qui vend les graines directement aux cultivateurs, en concurrence avec d'autres grainiers. Que le «General Swedish Seed Company» reconnait ses obligations à son voisin scientifique est démontré par le fait qu'il attribue aux fonds de l'institut une proportion considérable de ses profits, mais en même temps il est, et il reste, une entreprise commerciale, avec des actionnaires qu'il faut considérer, et avec beaucoup de concurrents.

Je sentis qu'il serait injuste, sinon impossible, d'établir une telle organisation en Angleterre. Le «Plant Breeding Institute» de Cambridge, comme l'institut du Dr. Nilsson à Svalöf ne s'occupe que de problèmes purement scientifiques; jusqu'à présent la distribution de ses produits s'était faite-faute d'une organisation-plus ou moins au hasard.

Incidemment les bénéficiaires, qui auraient dû s'accroître par la distribution de nouvelles variétés aussi notables que «Little Joss» et «Yeoman» sont passés dans des poches privées plutôt que dans les coffres publics.

Aucune proposition de donner les produits d'un Institut dépendant de l'Etat à une organisation purement commerciale, qui s'en serait servi pour ses propres bénéfices, n'aurait donné lieu à une clameur assez légitime.

Il me semblait tout clair que nous avions besoin d'un nouveau type d'organisation qui ferait la distribution des nouvelles variétés aux cultivateurs après les avoir soumises aux épreuves les plus complètes; les profits de ce système seraient utilisés pour la continuation de travaux de même genre. D'un autre côté il fallait gagner les sympathies et la coopération active de l'industrie des graines. J'ai donc projeté l'Institut National de Botanique Agricole, afin d'atteindre ce but.

Bientôt après l'ouverture du «Official Seed Testing Station» pour l'Angleterre et le pays de Galles un mémoire des nouvelles propositions fut écrit par moi-même, appuyé par les recommandations de Lord Ernle, Président du Board of Agriculture, et par beaucoup d'autres agronomes éminents. J'ai reçu de sources privées des dons d'argent et de terrain qui montaient à plus de £ 25,000, et ensuite j'ai soumis mon mémoire aux «Seeds Advisory Committee» et aux trois associations de l'industrie des graines. Ces associations ont répondu noblement à l'appel en souscrivant une somme de presque £ 23,000. Ainsi avant que l'institut ne fut formellement fondé en janvier 1918, j'avais reçu en argent et en terrain des souscriptions montant à environs £ 48,000 et une subvention du gouvernement d'une somme qui donna à l'institut un capital total de £ 94,000.

L'institut est par conséquent un établissement demi-officiel d'un type nouveau dont l'avenir est assuré par l'union de beaucoup d'intérêts et de beaucoup de bienfaiteurs. Cette collaboration est représentée dans la composition du Conseil de vingt et un membres qui gouvernent les affaires de l'institut et duquel j'ai l'honneur d'être le Président. Trois des délégués sont nommés par le «Ministry of Agriculture», deux par l'université de Cambridge, un par l'université d'Oxford, quatre par des Associations Industrielles, deux par des Associations de Cultivateurs et les autres sont choisis parmi des agronomes tels que M. Beaven, l'expert sur la question de l'orge, et M. le Docteur Salaman auquel ses recherches sur la génétique des plantes ont fait une réputation qui s'étend bien au delà des côtes d'Angleterre.

Il fut convenu que le nouvel Institut se chargerait, à la place du «Ministry of Agriculture», du contrôle des Laboratoires Officiels d'Angleterre et du Pays de Galles. Ce sera fait aussitôt

que le nouveau bâtiment que nous faisons construire sur un terrain de 35 acres à Cambridge sera fini nous espérons vers le mois d'août prochain. Les plans que je soumets montrent — j'ose le dire — qu'en fait d'aménagement et de facilités nous ne serons inférieur à aucun des autres laboratoires du Monde. Même avec les facilités bornées que nous avons eues jusqu'à présent au laboratoire Anglais temporairement logé, nous avons achevé obtenu notre part de succès.

L'opération du »Testing of Seeds Order« a amené les agriculteurs britanniques à une perception très claire des avantages du contrôle des graines. Les statistiques pour les épreuves des graines pendant les cinq dernières saisons sont les suivantes.

	Angleterre et le pays de Galles.	Ecosse.	Irlands.	Totale.
1916/17	—	850	6,089	6,939
1917/18	7,744	5,382	12,487	25,613
1918/19	23,604	8,554	8,560	40,718
1919/20	22,903	9,451	7,403	39,757
1920/21	22,098	9,183	2,767	34,748

(jusqu' à la fin d'avril).

Pendant les quatre dernières saisons les laboratoires officiels du Royaume Uni ont effectué, en tout, plus de 140,000 épreuves, et les travaux des laboratoires anglais et écossais s'accroissent rapidement et on a tout lieu de s'attendre à ce qu'elles se développeront encore bien davantage pendant l'année prochaine. Au laboratoire anglais les échantillons soumis pendant la saison courante sont de 1,200 de plus que pendant la même période de la saison dernière. Aussi en Ecosse il y a une augmentation de 276 échantillons.

Un trait intéressant de l'organisation du nouveau laboratoire à Cambridge est la provision qu'on a fait pour le personnel. Une »Military Charity« (fonds pour améliorer les conditions des militaires) dont je suis le Trésorier est en train de construire quatorze maisons avoisinant l'institut. Elles seront occupées par les veuves des officiers anglais morts en guerre et par les officiers mutilés. Ceux qui sont capables de le remplir, et en tout cas leurs filles, trouveront l'occasion d'obtenir un emploi dans le laboratoire.

Le chef de l'institut est M. Parker, jadis assistant de M. le Professeur Biffen, qui aura le contrôle de ce que je puis appeler nos travaux Svalöf; et le côté technique du laboratoire est dirigé par mon collègue M. Saunders, qui a succédé à M. le Professeur Stapledon en 1919.

Je ne puis faire qu'une allusion très brève à une autre fonction très importante de l'institut, celle qui s'occupe du danger pour les récoltes de pommes de terre résultant de la maladie de »synchitrium endobioticum! La seule solution à cette difficulté d'après notre connaissance actuelle est de créer une grande série de variétés de pommes de terre qui ne sont pas sujettes à la maladie, et nos éleveurs de plantes y obtiennent un succès toujours croissant. Les épreuves pour l'immunité, qui sont alliées d'une manière importante au contrôle légal de la maladie par le Ministère, sont d'une grande importance et elles sont faites par le Ministère. Ce devoir, cependant comme celui des épreuves officielles des graines, est confié à l'institut qui a acquis dans ce but une ferme à Ormskirk en Lancashire, laquelle est destinée à être le La Mecque tous ceux qui sont intéressés à lutter contre une maladie qui présente une menace sérieuse pour l'industrie des pommes de terre dans le monde entier. Je voudrais rendre tout à fait clair ce que sont les fonctions de l'institut. Il a le dessein de ramener à une seule organisation, je pourrais dire à placer dans un seul bâtiment, toutes les activités pour l'amélioration des graines agricoles sauf seulement le contrôle légal. Quand même il est relié directement au »Ministry of Agriculture« et s'attend à en recevoir d'elle quelque assistance financière pour continuer le travail important qui lui est confié, sa constitution est en partie — mais non entièrement — officielle.

Il ne s'intéresse pas à l'administration de la »Seeds Act« qui reste entièrement le devoir du Ministère. Il n'est pas le gendarme des agriculteurs, mais plutôt leur conseiller, leur directeur et leur ami. Sous son aspect de laboratoire officiel pour les épreuves

des semences, dont les travaux seront surveillés par un comité composé de botanistes éminents et d'agronomes, assistés par deux chefs de l'industrie des graines sous la présidence de Sir Daniel Hall, conseiller scientifique en chef du Ministère, il sera l'arbitre impartial dans toutes les questions techniques qui pourraient être soulevées au sujet du 'Seeds Act'. En faisant les épreuves extensives menant à la distribution de nouvelles variétés de plantes de grande culture découvertes par les Universités et par les recherches des personnes privées, il aura le conseil et la co-opération cordiale de l'industrie des graines qui voit dans cet Institut une organisation destinée à avancer ses plus grands intérêts.

J'espère que la Conférence voudra bien croire que je lui ai soumis la constitution et la politique de l'Institut en toute modestie, même si je suis optimiste, quant à ses résultats dans l'avenir. Je reconnais bien que ses différentes sections sont des enfants qu'on ne peut nullement comparer à l'âge mûr des grandes institutions déjà établies, telles que le Seed Control Station de Danemark présidé d'une manière si distinguée par mon ami si estimé M. le Directeur Dorph-Petersen, ou avec l'organisation merveilleuse de Svalof à laquelle je rends mes hommages les plus sincères. L'Angleterre est entrée tard sur le champ où tous ceux auxquels je m'adresse ont remporté des succès acclamés par le monde entier, mais je suis assuré que vous tous suivrez nos efforts avec sympathie. La grande science agricole de laquelle dépend en fin de compte la prospérité et le bonheur de tous les peuples, ne reconnaît pas de frontières, et mes collègues, ainsi que moi-même, sont assurés que nous pouvons vous faire appel pour tout conseil et aide dans notre nouvelle entreprise avec l'assurance que votre réponse ne nous apportera qu'une bienveillance universelle.

Professor Johannsen thanked Sir Lawrence Weaver. Summarized in German and introduced Mr. Saunders.

Mr. Saunders:

"Seed Testing in the United Kingdom."

By Mr. C. B. Saunders, Director of the Official Seed Testing Station, Ministry of Agriculture and Fisheries, London.

"At the outset I feel that I ought to express on behalf of myself and of my colleagues at the other official Seed Testing Stations our appreciation of the honour conferred on us in being asked to describe the methods of Seed Testing in the United Kingdom. At the same time I do not quite understand why our methods in particular should be of greater interest than those of any other country. The only suggestion that enters my mind is that our Stations are of more recent date than those of most other countries represented here, and that, therefore, it might be supposed that our methods might be more up-to-date and novel. If that suggestion is correct I would hasten to assure you that our methods are largely based upon the result of the work of many years at Copenhagen, Zurich and the various other Continental Stations, and in this connection I would like to place on record our appreciation of the value of the Official Regulations for Seed Testing published from time to time by the German Association of Experiment Stations.

As the general question of making purity and germination tests is subsequently to be raised by gentlemen more competent to do so than myself, I do not propose to discuss the British methods in any detail. I think it would be of greater interest if I were briefly to describe the requirements of our Seeds Act which has been referred to by Sir Lawrence Weaver in an earlier paper. I will then touch upon one or two details of routine Seed Testing where our practice differs from the usual Continental practice, and I hope I may be able to offer one or two suggestions which may be of interest.

Sir Lawrence Weaver has already told you that a Seeds Act has been passed which comes into force on the 1st August next. At present we are working under a temporary Order called "The Testing of Seeds Order", but the differences between the Act and the Order are not great. I will, therefore, refer to the Act all through. The Act itself does

not contain the whole of the legislation affecting the sale of seeds, but it empowers the Ministry of Agriculture to make Regulations for the sale of the seed. The Act is part of the Law of the Realm, but the Regulations can be varied from time to time provided that all such Regulations are submitted to the approval of the Houses of Parliament. For the purpose of this paper I will consider the Act and the Regulations together, since this will make an explanation more simple.

The Seeds Act requires the seller of practically all kinds of farm seeds and of the principal garden vegetable and forest tree seeds and of seed potatoes to make at the time of sale a declaration giving certain specified particulars regarding such seed. As these particulars vary with the nature of the seed, I will consider them under several headings.

In the case of Grasses and Clovers the main particulars to be declared are the country of origin, the percentage of purity, the percentage of germination and, in the case of Clovers, of hard seed and the percentage of Injurious Weed Seeds if over 1% are present. In the case of Clovers the presence of Dodder has to be notified if it occurs to an extent exceeding 1 seed in 4 ounces of the larger Clovers, and in excess of 1 seed in 2 ounces of the smaller Clovers. The Injurious Weeds for the purposes of the Seed Act are Docks and Sorrels (*Rumex* sp.), Cranesbills (*Geranium* sp.), Wild Carrot (*Daucus Carota*), Yorkshire Fog (*Holcus lanatus*) and Soft Brome Grass (*Bromus mollis* et sp.).

In the case of Root and Vegetable seeds it is necessary to declare the percentage of purity and the percentage of germination provided that the purity need not be specifically stated if it is over 97% and that the germination need not be specifically stated if it is above a certain figure called the "Minimum percentage of germination". The Regulations contain a list of these minimum percentages of germination for the different kinds of seeds covered by the Act, and if the growth of the sample is above this figure it is sufficient for the seller to state that this is the case provided that at the same time he states for the benefit of the buyer what this minimum percentage is.

In the case of Cereals the purity is not required, but it is necessary to declare the percentage of germination subject to the use of a minimum percentage figure similar to that referred to in the case of Root and Vegetable seed. In the case of Forest Tree seeds, in addition to purity and germination, the date of collection and the country of origin has to be stated, and in the case of seed Potatoes a statement as to the size and dressing as well as to the country of origin.

A declaration of this nature is only required in cases where the seed is being sold for purposes of sowing, and, to facilitate trade, a seed merchant is allowed to sell to another seed merchant without a declaration provided that the buyer gives a written statement that he will not sell the seed without having it tested or without getting a similar statement from his buyer. This means that the seed must be tested before it gets into the hands of the man who is actually going to sow it.

The above declarations required in the case of the sale of seed must be based upon tests made at one of the three Government Stations or at a Licensed Station. A Licensed Station is one maintained by a seed firm for purposes of its own Trade, and is only licensed after inspection by officials of the Ministry and upon giving an undertaking to comply with certain rules. It may be of interest to know that the conditions to be observed by a Licensed Station specify the amount of seed to be taken for Purity and Germination tests and also require the license to hold for three months all samples on which tests have been made, so that check tests can be made, if desired, by the Official Station. At present seed firms that have applied for licences are being inspected to see how far they are fit to receive licences. It is hoped by these means to improve the standard of Trade Seed Testing which at present is none too high.

A further provision of the Seed Act empowers representatives of the Ministry to enter shops and warehouses and to take samples of seed held or exposed for sale. These samples are submitted to one of the Official Seed Testing Stations, and if the result of the test there made shows that the seller's declaration is incorrect, subject to the usual scales of

latitude and subject to certain other clauses for the protection of the seller, then the Ministry can take action against the seller. Suitable penalties are imposed by the Act for cases of this sort. You will observe that this form of seed "control", as we call it, differs from the voluntary control existing in some of the Continental countries. Without arguing the merits of the two systems, I think that the Continental system would be impossible in Great Britain owing to the fact that the trade in seeds is not confined to a relatively few firms, but is in the hands of thousands of traders and firms of all sizes some of whom only deal in seeds as a side line. I think that the advantage of our Seeds Act is that it enables the supervision of these smaller traders, since they undoubtedly are the people who handle the seed of low quality. These people would probably remain outside any scheme of voluntary control and there would be nothing to prevent them selling inferior seed to the farmer.

The Seeds Act contains no special regulations with regard to imported seed, such seed as soon as it reaches this country becoming subject to the ordinary requirements of the Seeds Act. The only entirely prohibitory clause in the Act is one which forbids the sale of any seed for sowing which contains more than 5% of Injurious Weeds.

I think that is all I need say about the requirements of the Seeds Act, and before turning to our actual methods of testing there are one or two points regarding the administrative side of a Seed Testing Station to which I would like to refer. From my knowledge of the other Stations in the United Kingdom, and the principal Continental Stations, I am inclined to think that the English Station goes further than do other Stations in dividing the work into sections which are more or less self contained. Most Stations I know keep Purity and Germination rooms separate, and my impression is that the personnel of the Purity room is usually distinct from the Germination staff. There may be a certain amount of division of the work in the Purity or in the Germination rooms, but each staff deals more or less with all classes of seed. Our method in England is rather different. The work is divided into four sections according to the kind of seed tested (Grasses, Clovers, Cereals, Roots and Vegetables), and there is a separate staff for each section who are responsible both for Purity and Germination. Thus the staff of the Clover section deals with Clover samples from beginning to end and does not handle Grass or Cereals at all. This appears to me to be a better plan, particularly where large numbers of samples have to be dealt with, for a single person or batch of persons can more quickly handle one hundred Clover samples than they can deal with one hundred samples of assorted species. I think moreover that it makes supervision more easy, and the head of each section in time becomes a specialist in her kind of seed. The junior assistants in each section are, of course, from time to time changed so that they get a chance of passing through all sections.

Another point to which I should like to refer is the method we adopt for recording samples on their receipt. Most Stations adopt what I will call the method of consecutive numbering. Thus a merchant sends three samples, one each of Reed Clover, Cocksfoot and Beet; these will be numbered perhaps 4067, 4068 and 4069. This method probably works satisfactorily where all samples go to the same room for Purity test, but where they go to different rooms, as they do with us, it might lead to samples being mislaid, since the numbers would not run consecutively in each section. Our method is to give a letter to each group of seeds and a further letter to designate the species, thus Red Clover is Aa, Alsike Ab, Perennial Ryegrass Ba, Italian Ryegrass Bb and so forth. Our ledgers are ruled accordingly and each species under its letter is numbered consecutively. Thus we might refer to the above samples as Aa 267, Bc 103 and Eb 182. Each section, therefore, gets its samples numbered consecutively under its own letters, and if a number is missing, the fact is at once obvious. It also enables report forms to be numbered and bound into books which need pass only from the office to the special section concerned. To make this description more clear I will pass round for inspection a page from one of our ledgers.

Our methods for making the actual tests of seeds are naturally based upon the requirements of the Seeds Act, thus for example we do not make quantitative Purity tests

of Cereals because the Purity of Cereals does not have to be declared. The method of making Purity tests does not differ materially from that adopted in other Stations, but there is one important exception. At present and until 1st August when the Seeds Act comes into force, Purity tests on Grasses are made on what we call the Irish Method. Light seeds are called pure seeds or in the words of the Testing of Seeds Order, a Grass seed shall be considered to be pure "if it consists at least of the two united pales, regardless of the state of development or even the entire absence of the caryopsis or kernel within the pales" This is contrary to all Continental practice, though this method is adopted in some of the British colonies. I am aware that Continental analysts despise this method and my friend, Professor Voigt, described it to me last year as a method only fit for use by chemists! It may, therefore, be of interest to consider the reasons for adopting this method. When the Irish Station was started twenty years ago, the technical advisors of the Department were confronted with the problem of the occurrence of large quantities of Ryegrass seed containing much of this light seed. It appeared that the best way to encourage the cleaners to remove this would be to penalise it by bringing the light seeds into the Germination test where their inability to grow would reduce the percentage of Germination by a greater amount than their inclusion in the Impurities would reduce the Purity of the sample. It is unnecessary perhaps to elaborate this argument to an audience like this, but I will take, to show what I mean, an extreme case of a sample of Ryegrass, containing by number 50% good plump germinating seeds and 50% light seeds. This sample would show by an Irish test 100% purity and 50% germination, by a Continental test 75% to 80% purity and 100% germination. The Irish method gives the lower figures and more particularly shows a low germination for the sample. Since the farmer as a rule pays more attention to germination figures than to purity figures it is obvious that the cleaner will be encouraged to blow out the light seed. The adoption of this method proved very satisfactory in Ireland, and when the Scottish Station was opened they adopted the same method. The English Station was started in 1917, and though the Seed Trade asked for the adoption of the Continental method, it was thought inadvisable to have two methods in use in the same country. The Irish method was, therefore, adopted, and the matter left for reconsideration when the Seeds Act came into force. In framing the Regulations under the Seeds Act this wish of the Trade for the Continental method has been granted and after 1st August next we shall adopt, in England and Scotland at least, the Continental method of Grass Seed Testing. The reason stated by the Seed Trade for desiring the latter method is that the Irish method interferes with their Continental Trade. I sometimes wonder how far this is the real reason. Personally I hold no brief for either method. The Irish method as practised by us is illogical since we treat a Grass seed without any caryopsis and which, therefore, cannot grow as a pure seed, and at the same time we call broken Clover seeds or empty Mangel clusters impurities. On the other hand I really believe the adoption of a universal method for all seeds based on the Irish method of grass testing would result in improved seed. You may argue that the Irish method leads to absurdities in extreme cases, but so does the Continental method. I will not discuss the pros and cons of the two methods any further, since the matter will probably be brought up again before the end of this Conference.

I do not think that our methods of making Purity tests differ in other respects from those in common use elsewhere. I might perhaps mention that for Dodder examinations we use a home made machine with an endless velvet band which passes the whole of the sample before the eye of the analyst. Also I would like to draw the attention to those who do not use them to the torsion-balances made by the Torsion Balance Company of New York. I find that in weighing small unknown quantities of impurities three to five weighings can be made on this balance, while one weighing is being made on an ordinary chemical balance.

I might add that at present no field trials are being conducted by the English

Station, but it is hoped that it will be possible to start these next season. Special examinations of seed with a view to its being diseased are not made, but in the case of Cereals where Burnt, Smut and Ergot are visible to the naked eye, this fact would be noted on the report.

Our methods of making Germination tests are largely based on the established practice of the older Stations, but the three Stations in the United Kingdom do not necessarily adopt identical methods. For Grass both Scotland and England rely mainly on the Jacobsen Tanks, but Ireland prefers the Rodewald Incubator. In England a cabinet type of Germinator is used for Cocksfoot mainly owing to the difficulty of fluctuating the temperature of a Jacobsen Tank with any accuracy. As a matter of fact our Tanks are at present situated in a conservatory and they are subject to uncontrolled fluctuations of temperature which we look upon as being not undesirable. Clovers are usually germinated on filter paper in petri dishes placed in cabinet Incubators. The petri dish is covered with a flat glass plate containing a hole for ventilation. An alternative method which I have not seen in use anywhere else gives better results for some Clovers. The seed is placed upon filter paper lying on the surface of about 1 inch of moist sand contained in metal trays about 18 inches by 12 inches. The trays are placed in racks in a room maintained at 20 degrees centigrade. This method is usually preferable for all Clover samples which are likely to show a large percentage of burst and abnormal growths. Cereals and the larger seeds, such as Peas and Beans, are grown in sand, and sand is also used for Mangel and Beet germinations. In the latter case we use aluminium dishes 6 inches in diameter, each of which would contain a hundred clusters pressed into about half an inch of moist sand. We get much better results for Mangel and Beet by this method than we do by growing the seed between folded blotting paper, and in fact this latter method is not used in England for any kind of seed. At present the percentage of Mangel and Beet is expressed in terms of the number of sprouts per hundred clusters, but after the 1st August next it will be expressed in terms of germinating clusters instead.

In view of the fact that Purity and Germination questions are being dealt with in other papers, I would not be justified in taking up more of your time. As the representative of the youngest of the Seed Testing Stations, I think I can justly claim the indulgence granted to children, and I hope you will not be unduly critical of this paper. At the same time it is with a certain amount of pride that I can state that though not yet four years old the English Station is handling more samples than is any other Official Station with one exception. This venerable institution whose jubilee we are now celebrating is at present leading the field, but we are pressing closely behind it. As to the future, I will not venture to prophesy, but would prefer to be considered, in the words of Sir Walter Scott, one of our British authors, as one of "The better informed Philomats who, instead of loading their almanacs with vain predictions of political events — — pretended to know what seeds would grow and what would not".

Professor Johannsen thanked Mr. Saunders and stated that as there unfortunately was no delegate present from the United States of America, Mrs. Kølpin Ravn would read a paper on "Seed Testing in the United States of America" by Dr. Brown, Botanist in charge, Washington D. C.

"Seed Testing in the United States of America."

"Mr. President, Your Excellency, Ladies and Gentlemen!"

In the United States of America the importance of seed testing as an aid to agriculture was first brought to attention in 1876, when the State Agricultural Experiment Station of Connecticut included in its annual report an outline of seed testing as then carried on in Europe, based on the observations of two young American chemists,

Jenkins and Wernicke, who had visited Dr. Nobbe's laboratory at Tharand, and had become familiar with the work he was carrying on there.

In the succeeding years, Dr. Le Doux in North Carolina and Dr. Wm. J. Beal in Michigan pointed out the importance of seed testing. Dr. Chas. E. Bessey at the University of Nebraska, appreciating the importance of this practical application of botanical training, directed the attention of his students to this field. Through the personal influence of Dr. Bessey and Dr. Beal, more students of the University of Nebraska and of the Michigan Agricultural College than of all other institutions in the United States have become trained workers in this field. The work of these two men laid the foundation for seed testing in this country and kept it before the public during the next fifteen or twenty years.

A student and assistant to Dr. Beal, the late Gilbert H. Hicks, in 1896 organized seed testing as a definite line of investigations in the United States Department of Agriculture. Through publications, addresses and the preparation and distribution of authentic sets of seeds, as well as through testing seeds for farmers and seedsmen, Hicks carried on a vigorous campaign of education. From this time, seed testing was taken up by more and more of the State Agricultural Experiment Stations and Agricultural Colleges. They undertook the testing of seeds for farmers and seed dealers, issued bulletins of information as to the quality of agricultural seeds on sale and pointed out the abuses in the seed trade which were detrimental to agriculture. The work started by Hicks has been carried on by the United States Department of Agriculture, where not only seeds passing in domestic trade have been analyzed, but the quality of our imports has been carefully studied.

In 1906, approximately one million pounds of imported low-grade red clover seed examined, contained only forty-three per cent of pure live seed, and two hundred and seventy-five thousand pounds of imported low-grade alfalfa seed contained only forty-four per cent of pure live seed.

The Constitution of the United States distinguishes sharply between the powers of the Federal Government and of the individual States in regulating commerce, the Federal Government being given control over trade between individual States and trade with foreign countries, while the individual States may regulate trade within each State. This division of authority permits wide variation between laws governing the same line of trade in different States without reference to what regulations the Federal Government may establish governing interstate traffic.

In 1897, Maine was the first State to enact a law regulating the sale of agricultural seeds. This early law, however, did not take into account the important question of germination. Other States followed slowly with laws differing radically from each other; one requiring only a statement of the year of growth, and another prohibiting the sale of seed containing the seeds of a particularly noxious weed.

The value of greater uniformity in State laws was soon apparent, as was the necessity for restricting the quality of seeds brought into the United States from foreign countries.

At a conference of State and Federal Agricultural officials in November 1896, a committee was appointed to formulate uniform regulations for seed testing in the United States. These have since been revised and reissued from time to time.

The United States Department of Agriculture in 1904 was authorized to purchase forage-plant seeds to examine them and to publish the names of the dealers with the analyses when such seeds were found to be adulterated or misbranded. The result of this informational service has been to greatly reduce the sale of adulterated and misbranded forage-crop (grasses and clovers) seeds in the United States. This informational service, together with the State laws, has been largely responsible for the establishment by all of the large seed dealers of their own seed testing laboratories where they make tests of the seeds they are handling.

On December 31, 1908, a meeting of the State and Federal seed analysts was called for the purpose of uniting them in an organization in support of uniform state legislation, and for revising the regulations for seed testing. This was the beginning of the Association of Official Seed Analysts of North America, which has met in annual convention since that time. (At the second annual meeting, a bill was formulated as a basis for uniform State legislation governing the trade in agricultural seeds. This was discussed with the Seed Trade Associations of the United States and revised from year to year as the result of suggestions and criticisms of both the seed analysts and the seed trade. This co-operation resulted in turning the opposition to State legislation on the part of the seed trade to endorsement of it until thirty-seven States now have laws regulating the sale of agricultural seeds, the later ones following closely the uniform bill. These State laws are primarily labeling laws, requiring a statement of the name and address of the seller, the kind of seed and the percentages of pure seed, weed seeds, and germination.

One of the most helpful lines of activity of the Association of Official Seed Analysts of North America has been the work of the referees on methods of testing seeds. Each year a set of samples has been distributed to official analysts, Federal and State. These have been tested and the results reported and discussed at the meetings. In this way, the practices followed in the different seed testing laboratories have been compared and any discrepancies brought to light. Out of the reports of the referees, have developed modifications of the regulations for seed testing.

In the determination of the pure seed of grasses, only their caryopses containing embryos are considered as pure seed, and those without embryos are considered as inert matter.

In 1912, the Seed Importation Act became a law, restricting the quality of specified seeds imported into the United States. This Act establishes standards of pure live seed and of freedom from adulterants and weed seeds which must be reached by all seeds before they are permitted entry into the United States. The Act provides, however, that seeds may be recleaned under government supervision for the purpose of making them comply with the Act, the refuse removed in such cleaning to be destroyed and not exported.

All lots of seed subject to this Act are sampled by the United States Customs Service, the samples being submitted to the United States Department of Agriculture for examination as to quality. Samples are required from twenty per cent of the sacks of each lot. If the first test shows the seed to fall below the requirements of this Act, retests are made and second samples are drawn and tested whenever the interested parties so desire. The final action in the case of each shipment is based on tests made by the United States Department of Agriculture.

The volume of the international trade of the United States in agricultural seeds for the years 1914—1919 is shown in the following table, as reported by the Department of Commerce.

Imports

Forage-Plants	1914	1915	1916	1917	1918	1919
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Clover, red.	6 764 000	8 749 000	33 476 000	3 966 000	931 000	7 025 000
Clover, other.	23 343 000	15 406 000	8 363 000	7 914 000	8 588 000	18 016 000
Grass, other forage	31 937 000	34 690 000	8 790 000	6 277 000	6 076 000	15 609 000
Total forage.	72 337 000	74 727 000	59 671 000	33 579 000	19 892 000	50 480 000
Sugar Beet.	10 293 000	15 882 000	9 042 000	15 422 000	4 297 000	9 830 000

Exports

Forage-Plants	1914	1915	1916	1917	1918	1919
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Clover.....	4 640 000	9 750 000	7 116 000	8 738 000	5 985 000	7 943 000
Timothy.....	12 480 000	17 333 000	13 610 000	13 880 000	8 564 000	13 346 000
Other forage.....	5 156 000	4 342 000	3 613 000	5 426 000	2 952 000	4 440 000
Total forage.....	22 276 000	31 425 000	24 339 000	28 044 000	17 501 000	25 729 000
Imports Excess over Exports.....	50 061 000	43 302 000	35 332 000	5 535 000	2 391 000	24 751 000

Summary of conditions in the United States.

1. Seed testing is recognized as one of the essential factors in agriculture.
 2. Thirty-seven States have laws regulating the quality of agricultural seeds which may be sold within the State, and maintain seed testing laboratories.
 3. Most seed dealers have their own seed testing laboratories.
 4. Practically all of the field seeds sold in the United States are tested for quality either in official laboratories or privately by seed dealers.
 5. The Association of Official Seed Analysts of North America and the Seed Trade Associations are co-operating to improve the quality of agricultural seeds in the United States.
 - 5-A. The Association of Official Seed Analysts of North America, including in its membership all official analysts in the United States and Canada, while without authority to enforce its decisions, formulates and suggests remedial legislation and studies and recommends technical methods for seed testing.
 - 5-B. Many of the States having seed laws, specify that tests be made according to the methods recommended by the Association of Official Seed Analysts of North America.
 - 5-C. In testing grasses, caryopses without embryos are considered as inert matter.
 6. The sale of adulterated and misbranded agricultural seed has been very greatly reduced in the United States.
 7. The Seed Importation Act prevents the importation into the United States of low-grade field seeds.
 8. The United States is a large factor in the international trade in agricultural seeds.
- In view of the present conditions in the United States, our international needs appear to be as follows:
1. We should know the methods of testing seeds in all countries with which we have reciprocal trade.
 2. The greatest possible uniformity in such methods, but more particularly uniformity in results should be obtained.
 3. Both the analysts and the seed trade should be familiar with trade customs as well as with import restrictions of each country.
 4. As it is uneconomic to ship to a country seeds of such low quality that they are of little or no agricultural value, or will be prohibited from going into trade on arrival, some means should be found for preventing the export of such valueless material.
 5. At present, there is no sound basis for the determination of quality in the case of disagreement arising out of international commerce in seeds. Following the adoption of uniform methods by analysts, an agreement among international merchants to rest arbitration as to quality on official analyses made in the country of arrival would stabilize trade and largely eliminate the shipment of low grade seed."

Professor Johannsen thanked Mrs. Kølpin Ravn and introduced Mr. Clark.

Mr. Clark read a paper on:

"Seed Testing and Seed Control in Canada."

"Seed Laboratories in Canada follow primarily the methods for seed testing prescribed by the Association of Seed Analysts of North America and in addition, whenever occasion should require, duplicate and triplicate tests are made by following such other methods as experience may have shown to be good. The problems entailed in making dependable germination tests of some kinds of seeds that have matured in our northern climates with occasional slight frost before being fully matured, are not common to most countries. The prescribed method for testing seed oats if applied to oats that have suffered two or three degrees of frost before harvest commonly will give results much below the actual value of the oats for seeding purposes. Six months after harvest the same oats will give a decidedly higher percentage germination and with stronger vital energy. When freshly harvested they may be kiln dried at proper temperature, or for laboratory purposes, exposed to the sun under glass for a few days and then duplicate tests in good natural soil may give fair results in 6 and 14 days under temperatures ranging from 18° C to 20° C. Much depends on the judgement of the analyst, and for germination tests with frosted seeds he ought to have good training in botany and considerable experience in seed testing. With a very few exceptions, however, we do not find it necessary to depart from the prescribed methods of our Association.

Our seed testing staff consists of a Chief Analyst, one supervising analyst for each control district, a senior analyst for each division of seed testing work, and a larger number of analysts.

We have three district laboratories and now find it necessary to increase their number. It is our experience that a supervising seed analyst should not be expected to assume responsibility for seed test record certificates in excess of an average of one hundred and fifty per day. In addition to directing the work, his personal attention is needed to a considerable percentage of the samples in the hands of less expert workers. The chief analyst divides his time among all the laboratories under his direction. He has some time, with special assistants, for research work.

The purpose of our laboratories for seed analyses, is to provide a proper basis on which to establish our system of seed control, which form a separate division of service. The responsibility of the analyst does not extend beyond the issue of seed test records and operating the laboratory on the basis of service at cost. We have never succeeded in making our laboratories pay their operating expenses. It would seem to be the natural inclination of most seed analysts who possess superior technical training, to do very careful work requiring much time to make fine determinations by weight, the utility, value of which unfortunately neither the Canadian farmers nor the seedsmen appreciate or are willing to pay for. The aim has been to obtain the easiest and most effective seed control regulations with the simplest and shortest possible process of analytical work. The nature of the work to be done by the analyst is therefore prescribed in effect by the seed control regulations, which are designed by the staff of seed inspectors.

Our seed control staff of inspectors forms a separate division of the service. They have only a general knowledge of botany but are required to have a special training in the practices of commerce and agriculture. They are organized into six control districts and in addition to seed control have to administer other agricultural laws pertaining to feeding stuffs and fertilizers.

Seed inspectors also encourage the production of good seed among private growers, assist them to obtain pure stock seed that may have been bred and selected at federal or provincial government experiment stations, inspect their seed crops and certify the registration of same and finally inspect and seal the registered seed in the sacks ready for commerce.

When sold for seeding timothy, alsike, red clover and alfalfa seed must be graded

to conform to the seed control regulations. Seed merchants or farmers draw and send to the district seed control station a sample of the seed held for sale. This sample is known as the control sample and is kept for one year. After the sample is analyzed in the seed laboratory, to determine the number of noxious weed seeds and the number of other weed seeds per ounce of the control sample, the seed inspector who is expert in the judging of general quality as to vitality, colour, cleanliness and other factors, determines the grade of the seed, and a certificate of grade is issued accordingly; when shipping the seed in commerce the number of the certificate is quoted on the invoice or elsewhere, as a reference to the authority for the grade. It is the privilege of any purchaser to send a sample of the seed so obtained, together with the certificate number for comparison with the control sample on which the certificate was issued. Severe punishment is administered to any who attempt fraudulent practices under this system.

In addition to the principal grass and clover seeds used in Canada, this system of grading based on control samples is extended to most kinds of field seeds when requested by the seedsmen or farmers. This system is rapidly increasing in general practice because most farmers who buy prefer to pay a higher price and obtain seeds that are graded under the seed control system.

Because of the requirements of commerce the certificates of grade are issued on the day the sample is received and without waiting for the results of germination test for those kinds of seed as timothy, red clover, alsike, alfalfa, and cereal grains that may be judged as to vitality from careful examination to be not less than 90 % and probably 95 % germinable seeds. With all of the finer grass seeds and when any seeds appear to be of doubtful vitality the certificate is not issued until germination test is made.

In addition to control sample certificates, more important certificates are issued for wholesale quantities when official samples are drawn by control seed inspectors. When these certificates are issued at the request of seedsmen or producers, it is the common practice to seal the seeds in the sack and stencil the sacks with the origin of the seed, the special variety if any, the kind of seed, the grade and the number of the certificate.

It is understood that when the seal is broken the assurance of the quality of the seed contained in the sack may not be continued.

The following are the provisional definitions of grades that may be applied to Canadian Alsike seed for export to Europe. The percentages of weed seed content may have to be changed to apply to Europe in general if and when this seed control conference of Europe prescribe what may be included as "noxious weeds" and also what may be included as "other weeds"

Tentative Draft of Standard Grades Alsike Seed-Canadian.

(Prepared to confirm to the British seed control regulations. Statements of percentages are only suggestive.)

Extra No. 4 Export Alsike Seed shall be mature, sound, plump, of good colour, dry and sweet, well cleaned and graded, free from the noxious weed seeds prescribed by British Ministry of Agriculture, and contain not less than 99 % pure and 95 % germinable seeds.

No. 1 Export Alsike Seed shall be mature, sound, plump, of good colour, dry and sweet, well cleaned and graded, free from dodder, contain not less than 98 % pure alsike seed, not more than one tenth of one per cent by number of the other noxious weed seeds prescribed by British Ministry of Agriculture, and not less than 93 % germinable seeds.

No. 2 Export Alsike Seed shall be reasonably mature, sound, of medium colour, dry and sweet, well cleaned, free from dodder, contain not less than 92 % pure alsike and 97 % pure alsike, white clover, timothy, and other useful seeds, not more than one-fifth of one per cent by number of the other noxious weed seeds prescribed by the British Ministry of Agriculture and not less than 90 % germinable seeds.

No. 3 Export Alsike Seed shall be reasonably mature, sound, cleaned, dry and sweet, free from dodder, contain not less than 87 % pure alsike and 95 % pure alsike, white clover, timothy, and other useful seeds, not more than one half of one per cent by number

of the other noxious weed seeds prescribed by the British Ministry of Agriculture and not less than 85 % germinable seeds.

"Alsike Mixture" shall be the designation of any mixture in which alsike seed predominates, and any certificate of grade issued therefore shall include a statement of the kinds and the percent of each kind of clover and grass seeds which compose more than five per cent of the mixture, and shall in all other respects conform to the defined standards of quality for No. 1, No. 2, or No. 3 grades provided for "Export Alsike Seed."

Professor Johannsen thanked Mr. Clark and introduced Mr. Nissen and Mr. Frandsen, who invited the congress to Amagergaard and Øtøftegaard to see the experiment farms respectively of the seed firm "Trifolium Ltd." and "Danske Landboforeningers Frøforsyning" (Danish Farmers Association of Cooperative Wholesale of Seed).

Dr. Buchholz asked Mr. Saunders how long samples are kept. 3 months?

Mr. Saunders: "No. To the end of the season i. e. July 31. Some are kept a full year, others a shorter period. The average is 9 months".

Professor Johannsen: "In Denmark samples are kept the working year plus one entire additional year".

Mr. Falkentorp, Seed-merchant: "How is dodder (*Cuscuta* sp.) treated in England?"

Mr. Saunders: "The treatment is based on the legal requirements of the Seeds Act.

It is allowed present to the extent of

1 seed in 4 oz, in the case of large seeded clovers,

1 " " 2 " " " " " " small " " "

Seedsman are, on request, given more information according to the following scale:

Dodder present not exceeding 5 in 4 oz (115 gms)

20 " 4 "

100 " 4 "

more than 100 " 4 " "

Mr. Falkentorp: "If a lot contains more than 2000 seeds of dodder would it be excluded from the country?"

Mr. Saunders: "No, it may be imported. The only prohibitory clause is that seed shall not contain more than 5 % of seed of noxious weedlist given".

Professor Johannsen

asked if there were further remarks schloß die Sitzung bis Mittwoch, to be made. The meeting was adjourn- den 8. Juni um 9½ Uhr. ed until the next day, June 8, at 9:30 A. M.

8. Juin 1921.

Professor Johannsen

opened the meeting and introduced eröffnete die Sitzung und erteilte das the first speaker. Wort dem ersten Redner.

Mr. Dorph-Petersen:

“Remarks on the Investigations of the Purity of Strain and Freedom from Disease of Seed.

Mr. President, Ladies and Gentlemen!

I greatly regret that I am called upon to present this subject. I was only prepared to append a few remarks on the investigations we have made on the purity of strain and freedom from disease of seed, while we had requested Oberregierungsrat Professor Dr. Hiltner to tell us about the comprehensive investigations made by the „Bayrische Landesanstalt für Pflanzenbau und Pflanzenschutz“ on attacks of disease (especially *Fusarium*) on seed.

When I visited my very able colleague Oberregierungsrat Professor Dr. Hiltner in April I found him full of interest in this congress and of anticipations of being present and introducing this subject if his government so desired.

Unfortunately Germany was late in deciding to participate. Not until May 30th was I apprised that that nation would be represented by Oberregierungsrat Hiltner and Professor Voigt. I telegraphed at once to Professor Hiltner bidding him welcome and asking him whether he would present this subject as we had requested. Unfortunately enough, Professor Hiltner is not with us after all, and I have not received any answer from him. We are therefore forced, to do without a very important contribution to this very important question. I hope however, that many of the gentlemen here to day have interesting observations to add to the comparatively meagre remarks I will make about our investigations.

I hope that Professor Voigt will tell us something about the investigations in Munich. Besides what I saw and heard on this matter in Munich I know that there is much of interest on this subject to be reported from Zürich and Wageningen. I hope that my honoured colleagues Dr. Volkart and Director Bruijning will take part in the discussion and tell us of the investigations they have made.

At both places germinated diseased grains and non-germinated diseased grains are examined in order to diagnose the diseases by which they are attacked. This is a matter of the very greatest importance.

However the examination must be supplemented by field tests and before stating on the analysis certificates that the sample is attacked by a disease, proof must be found that it is a variety of said disease which is transmitted through the seed to the growing plant — as stripe disease and smut —. We have therefore confined ourselves to those varieties about which our knowledge is exact.

Ladies and Gentlemen!

After these few remarks in English I will repeat, what has been said in German and then tell you about our own investigations.

In the report of the subject*) which has been distributed, you will find a short English summary and as there is no corresponding German summary, I will now use that language.

Mitteilungen über die Untersuchungen der Sortenechtheit und des Freiseins von Pflanzenkrankheiten der Samenwaren.

Meine Damen und Herren!

Ich bedaure im höchsten Grade, daß ich es heute bin, der die Verhandlungen einleitet, indem ich mich nur darauf vorbereitet hatte, einen kurzen Bericht über die Untersuchungen auf dem Gebiet der Sorten- und Stammechtheit und des Freiseins von Krank-

*) J. Holmgaard: „Undersøgelser vedrørende Saasæds Sortsægthed og Frihed for Brand og Stribesygge, 1917—1920“ (Investigations on the Purity of Strain and Freedom from Burnt and Stripe Disease of Seed, 1917—1920) with an English Summary.

heiten hinzuzufügen zu den Mitteilungen, die wir Oberregierungsrat Professor Dr. Hiltner aufgefordert hatten, über die umfassenden Untersuchungen, die von der „Bayrischen Landesanstalt für Pflanzenbau und Pflanzenschutz“ namentlich betreffend der Krankheitsangriffe speziell von Fusariumarten ausgeführt werden, zu geben.

Ich besuchte im April meinen geehrten Kollegen Hiltner; er war damals an dem Kongreß sehr interessiert und wollte sehr gern kommen und die erwähnte Frage einleiten, wenn er von seiner Regierung dazu aufgefordert würde. Leider hat Deutschland verhältnismäßig spät eine endliche Zusage gegeben, an dem Kongreß teilnehmen zu wollen, indem erst am 30. Mai mitgeteilt wurde, daß Deutschland sich von Oberregierungsrat Professor Dr. Hiltner und Professor Dr. Voigt repräsentieren lassen wollte. Ich telegraphierte sofort an Kollegen Hiltner und hieß ihn herzlich willkommen und bat ihn zu bestätigen, daß er die erwähnte Frage einleiten wolle. Prof. Hiltner ist aber leider nicht gekommen und ich habe keine Antwort von ihm bekommen. Ich beklage dieses im höchsten Grade, weil uns dadurch eine wichtige Einlage in dieser bedeutenden Frage fehlen wird. Ich hoffe jedoch, daß viele der anwesenden Herren Mitteilungen, die sie zu den verhältnismäßig kurzen Auskünften, die hier über unsere Untersuchungen gegeben werden sollen, hinzufügen wollen.

Außer in München habe ich auch in Zürich und Wageningen interessante Untersuchungen auf diesem Gebiete gesehen und davon gehört, so daß ich hoffe, daß jedenfalls die geehrten Kollegen Volkart und Bruijning über diese Mitteilungen geben wollen.

Auf diesen beiden Anstalten werden bei der Beendigung des Keimens zurückgebliebene kranke Keime und die nicht gekeimten von Krankheit angegriffenen Samenkörner einer Untersuchung unterworfen. Ohne Zweifel ist dieses eine Sache von großer Bedeutung. Diese Untersuchungen müssen aber notwendigerweise mit Felduntersuchungen gepaart werden, weil man, bevor man auf einem Analysenbeweis anführt, daß eine Probe von der betreffenden Krankheit angegriffen ist, sich erst versichern muß, daß diese von einer solchen Art ist, daß sie von dem Samen zu der aufwachsenden Pflanze, wie z. B. Streifenkrankheit und Brand, überführt wird. Wir haben uns deshalb an die Untersuchung dieser Arten, von denen wir in dieser Hinsicht sicheren Bescheid wissen, gehalten.

Wir haben in den letzten Tagen viel über eine Ersetzung der unzutreffenden Bezeichnung „Gebrauchswert“ der reinen und keimfähigen Samen gesprochen. Für die meisten Samenarten und eine Reihe Getreidearten spielt die Sorten- und Stammechtheit und für andere die Provenienz eine außerordentlich große Rolle. Daher ist es notwendig, daß man in der Samenkontrolle die Kontrolle auch auf diese Verhältnisse ausdehnt, und dies kann nur mit Sicherheit durch sorgfältige Felduntersuchungen, wie die erwähnten, getan werden. Auch die Frage der Krankheitsarten spielt namentlich beim Getreide, bei Rübensamen, Erbsen, Bohnen und anderen eine entscheidende Rolle für den Gebrauchswert. Diese Untersuchungen im Laboratorium und im Felde sind darum Aufgaben für die Zukunft, die notwendigerweise aufgenommen werden müssen, wenn die Samenkontrolle ihren Platz völlig ausfüllen soll.

Wie ich am Montag angeführt habe, hat die Staats-Samenkontrolle bis 1917 nur Laboratorienuntersuchungen durchgeführt.

Diese Untersuchungen sind indessen nicht genügend, um erschöpfenden Bescheid über den Wert des Samens zu geben. Durch die Versuche der Staatsversuchsstationen ist festgestellt worden, mit welchen Sorten und Stämmen die besten Erträge erzielt werden. Samen von diesen erstklassigen Stämmen ist deshalb von wesentlich größerem Wert als von anderen Sorten. Auf eine Kontrolle der Sortenechtheit hatte sich die Samenkontrolle bis vor wenigen Jahren nicht eingelassen. Obwohl man sehr gut wußte, daß eine solche Kontrolle von sehr großer Bedeutung sein würde, um den Verbrauchern echten Samen zu sichern, und daß man hierdurch die soliden Firmen, die einen unter sicherer Kontrolle gebauten Samen liefern, unterstützen würde, unterließ man es dennoch, weil diese Kontrolle in den wenigsten Fällen im Laboratorium ausgeführt werden konnte. Der vor kurzem verstorbene Versuchsleiter Helweg hatte versuchsweise eine solche Feldkontrolle mit Rübensorten und Rübenstämmen bewerkstelligt. Es hat sich dabei gezeigt, daß man, obwohl man nicht

immer mit Sicherheit die Pflanzen der verschiedenen erstklassigen Stämme voneinander unterscheiden kann, doch stets die gröberen Fehler in der Echtheit des Samens (Mischung, Kreuzung) feststellen kann sowie auch in vielen Fällen die Stämme als Ganzes voneinander scheiden konnte.

Was das Getreide angeht, so fing die Staats-Samenkontrolle im Jahre 1917 gemeinschaftlich mit der Kontrolle für ansteckende Pflanzenkrankheiten des Landwirtschafts-Ministeriums (dem jetzt verstorbenen Professor Dr. Kølpin Ravn) versuchsweise eine Feldkontrolle an, ob die Lieferungen einer größeren Getreidefirma sortenecht und frei seien von Krankheiten wie Brand (*Ustilago*) und Streifenkrankheiten (*Pleospora graminea*), die mit dem Saatgut übertragen werden. Die betreffende Firma, die das Getreide als „sortenecht und gebeizt“ verkaufte, bat nämlich darum, eine solche Kontrolle ausgeführt zu bekommen, nachdem Professor Ravn und ich mitgeteilt hatten, daß man nicht sagen könne, inwiefern diese Bezeichnung korrekt sei, wenn sie nicht auf dem Felde kontrolliert werde.

Der jetzige Versuchsleiter, Herr Holmgaard, der als Assistent für diese Arbeit angestellt wurde, hat in den vergangenen Jahren mit großer Energie und Initiative sich mit dieser Arbeit befaßt und nachgewiesen, daß es in einigen Fällen möglich ist, an den Körnern und so gut wie in allen Fällen an den Pflanzen die Sortenechtheit für alles Getreide, das wir hier im Lande gewöhnlich benutzen, zu bestimmen. Die früher genannten Institutionen führen jetzt diese Kontrolle unter dem Namen „Staatliche Aussaatsinspektion“ durch, und zwar in bedeutendem Umfang über das Saatgetreide, das von hier exportiert wird, wie auch nach Verabredung mit den landwirtschaftlichen Organisationen entsprechende orientierende Untersuchungen über das Getreide zur Benutzung hier im Lande. — Herr Holmgaard, der seit dem 1. Juli 1920 als Versuchsleiter an der Samenkontrolle angestellt ist, hat als Leiter dieser sehr wichtigen Arbeit bei eingehenden Studien eine Reihe botanischer Kennzeichen gefunden, wodurch die verschiedenen Getreidevarietäten sicher voneinander getrennt werden können; entsprechende Untersuchungen sind, so weit wir wissen, von keiner anderen Samenkrollanstalt bewerkstelligt worden; auch vom Auslande haben wir deshalb Proben zur Untersuchung in dieser Richtung erhalten.

Über die Untersuchungen selbst werde ich nur wenige Mitteilungen geben, indem ich Sie auf den verteilten Bericht verweise*).

In den vier Jahren sind 499 Gersten-, 317 Hafer-, 17 Weizen- und 2 Roggenproben untersucht worden.

Vor den Felduntersuchungen sind die Proben in allen Fällen in den Laboratorien auf Reinheit, Gehalt an fremden Samen und Keimfähigkeit untersucht worden. Bei diesen Untersuchungen ist besonders wichtig, das Vorkommen von fremden Samen festzustellen, weshalb 1000 oder 500 g in dieser Hinsicht untersucht werden. Weil der garantierte Maximalgehalt in der Regel 0,1 % ist, ist es notwendig, so große Mengen zu untersuchen, um mit Sicherheit sagen zu können, daß die Garantie eingehalten ist. Wir haben von hier festgesetzt, daß guter Samen nicht über 0,1 % fremden Samen enthalten dürfe. Diese Forderung erscheint vielleicht sehr streng; ist aber der genannte Gehalt von 0,1 % im wesentlichen Gerste in Hafer oder umgekehrt, so ergibt dies bei gewöhnlicher Aussaat 4—5000 fremde Samen per Hektar, das heißt 1 Korn auf jeden zweiten Quadratmeter und besteht der Gehalt im wesentlichen aus Unkraut, so können 100 000 Unkrautsamen oder noch mehr in der Aussaatmenge auf 1 ha kommen. Für die Feldkontrolle mit der erwähnten Aussaatmenge müssen von jeder Partie, für die garantiert werden soll, ca. 30 000 und zum Zweck der Orientierung ca. 15 000 Pflanzen benutzt werden.

Die Felduntersuchung.

Um sich dagegen zu sichern, daß Pilzsporen von einer Probe auf eine andere übergehen, wird die Aussaat ohne Benutzung der Säemaschine vorgenommen. Nach der

*) J. Holmgaard: "Undersøgelser vedrørende Saasæds Sortsæghed og Frihed for Brand og Stribesygge. 1917—1920." (Untersuchungen betreffend der Sortenechtheit des Getreides und dessen Freisein von Krankheiten wie Brand und Streifenkrankheit, 1917—1920) 27. Band in "Tidsskrift for Planteavl" (Zeitschrift für Pflanzenbau). (Englisches Resumé.)

Markierung eines Reihenabstandes von 25 cm, und nachdem die Reihen mit einem Handpflug gezogen und die einzelnen Parzellen mit einem genügenden Schutzstreifen versehen sind, werden die Proben gesät, indem die Körner, die in Portionen in Papiertüten abgewogen sind, von den Papiertüten in die Reihen gestreut und hierauf gleichmäßig zugedeckt werden. Jede einzelne Probe wird im ganzen auf 4 Parzellen gesät, d. h. auf zwei Versuchsstellen (die eine auf leichtem und die andere auf schwerem Boden), und zu zwei verschiedenen Säezeiten (so früh wie praktisch möglich und 8—14 Tage später). Von Garantieproben werden 4×500 g auf 4 Parzellen zu 40 qm gesät, von Orientierungsuntersuchungen die halbe Menge des Gewichts auf das halbe Areal.

Unmittelbar vor der Bestockung wird der Pflanzenbestand der einzelnen Parzellen durch Zählung der Pflanzen auf genau ein Fünftel des besäten Areals berechnet. Man hat dadurch eine genaue Vergleichung der Keimfähigkeit im Felde im Verhältnis zur Zahl der ausgesäten Körner und im Verhältnis zur Keimfähigkeit im Laboratorium vornehmen können. Die Keimfähigkeit im Felde für normal keimenden Samen hat in den verschiedenen Jahren zwischen 60 und 75 % variiert; von Proben, wo die Keimfähigkeit im Laboratorium unter der Norm liegt, bekommt man eine wesentlich geringere Keimfähigkeit im Felde. War die Keimfähigkeit im Laboratorium z. B. 50 %, so ist die Keimung im Felde höchstens 10 %.

Die Untersuchung auf Streifenkrankheit (*Pleospora graminea*) wird kurz nach der Bestockung begonnen und bis kurz vor der Ernte fortgesetzt, sodaß die einzelnen Parzellen in der Zeit des Wachstums dreimal genau nachgesehen worden sind. Der Augenblick, wo die ersten Krankheitsangriffe sich zeigen, ist etwas wechselnd in den verschiedenen Proben. Unsere Erfahrung deutet darauf hin, daß der Angriff — wenn alle anderen Verhältnisse gleich sind — sich um so früher zeigen wird, je stärker die Probe angesteckt ist.

Die Untersuchung auf die verschiedenen Arten von Brand (*Ustilago*) beginnt gleich nach dem Ährenschieben und wird bis unmittelbar vor der Ernte fortgesetzt, so daß die Parzellen zweimal nachgesehen werden. Auch bei dem Erscheinen dieser Krankheit kann der Zeitpunkt etwas wechselnd sein.

Bei den Untersuchungen auf Beimengung fremder Sorten wird die Besichtigung bei den verschiedenen Sorten zu verschiedenen Zeiten vorgenommen.

Von den Parzellen, auf denen man bei der Untersuchung nennenswerte Krankheitsangriffe oder fremde Sortenbeimischung gefunden hat, wird zur Ausrechnung der Prozentzahlen die Pflanzenzahl bestimmt, indem man unmittelbar vor der Ernte die Pflanzen auf genau ein Fünftel des besäten Areals auszieht und zählt.

Die Streifenkrankheit (*Pleospora graminea*) tritt sehr verschieden bei den einzelnen Sorten auf; einige sind alle 4 Jahre hindurch sozusagen frei von dieser Krankheit geblieben, bei anderen ist sie so stark aufgetreten, daß die Prozentzahl kranker Pflanzen bis 50, ja sogar in einzelnen Fällen darüber betrug. Zu der erstgenannten Gruppe der widerstandsfähigen Arten kann z. B. „Tystofte Korsby“ gerechnet werden, während „Karlsby“ zu den am meisten angegriffenen Sorten gehört. Die Prenticeformen nehmen im Verhältnis zu diesen zwei Sorten eine Zwischenstelle ein; die Angriffe können aber hier sehr bösartig sein, indem ein Angriff von 20 % vorkommen kann. Bei „Svaløf Guldby“ sind, ein einzelnes Jahr ausgenommen, nur verhältnismäßig kleinere Angriffe, und bei „Abed Binderby“ sind stets nur kleinere Angriffe vorgekommen. Im ganzen haben die Untersuchungen bestätigt, daß die Empfänglichkeit für diese Krankheit in ziemlich hohem Grade eine Sorteneigentümlichkeit ist.

Die zwei Gersten-Brandarten (*Ustilago hordei* und *Ustilago nuda*) haben sich wie die Streifenkrankheit bei den verschiedenen Sorten in verschiedenem Grade gezeigt. Für *Ustilago nuda* sind die Durchschnittszahlen bedeutend höher für „Svaløf Guldby“ und „Abed Binderby“ als für die Prenticeformen, während das Umgekehrte der Fall ist bei dem *Ustilago hordei*. Im ganzen sind die Brandangriffe jedoch von viel geringerer Bedeutung als die Streifenkrankheitsangriffe gewesen.

Bei den am häufigsten untersuchten Hafersorten deuten die Durchschnittszahlen für

Ustilago avena auf eine ungleich starke Empfänglichkeit bei den verschiedenen Sorten hin. *Ustilago levis* ist nur in ganz einzelnen Fällen gefunden worden. Von 17 untersuchten Weizenproben sind 6 bei der Einsendung als mit warmem Wasser gebeizt angegeben worden, der Rest als ungebeizt. Die letzteren sind teils im ursprünglichen Zustand, teils nach Beizung mit einer 0,5 % Kupfervitriollösung ausgesät worden. Die Durchschnittszahlen des Stinkbrandes (*Tilletia caries*) sind:

warmwassergebeizte Proben.....	0,5 pro mille.
kupfervitriolgebeizte Proben	0,2 " "
ungebeizte Proben	19,4 " "

Der Flugbrand des Weizens (*Ustilago tritici*) ist nur in einem Fall bemerkt worden.

Ca. 40 % der untersuchten Proben sind sortenecht gewesen, ca. 56 % haben 0,1—10 pro mille fremde Sorten enthalten, während die Beimischung der übrigen 4 % zwischen 1 % und 35 % variiert hat, und endlich sind 13 Proben unter ganz unrichtiger Sortenbezeichnung eingesandt worden. Besonders bösartig war eine Verwechslung von Sommer- und Winterroggen.

In den Fällen, wo man, wie bei einigen Gerstensorten, sichere botanische Kennzeichen an den Körnern hat, kann die Sortenbestimmung zum Teil schon im Laboratorium stattfinden. Eine solche Untersuchung ist mit allen Proben von den im Winter 1920 exportierten Partien sowie auch mit einzelnen der übrigen Proben unternommen worden.

Bei der Felduntersuchung ist es möglich gewesen, die meisten von unseren am häufigsten angebauten Sorten von Weizen, Gerste und Hafer zu unterscheiden. Die Kennzeichen, wonach sie unterschieden werden, sind teils an die Körner, teils an die Pflanze geknüpft.

Was die erwähnten von Herrn Helweg angefangenen Rübenuntersuchungen auf diesem Gebiete angeht, so behaupten Vertreter des Samenhändlerstandes hier im Lande, daß es für den gesunden Samenhandel notwendig sei, daß Gelegenheit für solche Felduntersuchungen vorhanden ist, und daß diese großen praktischen und moralischen Einfluß haben. Die Fortsetzung dieser Arbeit ist vom Landwirtschaftsministerium der Staats-Samenkontrolle übergeben worden. Wenn wir aber diese Untersuchungen für immer übernehmen sollen, wird es notwendig, Verfügung über ein Areal von 10 bis 12 ha mit passendem, gleichmäßigem, ebenem und gutartigem Boden für diese Untersuchungen zu haben. Auch bei Gras- und Kleesamen wird versuchsweise eine Untersuchung der Sortenechtheit bewerkstelligt werden.“

Direktor Bruijning: „Wir setzen 600 Körner zum Keimen an. Beobachtet man dabei etwas Abnormes, wird noch eine Serie von 300 Körnern mykologisch von einem Fachmann untersucht. In dieser Weise kann man in einigen Fällen die Ursache der Krankheit feststellen. Dies ist aber nur ein Anfang. Professor Hiltners Methode scheint mir nicht gut, weil er die Samenkörner zu tief legt, sie also in eine zu schwierige Lage versetzt. Die Methode sollte deshalb revidiert werden, und es fragt sich, ob dies nicht eine Frage für internationale Verhandlungen ist.“

Professor Dr. A. Voigt: „Direktor Dorph-Petersen hat mich gebeten, etwas über Hiltners Methode zu sagen. Vorerst möchte ich bemerken, daß es sehr zu begrüßen ist, wenn die Kopenhagener Anstalt dazu übergehen will, auch an den nicht gekeimten Samen die Ursache des Absterbens festzustellen. Wir müssen dankbar sein, daß Direktor Dorph-Petersen diesen Weg gezeigt hat. Bei der Hiltnerschen Methode werden 200 Samenkörner in Zinkgefäßen in Ziegelgrus von bestimmter Korngröße, der 60 % feucht ist, ausgelegt. Die Samenkörner werden 3 cm hoch zu-

gedeckt. In anderen Stationen wird Sand von größerer oder geringerer Feuchtigkeit an Stelle des Ziegelgruses genommen. Das Verfahren hat den Zweck, festzustellen, ob die Keimlinge die Kraft besitzen, die Decke aus Ziegelgrus oder Sand zu durchbrechen. Dabei lassen sich ferner Fusariumbefall und andere Infektionen feststellen. Diese Methode ist bisher nur für Saatgetreide im Gebrauche, zeigt aber den Weg des Übergangs von quantitativer zu qualitativer Keimprüfung.“

Professor Johannsen: „Wenn wir hier verschiedene Gesichtspunkte haben, ist es nur die alte Frage, ob man seinen Kindern bei der Erziehung leichte oder schwierige Lebensbedingungen geben soll. Professor Hiltner hat für seine Pflanzen die schwierige Methode vorgezogen, wodurch er nachweisen kann, welche Samen imstande sind, eine gesunde und kräftige Pflanze zu entwickeln.“

Dr. Volkart: „In der Schweiz wird Streifenkrankheit der Gerste und Flugbrand bei der Feldbesichtigung festgestellt; die Fusariose des Roggens untersuchen wir dagegen wie in Deutschland. Dabei hat sich ergeben, daß der Roggen in den meisten Jahren sehr stark von dieser Krankheit befallen ist. Bei Feldversuchen mit verschiedenen Beizmitteln hat sich aber ergeben, daß die Krankheit eigentlich nur einigen deutschen Roggenzüchtungen (Petkuser und Professor Heinrichsroggen) gefährlich wird. Bei schweizerischem Landroggen, der bei der Untersuchung sich als stark fusariumkrank erwies, nützte das Beizen nichts, weil auch die unbeizten Parzellen einen ganz normalen Bestand aufwiesen. Die Beschaffung von Sublimat zum Beizen ist den schweizerischen Landwirten übrigens schwer, weil die Abgabe von solchem sehr strengen Vorschriften unterliegt.“

Prof. Dr. A. Voigt

asked whether Hiltner's method fragte, ob in Zürich die Methode was employed in Zürich. Hiltners benutzt wird.

Dr. Volkart: „Gewiß, aber nur zur Bestimmung des Befalles des Roggens mit Fusarium, nicht zur Ermittlung seiner Triebkraft. Da wir übrigens in der Schweiz vorherrschend Kleinbesitz haben, können nicht alle Proben von Feldern besichtigten Saatgutes untersucht werden. Wir bestimmen nur bei einer gewissen Zahl alljährlich den Befall und schließen daraus allgemein auf die Stärke des Auftretens der Fusariose im betreffenden Jahre.“

Staatskonsulent A. Elofson, Upsala, Schweden: „In Schweden spielt die Fusariumkrankheit eine große Rolle. Wir glauben, daß kleine Körner nach Untersuchungen von Henning am meisten angesteckt sind, und es ist deshalb eine Frage, ob man nicht durch Sortierung des Getreides die fusariumkranken Körner annähernd ausscheiden kann. Ich wollte fragen, ob andere solche Versuche vorgenommen haben. Ich halte dafür, daß fusariumkranke Körner auch mit bloßem Auge als solche erkannt werden können.“

Direktor Widén: „Ich selbst habe keine Erfahrung in dieser Frage, aber Professor Henning an der schwedischen agrikultur-botanischen Versuchstation bei Stockholm hat sich damit beschäftigt und Untersuchungen

darüber gemacht, ob es möglich sei, mit den bloßen Augen oder mit der Lupe zu erkennen, ob die Körner von *Fusarium* angesteckt sind. Man kann tatsächlich oft sehen, daß die Körner krank sind, aber diese Untersuchung ist nicht zuverlässig genug; es müssen noch Keimversuche gemacht werden. Manche Proben erscheinen wenig angesteckt, sind aber doch bis zu 40% befallen. Hiltners Methode wird bei uns nicht mit Ziegelmehl, sondern mit lehmiger Erde ausgeführt. Wir bekommen auf diese Weise Resultate, die mehr praktischen Wert haben.“

Mr. Dorph-Petersen asked Mr. E. Gram, leader of the botanical department of the State Experiment Station in Plant Diseases, Lyngby, what measures have been taken against *Fusarium* in Denmark.

Mr. E. Gram: “*Fusarium* on grain is not very prevalent here. A series of experiments are being made now, but the results are not yet published. Nothing has been published since Mr. L. Mortensen's report. The development of the seed depends on the infection. If the infection occurs early, the grains are small. If late they are large, but still infected. A report in the Journal of Agricultural Research on investigations made in the United States of America shows the same conclusions.”

Direktor Widén: „Kleine Körner sind sehr unzuverlässig, wir haben aber nicht viele Versuche damit gemacht.“

Mr. Clark stated that Mr. Gussow reported from Canada that *Fusarium* gives trouble in coast climates (Atlantic and Pacific). Inland and in elevated districts it was less difficult. A moist climate seemed to favour the disease. Had this been observed by others?

In what I may call the maritime province along the Atlantic only a narrow range of varieties can be grown. The variety of grain giving the best results in Manitoba and Saskatchewan cannot be grown along the coast on account of this disease. The only thing to do is to choose varieties immune to the disease.“

M. Fr. Walldén, Directeur de la Station d'essais de semences, Svalöf, Suède:

wished to say a few words on another subject. It had been his experience that the inspection method is uncertain. Therefore he used the following device: Seeds of rye are placed in a glass box with water in the bottom. This is then placed in a Jacobsen Germinator. After 3 or 4 days mycelium develops. By this method it is, however, impossible to fix the exact percentage of attacked grains, but it is possible to see if many or a few are attacked.

„An den Körnern kann man durch Besichtigung allein nicht mit Sicherheit bestimmen, ob sie krank sind oder nicht. Wenn man aber einige Körner in eine Glasschale legt, etwas Wasser zufügt und sie 3 bis 4 Tage in dem Jacobsenschen Keimapparat warm stellt, so ist das *Fusarium* ausgewachsen. Man kann damit nicht den genauen Prozentsatz der befallenen Körner ermitteln, aber man kann doch sehen, ob viele oder wenige Samen angegriffen sind.“

Mr. Dorph-Petersen: "What is known as "Fusarium" abroad is most prevalent here as Stripe disease. There is an account of the attacks on page 579 of the report by Mr. Holmgaard. Too strong a treatment with hot water must be avoided. That method is a two-edged sword."

Dr. Volkart: „In der Schweiz haben wir die Streifenkrankheit hauptsächlich bei der Wintergerste, die sie oft sehr bösartig befällt, seltener bei der Sommergerste. Die verschiedenen Sorten sind verschieden widerstandsfähig. Sommergerste leidet im Gebirge oft sehr stark an der Helminthosporiosis. Streifenkrankheit konnte ich bisher noch nicht finden.“

Professor Johannsen:

"If there is no further discussion „Die Sitzung ist bis morgen ge-
the meeting is adjourned for to-day. schlossen.“

At 2:00 automobiles will be waiting to conduct all those desiring to Lyngby, where an opportunity will be given of seeing:

1. One of the two fields belonging to the Danish State Seed Testing Station for investigating the purity of variety and strain of cereal seeds, and their freedom from those diseases which are transmitted through the seed.
2. State Experiment Station in Plant Culture.
3. Some of the fields belonging to the State Experiment Station in Plant Diseases.
4. Agricultural Museum and the "Old Danish farm-houses."

9. Juin 1921.

Professor Johannsen opened the meeting. "The first matter to be decided is whether the different stations are willing to disclose their identity in the report of the results of the seed analyses made (see page 77—83). The roll will be called and the name can be given if wished."

Where the names of the stations Wo die Namen der Stationen
are given in the following table it angeführt sind, geschieht es mit Er-
is done with the sanction of the laubnis der betreffenden Vorsteher.
respective leaders.

Professor Johannsen erteilte das Wort an Professor Dr. A. Voigt:

„Der heutige Standpunkt der Keimprüfungsmethoden.

Herr Präsident! Meine Damen und Herren!

Gestatten Sie, vordem ich mich dem Gegenstande meines Referats zuwende, ein kurzes allgemeines Wort.

In der Eröffnungssitzung unseres Kongresses wurde außer mir auch noch der Herr Kollege Hiltner aus München erwartet, und ich habe deshalb zurückgestanden, um ihm die offiziellen Worte für die deutschen Teilnehmer zu überlassen. Da nunmehr feststeht, daß Herr Hiltner nicht erscheinen wird, darf ich wohl das Versäumte nachholen.

Der dänischen Regierung und dem Herrn Kollegen Dorph-Petersen spreche ich zunächst im Namen des deutschen Ministeriums für Ernährung und Landwirtschaft und weiter für meine beteiligten Kollegen den herzlichsten Dank für die freundliche Einladung zu diesen Beratungen sowie für die sorgfältige Vorbereitung dieser Tagung aus.

Wie Ihnen bekannt sein dürfte, liegen in Deutschland die Verhältnisse für die Samenprüfung wesentlich anders wie in den meisten übrigen Ländern. Während diese fast ausnahmslos nur eine zentrale Samenprüfungsanstalt besitzen und im höchsten Falle einige

Tab. I.

	Trifolium pratense 1.					Trifolium pratense 2.					Medicago lupulina 3.				
	Purity	Reinheit	Germination speed	Keimungsenergie	Germination power	Keimfähigkeit	Pure viable seed	*) Gebrauchswert	**) Gebrauchswert	Purity	Germination speed	Keimungsenergie	Germination power	Keimfähigkeit	Pure viable seed
a) Kristiania.....	97,7	97,7	74	83+9	81,1	89,6	89,7	81,1	89,6	91,2	39	56+38	51,1	85,7	95,1
b) Paris.....	97,5	97,5	77	83+9	80,9	89,7	89,7	80,9	89,7	92,7	45	61+25	56,5	79,7	90,5
c) Hamburg.....	97,1	97,1	69	78+14	75,7	89,8	89,8	75,7	89,8	88,4	41	57+36	50,4	82,2	90,9
d) Wageningen.....	96,2	96,2	78	82+12	78,9	90,4	90,4	78,9	90,4	92,0	48	56+33	51,5	81,9	96,7
e) Wien.....	95,6	95,6	69	88+6	84,1	89,9	89,9	84,1	89,9	85,8	44	59+34,5	50,6	80,2	94,9
f) Bukarest.....	85,8	85,8	78	88,5	75,5	—	—	75,5	—	81,8	55	61	49,9	—	—
g) London.....	98,0	98,0	77	84+7	82,3	89,2	89,2	82,3	89,2	90,8	50	68+18	61,7	78,1	—
h) Edinburgh.....	97,4	97,4	78	82+10	79,9	89,6	89,6	79,9	89,6	91,5	49	61+28	55,8	81,4	—
i) Dublin.....	95,6	95,6	68	73+9	69,8	78,4	78,4	69,8	78,4	94,0	43	60+23	56,4	78,0	91,7
j) Lund.....	97,5	97,5	74	79+9	77,0	85,8	85,8	77,0	85,8	90,4	43,5	56,5+35	51,1	82,7	94,1
k) Ørebro.....	96,7	96,7	75	79+8	76,4	84,1	84,1	76,4	84,1	90,6	51	61+29	55,3	81,5	92,9
l) <i>Århus</i>	98,7	98,7	78	84,5+9	83,4	92,3	92,3	83,4	92,3	92,2	33	55+41,5	54,6	95,7	—
m) Zürich.....	94,6	94,6	59	78+11	73,8	84,2	84,2	73,8	84,2	90,7	49	54+40	49,0	85,3	—
n) Kurashiki.....	98,0	98,0	77	86+6	89,2	—	—	89,2	—	95,6	50	66+11	63,1	85,3	91,7
o) München.....	96,8	96,8	77	83+5	80,3	85,2	85,2	80,3	85,2	92,6	44	57+30	52,8	80,6	98,0
p) Budapest.....	97,3	97,3	71	81+10	78,8	88,5	88,5	78,8	88,5	90,9	33	48+42	43,6	81,8	91,5
q) København.....	96,5	96,5	73	78+10	75,3	84,9	84,9	75,3	84,9	91,4	44	56+34	51,2	82,8	96,5
r) Wisconsin.....	97,7	97,7	67	76+10	74,3	84,0	84,0	74,3	84,0	91,2	34,5	47+34,5	42,9	74,3	88,6
s) Colorado.....	97,5	97,5	77	80,6+7	78,5	85,3	85,3	78,5	85,3	92,3	51	58,5+26,5	54,0	78,5	91,6
t) u) v) w) x) Washington	96,4 91,0 97,8	96,4 91,0 97,8	71 86 —	80+9 88,5+8,5 70,5+12	77,1 80,5 68,9	85,8 88,3 80,7	85,8 88,3 80,7	77,1 80,5 68,9	85,8 88,3 80,7	90,5 92,9 92,8	44 54 —	59+31 62+34 45,5+36,5	53,4 51,4 42,6	79,6 97,0 99,3	91,6 96,1 91,9

*) "Hard grains" not included.

**) "Hard grains" included.

*) "Harte Körner" nicht mitgerechnet.

**) "Harte Körner" mitgerechnet.

The results are stated in the order in which the Danish State Seed Testing Station has received them.

Die Resultate sind der Reihe nach, in welcher die dänische Staatssamenkontrolle diese erhalten hat, angeführt.

Tab. I.

Medicago lupulina 4.

Lotus corniculatus 5.

Anthyllis vulneraria 21.

	Medicago lupulina 4.				Lotus corniculatus 5.				Anthyllis vulneraria 21.			
	Purity	Keimungsenergie	Keimfähigkeit	Pure viable seed (*) Gebrauchswert	Purity	Keimungsenergie	Keimfähigkeit	Pure viable seed (*) Gebrauchswert	Purity	Keimungsenergie	Keimfähigkeit	Pure viable seed (*) Gebrauchswert
a) Kristiania.....	94,8	95	95+0	90,1	96,5	31	34+65	32,8	92,8	49	67+15	62,2
b) Paris.....	94,5	90	93+0	87,9	98,0	38	40+55	39,2	92,1	53	65+7	59,9
c) Hamburg.....	94,5	96	96+0	90,7	96,8	32	42+55	40,4	88,7	43	62+19	56,0
d) Wagingen.....	93,6	100	93,6	—	97,4	28	33+63	32,1	83,1	54	68+19	56,5
e) Wien.....	89,6	77	100	89,6	97,1	34	37+61,5	35,9	87,5	57,5	67+9	58,6
f) Bukarest.....	94,1	93,5	99,5	93,6	92,7	46	73,5	68,1	93,5	53	67,5	63,1
g) London.....	95,9	90	92+0	88,2	97,3	32	38+57	37,0	90,2	51	61+10	55,0
h) Edinburgh.....	95,2	97	100	95,2	97,3	38	41+56	39,9	91,7	57	69+12	63,8
i) Dublin.....	93,2	89	92+0	85,7	96,4	44	51+48	49,2	87,7	49	63+8	55,8
j) Lund.....	95,4	94,5	98,5+0	93,5	97,3	29	32+66	31,1	90,1	63,6	72,5+11	65,8
k) Ørebro.....	92,7	94	95+0	88,1	97,1	30	32+65	31,1	89,0	45	63+15	56,1
l) Lund	99,6	69,5	99	98,6	97,0	21	27	26,2	—	68	69,5	68,2
m) Zürich.....	93,4	88,0	88+0	82,2	97,9	29	32+65	31,8	95,0	49	56+18	51,8
n) Kurashiki.....	96,6	98,5	99,5+0	96,1	97,5	56,5	62	60,5	91,7	51	67+3,5	58,9
o) München.....	89,0	70	96+0	85,4	97,5	72	80+17	78,0	88,8	45	58+18	51,2
p) Budapest.....	95,0	97	99,5+0	94,5	97,6	3	45+51	39,0	93,7	56	62,5+20	56,4
K) København.....	95,7	79	89+0	85,2	97,3	24,5	30+67	29,2	94,4	50	62+20	56,5
r) Wisconsin.....	97,3	94	93,5+0,5	91,5	97,1	31	34+58,5	33,0	94,6	56,5	60+16	56,8
s) Colorado.....	96,2	75	98+0	94,8	97,1	34,5	36+62,5	35,0	95,6	50,5	64,5+15,5	60,7
t).....	95,8	86	94+0	90,1	97,4	38	42+55	40,9	94,5	47	65+6	60,6
u).....	91,8	99	99,5+0	91,8	96,2	39,5	41+56,5	39,4	93,8	56,5	67+8,5	59,1
x) *** Washington	97,0	—	88,5+1	85,8	98,5	—	27+69	26,7	94,6	—	58+14	55,6

*) "Hard grains" not included.

*) "Harte Körner" nicht mitgerechnet.

**) "Hard grains" included.

**) "Harte Körner" mitgerechnet.

Tab. I.	Lolium italicum 6.				Lolium italicum 7.				Festuca pratensis 8.				Festuca pratensis 9.			
	Purity	Germination speed	Keimungsenergie	Germination power	Pure viable seed	Purity	Germination speed	Keimungsenergie	Germination power	Pure viable seed	Purity	Germination speed	Keimungsenergie	Germination power	Pure viable seed	Purity
a) Kristiania	98,3	93	96,3	98	96,3	91,1	67	81	73,8	98,8	66	93	91,6	80,1	48	76
b) Paris	98,3	96	96,3	98	96,3	88,1	80	84	74,4	97,0	83	96	93,1	79,6	81	84
c) Hamburg	97,8	92	94,9	97	94,9	89,3	73	84	75,0	97,4	68	95	92,5	84,8	51	83
d) Wageningen	98,2	95	95,3	97	95,3	90,4	77	83	75,0	97,7	84	96	93,8	80,0	60	79
e) Wien	98,3	87	93,9	95,5	93,9	91,7	81,5	88	80,7	97,0	73	95	92,2	81,5	67	85
f) Bukarest	99,5	90,5	97,5	98	97,5	98,5	81,5	93	91,6	99,5	94	96	95,5	96,7	33	40,1
g) London	98,5	94	94,6	96	94,6	93,0	78	83	77,2	97,5	77	96	93,6	84,4	54	78
h) Edinburgh	97,6	98	96,6	99	96,6	91,0	83	85	77,4	97,1	81	96	93,2	83,4	73	77
i) Dublin?	99,5	91	92,5	93	92,5	97,5	66	69	67,5	97,8	81	95	92,9	95,9	39	55
j) Lund	98,1	98,1	97,1	99	97,1	88,2	86	88	77,6	97,3	90	97	94,4	80,8	72	82
k) Örebro	98,1	95	95,2	97	95,2	90,7	80	81	73,5	97,4	77	96	93,5	82,9	42	74
l) Örebro	99,9	68	75,5	75,5	75,5	99,9	58	71,5	71,4	99,9	74	90	89,9	99,7	32	71,5
m) Zürich	98,1	93	97	97	95,3	88,4	78	82	72,5	97,8	66	93	91,0	80,6	44	83
n) Kurashiki	97,3	78	86,6	89	86,6	97,7	67,5	76	74,3	98,1	51	94	92,2	88,0	30	63
o) München	98,6	46	94,7	96	94,7	91,1	75	80	72,9	97,9	48	95	93,0	80,5	59	77
p) Budapest	97,8	95	95,4	97,5	95,4	90,7	69	83	75,3	98,2	73	93	91,3	84,6	59	75
q) København	97,9	96,5	95,9	98	95,9	88,1	83,5	86	75,8	96,3	83,5	95	91,5	80,5	68,5	79
r) Wisconsin	97,5	59	93,6	96	93,6	92,3	81	87	80,3	98,3	86	95	88,2	85,2	59	72
s) Colorado	98,5	51	83,7	85	83,7	89,6	68	82	74,5	98,9	84,5	96	94,9	83,5	45,5	67
t)	98,0	98	96,0	98	96,0	86,9	81	84	71,2	97,7	75	97	94,8	82,5	50	78
u)	98,1	58	76,5	78	76,5	86,7	58	86,5	75,0	96,8	53	94,5	91,5	83,3	17	83
x) *** Washington	98,1	—	95,2	97	95,2	88,1	—	78,5	69,2	97,4	—	93,5	91,1	78,3	—	76

*) The tests are made by the Irish method.

Die Untersuchungen sind nach der irischen Methode ausgeführt.

The results are stated in the order in which the Danish State Seed Testing Station has received them.

Die Resultate sind der Reihe nach, in welcher die dänische Staatssamenkontrolle diese erhalten hat, angeführt.

Tab. I.

Dactylis glomerata 10. Dactylis glomerata 11. Dactylis glomerata 22. Alopecurus pratensis 12. Poa pratensis 13.

	Dactylis glomerata 10.				Dactylis glomerata 11.				Dactylis glomerata 22.				Alopecurus pratensis 12.				Poa pratensis 13.			
	Purity	Keimungsenergie	Keimfähigkeit	Pure viable seed	Purity	Keimungsenergie	Keimfähigkeit	Pure viable seed	Purity	Keimungsenergie	Keimfähigkeit	Pure viable seed	Purity	Keimungsenergie	Keimfähigkeit	Pure viable seed	Purity	Keimungsenergie	Keimfähigkeit	Pure viable seed
a) Kristiania	95,7	90	98	93,8	96,5	96	99	95,6	74,2	—	67	49,7	—	68	85	—	86,5	25	53	45,9
b) Paris	95,7	86	97	92,9	96,5	88	98	94,6	63,0	—	92	58,0	65,8	81	92	55,9	75,3	59	83	62,5
c) Hamburg	95,8	86	97	92,9	96,5	90	98	94,1	63,0	—	92	58,0	62,5	81	92	57,5	74,3	46	82	60,8
d) Wagnungen	95,8	73	98	93,9	96,5	76	98	94,6	64,5	68	85	54,8	66,0	73	86	56,8	73,3	72	77	56,4
e) Wien	92,2	60	98	90,4	94,4	59	98	92,5	60,0	80	87	52,2	58,7	45	74	43,4	73,8	37,5	71,5	52,8
f) Bukarest	98,3	54,5	98,5	96,8	99,7	40	93,5	93,2	—	—	—	—	95,9	30,5	63,5	60,9	85,0	13	36,5	22,5
g) London	96,3	88	97	93,4	96,4	89	96	92,5	—	—	—	—	67,3	81	87	58,6	74,3	39	80	59,4
h) Edinburgh	95,3	91	97	92,4	95,9	94	99	94,9	59,8	86	91	54,4	67,5	77	84	56,8	72,8	52	78	56,8
i) Dublin	98,8	92	98	96,8	99,8	95	97	96,8	93,7	45	50	46,9	91,1	40	44	40,1	93,4	39	49	45,8
j) Lund	95,2	91	98,5	93,8	96,2	95,5	99,5	95,7	64,4	87,5	93	59,9	64,4	80,5	89	57,3	80,6	52,5	84	67,7
k) Grebro	95,6	81	96	91,8	95,9	76	96	92,1	64,7	79	87	56,8	67,2	73	79	53,1	78,3	53	69	54,0
l) London	99,5	49,5	68,5	68,2	99,9	33,5	61	60,9	99,9	18	22,5	22,5	99,7	48	65	64,8	99,9	—	41,5	41,5
m) Zürich	95,5	75	97	92,5	96,2	84	98	94,3	60,2	—	—	—	64,3	57	88	56,6	74,6	41	77	57,4
n) Kurashiki	99,4	38,5	87	86,5	93,5	35,5	88	82,3	60,2	33	72	43,3	90,7	19,5	37	33,6	88,4	16	39	34,5
o) München	95,7	73	99	94,7	96,6	91	100	96,6	69,9	80	86	60,0	55,2	73	87	48,0	81,4	60	79	64,3
p) Budapest	94,2	78	96	90,4	96,2	71	96	94,3	63,6	74	88	56,0	71,6	54	71	50,8	81,6	21	50,5	41,2
q) København	94,5	95	98	92,6	96,0	94,5	99,5	95,5	61,6	92	94	57,9	64,6	82,5	90	58,1	71,0	67	82	58,2
r) Wisconsin	91,5	37	98	89,7	88,4	66	95,5	84,4	40,9	57	87	35,6	74,0	26	84,5	62,5	84,3	38	60	50,6
s) Colorado	94,5	67,5	93	87,9	95,5	83	97	92,6	—	—	—	—	—	—	—	—	75,0	51	77	57,8
t) Colorado	95,8	73	97	92,9	96,1	92	99	95,1	59,0	83	91	53,7	61,6	56	82	50,5	72,6	37	65	47,3
u) ***	95,5	66	93	86,8	96,7	66	92	89,0	63,5	49	87	55,4	63,4	37,5	64	40,6	71,6	19	26	18,9
x) Washington	94,8	—	98	92,9	96,5	—	96,5	92,1	62,1	—	95,5	59,3	62,1	—	79,5	49,4	63,9	—	84,5	54,0

Tab. 2.

Beta vulgaris 14.

Beta vulgaris saccharifera 15.

Beta vulgaris hortensis 16.

	Beta vulgaris 14.					Beta vulgaris saccharifera 15.					Beta vulgaris hortensis 16.					
	Purity	Germination speed	Keimungsenergie	Keimfähigkeit	Number of germs pr. 100 seed heads	Anzahl der Keimen von 100 Knäulen	Gewicht von 1000 Körnern	Pure viable seed (Gebrauchswert)	Purity	Germination speed	Keimungsenergie	Keimfähigkeit	Number of germs pr. 100 seed heads	Anzahl der Keimen von 100 Knäulen	Gewicht von 1000 seeds	Pure viable seed (Gebrauchswert)
	8 (7) d.	8 (7) T.	12 (14) d.	12 (14) T.	6 (7) d.	6 (7) T.	12 (14) d.	12 (14) T.	8 (7) d.	8 (7) T.	12 (14) d.	12 (14) T.	6 (7) d.	6 (7) T.	12 (14) d.	12 (14) T.
a) Kristiania	97,9	—	83	141	20,9	—	78,8	—	97,8	78	—	—	36	84	12,7	—
b) Paris	96,1	80	126	—	17,6	78,8	96,8	82	96,8	78	—	—	79	86	12,6	52,1
c) Hamburg	97,6	77	78	126	15,9	67,8	96,2	71	96,2	69	79	—	51	87	10,6	49,5
d) Wageningen	97,3	72	73	140	15,4	75,9	95,2	79	95,2	69	77	—	59	69	9,9	56,5
e) Wien	98,2	74	76	125	15,6	71,7	98,4	76	98,4	76	77	—	51	66	10,5	49,8
f) Bukarest	98,8	44,5	89	124	17,5	74,7	99,7	36	99,7	36	65,5	—	37	40	11,8	36,9
g) London	99,7	—	120	125	—	—	98,5	—	98,5	—	—	—	73	77	—	—
h) Edinburgh	97,3	—	116	119	14,5	—	97,4	—	97,4	—	—	—	69	73	10,4	—
i) Dublin	98,8	—	112	121	—	—	97,7	—	97,7	—	—	—	71	79	—	—
j) Lund	98,7	71	78	—	17,0	77,0	96,8	67,5	96,8	67,5	76,5	—	59	—	10,5	58,5
k) Ørebro	97,8	60	67	—	15,4	65,5	96,6	59	96,6	59	66	—	44	—	10,7	43,1
l) London	99,9	48,5	66	—	—	—	100,0	91	100,0	91	—	—	47	59	—	—
m) Zürich	—	65	98	119	16,2	—	—	68	73	68	73	—	48	65	10,9	—
n) Kurashiki	98,4	60	66,5	96	104	15,2	65,4	50,5	97,2	50,5	58	—	51	52	10,4	40,9
o) München	97,8	78	80	128	14,1	78,2	95,5	61	95,5	56	61	—	70	73	10,2	48,7
p) Budapest	97,0	73	76	—	15,9	73,7	96,4	71	96,4	64	71	—	45	—	10,5	46,8
q) København	97,1	77	80	126	16,6	77,7	96,9	73	96,9	73	75	—	79	91	10,3	57,4
r) Wisconsin	99,8	60,5	69	—	—	68,9	99,5	53	99,5	53	65	—	30	—	—	32,2
s) Colorado	—	73	79	—	—	—	—	80	—	74	80	—	33	—	—	—
t)	97,8	72	74	135	15,3	72,4	98,3	71	98,3	71	74	—	54,5	100	10,0	52,5
u)	97,4	57	71,5	—	16,9	69,7	98,3	66	98,3	66	66	—	52	—	10,9	43,6
x) ***) Washington	99,0	—	64	—	—	63,4	98,4	—	98,4	—	62	—	36,5	—	—	36,4

The station marked *** has received the samples two months later than the other stations.
Die mit *** bezeichnete Anstalt hat die Proben zwei Monate später als die anderen Anstalten erhalten.

Tab. 2.

Avena sativa 20.

Brassica oleracea
capitata alba 19.Brassica Napus
rapifera 18.Brassica campestris
rapifera 17.

	Brassica campestris rapifera 17.				Brassica Napus rapifera 18.				Brassica oleracea capitata alba 19.				Avena sativa 20.			
	Purity	Reinheit	Germi- nation speed	Keimungsenergie	Germi- nation power	Pure viable seed	Gebrauchswert	Purity	Reinheit	Germi- nation speed	Keimungsenergie	Germi- nation power	Pure viable seed	Gebrauchswert	Purity	Reinheit
a) Kristiania.....	99,7	99,7	69	74	97	96,7	96,7	99,1	99,5	81	88	88	87,6	99,4	99,4	94,4
b) Paris.....	99,2	98,6	74	59	94	93,2	90,7	98,6	99,3	69	83	83	82,4	99,5	99,5	92,9
c) Hamburg.....	98,2	97,5	74	72,7	94	93,2	88,7	97,5	99,0	—	—	—	—	99,7	99,7	93,7
d) Wagingen.....	98,3	96,5	63	97	97	95,3	91,7	98,8	99,3	62	83	83	82,0	99,9	99,9	94,9
e) Wien.....	98,8	91,9	75,5	93	93	91,9	90,7	98,4	98,4	59	84,5	84,5	83,1	99,8	99,8	97,8
f) Bukarest.....	97,4	96,6	44,5	96	96	93,5	94,2	98,7	98,7	63	96,5	96,5	95,2	99,8	99,8	47,4
g) London.....	99,2	98,5	48	90	90	92,0	90,6	98,5	99,0	67	81	81	80,2	100,0	100,0	96,0
h) Edinburgh.....	98,9	97,4	68	87	93	92,0	88,6	98,9	98,9	72	82	82	81,0	100,0	100,0	96,0
i) Dublin.....	99,0	98,0	57	87	96	96,1	92,1	98,8	98,8	80	86,5	86,5	86,0	99,9	99,9	94,9
j) Lund.....	99,5	97,7	64	96	96	95,5	92,3	99,4	99,4	78	88	88	81,0	99,8	99,8	96,3
k) Örebro.....	99,0	97,7	67	91	91	90,1	91,8	98,8	98,8	78	88,5	88,5	79,5	100,0	100,0	96,3
l) Iowa.....	100,0	100,0	77	96	96	96,0	84,5	100,0	100,0	61	79,5	79,5	79,5	97,7	97,7	86,0
m) Zürich.....	98,5	96,5	10	88	88	86,7	88,8	98,0	98,0	61	86	86	84,3	99,3	99,3	92,8
n) Kurashiki.....	99,2	96,4	66	83	83	82,3	84,8	97,3	97,3	69,5	81,5	81,5	79,3	99,9	99,9	90,9
o) München.....	98,3	96,7	67	81	81	79,6	86,1	99,8	99,8	58	86	86	85,8	99,9	99,9	93,9
p) Budapest.....	99,0	98,3	63	87	87	86,1	90,4	99,3	99,3	76	87	87	86,4	100,0	100,0	93,0
q) —.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
K) København.....	98,8	97,9	68	94,5	94,5	93,4	93,5	98,1	98,1	73,5	87	87	85,3	96,7	96,7	95,3
r) Wisconsin.....	99,8	99,7	70	90	90	89,8	90,7	99,6	99,6	62	76	76	75,7	99,7	99,7	94,2
s) Colorado.....	—	—	66	82	82	—	—	—	—	68	76	76	—	99,9	99,9	94,5
t) —.....	—	—	—	—	—	—	—	—	—	76	84	84	82,5	99,6	99,6	97,6
u) —.....	99,0	97,9	44	92	92	91,1	91,4	98,3	98,3	72	83	83	82,4	99,8	99,8	95,5
v) —.....	98,9	97,9	52	—	—	91,0	88,6	98,5	98,5	—	—	—	—	—	—	—
w) —.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
x) ***) Washington	99,7	99,6	—	—	74	73,8	88,1	99,6	99,9	—	77	77	76,9	100,0	100,0	95,5

Tab. 2.

	Abies pectinata.					Picea sitkaensis.					Pinus silvestris.				
	Purity	Germination speed	Keimungsenergie	Keimfähigkeit	Pure viable seed	Pure viable seed	Purity	Germination speed	Keimungsenergie	Keimfähigkeit	Pure viable seed	Purity	Germination speed	Keimungsenergie	Pure viable seed
a) Kristiania	95,1	33	—	37	—	—	92,5	14	—	28	—	98,7	89	—	—
b) Paris	—	39	—	45	—	—	—	47	—	54	—	—	59	—	89,8
c) Hamburg	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
d) Wageningen	96,4	43	46,3	48	46,3	—	90,3	25	51,5	57	94	97,7	91	91,8	—
e) Wien	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
f) Bukarest	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
g) London	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
h) Edinburgh	96,7	20	34,8	36+4	33,7	44,3	88,5	16	—	50+5	94+2	98,1	93	94+2	92,2
i) Dublin	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
j) Lund	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
k) Ørebro	91,8	31	32,1	35+6	37,6	46,7	89,3	42	—	52+1	94+1	98,2	73	94+1	93,3
l) <i>London</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
m) Zürich	—	32	35,2	36	—	47,4	—	37	—	52	94	—	94	91,8	—
n) Kurashiki	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
o) München	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
p) Budapest	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
q) Kopenhagen	97,5	26	26,3	27+2	28,3	34,4	93,0	23	—	37+6	82+11	98,5	45	82+11	91,6
r) Wisconsin	77,7	43	44,3	57+1	45,1	21,5	78,2	14	—	27,5+0	94+0	97,5	91	94+0	91,7
s) Colorado	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
t) —	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
u) —	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
v) —	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
x) ***) Washington	91,1	26	—	44	—	—	89,8	37	—	50	94	98,3	90	94	65

*) "Hard grains" not included.

**) "Harte Körner" nicht mitgerechnet.

***) "Hard grains" included.

***) "Harte Körner" mitgerechnet.

wenige, ist in Deutschland die landwirtschaftliche Versuchstätigkeit und mit ihr die Samenkontrolle auf die einzelnen Bundesstaaten und in Preußen auf die einzelnen Provinzen dezentralisiert. Das hat dazu geführt, daß die Einführung einheitlicher Normen bald ein Bedürfnis wurde. Was wir hier jetzt international anstreben, ist in Deutschland für die vielen einzelnen Stationen seit Jahren eine zwingende Notwendigkeit. Der Verband landwirtschaftlicher Versuchsstationen besitzt daher umfangreiche technische Vorschriften für die Prüfung von Saatwaren, die gerade im Jahre 1916 eine Neubearbeitung und damit eine wesentliche Erweiterung und Vertiefung erfahren haben. Sie werden dauernd von einem besonderen Ausschuß unter der bewährten Führung Hiltners auf ihre Brauchbarkeit überwacht und geprüft.

Durch die besondere Lage Hamburgs, dessen Samenkontrollstation in erster Linie die Untersuchungen für den internationalen Handel ausführt, trat bald nach ihrer Gründung im Jahre 1891 das Bedürfnis zu einer Verständigung mit den ausländischen Stationen hervor und führte bereits 1906 zu dem ersten internationalen Kongreß für Samenprüfungen in Hamburg, an dem die meisten auch hier beteiligten Nationen teilnahmen, und der die Bildung eines ständigen internationalen Ausschusses brachte. 1910 wurde dann der 2. internationale Kongreß in Münster in Westfalen abgehalten und mit einer Besichtigung Wagenings in Holland verbunden. Etwa 1914 war dann ein weiterer Kongreß in Aussicht genommen, an den sich eine Besichtigung von Kopenhagen und Svalöf anschließen sollte.

Sie verstehen, meine Damen und Herren, daß Deutschland ein besonderes Interesse an dieser dritten internationalen Beratung hat, und ich verbinde daher mit dem nochmaligen Dank für die freundliche Einladung den aufrichtigen Wunsch für eine erfolgreiche Tagung hier in Kopenhagen.

Und nun zu meinem eigentlichen Thema.

Wie bereits Herr Kollege v. Degen vorhin erwähnte, gehören die Keimprüfungen wohl zu dem schwierigsten Gebiet der Samenuntersuchungen. Während für die Herkunftsbestimmungen, wie es durch die sachkundigen Ausführungen des Herrn Kollegen Volkart am gestrigen Tage wiederum bestätigt wurde, greifbare und wissenschaftlich begründete Anhaltspunkte und auch für die Reinheitsbestimmungen feste Unterlagen vorhanden sind, fehlen sie uns für die Keimprüfungen fast noch überall. Der Keimversuch ist eben ein physiologisches Experiment und keine mechanische oder chemische Analyse. Die Natur löst jeden Augenblick das Problem der Keimung ohne Schwierigkeiten. Aber die äußeren und inneren Ursachen des Keimungsprozesses sind trotz vieler verdienstvoller Arbeiten bei weitem noch nicht hinreichend geklärt. Einen Beweis dafür liefern uns ja auch wieder die vergleichenden Versuche der verschiedenen Stationen, unter denen sich viele mit langjähriger, gründlicher Erfahrung befinden. Sie haben für viele der untersuchten Samenarten recht gute und befriedigende Übereinstimmungen gebracht. Aber bei manchen, gerade als besonders einfach geltenden Versuchen sind zum Teil zunächst noch unaufklärbare Abweichungen festgestellt.

Es ist daher nach meinem Dafürhalten nicht angängig, für die Keimprüfung so feste und die Bewegungsfreiheit einengende Vorschriften oder Regeln aufzustellen, wie es für die anderen Untersuchungszweige der Prüfung von Kultursamen möglich ist. Es kann sich im wesentlichen nur um Richtlinien handeln. Am leichtesten läßt sich die rechnerische Seite der Sache festlegen. Sie wird immer ein Kompromiß zwischen Arbeitsleistung, Arbeitsmöglichkeit und Genauigkeit sein. Während im Anfang z. B. die Zahl der einzukeimenden Samen auf Grund empirischer Erfahrung festgestellt wurde, hat Rodewald-Kiel diese angenommenen Werte von dreimal 200 Samen auf Grund theoretischer Erwägungen bestätigt. Man ist heute wohl allgemein der Meinung, daß man bei der Verwendung von viermal 100 Samen ein brauchbares, dem wahren Werte näherkommendes Durchschnittsergebnis erhält, und daß bei Verwendung weiterer 100 Samen und mehr die Genauigkeit nur noch langsam wächst. Es ist zweifellos ein großes Verdienst Rodewalds, daß er die Wahrscheinlichkeitsrechnung in die Beurteilung der Fehlergrenzen und Fehlerquellen der Samenkontrolle eingeführt hat. Leider sind diese elementaren Grundlagen bei einer großen

Anzahl von wissenschaftlichen Untersuchungen über die Keimbedingungen nicht oder nicht genügend berücksichtigt worden, indem aus Abweichungen einzelner Versuche Schlüsse gezogen wurden, die durchaus noch innerhalb der Fehler- und Wahrscheinlichkeitsgrenzen lagen. Es ist dies ein sehr bedauerlicher Mangel, der einen großen Teil der Arbeiten wertlos macht.

Was dann ferner den Keimversuch selbst betrifft, so ging man fast allgemein kritiklos von dem vorhandenen Saatgut aus, ohne sich um den näheren Umstand der Ernte- und der Lagerungsverhältnisse zu bekümmern. Das war bei den zur Keimprüfung eingesandten Handelsproben meist ja auch nicht anders möglich. Bei wissenschaftlichen Untersuchungen muß aber eine derartige Beurteilung des Saatgutes unbedingt gefordert werden. Neuere Arbeiten, wie von Kinzel, Hollrung und manchen anderen tragen anerkennenswerterweise diesen Forderungen Rechnung.

In Deutschland, wo wegen der vielen Stationen wohl zuerst das Bedürfnis nach einheitlichen Vorschriften entstanden war, glaubte man durch möglichst scharf gefaßte Bedingungen, am sichersten übereinstimmende Ergebnisse zu erzielen. Man schrieb eine konstante Temperatur von 20 Grad und den Feuchtigkeitsgehalt vor und setzte fest, daß alle Keimversuche im Dunkeln vorzunehmen seien. Man glaubte damit einmal wohl den natürlichen Verhältnissen am nächsten zu kommen, und andererseits Bedingungen festgesetzt zu haben, die leicht ausgeführt werden könnten.

Für eine bestimmte Anzahl von Sämereien ergaben sich nach diesen Vorschriften auch gut übereinstimmende Resultate. Aber mit der Zunahme der verwendeten Samenarten, namentlich der Gräser, stellten sich bald recht erhebliche Differenzen ein, und auch bei den im allgemeinen gleichmäßig ausfallenden Untersuchungen blieben die Abweichungen nicht aus. Die empirisch festgelegten Keimbedingungen ließen sich nicht verallgemeinern. Es zeigte sich mehr und mehr, daß es eine ganze Reihe innerer Faktoren gibt, die den Keimprozeß beeinflussen, und die man auch heute noch nicht hinreichend kennt.

Zürich trug wohl zuerst diesen Verhältnissen Rechnung, indem es sowohl die Temperatur als auch die Beleuchtung und Feuchtigkeit je nach den Samenarten variierte. In Kopenhagen bot schon der bekannte Jacobsensche Keimapparat die Möglichkeit, diese Keimfaktoren zu variieren, und man ist auch in Deutschland, zum Teil nach schweren Kämpfen, ziemlich allgemein zur Variation dieser Faktoren je nach den Samenarten übergegangen.

Man kommt ja mit dieser Anordnung für die Keimversuche zweifellos den natürlichen Verhältnissen näher. In unseren Breiten, in denen die meisten Samen in der Natur entweder im Herbst oder im Frühjahr keimen, ist das natürliche Keimbett in der Regel feucht und kühl. Die Erwärmung erfolgt unregelmäßig durch längere oder kürzere Sonnenblicke am Tage und zwar meist auch direkt, da die meisten kleinen Sämereien auf dem Boden liegen und nicht von Erde bedeckt sind.

Man erkannte dann ferner, daß dies Intermitteren von Feuchtigkeit, Wärme und Licht nicht wieder wie früher als allgemeine Regel für alle Samenarten nach festen Vorschriften durchgeführt werden konnte, sondern daß dieses für die verschiedenen Gruppen von Samenarten verschieden sein müßte, und daß damit die Frage auch noch nicht gelöst war, sondern daß auch der jeweiligen Beschaffenheit des Saatgutes Rechnung getragen werden muß. Es sei hier nur u. a. auf die bekannten Arbeiten Atterbergs verwiesen, nach denen frisch geerntetes Getreide bei niedriger Temperatur besser keimt.

Der Fortschritt, den die praktische Keimprüfung auf diesem Wege gemacht hat, läßt sich kurz wohl als Übergang von einer rein analytischen zu einer biologischen Methode bezeichnen.

Wenn so die praktische Samenprüfung große Fortschritte auf diesem Gebiete gemacht hat, die sich in einer stetig steigenden Übereinstimmung der Untersuchungen bei den verschiedenen Stationen zeigen, so ist sie doch dabei nicht stehen geblieben. Das Ergebnis auch der biologisch gestützten Samenprüfung ist im wesentlichen immer nur ein zahlenmäßiges. Man erfährt den Prozentgehalt der unter den geeigneten äußeren Bedingungen keimfähigen Samen, aber nichts oder nur wenig über die inneren Eigenschaften.

Es ist wohl in erster Linie das Verdienst Hiltners, daß er in die Keimprüfung den Ihnen allen bekannten Triebkraftversuch eingeführt hat. Bei ihm wird nicht nur die

Keimfähigkeit, sondern auch die Keimkraft ermittelt, hauptsächlich allerdings nur für Getreide. Er ist aber auch bei anderen Sämereien anwendbar. Damit tritt an die Stelle der quantitativen Keimprüfung die qualitative, und es eröffnet sich der praktischen Samenkontrolle ein weites Gebiet neuer Forschungen. In erster Linie vertieft sich das Verständnis für die inneren Ursachen, auf die die Abweichungen der Keimkraft zurückzuführen sind. Auch hier sind aner kennenswerte Vorarbeiten vorhanden. Ich verweise nur auf die Arbeiten Kinzels über die keimhemmende oder keimfördernde Wirkung von Licht und Frost, die Studien Hollrungs über die pathologische Beeinflussung des Saatgutes, die Versuche Zades, die Keimfähigkeit verschiedener Bastarde und Linien zu ermitteln usw. Aus der praktischen Samenkontrolle liegen weitere Erfahrungen vor, die darauf hinzuweisen scheinen, daß manche Samen Saisonkeimer sind, d. h. daß zu bestimmten Zeiten die Neigung dieser Samenarten zu keimen größer ist wie zu anderen, daß die Hartschaligkeit der Saaten je nach den Jahreszeiten schwankt usw.

In Hamburg bemühen wir uns, Einblicke in einen Teil dieser Verhältnisse dadurch zu gewinnen, daß wir zu Beginn der Hauptuntersuchungszeit, also im Herbst, die neu eingehenden Sämereien nach verschiedenen Methoden einkennen, teils trocken, teils feucht, teils kalt, teils warm, teils im Dunkeln, teils im Licht, und haben auf diesem Wege manche Erfahrungen gesammelt. Bei einigen Saaten setzen wir diese Paralleluntersuchungen unter verschiedenen Bedingungen sogar während der ganzen Saison fort. Sobald genügend Material während mehrerer Jahre gesammelt ist, wird voraussichtlich die Bearbeitung der Ergebnisse manche wichtigen Anhaltspunkte geben.

Sie sehen, meine Damen und Herren, daß hier noch ein großes, weites Feld der Forschung vor uns liegt, das geeignet ist, unsere praktischen Keimprüfungen immer genauer und übereinstimmender zu gestalten. Der Weg führt uns aber immer mehr auf das schwierige Gebiet der Erforschung der Lebensäußerung und der Lebenserscheinungen, und dazu können wir mit unseren praktischen Untersuchungen Erhebliches beitragen, und zwar durch gründliches Studium der abweichenden Fälle bei unseren laufenden Untersuchungen, durch Mitteilung der Abweichungen in unseren Jahresberichten und allgemein durch allseitige jährliche Zusammenstellungen der Untersuchungsergebnisse. Wir können dadurch ein Material zusammenbringen, wie es die wissenschaftliche Untersuchung des Einzelnen nicht schaffen kann. Wenn wir bei der täglichen Kontrollarbeit stets bemüht bleiben, die inneren Zusammenhänge für die Entwicklung des Keimlings nicht aus dem Auge zu lassen, sie ständig zu beobachten und unsere Erfahrungen auszutauschen und zu besprechen, so wird es uns zweifellos gelingen, wenn auch langsam, die praktische Samenprüfung immer mehr zu vervollkommen. Wir werden so auch mehr und mehr in den Stand gesetzt, die jeweiligen Grenzen unserer Leistungsfähigkeit zu erkennen. Dann braucht auch die praktische Samenkontrolle bei gelegentlichen Abweichungen und Unstimmigkeiten die Kritik nicht zu fürchten und kann die Keimprüfung ebenbürtig neben die bereits fester begründeten anderen Untersuchungsgebiete stellen.

Meine Damen und Herren, ich habe mir nun erlaubt, die wichtigsten Richtlinien für die Keimprüfung nach Rücksprache mit einer Reihe von Kollegen zusammenzustellen und werde sie einzeln zur Besprechung bringen:

Richtlinien für Keimprüfungen.

General directions for germination tests.

Directions pour la détermination du pouvoir germinatif*).

1. Alle Keimprüfungen werden mit der reinen Saat im Sinne der sog. „kontinentalen“ Methode angestellt.

All germination tests shall be made upon pure seed (continental method).

Tous les essais de germination sont faits avec les semences pures (méthode continentale).

*). Wie ich eingangs meines Referats ausführte, werden wir mit festen Normen und Regeln nicht weiter kommen. Dagegen dürften allgemeine Richtlinien das Gegebene sein.

Durch diese allgemeinen Bestimmungen soll die sog. Gewichtsmethode, wie sie in England und Amerika üblich ist, endgültig beseitigt werden, wie wir es in Hamburg bereits 1906 für Deutschland beschlossen haben. Der Keimversuch ist ein physiologisches Experiment und darf nicht durch Unsauberkeiten — Spreu, taube Samen usw. — belastet werden.

Ferner ist die bekämpfte Methode eine Prämie auf feinkörniges Saatgut. Ein Ausgleich kann nur durch das Korngewicht der keimfähigen Saat geschaffen werden. Eine Feststellung, die auf gleichen Gesichtspunkten beruht wie die Reinheitsanalyse nach der kontinentalen Methode.

2. Es ist zweckmäßiger, 4 mal 100 bzw. 6 mal 100 Samen zu nehmen als 2 mal 200 bzw. 3 mal 200.

The result will be more correct by taking 4 or 6 times 100 seeds than 2 or 3 times 200.
Le résultat est plus précis quand les essais portent sur 4 ou 6 fois 100 graines, que lorsqu'ils ont lieu avec 2 ou 4 fois 200 graines.

Nach den theoretischen Ermittlungen steht allgemein fest, daß eine größere Anzahl Versuche mit kleinen Mengen der Wirklichkeit entsprechendere Durchschnitte gibt als zwei Versuche mit großen Mengen. Auch werden bei Versuchen mit je 100 Körnern die Umrechnung erspart und Rechenfehler eher vermieden.

3. Es ist stets das Gewicht der einzukeimenden Samen je 100 festzustellen.

It is necessary to test the weight of each 100 seeds put to germinate.

Il est nécessaire de fixer le poids des 100 semences mises à l'essai.

Durch diese Feststellung wird ein engerer Zusammenhang zwischen der Reinheit und dem Keimversuch geschaffen und die Möglichkeit gegeben, bei Differenzen zwischen zwei Versuchstationen durch Vergleichung der Gewichte die Gleichmäßigkeit der eingekeimten Proben festzustellen.

4. Die Art des Keimbettes kann gern verschieden sein. Es müssen nur alle Bedingungen erfüllt sein, um die Temperatur, die Feuchtigkeit und das Licht zu regeln und zu intermittieren.

The nature of the germinator and seedbed is optional, but it must be possible to regulate or vary the conditions of moisture, temperature and light.

L'appareil et les germoirs pour les essais de germination sont facultatifs, mais il faut que toutes les conditions soient réalisées pour obtenir des degrés de température, d'humidité et d'éclairement constants et pour les varier.

Wenn wir die Keimeinrichtungen der größeren Stationen der Welt miteinander vergleichen, so sind sie zum Teil recht wesentlich verschieden. Trotzdem haben die Versuche unserer Enquête recht gut übereingestimmt. Es kann daher entsprechend der allgemeinen Begründung in meinem Referat von bestimmten Vorschriften für den Bau und die Einrichtung der Apparatur abgesehen werden. Die jeweilig benutzten Apparate müssen aber die Möglichkeit zur Variation der drei wichtigsten Keimfaktoren, Licht, Wärme und Feuchtigkeit, möglichst unabhängig voneinander, in genügender Ausweitung bieten, so daß von Fall zu Fall die theoretisch ermittelten günstigen Keimbedingungen den Saaten auch geboten werden können. Ob dies mit einem Universalapparat möglich ist oder gemacht wird, ist gleichgültig. Der Zweck kann auch mit verschiedenen Apparaten erreicht werden.

5. Einheitliche Zeiten für Keimenergie und Keimdauer sind festzusetzen.

Period of tests for estimating germination energy and total germination should be standardized.

Il convient de fixer uniformément la durée des essais pour la détermination de l'énergie et de la faculté germinative.

Für Deutschland sind die Zeiten für die Keimung einheitlich festgelegt. International bestehen aber noch Verschiedenheiten. Dänemark schließt z. B.

Knaulgrasversuche nach 18 Tagen ab, Deutschland nach 21. Rispengräser werden häufig sehr lange im Keimbett gehalten.

6. Vorquellen. Soaking. Trempage.

Die deutschen Vorschriften lehnen jede Vorquellung ab. In Dänemark werden Rübensamen 10 Minuten in Wasser gelegt, bevor sie ins Keimbett kommen. In Hamburg haben wir durch Jahre vergleichende Versuche mit vorgequollenen und trocken angesetzten Samen gemacht und wechselnde Ergebnisse erzielt. Es erscheint wahrscheinlich, daß je nach der Ernte das Bedürfnis der Samen für das Vorquellen verschieden ist. Man sollte daher hier keine besonderen Vorschriften machen, wohl aber weitere Versuche anstellen zur Ermittlung derjenigen Fälle, wo das Vorquellen zweckmäßig erscheint.

7. Hartschaligkeit. Hard seeds. Graines dures.

Die Bewertung der hartschaligen Samen ist in den einzelnen Ländern verschieden. Österreich und die Schweiz rechnen die Hälfte der hartschaligen Körner zu den gekeimten, Dänemark bringt einen bestimmten Prozentsatz in Anrechnung, für den die durchschnittliche Hartschaligkeit als Unterlage dient.

8. Ritzbruch. Broken seeds. Graines brisées au battage.

Es ist wohl allgemein üblich, diejenigen Körner, die sich erst im Keimbett als verletzt erweisen und keine normalen Keimlinge bilden, als nicht gekeimt anzusehen. Das letztere ist nicht immer eindeutig festzustellen. Es sind hierfür weitere Anhaltspunkte erwünscht.

9. Für Gebrauchswert wird von jetzt an „reine keimfähige Samen“ gesagt.

Instead of intrinsic Value use in future „pure germinating seeds“.

Au lieu de valeur culturale on dira désormais »semences pures en état de germiner«.

Das Wort Gebrauchswert ist zu weitgehend und kann leicht als Urteil über den Kulturwert aufgefaßt werden. Die Bezeichnung „reine keimfähige Samen“ entspricht genau der ausgeführten Analyse.

10. Jedes Jahr müssen die Durchschnittswerte festgestellt und unter den einzelnen Stationen verglichen werden.

Every year the average of all analyses ought to be taken and compared with the results of the other stations.

Chaque année les moyennes obtenues devront être communiquées aux différentes stations.

Ich habe vorher bereits angeführt, welchen Wert und welche Bedeutung für das Studium der Keimbedingungen die Erfassung des gesamten untersuchten Materials hat. Aus diesem Grunde ist die allseitige Veröffentlichung der Untersuchungsergebnisse und der Laboratoriumserfahrungen dringend erwünscht.

Direktor Widén:

„Die Keimung des Getreides.

Herr Präsident, meine Damen und Herren!

Es wäre wohl zu vermuten, daß die Frage, wie man die Keimungsuntersuchung von Getreide am besten ausführen soll, schon längst ihre endgültige Beantwortung gefunden hätte, weil die Bestimmung der Keimfähigkeit hier im allgemeinen viel leichter ist als bei den meisten übrigen Saatwaren.

In vielen Ländern sind die Wärme- und Witterungsverhältnisse fast ausnahmslos derartig, daß das Getreide vollreif und fast sofort keimfähig wird, und in besonders guten Jahren ist dies in allen Ländern, wo Getreide überhaupt reif werden kann, der Fall.

Unter solchen Umständen spielt es keine Rolle, nach welcher Methode man die Keimungsuntersuchung ausführt, wenn bloß die zur Keimung gelegten Körner in Bezug auf Feuchtigkeit und Wärme nicht zu stiefmütterlich behandelt werden. Aber in nördlicheren oder höher liegenden Gegenden mit rauhem Klima erreicht das Getreide infolge ungünstiger Witterung oder mangels an Wärme während der Reife- und Erntezeit oft nicht die schnelle

und volle Keimfähigkeit. Das Getreide wird unter solchen Vegetationsbedingungen nicht sofort keimreif.

Bei der Keimungsuntersuchung eines solchen Getreides in der früher gewöhnlichen Weise im Papierbett bei 20° C findet man, daß auch nach Ablauf der normalen Keimzeit von 10 bis 12 Tagen oft eine beträchtliche Anzahl von Körnern überhaupt nicht keimt. Von diesen sind viele gequollen und können wochen-, ja monatelang in diesem Zustande verharren, ohne weder zu verfaulen noch zu keimen, keimen aber schnell, wenn, wie ich glaube, Regierungsrat Hiltner zuerst nachgewiesen hat, die Samenschale angestochen oder angeschnitten wird, z. B. wenn das dem Embryo entgegengesetzte Ende abgeschnitten wird. Die vielen Versuche, die sowohl über die Erzielung der besten Resultate bei der Keimung im allgemeinen wie zur Erklärung des Wesens der Keimunreife ausgeführt worden sind, haben über die Ursachen vieler vorher nicht klargelegter Verhältnisse bei der Keimung Licht gebracht, weshalb wir jetzt viel besser als vor etwa 20 Jahren imstande sind zu beurteilen, wie ein einwandfreier Keimversuch angesetzt werden soll.

Von den vielen und vielenorts angestellten Versuchen möchte ich bei dieser Gelegenheit nur einige von Dr. J. N. Walldén, Vorsteher der Kontrollabteilung des Saatzuchtvereins in Svalöf in Südschweden*), ausgeführten hervorheben, teils weil das Versuchsmaterial aus den besonders schlechten Jahrgängen 1907 und 1908 stammt, teils weil sehr viele Sorten, darunter auch unter verschiedenen Breiten — Svalöf bei 56° n. Br. und Upsala bei 60° n. Br. — geerntete, geprüft wurden und nicht nur für die Verhältnisse der nördlichen Länder, sondern auch für die Großbritanniens und Irlands, der Niederlande, Belgiens, des nördlichen Teiles von Deutschland und Rußland sowie Canadas und des nördlichen Teils der Vereinigten Staaten von Nordamerika Geltung beanspruchen können.

Tab. 1.

Keimungsversuche im Papierbett mit unverletzten und angeschnittenen Körnern. Temp. 18 bis 20° C.

Getreideart	Versuch angestellt	Keimzahl nach 12 Tagen %	
		Unverletzte Körner	Angeschnittene Körner
Wintergetreide:			
Squareheadweizen, Svalöfs	30/9. 07	78,0	99,5
Grenadierweizen	17/10. 08	56,0	100,0
Petkuser Roggen	4/8. 08	48,0	100,0
Schlanstedter Roggen	1/9. 08	90,0	95,0
Sommergetreide:			
Perlweizen	23/10. 08	35,0	93,0
Brauner Schlanstedter Weizen	21/4. 09	18,0	97,0
Chevaliergerste	10/9. 08	16,0	100,0
Primusgerste	15/8. 08	6,0	98,0
Probsteier Hafer	11/10. 07	45,5	98,0
Segerhafer	13/1.	68,0	100,0

Die Versuche zeigen, wie wenig von der in dem Samen enthaltenen Lebenskraft bei der in gewohnter Weise ausgeführten Papierkeimung bei 18 bis 20° C, wenn die Samen noch keimunreif sind, bei dem Keimversuche zum Vorschein kommt.

*) Walldén: Eftermognad hos spanmålsvaror, Sveriges Utsädesförenings Tidskrift 1910. Seite 88.

Aus den Zahlen ist auch ersichtlich, daß Schlanstedter Roggen schon am 1. September fast keimreif war, daß der Segerhafer dagegen noch nicht Mitte Januar und Brauner Schlanstedter Sommerweizen sogar spät im Frühjahr noch nicht keimreif war, also, daß die Ernteprodukte solcher Jahrgänge sehr verschiedene Zeit gebrauchen, um keimreif zu werden. Bei günstiger Witterung zur Reife- und Erntezeit dagegen wird das Wintergetreide nach einigen Tagen, höchstens nach ein paar Wochen keimreif, das Sommergetreide nach einem bis zwei Monaten.

Tab. 2.

Gerste gekeimt im Papierbett bei verschiedener Nässe
und verschiedenen Temperaturen.

Kalte Keimung Temp. + 10 bis + 15° C		Warme Keimung Temp. + 18 bis + 20° C	
mäßig feuchtes Keimbett ‰	sehr feuchtes Keimbett ‰	mäßig feuchtes Keimbett ‰	sehr feuchtes Keimbett ‰
69,0	61,0	63,0	52,0
86,0	74,5	80,0	32,0
99,5	47,0	59,5	18,5
86,0	61,0	69,0	50,5
98,0	11,0	93,0	32,0
90,5	63,0	98,0	32,0
100,0	98,0	100,0	94,0
100,0	87,0	100,0	92,0
90,0	63,5	90,5	66,0
93,0	93,0	86,0	83,0
85,5	91,0	83,5	81,5
97,0	98,5	87,0	86,5
100,0	98,0	100,0	95,0
99,0	50,0	82,0	42,0
96,0	45,0	55,0	31,0
98,0	50,0	93,0	38,0
97,0	96,0	76,0	30,0
99,0	92,0	92,0	59,0
98,0	74,0	96,0	32,0
100,0	83,0	98,0	35,0
68,0	16,0	6,0	5,0
100,0	72,0	16,0	10,0
96,0	90,0	95,0	66,0
97,0	83,0	91,0	69,0
Im Mittel 93,5	70,7	79,6	51,2

Tabelle 2 zeigt die keimungshemmende Einwirkung höherer Temperatur und zu großer Feuchtigkeit des Papierkeimbettes. Das Mittel der 24 bei + 10 bis + 15° C ausgeführten Keimversuche zeigte für Gerste in mäßig feuchtem Papierbett 93,5 ‰ Keimfähigkeit, bei großer Feuchtigkeit nur 70,7 ‰, bei 18 bis 20° C und in mäßig feuchtem Bett 79,6 ‰ und bei sehr feuchtem nur 51,2 ‰ Keimfähigkeit.

Die Zahlen zeigen, wie wichtig es ist, beim Keimen von keimunreifem Getreide im Papierbett niedrige Temperatur und mäßige Feuchtigkeit innezuhalten.

Tab. 3.

Keimungsversuche mit Gerste im Papier- und Sandbett bei verschiedener Nässe und verschiedenen Temperaturen.

Gerstensorten	Papierbett		Sandbett				Angeschnittene Körner
	+ 20° C	+ 12 bis + 15° C	sehr feucht, etwa 100 0/0 der wasserhaltenden Kraft		mäßig feucht, etwa 50 0/0 der wasserhaltenden Kraft		
			+ 20° C	+ 12 bis + 15° C	+ 20° C	+ 12 bis + 15° C	
	%	%	%	%	%	%	
Gullkorn (Goldgerste)	8,0	35,0	6,0	16,0	5,0	68,0	99,0
" "	3,0	80,0	16,0	72,0	10,0	100,0	
Hannchengerste	13,0	39,0	34,0	89,0	50,0	98,0	
Gullkorn	92,0	97,0	32,0	74,0	96,0	98,0	
Gerste 0232	96,0	99,0	35,0	83,0	98,0	100,0	
Hannchengerste	83,0	99,0	38,0	55,0	93,0	98,0	
Gerste 0125	69,0	98,0	59,0	92,0	92,0	99,0	
Landgerste	57,0	90,0	42,0	50,0	82,0	99,0	
Gerste 0123	56,0	95,0	30,0	90,0	76,0	99,0	
Prinzeßgerste	34,0	78,0	31,0	45,0	55,0	96,0	
Im Mittel	51,1	81,6	32,8	66,6	65,7	95,5	

Tabelle 3 zeigt die oft sehr bedeutenden Unterschiede der Keimungsuntersuchungsergebnisse, wenn bei keimunreifem Getreide verschiedene Methoden, in dem einen Falle Papierbett, in einem anderen Sandbett benutzt werden, sowie daß höhere Temperatur und übermäßige Nässe auch beim Sandkeimbett sehr keimungshemmend einwirken können.

Aus den hier ausgeführten Versuchen ist ersichtlich, wie leicht bei nicht keimreifem Getreide große Unterschiede entstehen können, nicht nur zwischen verschiedenen Anstalten, sondern an ein und derselben Samenkontrollanstalt bei Wiederholung der Keimung an derselben Probe nach kurzer Aufbewahrung im warmen Zimmer, wenn nicht solche Keimungsweise innegehalten wird, die auch bei keimunreifem Getreide befähigt ist, nahezu volle Keimfähigkeit hervorzulocken.

Auch verschiedene andere Umstände, wie angefangene Keimung in der Ähre (Vorkeimen), Organismenbefall infolge schlechten Erntewetters und schlechter Aufbewahrung, wirken schädigend und herabsetzend auf die Keimfähigkeit, machen die Ware ungleichmäßig und geben deshalb auch Veranlassung zu bedeutenden Differenzen der Keimungsbestimmungen. Auch in solchen Fällen hat es sich gezeigt, daß beim Keimen in nicht zu nassen Sandbetten bei nicht zu hoher Temperatur die am besten übereinstimmenden Resultate erhalten werden.

Vielleicht werden bei viel und anhaltender Nässe im Boden gleich nach der Saat von keimunreifem Getreide bedeutend weniger Körner keimen, als bei den günstigeren Verhältnissen im Sandbett; doch scheint es mir nicht richtig, daß die Samenkontrolle mit der Einwirkung solcher zufälliger Faktoren rechnet. Dagegen kann es unter Umständen wünschenswert sein, die der Keimlinge innewohnende Triebkraft zu bestimmen.

Weil wir im Norden sehr oft mit keimunreifem Getreide zu tun haben, ist in der vereinbarten und offiziell festgestellten Methode der drei nordischen Länder, Dänemark, Norwegen und Schweden, vorgeschrieben, daß wenigstens 200 Körner ins Sandkeimbett gelegt werden müssen, und daß beim Keimen im Papierbett eine Temperatur von + 10° bis + 15° C innegehalten werden soll. Die dänische und einige schwedische Samenkontrollanstalten haben die Papierkeimung bei Getreide jetzt ganz aufgegeben.

Wie aus dem hervorgeht, was ich hier die Ehre gehabt habe anzuführen, hoffe ich dargetan zu haben, daß wir für die Keimung des Getreides (und der großkörnigen Leguminosensamen) bei Anwendung des mäßig feuchten Sandbettes und Innehaltung einer Temperatur von 18° bis höchstens 20° C eine Methode haben, die allen anderen bisher benutzten an Zuverlässigkeit übertrifft, und ich möchte deshalb den Antrag stellen, daß der dritte internationale Samenkontrollkongreß sich dahin aussprechen wollte, daß in den Ländern, wo keine offiziellen Bestimmungen im Wege stehen, die Keimung des Getreides und der großkörnigen Leguminosensamen stets im Sandbett mit einem Feuchtigkeitsgehalt von höchstens 60 % der auf das Gewicht bezogenen wasserhaltenden Kraft auszuführen und bei einer Temperatur von 18° bis höchstens 20° C und als Minimum 300 Körner in 3 Serien oder 400 Körner in 2 Serien verteilt anzusetzen.

Wünschenswert, doch nicht obligatorisch, wäre es außerdem, bei Jahreszeiten, wo das Vorkommen keimunreifen Getreides zu vermuten ist, auch einen Versuch im Papier, bei 20° C auszuführen, um zu erfahren, ob das Getreide nicht keimreif ist, um den Einsender darauf aufmerksam zu machen, wie die Ware am zweckmäßigsten behandelt werden soll.

Resumé en français.

Il résulte de la communication que j'ai eu l'honneur de vous faire, qu'en employant pour la germination des semences de céréales et des grosses semences de légumineuses le sable modérément humide à la température de 18° à 20° C, au maximum, nous aurons là une méthode surpassant toutes les autres comme donnant des résultats certains.

Conséquemment je voudrais proposer que le 3. congrès international pour le contrôle des semences décide que dans les pays où il n'y a pas d'obstacles légaux, l'essai germinatif des semences de céréales et des légumineuses à gros grains se fasse dans du sable contenant une quantité d'eau égale à tout au plus 60 % de la quantité Maximum que peut absorber la matière employée. La température à observer serait de 18° C, au maximum 20° C. On mettrait en germination 300 graines en 3 séries de 100, ou 400 graines en 2 séries de 200. Il serait désirable, mais pas obligatoire, de faire en plus un essai dans le papier à la température de 20° à certaines époques de l'année ou pendant certaines années ou l'on peut prévoir l'obtention de semences imparfaitement mures, on expérimenterait de la sorte si les céréales ne sont pas mures et aptes à germer. On pourrait ainsi en avertir l'expéditeur et l'on pourrait étudier aussi de quelle façon la marchandise devrait être traitée.

Professor Dr. A. Voigt referierte über folgenden Bericht:

„Untersuchung und Bewertung des Rübensamens.“

Berichterstatter: Ing. Karl Komers,

Regierungsrat an der Staatsanstalt für Pflanzenbau und Samenprüfung in Wien.

„Die eigenartige Beschaffenheit des Rübensamens bringt es mit sich, daß bei dieser Samenart die Untersuchung auf größere Schwierigkeiten stößt, als dies sonst bei Sämereien der Fall ist. Dieser Umstand, im Verein mit dem Mangel einer einheitlichen Untersuchungsmethode, gibt mitunter zu solchen Abweichungen in den Prüfungsergebnissen und im Kaufpreise ein und derselben Ware Anlaß, daß eine Einigung zwischen Käufer und Verkäufer oft bei bestem Willen nicht möglich ist. Diese Verhältnisse wirken ungemein hemmend auf die glatte Abwicklung des Rübensamenhandels und bedürfen dringlich einer Verbesserung. Die Untersuchung und Bewertung des Rübensamens war im Hinblick auf diesen Sachverhalt begreiflicherweise schon wiederholt Gegenstand von Verhandlungen verschiedener fachwissenschaftlicher Kongresse. Wenn es gleichwohl zu einem einheitlichen, allgemein gültigen Verfahren bisher nicht gekommen ist, so kann dies zweifellos nicht dem Mangel an Gelegenheit und gutem Willen zugeschrieben werden. Der Grund dürfte vielmehr der sein, daß die Zeit, die einem Verhandlungsgegenstande

auf einem Kongresse zugewiesen werden kann, nicht ausreicht, um die unterschiedlichen Ansichten der Fachgenossen erst hier einander näher zu bringen und den gewichtigeren Gründen erst im Wege der kurzen, mündlichen Verhandlungen die allgemeine Anerkennung zu verschaffen. Es dürfte daher zweckmäßiger sein, wenn von allen beteiligten Versuchsanstalten über die strittigen Fragen und Methoden, unter Vermittlung einer hierfür auserlesenen Stelle, Versuche nach einem einheitlichen Plane angestellt würden. Jeder Fachmann, der sich für die Frage interessiert, hätte Gelegenheit, die Vor- und Nachteile auch der an anderen Anstalten gebräuchlichen Verfahren aus eigener Anschauung kennen zu lernen, ein Umstand, der geeignet wäre, schließlich eine Einigung der Interessenten in allen sachlich wichtigen Fragen herbeizuführen. Dem nächsten Kongresse fiele dann nur die Aufgabe zu, die endgültige Fassung der von den Fachgenossen vereinbarten Grundsätze offiziell zum Beschlusse zu erheben und zu verlautbaren. Dies ist gewiß ein langwieriger, umständlicher Weg, doch können wir uns der Ansicht nicht verschließen, daß er immerhin noch früher zum Ziele führen werde, als der bisher übliche.

Wenn wir uns im nachstehenden mit der Untersuchung und Bewertung des Rübensamens befassen, so geschieht dies nicht in der Absicht, eine bestimmte Methode*) eingehend darzulegen und als einheitliches Untersuchungs- und Bewertungsverfahren in Vorschlag zu bringen, da dies erfahrungsgemäß ein ziemlich aussichtsloses Unternehmen wäre, sondern wir beschränken uns darauf, die Verhältnisse, die bei der Bewertung im allgemeinen in Betracht kommen, zu besprechen, anschließend daran die gebräuchlichsten Verfahren zur Feststellung der einzelnen wertbestimmenden Eigenschaften sowie die Umstände, die vor allem die Genauigkeit der Prüfungsergebnisse beeinflussen, kurz zu erwähnen, um daran den Vorschlag zu knüpfen, daß unter diesen Gesichtspunkten Versuche seitens der Fachgenossen zur Erzielung eines einheitlichen Untersuchungsverfahrens angestellt werden mögen.

Untersuchung.

Die Klagen über große Differenzen bei Rübensamenuntersuchungen haben wohl zum Teil ihren Grund auch darin, daß man über den Genauigkeitsgrad, der von Samenuntersuchungen gefordert werden kann, nicht immer zutreffend unterrichtet ist, und man daher verleitet wird, die von der chemischen Untersuchung her gewohnte Übereinstimmung der Untersuchungsbefunde annähernd auch bei Samenuntersuchungen vorauszusetzen. Zwischen beiden Arten von Untersuchungen besteht jedoch, abgesehen von allen sonstigen Umständen, schon deshalb ein grundsätzlicher Unterschied, als die Behandlung der Proben, die der eigentlichen Untersuchung vorausgeht, in beiden Fällen eine ganz andere sein muß. Eine Samenprobe z. B. wird bei der chemischen Untersuchung auf das feinste pulverisiert und kann daher so innig durchgemischt werden, daß alle daraus entnommenen Teilproben für die Untersuchung in ihrer prozentischen Zusammensetzung nahezu vollständig übereinstimmen. Eine Saatgutprobe hingegen ist, je nach der Samenart, ein mehr oder weniger grobes, mechanisches Gemenge, in welchem zum Zwecke der Ermittlung des Gebrauchswertes die Samenindividuen erhalten bleiben müssen.

Bedenkt man weiter, daß die einzelnen Samenkörner ein und derselben Art nur unwesentlich in ihrer chemischen Zusammensetzung voneinander abweichen, der Samen aber als Saatkorn entweder keimfähig oder nichtkeimfähig ist, also entweder nur den Wert 0 oder 100 haben kann, so sieht man sofort ein, daß hier dem Zufall ein weit größerer Spielraum gelassen ist, als bei der chemischen Untersuchung. Trotz sorgfältigen Durchmischens werden daher die entnommenen,

*) Bezüglich der an der Staatsanstalt in Wien gebräuchlichen Methode ist dies durch den ehemaligen Direktor dieser Anstalt, Hofrat Dr. v. Weinzierl, auf dem Internationalen Kongresse für Samenprüfung in Hamburg im Jahre 1906 bereits gesehen.

engeren Untersuchungsproben merklich verschiedene Ergebnisse aufweisen. Diese durch den Zufall bedingten Abweichungen können durch keine wie immer geartete Untersuchungsmethode ganz ausgeschaltet werden. Da sich die ausschließlich durch den Zufall bedingten positiven und negativen Abweichungen aber nach Zahl und Größe ziemlich gleichmäßig um den Mittelwert gruppieren und ihre Summe sich in dem Maße dem Werte 0 nähert, als die Zahl der Beobachtungen wächst, so wäre ihnen höchstens durch eine Steigerung der Zahl der Einzelversuche beizukommen, ein Mittel, dessen Anwendbarkeit in der Praxis der Handelsanalyse begreiflicherweise enge Grenzen gezogen sind. Was die Größe der durch den Zufall bedingten unvermeidlichen Fehler betrifft, so kommen wir darauf an geeigneter Stelle später zurück.

Probenahme. Soll eine Samenprüfung ihren Zweck erfüllen, so müssen nicht nur die für die verschiedenen Prüfungsstellen bestimmten Samenmuster in ihren Eigenschaften untereinander übereinstimmen, sondern sie müssen auch vor allem dem Durchschnittscharakter der Ware, aus der sie entnommen worden sind, entsprechen. Nun sind aber die einzelnen Ballen einer Rübensamenlieferung zu meist unterschiedlicher beschaffen, als man gemeiniglich annimmt. Es fällt zwar nicht besonders schwer, aus einem kleineren Warenposten annähernd richtige Durchschnittsmuster zu entnehmen; der Erfolg wird jedoch in dem Maße unsicherer, als die Ballenzahl wächst. Soll die Ermittlung des Durchschnittswertes einer Rübensamenlieferung nicht von Haus aus in Frage gestellt werden, so muß daher bei der Musterziehung stets der gleiche Vorgang eingehalten werden.

Wir unterscheiden eine Probeziehung zur Gewinnung der für die Untersuchungsstellen bestimmten Samenmuster und eine solche zur Entnahme der eigentlichen, engeren Untersuchungsprobe:

Zu ersterem Zwecke werden die Ballen in leicht zugänglichen Reihen aufgestellt. Es empfiehlt sich, bei jedem Warenposten stets die gleiche Menge Rübensamen pro Ballen zu entnehmen und stets die gleiche Anzahl von Ballen anzustechen, z. B. je 5 Ballen. Besteht die Lieferung also aus 5 oder weniger Ballen, so wäre jeder einzelne anzustechen. Bei 10, 15, 20 beziehungsweise 50 Ballen jeder 2., 3., 4. beziehungsweise 10. Ballen. Die entnommenen Proben werden in einem geeigneten Gefäße gesammelt, durchgemischt und daraus Samenmuster von etwa 250 Gramm in der erforderlichen Anzahl entnommen. Soll in diesen Mustern auch der Wassergehalt ermittelt werden, so sind die Proben sofort in gut schließenden Blechbüchsen oder Gläsern zu verpacken. Im Interesse einer besseren Übereinstimmung der Proben sollte sich eine Untersuchung auf nicht mehr als 50 Ballen erstrecken.

Die engeren Proben für die Untersuchung im Gewichte von 20—25 Gramm werden am sichersten auf automatischem Wege mittels eines Probeziehers entnommen, bei welchem gleichzeitig auch ein gründliches Vermischen des Samenmusters erfolgt. Der an der Staatsanstalt in Wien seit mehr als fünfzehn Jahren in Verwendung stehende Probezieher hat sich bisher gut bewährt und den an ihn gestellten Anforderungen vollauf entsprochen.

Bestimmung der Reinheit und des Knäuelgewichtes. Trotz sorgfältiger Probeentnahme werden die einzelnen Untersuchungsproben aus bereits erwähnten Gründen immer noch merkliche Unterschiede in ihrer Zusammensetzung aufweisen. Zur Kontrolle und zur Verringerung des hierdurch bedingten Fehlers ist es ratsam, die Reinheitsbestimmungen stets doppelt auszuführen. Der Vorgang bei der Reinheitsbestimmung besteht im wesentlichen darin, daß die Probe mittels Handauslese, unter Zuhilfenahme eines Siebes, in Fremdbestandteile und Rübenknäule getrennt wird. Da taube und leere Knäule füglich nicht zu den Fremdbestandteilen gerechnet werden können, ihre Belassung bei den reinen Knäulen aber die Übereinstimmung der Keimergebnisse beeinträchtigt, so ist es zweck-

mäßig, neben dem Gehalte an Fremdbestandteilen und reinen Knäulen auch den an Abfallknäulen gesondert anzugeben. Aus gleichem Grunde wird man auch gut tun, Knäule unter einem bestimmten Querschnitte z. B. 2 mm mittels eines Siebes abzuschneiden und den Abfallknäulen zuzuzählen. Wenn auch nicht vollends unkeimfähig und daher nicht völlig wertlos, so liefern solche Knäule doch nur wenige*) und schwächliche Keime. Zudem benutzt man in der Praxis der Rübensamenputzerei gewöhnlich Siebe mit einer Schlitzweite von 3 mm; es würden demnach durch die Abscheidung unter 2 mm nur die nicht einwandfrei geputzten Saatwaren getroffen werden, was kein Grund sein kann, diese kleinen minderwertigen Knäule von der reinen Probe nicht abzuschneiden. Auf Grund vieljähriger Erfahrung können wir feststellen, daß bei den bisher untersuchten Rübensamenproben der Gehalt an Abfallknäulen, bis auf wenige Ausnahmen, meist weit unter der zulässigen Grenze von 2% zurückgeblieben ist; er beträgt im großen Durchschnitte nicht mehr als 0,5%.

Nach der Trennung der Probe in reine Knäule, Abfallknäule und Fremdbestandteile werden dann noch die reinen Knäule abgezählt, das Gewicht dieser drei Produkte festgestellt und ihr prozentischer Gehalt berechnet. Aus Knäuelzahl und Gewicht der Knäule ergibt sich die Zahl der Knäule pro 1 Gramm. Wir wollen es nicht versäumen, hier auf eine Fehlerquelle hinzuweisen, die oft nicht beachtet wird. Die Untersuchungsprobe verliert durch Austrocknung bei der Aufarbeitung, namentlich dann, wenn die Samenprobe einen hohen Feuchtigkeitsgehalt besitzt und der Versuch etwa erst am nächsten Tage zum Auswiegen kommt, mehr oder weniger Wasser, infolgedessen sich die gefundenen Werte auf einen andern als den tatsächlichen Wassergehalt der Probe beziehen. Damit sind nicht nur Fehler in der Reinheit und Knäuelzahl, sondern auch in der Anzahl der Keime und keimfähigen Knäule pro 1 Gramm (infolge der Umrechnung auf eine unrichtige Knäuelzahl pro 1 Gramm) verbunden. Diese Fehler können nur durch Berechnung der Ergebnisse auf den ursprünglichen Wassergehalt der Samenprobe vermieden werden.

Sind Samenmuster stärker verunreinigt oder sind darin auch nur vereinzelt größere Erdklümpchen, Steinchen oder größere Unkrautsämereien vorhanden, so kann es vorkommen, daß von diesen Fremdbestandteilen zufällig ein bei weitem größerer Anteil in die Untersuchungsprobe gerät, als es der durchschnittlichen Reinheit des ganzen Samenmusters entspricht. Bei der Umrechnung des Gehaltes an Fremdbestandteilen von der verhältnismäßig kleinen Untersuchungsprobe (20–25 Gramm) ergeben sich dann mitunter zwischen den Parallelbestimmungen solche Differenzen, daß eine Wiederholung der Reinheitsbestimmung notwendig wird. Sicherer geht man, wenn man die Reinheitsbestimmung in zwei Operationen zerlegt. Die eine besteht in der rohen Reinigung des ganzen Samenmusters. Zu diesem Behufe wird dieses über ein Sieb von etwa 1 mm Schlitzweite abgesiebt; hierdurch wird Staub, Sand und Erde entfernt. Das abgesiebte Samenmuster breitet man dann auf einem steifen, schwarzen Papier aus, so daß die Samen nur in einer Schichte zu liegen kommen. Mittels einer Pinzette entnimmt man daraus alle größeren Fremdbestandteile, soweit sie dem Auge sofort auffallen, und vereinigt sie mit dem Siebabfall. Zur Ermittlung des Gewichtes dieser nur flüchtig gereinigten Samenprobe sowie der dazu gehörigen Verunreinigungen bedient man sich vorteilhafterweise einer Bogenwage, die auf etwa 0,1 Gramm genau ist und die Erhebung des Gewichtes ohne Gewichtsaufgabe durch Ablesen an der Bogenskala gestattet. Aus den erhaltenen Zahlen berechnet man den vor-

*) So ergab der Durchschnitt aus 10 verschiedenen Rübensamenproben für Knäule mit einem Querschnitt von 2,0–2,5 mm 205 Samen für je 100 Knäule; von 100 Samen keimten 26%. Bei Knäulen von der Größe 5–6 mm waren 386 Samen in je 100 Knäulen enthalten mit einer Keimfähigkeit von 75%. Bei Knäulen unter 2 mm ist das Verhältnis natürlich noch ungünstiger als im zuerst erwähnten Falle.

läufigen prozentischen Gehalt an Fremdbestandteilen, soweit sie bisher abgeschieden worden sind. Die so vorbereitete Samenprobe ist nunmehr viel reiner und gleichmäßiger geworden; führt man die bereits geschilderte Reinheitsbestimmung in dieser Probe aus, so werden die Ergebnisse stets in befriedigender Weise übereinstimmen. Die Befunde der zweiten Reinheitsbestimmung sind dann natürlich noch auf das ursprüngliche Samenmuster umzurechnen, z. B..

Ergebnis der rohen Reinheitsbestimmung im ganzen Samenmuster:

Reinheit..... 96,5%

Fremdbestandteile... 3,5%

Ergebnis der zweiten Reinheitsbestimmung in der Teilprobe von 20 bis 25 g:

Reine Knäule..... 98,4%

Abfallknäule 0,7%

Fremdbestandteile... 0,9%

Umrechnung auf das ursprüngliche Samenmuster:

$98,4 \times 0,965$ 95,0% Reinheit

$0,7 \times 0,965$ 0,7% Abfallknäule

$0,9 \times 0,965 + 3,5$... 4,3% Fremdbestandteile

100,0%

Die Trennung der Reinheitsbestimmung in zwei Operationen erfordert nur einen geringen Mehraufwand, sichert aber dafür das Reinheitsergebnis in erheblichem Maße.

Bestimmung der Keimfähigkeit. Der Schwerpunkt der Untersuchung des Rübensamens liegt ebenso wie bei jeder anderen Saatware in der Bestimmung der Keimfähigkeit. Während die Abweichungen der Ergebnisse für die übrigen Eigenschaften sich in verhältnismäßig engen Grenzen bewegen, betragen jedoch die Differenzen in den Keimresultaten nicht selten 10 und mehr Prozent. Die von verschiedenen Seiten unternommenen Versuche, durch Ausgestaltung der Untersuchungsmethode den Keimprüfungen mehr Sicherheit zu geben, haben den Einfluß mancher Fehlerquellen zwar verringert, doch sind die Abweichungen trotzdem immer noch recht empfindliche. Wollen wir Aufschluß darüber erhalten, ob und wieweit eine bessere Übereinstimmung noch möglich wäre, so ist es notwendig, die Fehlerquellen genauer zu untersuchen.

Die Abweichungen bei Keimprüfungen sind zum Teil durch zufällige, zum Teil durch systematische Fehler verursacht. Es ist klar, daß eine Behebung der Differenzen auf methodischem Wege nur soweit erwartet werden kann, als diese durch systematische Einflüsse veranlaßt sind, denn nur diese, nicht aber die zufälligen Fehler können durch das Untersuchungsverfahren eingeschränkt werden. Um nun den zufälligen Fehler bei Keimprüfungen von den systematischen Fehlern reinlich scheiden zu können, haben wir folgenden Versuch ausgeführt:

3000 Weizenkörner von einer Keimfähigkeit von 100 % wurden mit 1000 durchwegs unkeimfähigen Weizenkörnern vermischt. Dieses Gemenge hatte somit eine tatsächliche Keimfähigkeit von genau 75 %. Um jeden systematischen Fehler auszuschneiden und die Keimfähigkeit in den aus diesem Gemenge entnommenen Keimproben nicht erst jeweils durch einen Keimversuch feststellen zu müssen, haben wir die 1000 nichtkeimfähigen Körner durch eine schwarze Beize kenntlich gemacht. Nach gründlichem Durchmischen wurden diesem Gemenge mittels eines kleinen Schöpfgefäßes annähernd 100 Körner entnommen, die darin enthaltenen keimfähigen (ungefärbten) und nichtkeimfähigen (schwarzen) Samen gezählt und die Keimfähigkeit auf 100 Körner berechnet. Nach Erledigung des Versuches wurden die entnommenen Körner verlustlos wieder mit der restlichen Weizenprobe vereinigt, so daß diese, wie zu Beginn des Versuches, wieder aus 4000 Körnern bestand. Bei der 48maligen Wiederholung des Versuches wurden folgende

Ergebnisse erzielt: 73, 75, 74, 78, 70, 70, 84, 78, 71, 76, 74, 81, 74, 76, 77, 72, 76, 78, 83, 78, 73, 75, 77, 68, 82, 78, 73, 74, 76, 69, 72, 80, 80, 79, 78, 74, 84, 82, 72, 73, 79, 74, 80, 67, 70, 77, 73, 74.

Dieser Versuch ist sehr lehrreich; er liefert uns den Beweis, daß wir selbst bei Verwendung einer völlig einwandfreien Keimmethode, d. h. bei Verwendung eines Verfahrens, bei welchem jeder keimfähige Samen auch tatsächlich immer einen Keim liefert, mitunter mit ziemlich großen Fehlern zu rechnen haben, je nachdem in die Keimprobe von 100 Körnern durch Zufall einmal mehr, einmal weniger von den nichtkeimfähigen Samen hineingeraten. Wir haben kein Mittel in der Hand, diesen Zufall auszuschalten, d. h. die Keimprobe stets so auszuwählen, daß ihre Zusammensetzung immer dem Durchschnittsverhältnis der keimfähigen und nichtkeimfähigen Samen im Samenmuster beziehungsweise in der Ware genau entspricht. Bis auf zwei Ergebnisse (je 75 %) sind alle gefundenen Werte mit einem mehr oder weniger großen Fehler behaftet. Die größten Abweichungen waren + 9 und - 8 Keime. Die übrigen Differenzen stufen sich von diesen Werten bis 0 ab. Die Abweichungen von der tatsächlichen Keimfähigkeit von 75 % werden in dem Maße kleiner, je mehr Einzelversuche in die Bildung des Mittelwertes (Endergebnis) einbezogen werden. Als durchschnittliche Streuung für den Einzelversuch ergab sich auf ganze Einheiten abgerundet: $s = \pm 3$. Die Variationsbreite (Abstand des höchsten und niedrigsten Wertes) beträgt nach der summarischen Regel $V_b \approx 6s = 18$; tatsächlich beobachtet wurde $V_w = 9 + 8 = 17$. Faßt man je drei Einzelversuche zusammen, so betragen die größten Differenzen der hierbei erhaltenen Mittelwerte gegen den wahren Wert von 75 nur mehr + 4 und - 2. Bei der Zusammenfassung von je 6 Einzelversuchen: + 2 und - 2, bei 12 Einzelversuchen: + 1 und - 1. Das Mittel aus sämtlichen 48 Versuchen war 75,6, rund 76, zeigt also schon eine starke Annäherung an den wirklichen Wert 75.

Im Rübensamen kommt es aber nicht nur auf die keimfähigen und nichtkeimfähigen Knäule, sondern auch auf die Zahl der Keime in 100 Knäulen oder in der Gewichtseinheit an. Da nun die einzelnen Knäule jeweils eine verschiedene Anzahl von Keimen liefern, so ist bei der Bestimmung der Zahl der Keime pro 100 Knäule durch diesen Umstand dem Zufalle ein noch größerer Spielraum eröffnet, als bei der Bestimmung der keimfähigen Knäule.

Um auch hier die Größe des zufälligen Fehlers kennen zu lernen, haben wir einen Versuch mit gefärbten Rübensamen in ähnlicher Weise wie vorhin ausgeführt. Hinsichtlich der Zusammensetzung der Samenprobe wurden annähernd die Verhältnisse nachgeahmt, wie sie bei Rübensamen vorkommen. Da der zufällige Fehler bei Keimversuchen am größten ausfällt, wenn das Mischungsverhältnis von keimfähigen und nichtkeimfähigen Knäulen 50 : 50 % beträgt, haben wir dieses Verhältnis auch dem für diesen Versuch verwendeten Rübensamen zugrunde gelegt. Dieser Rübensamen bestand aus 2000 schwarz gefärbten Knäulen (unkeimfähig), 410 roten (mit je 1 Keim), 1040 ungefärbten (mit je 2 Keimen), 360 grünen (je 3 Keime), 160 gelben (je 4 Keime) und 30 blauen (je 5 Keime). Die Rolle, 1, 2, 3, 4 und 5 Keime zu liefern, war natürlich jenen Knäuelgrößen zugewiesen, bei denen diese Zahl der Keime pro Knäuel erfahrungsgemäß am häufigsten vorkommt. Im übrigen war der Vorgang der gleiche wie bei dem vorher erwähnten Versuche. Die durchschnittliche Keimfähigkeit dieses Rübensamens betrug tatsächlich 109 Keime und 50 keimfähige Knäule pro 100 Knäule. Die bei unserem Versuche gefundenen Werte waren hingegen: 97 (47), 119 (52), 116 (49), 102 (46), 126 (58), 97 (47), 90 (45), 101 (49), 112 (51), 109 (48), 102 (45), 102 (48), 120 (54), 85 (39), 102 (43), 114 (56), 109 (49), 120 (53), 121 (51), 138 (55), 115 (50), 124 (58), 91 (44), 108 (47), 108 (49), 110 (48), 98 (52), 103 (49), 125 (55), 122 (53),

116 (46), 97 (51), 114 (57), 102 (45), 97 (49), 112 (51), 95 (45), 130 (63), 123 (54), 123 (52), 99 (47), 107 (53), 108 (54), 91 (46), 105 (46), 105 (48), 98 (48), 116 (53), 112 (51), 116 (54) Keime (keimfähige Knäule).

Für die keimfähigen Knäule ergab sich als höchste Abweichung vom wahren Werte $+13$ und -11 (entsprechend dem höchsten und niedersten Wert 63 und 39); das Gesamtmittel war 50, die Streuung für den Einzelversuch $s = \pm 4^*$, $V_b = 24$, $V_w = 24$.

Bei der Bestimmung der Keime hingegen erhielten wir als höchsten und niedersten Wert 138 und 85 Keime und daher als größte Differenz gegenüber der wirklichen Keimzahl von 109 die Werte $+29$ und -24 . Das Mittel aus sämtlichen Versuchen war 109**) Keime; die Streuung für den Einzelversuch $s = \pm 9$, $V_b = 54$, $V_w = 53$. Die durchschnittliche Abweichung bei der Bestimmung der Zahl der Keime beim Rübensamen ist somit etwa zwei- bis dreimal so groß als beim Keimversuch mit einer beliebigen anderen Samenart oder bei der Ermittlung der keimfähigen Knäule im Rübensamen. Nach dem Ergebnisse unseres Versuches müssen wir also mit folgenden durchschnittlichen zufälligen Fehlern für den Einzelversuch rechnen:

$$\begin{aligned} \text{Keime pro 100 Knäule} &= M_1 \pm s_1 = M_1 \pm 9 \\ \text{keimfähige Knäule 100} &,, = M_2 \pm s_2 = M_2 \pm 4 \end{aligned}$$

Doch fallen bekanntlich innerhalb dieser Grenzen der Zahl nach nur etwa zwei Drittel der Einzelergebnisse; die übrigen zeigen größere Abweichungen. Wollen wir somit die Grenzwerte erfahren, über welche hinaus erst der entfallende Anteil der Abweichung mit ziemlicher Sicherheit auf Rechnung anderer Einflüsse als dem zufälligen Fehler zu setzen ist, so müssen wir nach dem Gesetze der großen Zahlen als Grenzen die Werte annehmen:

$$\begin{aligned} \text{Keime pro 100 Knäule} &= M_1 \pm 3s = M_1 \pm 27 \\ \text{keimfähige Knäule „ 100} &,, = M_2 \pm 3s = M_2 \pm 12. \end{aligned}$$

Da nicht das Ergebnis eines einzelnen Versuches, sondern stets der Mittelwert mehrerer Keimprüfungen als Endergebnis hinausgegeben wird, die Streuung aber für das Mittel aus mehreren Einzelversuchen, gemäß der Formel

$s_n = \pm \frac{s}{\sqrt{n}}$, geringer ist, als für den Einzelversuch, so stellen sich obige Grenzwerte für das Mittel aus drei Parallelversuchen rund auf:

$$\begin{aligned} \text{Keime pro 100 Knäule} &= M_1 \pm 16 \\ \text{keimfähige Knäule „ 100} &,, = M_2 \pm 7. \end{aligned}$$

Also erst bei Befunden, die um mehr als rund 16 Keime oder 7 keimfähige Knäule über den tatsächlichen Wert hinausgehen oder untereinander abweichen, könnte man mit ziemlicher Sicherheit annehmen, daß neben dem Zufalle auch andere Einflüsse (Probeziehung, Auswahl der Keimprobe, Keimbett, Wassermangel, mangelhafte Lüftung u. a. m.) am Werke waren, diese Befunde also einer Überprüfung bedürfen. Systematisch beeinflußt können natürlich auch Resultate sein mit kleineren als den angegebenen Differenzen, doch ist in solchen Fällen eine Abgrenzung zwischen beiden Fehlerquellen nicht möglich. Eine Verringerung des unvermeidlichen, zufälligen Fehlers wäre nur durch Ausführung des Einzelversuches in größerer Zahl erreichbar, ein Mittel, dessen Anwendbarkeit bei der Handelsanalyse naturgemäß enge Schranken gesetzt sind, da der Fehler mit der ansteigenden Zahl der Versuche nur langsam zurückgeht. Er beträgt für das Mittel aus den Einzelversuchen:

* Dieser Wert gilt für die Auswahl der Knäule nach der sogenannten Abzählmethode.

**) Also trotz der großen Einzelschwankungen bereits absolute Übereinstimmung mit den wirklichen Werten 109 Keime und 50 keimfähige Knäule pro 100 Knäule; allerdings nur zufälligerweise, da selbst bei 50 Versuchen noch eine Abweichung (des Mittelwertes vom wirklichen Werte) von ± 4 Keimen oder ± 2 keimfähigen Knäulen möglich ist.

Anzahl der Einzelversuche: $n=1$ $n=3$ $n=6$ $n=12$ $n=24$ $n=50$
für Keime: $s=\pm 27$ $s=\pm 16$ $s=\pm 11$ $s=\pm 8$ $s=\pm 6$ $s=\pm 4$
für keimfähige Knäule: $s=\pm 12$ $s=\pm 7$ $s=\pm 5$ $s=\pm 3$ $s=\pm 2$ $s=\pm 2$

Der von uns bei diesen Versuchen eingeschlagene Weg hat somit zu Ergebnissen geführt, die für unsere Zwecke gut verwendbar sind, denn sie zeigen uns:

1. mit welchen Werten für die zufälligen Schwankungen der Untersuchungsergebnisse man in der Praxis der Samenprüfung und des Rübensamenhandels wird rechnen müssen, wenn auch fallweise bessere Übereinstimmungen als Zufallserfolge häufig vorkommen;
2. daß es unbeschadet aller durch den Zufall bedingten Abweichungen der Einzelversuche bei Untersuchungen zu wissenschaftlichen Zwecken, wie z. B. zum Ausbau der Untersuchungsmethoden, dennoch gelingt, den zufälligen Fehler durch entsprechende Vermehrung der Zahl der Einzelversuche fast vollständig auszuschalten*). Hierdurch ist die Möglichkeit geboten, den Unterschied in den systematischen Fehlern, mit denen die verschiedenen Verfahren behaftet sind, durch Vergleich untereinander dem Umfange nach genau kennen zu lernen und zu überprüfen, ob die zu deren Behebung unternommenen Schritte von Erfolg begleitet waren oder nicht.

Ein wertvolles, von verschiedenen Seiten erhärtetes Urteil über die einzelnen heute gebräuchlichen Untersuchungsmethoden sowie den ihnen anhaftenden systematischen Fehlern könnte erzielt werden, wenn von allen Anstalten, die sich für diese Frage interessieren, dieselben Rübsamen nach den gebräuchlichsten Verfahren — jede Samenprobe sowie jedes Verfahren in einer ausreichenden Zahl von Einzelversuchen — untersucht würden. Jenes Verfahren, welches bei einwandfreier Auswahl der Knäule im großen Durchschnitte merklich höhere Mittelwerte ergibt, wäre zweifellos mit den geringsten systematischen Fehlern behaftet und zur Einheitsmethode am geeignetsten. Doch darf hierbei niemals das Ziel aus den Augen verloren werden, daß die erreichte Verbesserung den Mehraufwand an Arbeit wirklich lohne. Bei der Vereinheitlichung der Untersuchungsmethode für Handelszwecke kommt es vor allem auf die Sicherheit und Handlichkeit des Verfahrens und erst in zweiter Linie auf geringe Gradunterschiede in der Annäherung an die tatsächliche Keimfähigkeit an.

Nachdem wir diese allgemeinen Erläuterungen über die beiden in Betracht kommenden Fehlerquellen in aller Kürze erledigt haben, wollen wir nunmehr mit einigen Worten die wichtigsten Grundsätze und gebräuchlichsten Verfahren der Keimprüfung erörtern.

Auswahl der Keimprobe. Für die richtige Auslese der Keimprobe ist die genaue Kenntnis der Beziehungen zwischen der Größe der Knäule und der Zahl sowie der Keimkraft der darin enthaltenen Samen von grundlegender Bedeutung. Um diese Beziehungen näher kennen zu lernen, haben wir seinerzeit eine Reihe Rübsamenproben mittels eines Siebsatzes in verschiedene Knäuelgrößen zerlegt und in je 100 Knäulen die Anzahl der Samen sowie deren prozentische Keimfähigkeit festgestellt. Im Durchschnitt hat sich ergeben:

Siebprodukt	1 samig	2 samig	3 samig	4 samig	5 samig	6 samig
2.0—2.5 mm	5	85	36	1	—	—
2.5—3.0 "	—	63	58	3	—	—
3.0—3.5 "	—	38	71	10	—	—
4.0—4.5 "	—	19	58	29	4	—
4.5—5.0 "	—	8	34	54	8	1
über 5.0 "	—	3	24	61	13	—

*) Die oben angegebenen Abweichungen wie z. B. ± 4 Keime und ± 2 keimfähige Knäule für $n = 50$ sind nur Grenzwerte; die meisten Serienergebnisse werden daher eine größere Annäherung an den wirklichen Wert zeigen, als dies bei obigen Grenzwerten der Fall ist.

Die Knäule verschiedener Größe enthalten jedoch nicht nur eine verschiedene, mit der Knäuelgröße ansteigende Samenzahl, sondern es steigt auch gleichzeitig damit die prozentische Keimfähigkeit der Samen. Diese betrug, von den Knäulen mit dem kleinsten Querschnitte ansteigend, im Durchschnitt (von 3 Proben): 26, 47, 47, 54, 62, 74 und 75 %. Wie bereits erwähnt, ist es nicht möglich, eine Keimprobe von z. B. 100 Rotklee-samen so auszuwählen, daß das Mischungsverhältnis der keimfähigen und nicht-keimfähigen Samen stets genau das gleiche ist wie im Samenmuster. Beim Rüben-samen kommt nun noch die weitere Fehlerquelle dadurch hinzu, daß man hier als Keimprobe nicht 100 Samen, sondern 100 Knäule auswählt und daher die aus einer verschiedenen Anzahl von Samen erhaltenen Keime stets auf die gleiche Zahl (100) der Knäule bezieht.

Bei der eben dargelegten Verschiedenwertigkeit größerer und kleinerer Knäule kann eine stärkere einseitige Bevorzugung der einen oder anderen Knäuelgröße zu empfindlichen Differenzen Anlaß geben. Kommen solche Fehler auch nur bei geringerer Erfahrung in der Auswahl der Keimproben vor, so bietet doch auch jahrelange Übung keine sichere Gewähr dafür, daß die Zusammensetzung der Keimprobe nach Knäuelgrößen dem Durchschnitt des Samenmusters tatsächlich entspricht.

Zählprozentmethode. An der Staatsanstalt in Wien werden daher die reinen Knäule der Untersuchungsprobe durch einen Siebsatz in verschiedene Knäuelgrößen zerlegt, die Zahl der Knäule in jedem Siebprodukt ermittelt und in Zählprozenten berechnet. Man entnimmt jedem Siebprodukte so viele Knäule, als auf dieses Zählprocente entfallen. Die so zustande gekommenen Keimproben von 100 Knäulen zeigen eine weitgehende Annäherung an das Samenmuster in der Zusammensetzung nach Knäuelgrößen. Da die Gewichte solcher Keimproben nicht nur untereinander, sondern auch mit dem Durchschnittsgewichte von 100 Knäulen des zugehörigen Samenmusters innerhalb der zulässigen Grenzen übereinstimmen, so ist bei dieser Art der Auslese der Keimprobe allen Umständen, die für die Untersuchung zu Handelszwecken in Betracht kommen können, soweit als möglich Rechnung getragen. In Anbetracht der Unsicherheit des Ergebnisses des Einzelversuches werden stets mehrere Parallelversuche (zumindest drei) ausgeführt.

Gewichtsmethode. Nach den technischen Vorschriften des Verbandes der deutschen landwirtschaftlichen Versuchstationen vom 13. September 1912 für die Wertbestimmung des Rübensamens will man einer Bevorzugung einer Knäuelgröße dadurch vorbeugen, daß man die Keimprobe nach dem Abzählen wägt; falls ihr Gewicht um 10 % oder mehr vom Durchschnittsgewichte für 100 Knäule der Probe abweicht, stellt man das Gewicht dieser Keimprobe durch Auswechseln der Knäule richtig. Neben dieser Methode (Zählgewichtsmethode) ist auch die von der Staatsanstalt in Wien im Jahre 1906 vorgeschlagene*) und daselbst seither gebräuchliche Zählprozentmethode zulässig. Durch die Zählgewichtsmethode ist zweifellos einer weitgehenden Willkür bei der Auslese der Keimprobe ein Riegel vorgeschoben. Eine genaue Übereinstimmung der Keimprobe mit dem Samenmuster ist jedoch hierdurch keineswegs gesichert, da man 100 Knäule von bestimmtem Durchschnittsgewichte einmal, unter Ausschluß der großen und kleinen Knäule, nur aus mittleren (d. h. aus Knäulen mit dem durchschnittlichen Knäuelgewichte der Samenprobe), dann wieder, unter Ausschluß der mittleren, nur aus kleinen und großen Knäulen und unter allmählicher Einbeziehung der mittleren, entsprechend allen möglichen Zwischenstufen zwischen diesen beiden Gegensätzen, auswählen kann. Eine Keimprobe kann somit ein dem Samenmuster entsprechendes Gewicht besitzen und doch in bezug auf die Zahl der darin vertretenen Knäule

*) Siehe: K. Komers und E. Freudl, „Die Wertbestimmung des Rübensamens“. *Osterr.-ung. Zeitschrift für Zuckerindustrie und Landwirtschaft*. 1906, Heft 5.

verschiedener Größe eine vom Samenmuster ganz verschiedene Zusammensetzung aufweisen. Eine Überprüfung der Genauigkeitsverhältnisse beider Methoden im Hinblick auf die eben erwähnten Umstände wäre jedenfalls wünschenswert. Ergibt sich hierbei die gleiche Zuverlässigkeit für beide Methoden, so wäre der, wenn auch nur geringe Mehraufwand, der mit der Zählprozentmethode jedenfalls verbunden ist, ein überflüssiger und daher die Gewichtsmethode entschieden vorzuziehen. Sind beide Verfahren hingegen nicht gleichwertig, so ist die Ausschaltung der minder zuverlässigen Methode eine selbstverständliche Sache. Die Übereinstimmung verschiedener Untersuchungsbefunde kann durch die Zulassung nur einer Methode zweifellos gewinnen.

Abzählmethode. Bei diesem Verfahren werden 100 Knäule in der Reihenfolge, wie sie zu liegen kommen, einfach abgezählt. Von dieser Art der Auslese wird heute wohl nur mehr in Ausnahmefällen Gebrauch gemacht. Als Einheitsmethode zur Erzielung einer besseren Übereinstimmung in den Prüfungsergebnissen verschiedener Versuchsanstalten bei ein und demselben Rübensamen dürfte sie sich nach den bisherigen Darlegungen schwerlich eignen.

Vorquellen der Keimprobe. Statt die Keimproben unmittelbar ins Keimbett einzulegen, quillt man sie vorher im Wasser ein, wodurch das Auskeimen rascher und gleichmäßiger vor sich geht. Nach unseren Erfahrungen ist ein sechsstündiges Vorquellen vollkommen ausreichend. Jede Keimprobe wird in einer kleinen Kristallisierschale mit einer ausreichenden Menge Wasser von Zimmertemperatur übergossen, wobei die oben aufschwimmenden Knäule untergetaucht werden. Nach Ablauf der Quellzeit gießt man das Wasser über einem kleinen Sieb ab, läßt abtropfen und überträgt die Knäule ins Keimbett.

Das Keimbett und seine Behandlung. Als Keimbettmaterial kommt beim Rübensamen vor allem Sand, daneben vereinzelt auch Fließpapier in Betracht. Das von Märker eingeführte Sandkeimbett hat sich bei Keimprüfungen von Rübensamen vorzüglich bewährt und ist daher auch heute an den meisten Versuchsanstalten in Gebrauch. Man verwendet hierfür feinen, staubfreien Sand, der frei von organischen Beimengungen ist. Durch Vermengen mit Wasser wird aus dem Sande ein steifer Brei hergestellt. Von großer Wichtigkeit hierbei ist, daß das Verhältnis von Wasser und Sand richtig getroffen wird. Bestimmte Vorschriften darüber lassen sich schwer geben, da dies ausschließlich von der Beschaffenheit des Sandes abhängt. Sehr feiner Sand hat eine größere Benetzungsoberfläche und nimmt daher mehr Wasser auf als grober Sand. Es ist daher notwendig, die richtige Wassermenge für die in Verwendung stehende Sandqualität jeweils durch Keimversuche erst auszuprobieren. Das Mischungsverhältnis von Wasser und Sand wird dann richtig getroffen sein, wenn die Keimlinge ein gesundes, strotzendes Aussehen zeigen und wenn im Keimbette keine Neigung zur Schimmelbildung zu beobachten ist. Für die Größe des Keimbettes ist einerseits dessen Handlichkeit und andererseits der Umstand maßgebend, daß das Keimbett umso leichter austrocknet, je kleiner die Keimbettmasse ist. Man wird daher gut tun, nicht unter eine Sandmenge von 350 Gramm herabzugehen. An manchen Untersuchungsanstalten zieht man das Keimbett aus Fließpapier dem Sandkeimbette vor. So hat unseres Wissens nach die staatliche Samenkontrollstation in Kopenhagen mit dem Papierkeimbette bisher gute Erfahrungen gemacht. Auch der Verein für Zuckerindustrie in Prag hat in seinem Berichte 260 vom November 1913 „Über Rübenanalysen für Handelszwecke“ die Verwendung des Papierkeimbettes befürwortet und zumindest zur Kontrolle neben dem Sandkeimbette empfohlen. Nach dem Ergebnisse der vom Kuratorium der Versuchsstation für Zuckerindustrie in Prag durchgeführten Versuche hatte die Keimung auf Papier höhere Werte ergeben als im Sandkeimbette. Da diese Versuche aber nur mit einem Rübensamen durchgeführt wurden und aus dem Berichte auch nicht zu entnehmen ist, aus wie-

viel Einzelversuchen die zugunsten des Papierkeimbettes beobachteten Differenzen von 19 Keimen und 8 keimfähigen Knäulen abgeleitet wurden, so läßt sich nicht beurteilen, inwieweit dieses Ergebnis dem Zufalle oder der besseren Eignung des Papierkeimbettes zu danken ist. Bei der verhältnismäßig großen Schwankung der Einzelversuche ließe sich diese Frage nur durch Serienversuche lösen, da, wie im vorangegangenen, des näheren dargetan wurde, nur die Mittelwerte größerer Versuchsreihen sichere und den wahren Wert hinreichend nahe kommende Ergebnisse liefern. Auch hier werden hoffentlich weitere Versuche klärend wirken und zu dem Ziele führen, daß für Rübensamenuntersuchungen zu Handelszwecken nur eine Art von Keimbetten als zulässig erklärt werde.

Um die Keimversuche stets unter gleichen Temperaturverhältnissen vornehmen zu können, ist es notwendig, die Keimbette nach ihrer Beschickung mit den Keimproben in Keimschränken unterzubringen, die eine genaue Einhaltung eines bestimmten Wärmegrades ermöglichen. Die für den Verlauf des Keimversuches günstigste Temperatur ist bekanntlich je nach der Samenart verschieden; auch geben manche Arten bei wechselnder Temperatur günstigere Ergebnisse als bei gleichbleibender*) Hinsichtlich des Einflusses des Temperaturwechsels auf den Keimungsverlauf beim Rübensamen sind die Meinungen zur Zeit noch geteilt. Während die Verbandsmethode der österreichischen Versuchsstationen einen Wechsel zwischen den Temperaturen 28° und 18° C vorschreiben, genügt es nach den technischen Vorschriften (des Verbandes der landwirtschaftlichen Versuchsstationen im Deutschen Reiche) für die Prüfung von Saatgut, wenn der Keimprozeß tagsüber bei einer beständigen Temperatur von 20° C vor sich geht. Ob ein derartiger Unterschied in der Wärmeführung des Keimversuches den Befund tatsächlich nicht merklich beeinflusst, sollte doch einer nochmaligen Überprüfung durch Versuche von überzeugender Beweiskraft unterzogen werden. Bei der starken Schwankung der einzelnen Keimresultate können Versuchsergebnisse, die sich nur auf eine unzulängliche Zahl von Einzelversuchen stützen, nur zu leicht zu Trugschlüssen führen. Die Keimbetten müssen während des Keimverlaufes zur Erneuerung der Luft häufig gelüftet werden. Das Auszählen der Keime wird in zwei Abschnitten vorgenommen; die Termine hierfür sind verschieden. Die erste Auszählung erfolgt nach 6 oder 7 Tagen, die zweite (Abschluß des Keimversuches) nach 12 oder 14 Tagen.

Kranke Keime. Da die Einflüsse, die erfahrungsgemäß das Auftreten des Wurzelbrandes im freien Lande hervorrufen können, verschiedener Art sind, ist man berechtigterweise schon lange davon abgekommen, ausschließlich den Samen für die im Keimlingsstadium auftretenden Krankheiten verantwortlich zu machen. Angaben über Krankheiten der Keimpflanze sollten daher nur dann gemacht werden, wenn dies seitens des Einsenders ausdrücklich gewünscht wird.

Wasserbestimmung. Nach der österreichischen Verbandsmethode werden 10 Gramm Rübensamen bei 70° C vorgetrocknet und dann durch 8 Stunden bei 100° C weitergetrocknet. Bei stärkemehltreichen Samen, wie z. B. Getreide, ist ein Vertrocknen der Probe unter der Verkleisterungstemperatur der Stärke zweifellos am Platze. Diese Vorsichtsmaßregel halten wir jedoch beim Rübensamen, wo der eigentliche Same nur einen geringen Bruchteil der Knäuelmaße ausmacht und die Hauptmenge des Wassers nicht im Samen, sondern im Knäuelgewebe ihren Sitz hat, für überflüssig. Sie könnte daher, ohne Differenzen im Wassergehalte befürchten zu müssen, unterlassen werden.

*) Siehe: G. Pammer, „Versuche über den Einfluß intermittierender Erwärmung und des Keimbettes auf die Keimung des Zuckerrübensamens“. *Osterr.-ung. Zeitschrift für Zuckerindustrie und Landwirtschaft*. 1892, Heft 4, und J. Vanha, „Versuche über die intermittierende Erwärmung auf die Keimung von Samen.“ *Mitteilung des Vereines zur Förderung des landw. Versuchswesens in Österreich*. 1898, Heft 2.

Wertbeurteilung.

Die Wertbeurteilung der landwirtschaftlichen Sämereien zu Saatzwecken erfolgt gewöhnlich in der Weise, daß man den jeweils ermittelten Gebrauchswert mit dem durchschnittlichen, der sich im Laufe der Jahre für die betreffende Samenart ergeben hat, in Vergleich zieht. In dem Maße, als er höher oder niedriger ist als dieser, wird die betreffende Ware zu Saatzwecken mehr oder weniger gut geeignet eingeschätzt. Beim Rübensamen hat man damit jedoch nicht das Auslangen gefunden, weshalb für diese Samenart eigene Normen, die den fallweise verschiedenen Verhältnissen des Rübensamens besser Rechnung tragen, aufstellen mußte. Diesem Bedürfnisse ist man von verschiedenen Seiten entgegengekommen, so daß wir heute ebenso wie über verschiedene Untersuchungsmethoden auch über mehrere Normen für Rübensamen verfügen, zwei Umstände, die sich jedoch nicht gegenseitig bedingen; die Beurteilung des Rübensamens nach den derzeit gebräuchlichen Normen ist vielmehr, wenn man von den Terminen für die Auszählung des Keimversuches absieht, dem Wortlaute nach nirgends eigentlich an eine bestimmte Methode gebunden; denn die Normen enthalten nur Anhaltspunkte zur Beurteilung der Saat auf Grund der Untersuchungsergebnisse, nicht aber Vorschriften über die Untersuchungsmethode selbst. Der häufig seitens der Parteien gelegentlich der Übermittlung des Samenmusters geäußerte Wunsch, den übersandten Rübensamen nach diesen oder jenen Normen zu untersuchen, ist daher eigentlich gegenstandslos. Es kann nicht behauptet werden, daß die Schwierigkeiten, die dem Rübensamenhandel aus dem Mangel an einer einheitlichen Untersuchungsmethode erwachsen, durch die Aufstellung mehrerer Normen verringert worden sind. Es würde daher unserer Sache ein guter Dienst erwiesen werden, wenn neben Vereinheitlichung des Untersuchungsverfahrens auch die der Normen angestrebt würde.

Die Abweichungen der Normen in manchen Belangen, wie z. B. in den Durchschnittswerten für Wassergehalt, Reinheit, ferner in den Zeiträumen für die Auszählung der Keimversuche, sind geringfügige, formelle Differenzen, deren Beseitigung sachlich auf keine Schwierigkeiten stoßen kann. Anders liegt die Sache hinsichtlich einer Annäherung in verschiedenen anderen Festsetzungen. Um die unserem Berichte zugemessenen Grenzen nicht zu überschreiten, können wir hier nicht auf alle in Betracht kommenden Umstände näher eingehen und erwähnen daher in Kürze nur einige Grundsätze, über welche vor allem eine Einigung dringlich geboten wäre.

Sortenechtheit. Die häufigsten Anstände im Rübensamenhandel ergeben sich aus den Differenzen der Untersuchungsbefunde über die Keimfähigkeit. Handelt es sich in solchen Fällen oft um recht namhafte Beträge, so ist dieser Umstand, so lästig er auch empfunden wird, immerhin noch erträglich, da eine Klärung des wirklichen Sachverhaltes meist noch vor Verwendung der Saat möglich ist. Viel schwerer fällt es ins Gewicht, daß die Sortenechtheit bei der Untersuchung des Samens nicht festgestellt werden kann. Dies war zweifellos der Grund, daß bis zum Jahre 1913 diese wichtige Eigenschaft des Rübensamens in den Normen keine Berücksichtigung gefunden hatte. Da dieser Umstand von den unlauteren Mitläufern des Samenhandels redlich ausgenutzt wurde, hatten die gerichtlichen Streitfälle über nichtgarantiegemäße Rübensamenlieferungen fast ausschließlich nur die Sortenechtheit zum Gegenstande. Durch die vollständige Nichtberücksichtigung der Sortenechtheit in den Normen, wegen der Unmöglichkeit, diese Eigenschaften am Samen feststellen zu können, ist zweifellos die Sachlage nicht besser geworden. Diese Lücke in den Normen veranlaßte den Berichterstatter im Jahre 1913 in Vorschlag zu bringen*), die Satzungen der Normen in

*) Siehe: K. Komers, „Über Sortenechtheit von Rübensamenlieferungen“. Blätter für Zuckerrübenbau. 1913, Nr. 5.

dem Sinne zu ergänzen, daß eine etwa notwendig werdende, nachträgliche Überprüfung der Sortenechtheit durch einen Anbauversuch an der Hand eines authentischen Samenmusters ermöglicht werde. Diese Anregung hat zuerst bei den Wiener Normen und später auch bei anderen Normen Berücksichtigung gefunden. Bei den Magdeburger Normen ist dies leider noch nicht der Fall, was insofern zu bedauern ist, als viele Käufe nach diesen Normen abgeschlossen werden und im Falle einer nichtsortenechten Lieferung daher jede Handhabe zur Austragung des Streitfalles fehlt.

Abstufung der zu fordernden Keimfähigkeit nach der durchschnittlichen Knäuelgröße des Rübensamens. Mit zunehmender Knäuelgröße steigt das Gewicht der Knäule stärker an, als dies bei der Zahl der darin enthaltenen Samen sowie der daraus hervorgehenden Keime der Fall ist. Die Zahl der auf die Gewichtseinheit entfallenden Anzahl der Keime sinkt daher mit der zunehmenden Knäuelgröße. Eine sachgemäße Beurteilung des Rübensamens ist somit ohne Beachtung dieser Umstände ausgeschlossen. Folgerichtig haben diese Verhältnisse auch bei allen heute gültigen Normen durch Abstufung der zu fordernden Keimzahlen Ausdruck gefunden, wenn auch in sehr verschiedenem Ausmaße. So unterscheiden die Magdeburger Normen nur kleine und große, die Deutschen Normen 1914 bei Zuckerrübensamen große, mittlere und kleine, bei Futterrübensamen hingegen wieder nur große und kleine Knäule. Diese zur Vereinfachung der Normen gewählte Abstufung ist nicht einwandfrei. Es gibt hier nur zwei Standpunkte. Entweder ist die Abstufung sachlich gerechtfertigt oder sie ist es nicht; im ersteren Falle muß dies in hinlänglichem Maße geschehen. Durch halbe Maßregeln erreicht man schließlich seinen Zweck doch nicht und entwickelt sich in Widersprüche. So stufen beispielsweise die „Deutschen Normen 1914“ die Forderungen für groß-, mittel- und kleinknäuligen Zuckerrübensamen auf 60, 65, 70 Keime pro 1 Gramm ab. Bestimmt wird die Keimfähigkeit in 100 Knäulen. Bei der Umrechnung der Keimfähigkeiten pro 100 Knäulen auf 1 Gramm Knäule ergibt sich dann selbstverständlich der Widerspruch, daß z. B. ein mittelknäuliger Zuckerrübensamen mit der Knäuelzahl von 41 Knäulen pro 1 Gramm und einer Keimfähigkeit von 157 Keimen pro 100 Knäule diesen Normen nicht entspricht, während ein großknäuliger Zuckerrübensamen mit 40 Knäulen pro 1 Gramm nur 150 Keime pro 100 Knäule zu liefern braucht, um diesen Normen gerecht zu werden. In ähnlicher Weise ist für einen mittelknäuligen Zuckerrübensamen mit einer Knäuelzahl von 50 Knäulen pro 1 Gramm eine Keimfähigkeit von 130 Keimen pro 100 Knäule ausreichend, während ein kleinknäuliger Zuckerrübensamen mit 51 Knäulen pro 1 Gramm bei einer Keimfähigkeit von 136 Keimen pro 100 Knäulen nicht lieferbar ist. Die Magdeburger Normen entgehen diesen Widersprüchen nur dadurch, daß sie für die zu fordernden Keime pro Gewichtseinheit nur einen unteren Grenzwert aufstellen, ansonsten aber die hinsichtlich der Keimfähigkeit zu erfüllenden Bedingungen nur für je 100 Knäule festsetzen, ein Nachteil, auf den wir im nächsten Absatze noch zurückkommen werden. Um die Forderungen hinsichtlich der Keimfähigkeit sachgemäß und widerspruchsfrei der Knäuelgröße des Rübensamens anzupassen, sind daher in den Wiener Normen die von der Gewichtseinheit zu liefernde Anzahl der Keime und keimfähigen Knäule für alle vorkommenden Knäuelgrößen von Knäuel zu Knäuel abgestuft. Die Anzahl der Keime sowie keimfähigen Knäule nach 12 Tagen läßt sich ohne Umstände nach folgenden einfachen Formeln*) berechnen:

$$\text{Keime} \dots \dots \text{pro 1 g (nach 12 Tagen)} = \text{Knz (pro 1 g)} \text{ mal } 0.528 + 45.4$$

$$\text{keimfähige Knäule pro 1 g (nach 12 Tagen)} = \text{Knz (pro 1 g)} \text{ mal } 0.647 + 5.3$$

*) Die Ableitung dieser Formeln sowie der Formeln für die Keimfähigkeit nach sechs Tagen kann aus der Abhandlung „Wertbestimmung des Rübensamens“ von K. Komers und E. Freudl (Zeitschrift für Zuckerindustrie in der österr.-ung. Monarchie, 1906, Heft 5) entnommen werden.

Will man sich diese einfache Rechnung ersparen, so kann man sich einer Tabelle bedienen, in der die Werte für alle Knäuelgrößen ein für allemal berechnet sind.

Wir glauben hiermit dargetan zu haben, daß die Normen kaum umständlicher als sonst ausfallen, wenn alle Knäuelgrößen vollauf berücksichtigt werden. Nur auf diesem Wege gelingt es, die Folgen zu vermeiden, die mit der Einzwängung der Rübensamen verschiedener Knäuelgröße in eine unzulängliche Schablone verbunden sind und die Erreichung des hierbei beabsichtigten Zweckes wieder zum großen Teile vereiteln.

Angabe der Keimfähigkeit für die Gewichtseinheit des Rübensamens. Um eine etwaige Vergütung im Falle einer Minderwertleistung in der Keimfähigkeit einwandfrei berechnen zu können, empfiehlt es sich, in den Normen die Keimfähigkeitswerte für die Gewichtseinheit festzusetzen, da auch der Kaufpreis auf das Gewicht bezogen wird. Mit Rücksicht auf die unvermeidlichen Schwankungen der Untersuchungsergebnisse bei ein und demselben Rübensamen ist es sachlich nicht gerechtfertigt, daß durch die Normen ein Rübensamen als nicht lieferbar bezeichnet wird, wenn das Untersuchungsergebnis auch nur um einen Keim oder einen keimfähigen Knäuel unter dem vorgeschriebenen Grenzwert ergeben hat. Solche starren Grenzwerte sind, vom unparteilichen Standpunkte aus betrachtet, praktisch ohne Nutzen, nur bieten sie dem Käufer, der jeden Mehrwert bei Rübensamenlieferungen ohne Aufzahlung ruhig in die Tasche steckt, auch noch den weiteren einseitigen Vorteil, aus dem Kaufvertrag ausspringen zu können, falls ihm dieses zufällig in den Kram paßt. Wenn wir auch den Grundsatz, nur hochwertigen Rübensamen zur Saat zu verwenden, vollauf anerkennen, so finden wir doch, es sei weder im Interesse des Käufers noch Verkäufers gelegen, daß selbst bei ganz geringfügigen und daher sachlich fast gegenstandslosen Minderwerten die Lieferung abgelehnt und von der Vergütung eines etwaigen Minderwertes Abstand genommen werden kann. Für eine Vergütung sollte wenigstens in solchen Fällen vorgesehen sein, wo der Minderwert noch innerhalb der Fehlergrenzen der Untersuchungsergebnisse zu liegen kommt, da sonst der Rübensamen für etwas verantwortlich gemacht wird, was etwa nur durch die Unzulänglichkeit der Untersuchungsmethode verschuldet worden ist. Die Ablehnung der Vergütung jedweder Minderwertleistung in der Keimfähigkeit oder besser gesagt die Ablehnung der Lieferung, wie sie nach den Deutschen Normen 1914 dem Käufer zugebilligt wird, kann daher nicht als sachlich gerechtfertigt bezeichnet werden. Die Magdeburger Normen nehmen zur Lieferbarkeit oder Vergütung im Falle von Minderwertleistungen überhaupt nicht Stellung. Eine etwa zwischen Käufer und Verkäufer dennoch vereinbarte Vergütung des Minderwertes einer Lieferung läßt sich hier aber nicht einwandfrei berechnen, weil die für die Gewichtseinheit und für je 100 Knäule vorgeschriebenen Keimfähigkeitswerte einander nicht entsprechen, wie aus folgendem Beispiel ersehen werden kann:

Ein großknäuliger Rübensamen, z. B. mit 45 Knäulen pro 1 Gramm, soll nach den Magdeburger Normen mindestens 150 Keime pro 100 Knäule ergeben. Hatte nun die gelieferte Ware bei der gleichen Knäuelgröße (45 Knäule pro 1 Gramm) nur 115 Keime pro 100 Knäule, und soll der aus dieser Minderleistung von 35 Keimen pro 100 Knäulen sich ergebende Preisabzug festgestellt werden, so muß diese Minderleistung pro 100 Knäule auf die Gewichtseinheit umgerechnet werden, da sich auch der Preis der Ware nicht auf eine bestimmte Zahl von Knäulen, sondern auf die Gewichtseinheit bezieht. Hierbei ergibt sich, daß in 1 Gramm dieses Rübensamens nur 52 Keime vorhanden sind, während, entsprechend der Forderung 150 Keime pro 100 Knäule, 68 Keime in 1 Gramm vorhanden sein sollten. Nun entspricht aber jeder Rübensamen, gleichgültig, ob groß- oder kleinknäulig, den

Magdeburger Normen, wenn er zumindest 50 Keime pro 1 Gramm liefert. Der gelieferte Rübensamen hatte 52 Keime pro 1 Gramm. Wir stehen also vor dem Dilemma, daß der Rübensamen nach den Magdeburger Normen eine Minderleistung von 35 Keimen pro 100 Knäule aufweist, eine Vergütung dieses Minderwertes aber entfällt, da er der Forderung derselben Normen: 50 Keime pro 1 Gramm Rübensamen, vollauf entspricht. Wollte man somit auf eine Vergütung des nach dem Wortlaute der Magdeburger Normen im vorliegenden Falle tatsächlich vorhandenen Minderwertes nicht verzichten, so müßte der Berechnung direkt das Verhältnis 150 : 115 zugrunde gelegt werden. Dieser Vorgang gibt aber nur unter der Voraussetzung ein brauchbares Resultat, daß bei allen großknäuligen Rübensamen (45 und weniger Knäule pro 1 Gramm) das Gewicht von je 100 Knäulen immer gleich sei, oder mit anderen Worten, daß auf die Gewichtseinheit stets die gleiche Anzahl von Knäulen entfalle. Dies trifft aber nicht zu, da die Zahl der Knäule pro 1 Gramm bei den im Handel vorkommenden großknäuligen Rübensamen um 100 und mehr Prozent voneinander abweichen.

Wenn wir im vorstehenden auf einzelne, nicht zu leugnende Mängel von manchen der heute gebräuchlichen Normen hingewiesen haben, so geschah dies lediglich in der Absicht, zu zeigen, daß der ebenso einfache als natürliche Weg der Abstufung der Keimfähigkeitswerte von Knäuel zu Knäuel auch der einzige ist, der zu einer einwandfreien und widerspruchsslosen Wertbeurteilung des Rübensamens führt.

In unseren bisherigen Erörterungen glauben wir alle wichtigen Umstände, die bei der Untersuchung und Bewertung des Rübensamens eine Rolle spielen, in Kürze erwähnt zu haben und unterlassen es daher, auf weitere Einzelheiten einzugehen. Bei der großen Zahl der Fragen, die noch einer Klärung und Einigung bedürfen, ist eine baldige Erledigung des vorliegenden Gegenstandes kaum zu erhoffen, wenn nicht durch schriftliche Verhandlungen zwischen den Interessenten und durch Versuche seitens der beteiligten Versuchsanstalten dem Zustandekommen einer einheitlichen Untersuchungs- und Bewertungsmethode für Rübensamen bis zum nächsten Kongresse vorgearbeitet wird. Es wäre daher sehr zu begrüßen, wenn ein aus den Kongreßteilnehmern zu wählender Ausschuß die hierzu notwendigen Maßnahmen in die Wege leiten würde.

Dr. Vitek:

„Die Kleeseidebestimmung.

Der Herr Direktor Dorph-Petersen war so liebenswürdig, in die Verhandlungen des dritten internationalen Kongresses für Samenkontrolle auch ein Referat über Kleeseidebestimmung aufzunehmen und hat mich aufgefordert, über diese Frage zu referieren. Wenn ich dieser Aufforderung entsprochen habe, so bemerke ich von vornherein, daß ich mich nur auf eine ganz kurze Mitteilung beschränken werde, welche sich vielleicht nicht zur Gänze mit dem Thema, welches für diese Verhandlung projektiert war, decken wird. Den Grund kann ich gleich mitteilen. Die Kleeseidefrage wurde anläßlich des ersten internationalen Kongresses für Samenkontrolle im Jahre 1906 in Hamburg ausführlich behandelt, wo Herr Direktor Arpad von Degen von der Samenkontrollstation in Budapest ein eingehendes Referat erstattete, welches eine umfangreiche meritorische Verhandlung hervorrief, die wohl alle die Kleeseidefrage betreffenden und in Betracht kommenden Momente erschöpfte. Es wurde die Frage der Kleeseidevernichtung auf dem Felde gelöst, ebenso wie die Frage, betreffend die Aufsicht über den Verkehr mit Kleeausreuter, was als eines der wichtigsten Probleme bezeichnet werden kann,

mit denen die Samenkontrollstation auf die Unterdrückung und Ausrottung der Kleeseide einzuwirken sich bemühen.

Es wurden Bestimmungen von Normen für die höchst zulässige Anzahl von Kleeseidekörnern in Kleesaaten erwogen, eine technische Methodik für die Untersuchung der Kleesamenproben auf Kleeseide, eventuell unter Benutzung normalisierter Siebe, beantragt, das niedrigste Gewicht der Kleesaatenproben für die Kleeseidefeststellung bestimmt und eine Resolution, betreffend die Zulässigkeit einer Latitude bei der Probeuntersuchung auf Kleeseide, angenommen.

Mit all diesen, speziell die Samenkontrollstationen tangierenden Fragen sollte sich eine spezielle Kommission befassen, über deren Zusammensetzung resp. Konstituierung nichts bekannt wurde, ohne daß auch am zweiten internationalen Kongresse der Samenkontrollstationen darüber Bericht erstattet wurde, welche von dem am ersten Kongresse behandelten Fragen ihre praktische Lösung gefunden haben. Diese Umstände, welche in bedeutendem Maße Interesse für die Samenkontrollstationen, speziell jener Produktionsländer, haben, aus denen Kleesaaten exportiert werden, bewogen mich dazu, die Frage der Kleeseidebestimmung von einem erweiterten Gesichtspunkte aufzufassen und zu versuchen, dieselbe bei den Verhandlungen des dritten internationalen Kongresses der Samenkontrollstationen wieder aufzufrischen.

Ich beabsichtige nicht, durch meine Mitteilungen in das Meritum der Angelegenheit einzugehen, indem ich wiederholt auf die umfangreichen Debatten bei der Verhandlung dieser Frage auf dem ersten internationalen Kongresse hinweise. Es würde sich eher darum handeln, daß eine aus dem Plenum des dritten internationalen Kongresses hervorgegangene Kommission sich neuerdings mit dem Programm der Kleeseidefrage des ersten internationalen Kongresses befasse, indem sie allerdings in erster Reihe die Fragen, welche die Samenkontrollstationen berühren, berücksichtigt, und zwar vor allem ihre technischen Methoden bei der Feststellung speziell von Grobseide in Rotklesaaten und Luzerne, wofür sich die Einführung normalisierter Siebe nach Größe der Probe und solchen, welche nach dem unterschiedenen Durchmesser der Kleeseidekörner dimensiert sind, empfehlen würde (1 mm 1,25 mm).

Es möge die Frage der Kleesaatenplombierung speziell in jenen Produktionsgegenden gelöst werden, aus denen Kleesaaten, speziell Rotklee und Luzerne, ausgeführt werden, nicht nur mit Rücksicht auf eine eventuelle Konstatierung von Kleeseide, sondern auch, daß dadurch gleichzeitig die Provenienz der Kleesaat bezeichnet werde, welche Verfügung in den letzten zwei Jahren die tschecho-slowakische Republik, und zwar mit gutem Erfolge, eingeführt hat, indem sie die fremdländischen Märkte direkt informieren wollte, aus welchen Produktionsdistrikten Rotklesamen und Luzerne verschieden rein und auch im Hinblick auf Grobseide stammen.

Es wären präzise diejenigen Gebiete festzustellen, denen eine Infektion speziell mit Grobseide nicht droht, in welche infolgedessen der Import von grobseidehaltigen Kleesaaten möglich war, ohne daselbst die Kleesaatenproduktion zu bedrohen. Auf Grund dessen wäre es möglich, auch die Frage der Normen über die maximale Zulässigkeit der Kleeseidekörner in den exportierten Kleesaaten zu lösen.

Formell wird beantragt, die Kommission möge in erster Reihe aus Vertretern der Kleesaaten produzierenden und exportierenden Länder zusammengesetzt werden, zu denen auch Vertreter der konsumierenden Länder zuzuziehen wären. Die derart zusammengesetzte Kommission möge sich mit allen die Kleeseide betreffenden und bereits während des ersten internationalen Kongresses für Samenkontrolle verhandelten Fragen befassen, dieselben in bestimmte Anträge zusammengefaßt dem nächsten künftigen internationalen Kongresse für Samenkontrolle vorlegen, damit dieser über solche rechtsgültig beschließen und sie zur Sanktionierung den zuständigen Regierungen vorlegen könne.“

Professor Johannsen:

“Meeting is adjourned until after luncheon.” „Die Sitzung ist bis um 2 Uhr geschlossen.“

Professor Johannsen

opened the meeting and introduced the first speaker, Dr. v. Degen. eröffnete die Sitzung und erteilte das Wort an Hofrat v. Degen.

Dr. v. Degen:

“With regard to the determination of the limits of the damages caused by dodders I must refer again to what I reported on the occasion of the Hamburg Congress*). I then proposed — perhaps in other words — that investigations should be instituted, to determine, where this limit should be fixed in Europe, for a knowledge of this limit will be of highest importance in establishing the dodderlatitude. According to my experience this line should be drawn approximately across Europe from East to West starting perhaps near Samara passing probably through Kiew - Krakau, omitting the Carpathians and the Austrian Alps and turning southwards from Vienna to Carniola and from here across North Italy, runs then along the Mediterranean, then it crosses France, avoiding perhaps the Central Plateau, westwards to the Atlantic. South of this line the dodder ripens its seeds, and therefore is to be judged quite differently in the marketed seed, than when found North of this line.

This limit must be regarded as a more or less broad band or zone within which the dodder can mature its seeds or not, according to the climatic conditions during the different years of observation; that is to say, a zone in which the naturalisation of dodder is doubtful.

But also North of this line there exist certain districts in which the Dodder can inflict damage; these are districts, the more favourable climatic conditions of which are characterized by the occurrence of southern wild plants.

I again urge the importance of fixing this limit in Europe and believe that in America also there should be made a similar determination, for in America surely Dodder has also a polar limit, which lies further south than the clover-culture.

I therefore propose that a resolution shall be adopted, according to which the Seed-Testing Stations shall be invited, to include in their programme the investigation of this line. In this respect the work of those Stations in the countries through which this line probably passes, would be of special importance.

I shall perhaps from the part of the English meet with the objection, that the most widely spread Dodder (*Cuscuta Trifolii*) was first known and first described precisely in England by Babington, one of the keenest of observers. But if we read the original text of the first description, we find that it treated of an introduction at that time, with seed — if I am not mistaken — from Flanders.

The Budapest Station has thoroughly investigated several questions relating to the Dodder. Thus an experiment was made to determine the influence of the seeding-depth on the occurrence of the Dodder and on the damage, which this parasite causes in the open field; and an experiment to determine the proportion of the occurrence of Dodder to the number of the sowed Dodder-grains. Both experiments are finished and the results published**).

Since then we have been occupied with the question as to the manner in which way the Dodder-seeds can be most surely and with the least possible loss removed from the clover or alfalfa-seeds. For this purpose generally sieves are employed. In the case of *Cuscuta Trifolii* this method is satisfactory, but not so for removing the Dodders of larger seeds introduced into Europe from America in recent years, such as *Cuscuta arvensis*, *C. suaveolens* („*C. racemosa*“). For the removal of these seeds indeed sieves are also employed, but yet we have no specially constructed sieves at our disposal

*) Jahresbericht der Ver. f. angew. Bot. IV. 1906: 298.

**) Landwirtschaftliche Versuchs-Stationen, LXXVII 1912 p. 67—128.

adapted for this purpose. The different sieves to be found on the market have been tried with more or less, generally less satisfactory results. In some places also Trieurs have been employed. Experiments have also been made in separating Dodder seeds by the different specific weight in liquids, but these could not lead to any satisfactory result, because the limits of the specific weight of the two seeds overlapped.

We early recognized the importance of having a standard-sieve for large Dodder-seeds, and to construct this we took many thousands of measurings for the purpose of getting average of the largest diameters of the seed, on the basis of which the standard-sieve should be constructed.

In the course of these experiments we struck by chance on a device which is calculated to lead the matter in quite another direction.

An employé of our Station whose name — Louis Nádai — deserves to be mentioned here, made the discovery, that clover and Dodder seeds, when dropped from a certain height on a porcelain-plate, rebound in a different manner. Whereas the clover seeds — so far as they are normally developed and uninjured, rebound, without exception, out of the plate, the Dodder seeds, which are of quite different elasticity, remain on it. In virtue of this quality, which — so far as I know — has never yet been employed for the separation of seeds, we have found a new method of cleaning seeds. The process has been patented and now attempts are being made to construct a suitable machine. Some difficulties have appeared to its application in practice, which, however, will surely be overcome by technical devices. I should here only point out, that an exact separation of the seeds of different elasticity can only be obtained if the seeds are dropped one by one on the hard surface, otherwise they collide and spoil the result. I show you here this very simple experiment and you can convince yourselves that the separation succeeds immediately, if the seeds are dropped one by one.

I believe the principle has a great future, for all the difficulties which are still connected with the construction of a suitable machine are outweighed by the advantage that the separation of the seed (other seeds, for instance broken seeds can be also separated by this method) can be effected without the necessity of using continuous motive power.

Of this I wished to inform you as the most important of the results obtained at the Budapest Testing Station."

M. Bussard:

• Les mesures prises en France pour combattre la cuscute.

La cuscute est, en France, un fléau pour les prairies artificielles. Pour la combattre, plusieurs mesures légales ont été prises.

La loi générale du 1 Août 1905, sur les fraudes en matières commerciales, trouve son application à ce sujet. Considérant que la présence de la cuscute dans une semence constitue un vice caché, qu'elle est de nature à causer à l'agriculteur un préjudice contre lequel il importe de la prémunir, le Service de la Répression des Fraudes interprète ainsi cette loi:

« La vente à la culture des semences cuscutees est tolérée, au moins jusqu'à présent, mais à la condition expresse de fixer aux sacs une étiquette renseignant l'acheteur, portant en caractères bien apparents, la mention: »Non Décuscutee«, mention qui doit figurer également sur les factures de livraison.

A défaut d'indication sur le sac et sur la facture, la marchandise est considérée comme »décuscutee«, et alors elle ne doit pas renfermer plus de 10 graines de cuscute par kilogramme de la marchandise, s'il s'agit de trèfle des prés, de luzerne, d'anthyllide, de minette ou de trèfle incarnat. La tolérance est de 20 graines pour le trèfle blanc, le trèfle hybride, les lotiers et la fléole (Le commerce des semences et la loi du 1 Août 1905, par E. Schribaux, Directeur de la Station d'Essais de Semences).

Il n'est pas inutile de faire remarquer que la tolérance dont il est ici question, tolérance qui peut paraître excessive lorsqu'on ne prend pas la peine de réfléchir, trouve sa justification

à la fois dans la difficulté, sinon dans l'impossibilité, de réaliser pratiquement, avec certitude, l'élimination absolue de la cuscute dans les lots du commerce, et dans les écarts entre plusieurs analyses d'un même lot que le défaut d'homogénéité de la matière rend inévitables.

A l'interprétation provisoire que nous venons de signaler, un Règlement d'Administration publique, actuellement en préparation, substituera l'indication précise des obligations imposées par la loi en matière de semences. On peut prévoir qu'il ne s'en tiendra pas aux exigences énoncées plus haut. La commission chargée d'élaborer le projet du futur Règlement, commission ou figuraient les représentants les plus autorisés du commerce des graines, s'est, en effet, prononcée pour l'adoption des principes suivants :

1. Décuscuté signifie « sans cuscute » sous réserve de la tolérance prévue par le règlement (tolérance à fixer, mais certainement voisine de celle actuellement admise).

Soulignons, en passant, le sens attribué au terme « Décuscuté » à la fois par la Commission et par le Service des Fraudes ; il n'a plus ici l'imprécision de celui de « passé au décuscuteur » qu'on lui a si longtemps donné dans le commerce.

2. La vente à la culture des semences non décuscutées est interdite. Cette vente reste libre entre commerçants et de producteur à négociant.

C'est la prohibition définitive de la vente des graines cuscutees comme semences. La commission reconnaît implicitement que le rôle du marchand grainier ne saurait se borner à recevoir la graine d'une main pour la revendre à l'autre ; qu'à la fois plus élevé, plus difficile et d'une utilité moins contestable, il consiste à transformer, par une épuration appropriée, les graines dites « de culture » en semences dignes de ce nom. Cette mission incombe au moins à l'un des intermédiaires placés entre producteur et consommateur, et le fournisseur direct de ce dernier doit s'assurer, quelle a été remplie, car c'est sur lui que pèsent les responsabilités immédiates.

Ajoutons qu'à l'égard de la cuscute, la réglementation projetée s'applique aussi bien au cultivateur qui vend, comme semences, les graines de sa récolte qu'au négociant lui-même ; au point de vue des résultats comme à celui de la stricte équité, l'assimilation s'impose.

Les pouvoirs publics ne se sont pas bornés aux mesures permettant d'atteindre la cuscute sur le territoire français : par un décret en date du 21 Février 1908, l'importation en France de la cuscute et des semences cuscutees est interdite ; l'arrête du 10 Mars de la même année organise, à cet effet, le contrôle des semences provenant de l'étranger. Les espèces suivantes ne sont admises à pénétrer en France qu'à la condition d'être reconnues exemptées de cuscute à l'analyse ; luzerne, minette, trèfle des prés, trèfle blanc, trèfle hybride, trèfle jaune des sables, lotier corniculé, lotier velu, fléole, ainsi que tout mélange de graines dans lequel figure l'une de ces espèces.

Dans un avenir prochain, le cultivateur se trouvera donc dans la mesure où la loi peut intervenir, protégé par elle contre le danger d'introduire dans ses terres des graines de cuscute avec les semences qu'il se procure hors de son exploitation ; actuellement, il est averti déjà que ce danger le menace, quand les graines des trèfles ou de luzerne qui lui sont offertes portent la mention « non décuscutées » obligatoire pour tous les lots n'ayant pas subi d'épuration suffisante ; à lui de profiter de l'avertissement.

Mais la cuscute a d'autres modes de propagation que l'ensemencement des terres avec des légumineuses souillées de ses germes. Ses graines peuvent être véhiculées dans les champs par les fumiers, les composts ou autres engrais organiques, les eaux, les animaux, etc. ; elles conservent dans le sol, pendant de longues années, la faculté de donner naissance à des plantes viables, de telle sorte que celles-ci peuvent apparaître et se développer dans les cultures de légumineuses après une interruption prolongée de ces cultures sur les terrains contaminés. Et puis, la graine n'est pas seule en état de multiplier le végétal parasite. Ses filaments se bouturent avec une extrême facilité, d'où le danger de leur dissémination par le râtelage, le transport des fourrages, le passage même des hommes et des animaux.

Par suite de cette remarquable faculté de se reproduire, la cuscute ne menace pas seulement le champ même où ses taches apparaissent, mais encore tous les champs voisins. Aussi tient-elle l'une des premières places, sinon la première même, parmi les végétaux nuisibles auxquels s'applique la loi du 24 Décembre 1888. Aux termes de cette loi, les préfets sont autorisés à prendre des arrêtés rendant la destruction de la cuscute obligatoire dans leurs départements respectifs. Nombreux ont été les arrêtés de ce genre. L'application rigoureuse de la loi de Décembre 1888 est le corollaire des mesures sévères prises à l'égard des fournisseurs de semences cuscutées; ces mesures ne s'expliqueraient pas si le cultivateur négligent conservait la liberté de laisser le parasite envahir ses cultures et se répandre ensuite dans celles de ses voisins, au grand détriment de leurs récoltes fourragères.

Professor Dr. A. Voigt: „Ich halte es für dringend erforderlich, daß ein bestimmtes Verhältnis zwischen der eingesandten Probe und der Menge der Ware eingeführt wird; es ist nach meiner Meinung nicht gleich, wenn man von einer Ware, die nur 1 Zentner ausmacht, 100 g auf Seide untersucht und von einer Ware von 100 Zentner ebenfalls nur 100 g. Man könnte z. B. festsetzen, daß für je 10 Zentner der Ware eine Probe von 100 g zu untersuchen ist. So wird z. B. für die großen in Hamburg zu analysierenden Getreideladungen für je 50 t eine Probe genommen, für 2000 t gibt es somit 40 Proben, die einzeln untersucht werden. Aus ihnen wird das Mittel genommen.“

Dr. v. Degen disagreed and expressed surprise at the method used in Hamburg, preferred another method using two kinds of certificates: 1) a simple certificate on the sample, not on the quantity of the seed, 2) a certificate on a more expert test in which the amount tested bears a definite relation to the amount of the lot.

Professor Dr. A. Voigt replied that the whole lot was not judged on the test of a few seeds.

Dr. Buchholz: „Professor Voigt hat uns auf eine Sache von großer Wichtigkeit aufmerksam gemacht. Eine Probe, die untersucht wird, ist nicht immer eine Durchschnittsprobe. Wenn eine Durchschnittsprobe von einer großen ungleichen Partie genommen wird, ist diese eine Mischung. Auf dem Gebiete der Samenkontrolle ist es sehr wichtig, daß das, was untersucht wird, auch richtig gezogene Proben sind. Man muß nicht nur Durchschnittsproben untersuchen, sondern eventuell auch einzelne Proben, und wenn diese nicht übereinstimmen, muß es auf dem Analysenattest bemerkt werden. Es ist wünschenswert, daß die Frage der Probenahme auf diesem Kongreß behandelt wird.“

Professor Johannsen:

“What Dr. Buchholz has said is important and interesting, but we must continue the discussion concerning dodder.” teilte mit, daß diese Sache sehr wichtig wäre, daß aber erst die Frage der Seide diskutiert werden müßte.

Mr. Dorph-Petersen:

Dr. Buchholz's question should be referred to a committee. „Die Frage von Dr. Buchholz muß an ein Komitee verwiesen werden.“

Adjunkt Vilke möchte den Vorstand Vitek fragen, was unter böhmischem Rotklee zu verstehen ist. In Schweden verkaufte man viel böhmischen Rotklee; dieser ist aber sehr verschieden. Welche Erfahrung hatte Vitek mit dem Vorkommen von groß- und kleinkörnigen Seidenkörnern in dieser Herkunft?

Vorstand Vitek: „In der tschecho-slovakeiischen Republik muß man zwischen den Saaten, die aus Böhmen und Mähren stammen, und denjenigen, die aus der Slowakei stammen, in welcher Grobseide vorkommt, unterscheiden. Aus diesen Gründen müssen die Rotkleesamen, sowohl von Böhmen und Mähren als auch von der Slowakei, verschieden plombiert und signiert werden, und zwar als echt böhmisch, entweder als seidefreie oder als merkantile Ware, diejenige aber, welche aus der Slowakei stammt, wird als solche bezeichnet, ob sie schon grobseidefrei oder grobseidehaltig ist. Die staatliche Verordnung über die Kleesamenplombierung bleibt auch für 1920--21 in Gültigkeit.“

Dr. v. Degen: „Ich möchte beantragen, daß die Stationen, die mit der Seidenfrage beschäftigt sind, beauftragt werden, die Nordgrenze des Reifens der Seidesamen festzustellen und diese auf dem nächsten Kongreß vorzulegen. Sollten wir nicht einen Beschluß betreffend dieser Fragen fassen?“

Direktor Dorph-Petersen: „Diese Frage muß auf morgen verschoben werden.“

Mr. Clark: „Since 1902 and the establishment of seed laboratories in Canada we have never failed to determine the provenience of the seeds in which *Cuscuta* sp. are found. Red clover and alsike of Canadian growth has never shown *Cuscuta*. The line north of which *Cuscuta* will not grow is far south of the Canadian boundary except on the Pacific coast. A *Cuscuta* sp. has been found on alfalfa. It is very noxious; the exact species has not been determined. There is a possibility of obtaining a machine for cleaning *Cuscuta*. One is in use in Canada. It was put on the market for the first time in 1920, but has not been thoroughly tested yet. It is based on the principle of a cream separator. Red clover and weed seed are placed in a test tube with water and nitrate of soda (different % strength) just as cream and milk are placed in a centrifugal. If there is a difference in the specific gravity of weed seeds and clover, many weeds can be detected by this method. The machine can handle 7 bushels per hour. After treatment the seed is dried. It is not expensive.“

M. Douven, Directeur de la station d'essais de semences à Louvain, Belgique: „What kind of salpeter is preferred?“

Mr. Clark: „Chili Salpeter“.

Discussion on germination.

Die Diskussion
über Keimfähigkeit.

Adjoint Vilke:

„In making investigations of the germinating power of cereals ordinary soil is used. A higher percentage is obtained than when filter paper is used. For 30 years garden soil, sand and filter paper has been used in these tests, and the results are similar to these found by Mr. Widén.”

„Ich habe während 30 Jahren mit der Keimung der Getreidesamen in Papier, Sand und Gartenerde gearbeitet und kann, was Herr Widén mitgeteilt hat, bestätigen. Wenn Getreide gut geerntet ist, wird es immer gut keimen. Das nicht gut geerntete Getreide macht dagegen Schwierigkeiten. In Schweden sind

spät im Herbst geerntete Gerste- und Haferpartien oft noch unreif. Wenn man sie dann in Papier keimen läßt, bekommt man schlechte Ergebnisse. Man kann ja die Keimenergie verbessern, wie es Herr Widén ausgeführt hat. Man soll dies aber nicht tun; man darf nicht künfteln. Das Anschneiden ist schlecht. Wenn man anstatt Papier Sand gebraucht, bekommt man bessere Resultate; wenn aber Gartenerde gebraucht wird, bekommt man noch viel bessere Resultate. Die Humussäure hat dieselbe Einwirkung wie die Natur. Ich gebrauche dieselben Schalen wie Herr Widén, aber gesiebte Gartenerde statt Sand. Die Samen werden mit 1 bis 1½ cm Erde zugedeckt. Man bekommt allgemein ca. 5-bis 10 % bessere Resultate als mit Sand. Die Untersuchung einer Probe Hordeum im Herbst ergab in Papier 40 %, in Sand 85 % und in Gartenerde 98 % Keimlinge. Ich habe auch mit Triticum und Secale Versuch gemacht und habe dieselben Resultate, aber nicht so große Unterschiede bekommen. Es wäre wünschenswert, daß die verschiedenen Anstalten diese Versuche wiederholen und ihre Erfahrungen veröffentlichen würden.“

Direktor Dorph-Petersen: „In Dänemark haben wir Papier aufgegeben. Wir brauchen nun immer Sand. Wir haben mit dem im Herbst unreifen Getreide Versuche gemacht. Es hat oft schlecht gekeimt; wir haben dann eine Nebenuntersuchung mit 100 angeschnittenen Samen gemacht. Dadurch können wir beurteilen, ob die Ware später, wenn sie keimreif wird, besser keimen will. Es wird dann in dem Analysenattest angegeben, daß die Ware besser keimt, wenn sie keimreif wird.“

Direktor Walldén: „Es ist sehr oft vorgekommen, daß Getreidesamen von den nordischen Ländern nicht immer richtig beurteilt wurden. Ich möchte deshalb bitten, daß die Vertreter der Länder, wo die Sandmethode nicht benutzt wird, für Getreide aus Dänemark, Norwegen und Schweden in Zukunft stets Sand verwenden. Die Art des Sandes ist nicht die Hauptsache, sondern daß man das Material gut kennt, weil die absolute Wasseraufnahme bei verschiedenen Arten verschieden ist. Feiner Sand nimmt mehr Wasser auf als grober. Die Wasserzufuhr muß gut reguliert werden. Wenig oder mehr Wasser gibt verschiedene Resultate.“

Mr. Clark: "In our laboratories, in making tests for the germinating power of cereal grains we restricted ourselves to the use of sand in all cases in which preliminary tests indicated that germination was below the requirement for good seed. There has been painful past experience in crop loss due to poor germinating power. Oats for instance could not resist frost. We have found germinating tests to be more reliable when made on good soil with a limited degree of moisture than on sand and blotting paper. In frosted samples in sand we have used 1—2—3 % sugar solution to feed the germ whose enzyme was out of commission. The germination results were almost as good as when planted in soil. Check tests were made on good soil (unsterilized) in which no cereals had been grown hitherto."

Direktor Bruijning: „Die Frage ist: Wie soll man unreifen Samen untersuchen? Wir sind nicht unzufrieden mit Papier und haben keine Schwierigkeiten damit. Wenn Weizen im Keimbette liegt, sieht man bald, ob er unreif ist oder nicht. Erweist er sich als unreif, so wird eine neue Analyse gemacht; der Samen wird dann aber erst künstlich auf 30° erwärmt, und dann keimt er gut. Wir sind der Frage weiter nachgegangen dadurch, daß wir auf verschiedenen Böden künstlich ausgereiften und nicht künstlich ausgereiften Samen ausgesät haben. Der erste keimte gut. Wir benutzen einen großen Thermostat, worin wir die Samen 48 Stunden liegen lassen. Der Luftstrom darf höchstens 30° sein. Das Sandkeimbett ist nicht immer gut. Manche Samen keimen besser in Papier, weil der Sand die Luft ausschließt.“

Dr. Buchholz: „Ich will nur bestätigen, daß wir auch in Norwegen große Schwierigkeiten mit dem unreifen Getreide haben. Das Schneiden ist aber nicht empfehlenswert. Demnach muß man oft in so kurzer Zeit wie möglich die Proben untersuchen, um die Resultate abgeben zu können. Die Behandlung der Proben mit einer Temperatur unter 0, wie es in Ungarn üblich zu sein scheint, ist künstlich. Die Keimung in Erde ist viel natürlicher. Ob es aber die Humussäuren sind, die den Unterschied ausmachen, kann nicht gesagt werden. Bohnen keimen oft besser in Sand als in Papier, weil sie in Papier leicht schimmelig werden.“

Dr. E. F. Simola, Helsingfors, Finnland:

„Die verschiedenen Jahre üben einen merkbar verschiedenen Einfluß auf die Reifezeit des Saatgutes aus. Es können Jahre vorkommen, in welchen das Saatgut nicht vollständig reifen kann, sondern ungleichmäßig bleibt. In solchen Jahren ist es sehr wichtig, daß das Saatgut auf dem Lager nachreifen kann oder getrocknet wird. In nördlichen Ländern gebraucht man Darren; diese haben ohne Zweifel einen sehr großen Einfluß auf die Keimfähigkeit der unreifen Körner. In Finnland gibt es viele solcher Darreeinrichtungen. Wenn aber das Darren die Keimfähigkeit der Körner künstlich beeinflusst, so soll man wissen, wie hoch die Temperatur sein darf, und wie lange man das Getreide trocknen kann; z. B. darf man nicht alle Hafersorten gleich stark trocknen. Einige Hafersorten verlieren ihre Keimfähigkeit bei 62° C nicht, andere Sorten verlieren sie schon bei 60° C. Beim Darren ist es wichtig, daß die Samenproben nicht kurz nach dem Darren gezogen werden, sondern erst nach 10 bis 15 Tagen, oder noch besser nach einem Monat, wenn das Saatgut

wieder ein wenig Feuchtigkeit aufgenommen hat. Wenn man Proben von gut getrocknetem Hafer nach ein oder zwei Tagen nimmt, keimt er schlecht, später aber sehr gut.“

Dr. Volkart: „Es wird besser sein, wenn wir nicht von Humussäuren sprechen, da wir noch nicht sicher sind, ob es solche überhaupt gibt. In der Schweiz haben wir hauptsächlich beim Weizen mit mangelnder Keimreife zu tun, und zwar immer bei deutschen und auch skandinavischen Squareheadzüchtungen, nie bei Landweizen. Sind die Wassergehaltsprozente des Sandes als Gewichtsprozente oder als Prozente der wasserhaltenden Kraft des Sandes zu verstehen?“

Direktor Widén: „Mit 50 % Wasser meine ich die halbe Gewichtsmenge Wasser, welche der betreffende Sand überhaupt aufnehmen kann (= 50 % der wasserhaltenden Kraft).“

Direktor Bruijning: „Wir brauchen einen Thermostat mit einem schnellen, trockenen, starken Luftstrom von 30°. Die Luft muß rein sein. Dieses ist auch zweckmäßig für feuchte Saat.“

Mr. Anderson: „Oats is the most important cereal in Scotland. The seed is subject to various troubles, frost, weathering (climatic changes) and heating (in the stack). Good oats will always germinate but conditions in the seed bed must suit the worst type. In making an experiment the temperature should not be too high. The seed bed should not be moist, but scarcely damp. In order that oat seeds secure enough water each seed is planted separately with the embryo pushed down into the sand.

The same trouble has been found with the new varieties of oats as Dr. Volkart spoke of for wheat in Switzerland.

Gartons new variety "Record", for example, shows difficulty in germination as do the Tartarian types. "Bosom pickles" (inner corns) frequently do not germinate. It is inexplicable why so large a percentage of "Bosom pickles" fail to germinate in an artificial seed bed, for when sown in soil in the open, they commonly germinate to the extent of 100 %. On the seed bed the amount of moisture should be equivalent to the amount of moisture the farmer allows as a perfect seed bed in good field soil.“

Direktor Dorph-Petersen: „Dieses Jahr haben wir Schwierigkeiten mit Hafer gehabt. Dieser ist allgemein keimreif im Oktober; dieses Jahr wurde er erst im Februar-März keimreif. Die inneren Körner keimen gewöhnlich besser im Boden als im Sand, aber nicht so gut wie die äußeren Körner.“

Fräulein Jacobsen, Vorsteherin des Keimlaboratoriums der Samenkontrollanstalt in Kopenhagen: „In den Fällen, wo man im Feld (Versuchsfeld) bessere Resultate bekommt, kriegen wir zur selben Zeit mit denselben Proben auch bessere Resultate im Laboratorium, wenn die Keimreife eingetreten ist.“

Direktor Walldén:

„Die Frage von Dr. Volkart, ob nicht die Landsorten von Weizen schneller keimreif werden als die veredelten Sorten, muß bejaht werden. Da die späte Keimreife bei Winterweizen eine unvorteilhafte Eigenschaft ist, sucht man nun in Svalöf Sorten zu

züchten, die in dieser Beziehung sich besser verhalten. Die Keimreifefrage ist also eine züchterische Frage geworden.

Betreffend der Keimung der Innenkörner des Hafers muß ich bemerken, daß sie schon seit mehreren Jahren in Svalof beobachtet worden ist, und daß die beim Abschluß der Keimversuche gesunden, aber nicht gekeimten im Keimbett liegenden Körner hauptsächlich Innenkörner sind. Dieses kommt davon, daß diese Körner später nachreifen als die Außenkörner.“

Direktor Widén: „Ich schlage vor, daß bei noch nicht keimreifem Getreide auf dem Analysenattest angegeben werden soll, wie das Getreide sowohl mit als auch ohne Keimreiz gekeimt hat.“

Professor Johannsen:

“Meeting is adjourned until schließt die Sitzung.
to morrow.”

10. Juin 1921.

Professor Johannsen

opened the meeting. The question eröffnete die Sitzung. Die Frage for discussion was Professor Voigts der Diskussion war Professor Voigts proposal from Juni 9 (page 86—88) Vorschlag vom 9. Juni (Seite 86—88).

Dr. Volkart: „Ich bin mit den meisten Vorschlägen von Professor Voigt einverstanden und möchte nur bemerken, daß es ja sicher besser ist, 6×100 statt 2×200 Körner für den Keimversuch zu verwenden. Nur finde ich, daß es für ein Laboratorium mit vielen Untersuchungen etwas schwierig wäre, stets 6 Parallelbestimmungen anstatt nur 2 zu machen. Ich weiß sodann nicht, ob der Auftrag, stets das Gewicht der einzukeimenden Samen festzustellen, nicht zu weit geht. Ich möchte vorschlagen, diesen Punkt nur als Wunsch, nicht als Vorschrift, aufzustellen.

Ferner ist wohl die Bezeichnung „Ritzbruch“ nicht immer ganz richtig, da es sich meistens um Druschbruch handelt. Mit der Einführung der Bezeichnung „reine keimfähige Samen“ an Stelle von „Gebrauchswert“ bin ich sehr einverstanden.“

Dr. v. Degen:

“1. With reference to the so-called “Continental Method” I should like to observe that in germination experiments we obtain results of quite unequal value according as we germinate naked seeds, or certain fruits, as in the case of Beta, Coniferous, Umbelliferae, hamp- and forest seedings. Where as we, in the case of the former and in case of almost all grass-seeds, examine the grains destined for the germination-bed by all the methods at our disposal (handling, transparency test etc.), so that all grains recognized as unsuited to the germination experiments, are separated in advance and added to the foreign matters, we do not pursue this method in the case of the second category, and consequently the results are not of equal value.

It was precisely this circumstance which induced our colleague Mr. Pethybridge to employ the so-called “Irish” method, which, however, is much older, since it was applied many years ago by Hiltner at Nobbe's Station and in other German Institutes, where it was formerly styled the “Weight-Method”.

The cutting-test, that is to say, the cutting of the fruits after the germination test, or the drying and weighing of the empty seeds (except in the case of forest seedings,

where the cutting method is in general use), is a process much too cumbersome as to be employed for all the fruits of the second category.

I am unfortunately unable to propose a better process, than the so-called "Continental method"; I must, however, again point out, that the results obtained are not at all of like equivalence, for instance the result which we obtain in the case of French Raygrass does not signify the same as that which we obtain in the case of hamp-seed, where the empty seeds which get into the germinating bed diminish the percentage of germination, whereas in the case of the Raygrass we removed the empty seeds beforehand.

We have made numerous experiments at the Budapest Station for the purpose of separating out the empty seeds by floating the seeds in different liquids. But all fluids which separate with certainty the empty seeds from the full ones (for instance Sulphuric Aether) are inapplicable in practice, as they have an injurious chemical effect on the seeds themselves.

In my opinion therefore, in the absence of a better, the Continental or Counting Method should be accepted, at the same time taking into account, that the results are not of equal value.

2. With reference to the proposition II, I should like to point out, that contrary to the probability, that more reliable results are to be obtained with 4×100 or 6×100 seeds, it depends, in reality, on what method is employed in the Station under consideration.

In our germination experiments with 4×100 or 6×100 seeds we have obtained in the greater number of experiments worse results, than when we employed our usual method, which consists in germinating 2×100 seeds.

I believe that the cause of this paradoxical result is to be found in the circumstance, that everything which disturbs the method practised through long years by the manipulating staff, is detrimental to the result.

In germination experiments long practice which leads to a certain perfection, plays the most important role.

Although long practice is liable to produce systematic errors, these errors are yet not so serious as those, which arise from want of practice.

3. With reference to proposition III, I will remark, that the 100 grain weight without examination for moisture-contents has no real purpose, and this is confirmed by the great discrepancies in the results, presented by the Copenhagen-Station. Also I am of opinion, that the 100 grain weight determination is not at all necessary for all seeds.

4. With regard to proposition VI, I will observe, that at the Budapest-Station and at many others, all procedures, also soaking, are used, which are suitable for accelerating the germinating process. I see no reason, why such procedures should not be employed.

5. With reference to proposition VII, I observe, that the Budapest-Station and also the Vienna-Station reckon all the hard seeds, which are almost all sure to be capable of germination, among the germinating seeds, and enters in a separate column the percentage of hard seeds. Through the addition of the hard seeds to the germinating seeds disappear, so to speak, at one blow all the differences which appear in the results obtained at the different stations. On the other hand, however, the buyer is adequately protected by the indication of the percentage of hard seeds."

Mr. Anderson asked whether the conference in relegating certain matters to committees, intended to make rules for determining the purity and germinating power of each species of seed.

Professor Dr. A. Voigt: "Yes, eventually".

Mr. Saunders approved Professor Voigt's memorandum. We should learn to walk before beginning to run. Detail should be avoided at first. All are agreed that these are merely suggestions, not rules. The wording should be discussed, in regard to

Par. 3 "desirable" not "necessary".

Par. 6 agreed with Hofrat v. Degen.

Par. 9 "intrinsic value" = pure seed able to germinate. Should "intrinsic value" include hard seeds? This is not included in England at present, but it is possibly desirable. The seed trade would wish it.

In the case of beet, forest tree seed and some Umbelliferae a true "Continental method" is impossible.

In beet and mangold seeds there are kinds of empty seed.

1. Cluster in which the seeds are undeveloped.

2. Cluster in which the seed is developed but removed by mice or other animals before or after threshing.

The latter (2) should be considered an impurity. The former (1) is more difficult to classify. Chaff? Perhaps it is not correct to call it a cluster. It will pass through 2 mm sieve in nearly all cases.

In pars. 8—9 a further point should be considered, namely the question of sprouting. Dr. Bruijning has dealt with this question. His suggestion, however, is contrary to the rules of German seed testing stations. The matter is a difficult one, but it should be discussed in a committee appointed for the purpose. Par. 9 (see page 88).

Professor Dr. A. Voigt: „Mr. Saunders meint, daß wir nicht für alle Samen die kontinentale Methode brauchen (spez. Rübensamen) und meint, daß wir Regeln für jede einzelne Samenart bekommen sollen. Es ist richtig, wir können nie alles mit den Regeln greifen. Keine Regel ohne Ausnahme. Ich will ja nur die Richtlinie angeben.

Bei dem Auszählen geht die Übung über die Regel. Ohne Übung keine Laboratorien. Es ist eine selbstverständliche Bedingung, daß es immer reiner Samen, welchen wir zum Keimen legen, ist. Ich will bemerken, daß wir schon durch unsere Reinheit gleichartige Unterlagen für die Keimuntersuchung bekommen. Bei den Koniferensamen, welche von Deutschland nach Schweden exportiert werden, haben die Kaufleute abgemacht, daß drei Anstalten diese untersuchen sollen. Diese mußten übereinstimmen, sonst wurde die Ware nicht angenommen.

Bei 6, 7, 8 habe ich nur das Stichwort gegeben. In Nr. 6 ist es in die Hand gelegt, ob man das Vorquellen brauchen will oder nicht. Der Satz könnte so lauten: „Vorquellen kann gebraucht werden, wenn es nötig erscheint“.

Bei 7 gilt dasselbe. Über die Hartschaligkeit sind wir einig. Mr. Saunders hat hingewiesen, daß in Nr. 9 zwei Meinungen vorkommen, wenn wir nicht wissen, ob wir die hartschaligen Körner mitrechnen oder nicht.

Wir schreiben das Resultat der Analyse so auf:

	gequollene		
gekeimte	nicht gekeimte	harte	gefaulte
88	4	4	4

Dann kann jeder sehen, was es bedeutet. Jetzt müssen wir festsetzen, was wir als gekeimt rechnen sollen. In Deutschland müssen wir frische nicht gequollene Samen als gekeimte aufgeben. Es ist eine Frage, ob wir die harten Körner ganz oder zum Teil mitrechnen sollen, wie es z. B. in der Schweiz und in Österreich geschieht. Wie macht man es in Kopenhagen?“

Direktor Dorph-Petersen: „Die Frage der harten Körner ist immer diskutiert worden. Die Frage ist: Haben sie praktischen Wert oder nicht? Die harten Körner sind die best reifen und entwickelten und enthalten verhältnismäßig wenig Wasser. Bei *Lotus corniculatus* können oft 60—70 % harte Körner vorkommen. In einem solchen Fall müssen wir notwendigerweise ritzen; sonst ist Ritzen aber ein zweischneidiges Schwert, weil hierdurch oft viele Samen verletzt werden. Die harten Körner werden zu dem Wert der gekeimten berechnet, wenn er nicht mehr als das Doppelte der Durchschnittszahlen der betreffenden Samensorte aus dem vorigen Jahrzehnt für Gehalt an „Harten Körnern“ ausmacht. Ist der Gehalt an „Harten Körnern“ größer, wird der Überschuß zum Drittel als gekeimte Samen gerechnet (siehe die verteilten Exemplare unserer Entschädigungsregeln, wo auch die Latituden angegeben sind). Wir geben auch — wie in Hamburg — das wirkliche Keimresultat an.“

Professor Dr. A. Voigt: „Wir sehen, daß die Beurteilung der harten Samen sehr verschieden ist. Ich glaube, wir kommen nicht weiter, wenn wir nicht auf jedem Attest das wirkliche Keimresultat angeben. In der Schweiz rechnet man die halben harten Körner mit, die gequollenen, nicht gekeimten Körner gar nicht. In Deutschland sagen wir nichts bestimmtes. Die deutschen Kaufleute haben sich selbst Regeln gemacht und rechnen die Hälfte der harten Körner als gekeimt.“

Proposed resolution:

Every certificate should give the true figure of the germination test.“

Mein Vorschlag ist:

Auf jedem Attest muß das wirkliche Keimresultat angegeben werden. Jedes Land kann dann die harten Samen in Anrechnung bringen, wie es zweckmäßig erscheint.“

Professor Johannsen:

“We are all agreeing and each country can carry out the matter as it wishes.”

„Ich glaube, daß wir damit einverstanden sein können.“

Professor Dr. A. Voigt bemerkte als Antwort der Frage, betreffend Ritzbruch, daß, wenn die gebrochenen Keime keine Pflanzen entwickeln, sie als tot aufgegeben werden müssen.

Professor Johannsen referred the matter to a committee and gave the floor to Professor Bussard.

M. Bussard

au nom de M. M. v. Degen, Budapest, et Professeur Schribaux, Paris.

Proposition

concernant les mesures permettant de déterminer les causes d'erreurs dans les essais de semences et de réunir des matériaux en vue d'établir une table des latitudes à admettre.

1. Une station, choisie par le Congrès, par exemple la station de Copenhague, divisera, chaque année, un gros échantillon en échantillons plus petits, d'un poids convenable, aussi uniformes que possible. Elle adressera ces échantillons, aux fins d'analyse, aux stations qui se déclareront prêtes à les exécuter.
2. Les analyses porteront sur un petit nombre d'espèces agricoles importantes; en première ligne, celles dont les essais donnent communément lieu aux écarts les plus élevés et auxquelles s'attache un intérêt spécial.
3. Les échantillons seront l'objet d'essais de pureté et de germination. Les résultats, adressés à la station centrale, seront communiqués, à titre rigoureusement confidentiel, à chaque station.
4. Les stations qui auront obtenu des résultats extrêmes échangeront entre elles les échantillons leur restant, en même temps qu'elles indiqueront, d'une façon aussi circonstanciée que possible, la méthode d'analyse employée. Elles feront également échange d'une partie de l'échantillon avec une deuxième station ayant obtenu un résultat se rapprochant de la moyenne de la majorité des résultats.
5. Les résultats du deuxième essai seront, comme ceux du premier, adressés à la station centrale.
6. Les expériences, répétées chaque année, permettront à la station centrale de réunir les matériaux d'une table internationale des latitudes; cette table sera présentée au prochain congrès.
7. La station qui acceptera d'être choisie comme station centrale, s'obligera, par cela même, à exécuter le travail nécessaire.

Antrag

von den Herren v. Degen und Professor Schribaux, Paris, betreffend Maßnahmen, welche es ermöglichen sollen, die Fehlerquellen der Samenprüfungen zu ermitteln und Material zu einer Fehlerlatitude-Tabelle zu sammeln.

1. Eine vom Kongreß zu wählende Station, z. B. die Station Kopenhagen, möge alljährlich ein größeres Muster in möglichst gleichförmige kleinere Muster jedoch von entsprechender Größe zerteilen und die einzelnen Muster an alle jene Stationen behufs Untersuchung einsenden, welche sich bereit erklären, die Untersuchung der Muster durchzuführen.
2. Es sollen möglich wenige, aber landwirtschaftlich wichtige Arten untersucht werden, in erster Linie solche, deren Untersuchung erfahrungsgemäß die größten Differenzen aufweisen, und solche, an welche spezielle Interessen geknüpft sind.
3. Die Muster wären auf Reinheit und Keimfähigkeit zu untersuchen und das Resultat der Zentrale zu melden, welche das Gesamtergebnis streng vertraulich den einzelnen Stationen mitteilen würde.
4. Die Stationen, deren Ergebnisse die entgegengesetzten Extreme aufweisen, tauschen die übriggebliebenen Muster miteinander aus, wobei sie sich die bei der Untersuchung angewandte Untersuchungsmethode möglichst ausführlich mitteilen.

Zugleich tauschen sie auch einen Teil des Musters mit einer zweiten Station aus, die ein Ergebnis erreicht hat, welches dem Durchschnittsergebnis der Mehrzahl nahe kommt.

5. Die Resultate der zweiten Untersuchung wären wieder der Zentrale anzumelden.
6. Die jedes Jahr wiederholten Versuche würden die Zentrale auch in die Lage versetzen, das Material zu einer internationalen Fehlerlatitude-Tabelle zu sammeln und dieses dem nächsten Kongreß vorlegen zu können.
7. Mit der Annahme der Wahl zur Zentrale wäre auch diese Verpflichtung zu übernehmen.

Mr. Dorph-Petersen: "It is to be hoped that each country will participate with regard to those species that have interest for the particular country."

Sir Lawrence Weaver: "The suggestions made are so obviously good that they should be accepted as a whole, whereas the details should be discussed and settled in a committee".

Dr. v. Degen:

Qu'il me soit permis d'ajouter encore quelques mots à notre motion, qui est basée sur la supposition, que 1) l'échange des échantillons est la seule méthode à relever les différences, qui se trouvent — par hasard — dans la composition de l'échantillon, 2) la communication détaillée des méthodes est le seul moyen de relever les différences causées par l'emploi de méthodes différentes. J'ai lieu de croire, qu'un échange systematique des échantillons et des communications conséquentes diminuera les différences quelquefois assez saillantes, et qu'en suivant cette méthode nous arriverons peu à peu au but, de fixer les latitudes internationales.

Il s'agit, en premier lieu, de fixer ces latitudes entre les stations en ce qui concerne les graines, qui sont l'objet d'un trafic commun entre les pays intéressés; p. e. il serait de plus grande importance d'employer les mêmes méthodes et de s'entendre sur les mêmes latitudes entre les stations de la Hongrie, de l'Allemagne, de la France et de l'Italie sur les graines de trèfle, de luzerne, de certaines graminées, que nous importons réciproquement. Il ne s'agit donc, en premier lieu, que d'un assez petit répertoire, qui pourrait être élargi au fur et à mesure.

Quant au travail même, les résultats que nous venons de recevoir de la station de Copenhague, qui s'est chargée de distribuer précédemment une série de semences entre 17 stations et qui nous a communiqué les résultats obtenus, nous donnent tout de suite une base pour commencer les échanges; la moitié du travail étant fait, il reste que les Stations qui ont obtenu les résultats les plus divergents commencent à suivre la voie indiquée. Pour le futur, je propose que la distribution se porte en premier lieu sur les semences qui ont la même importance pour les stations intéressées; il suffirait donc de commencer avec un petit nombre d'espèces.

Professor Johannsen

suggested a discussion of the publication of the report of the conference. "It is international and if the report is comprehensive it will be too expensive for Denmark alone. If the report is brief, that is another matter".

eröffnet die Diskussion über die Veröffentlichung des Berichts. „Dieser ist international und wird, wenn es ein umfassender Bericht werden soll, zu teuer für Dänemark allein. Wir haben nur Geld für einen ganz kurzen Bericht.“

Mr. Dorph-Petersen:

"It is possible to print just so

„Es ist möglich, so viele

many reports as each country wishes and will pay for; the government in each case being bound. Mr. Clark has said that Canada wishes 100 copies. Perhaps the delegates are not empowered to bind their governments financially; we are willing to wait a month."

Exemplare wie jedes Land wünscht und bezahlen will, zu drucken. Die Regierung verpflichtet sich aber in jedem Falle dazu. Mr. Clark hat gesagt, daß Canada 100 Exemplare wünscht. Die Delegierten haben vielleicht aber nicht das Recht, ihre Regierung finanziell zu binden; wir können jedoch einen Monat auf Antwort warten."

Sir Lawrence Weaver: "Great Britain will take £ 25 worth".

Mr. Bruijning: "Holland will take 50 copies."

Sir Lawrence Weaver suggested that the order be given on a monetary not a numerical basis. Each country will pay so and so much and the number of copies sent out will depend on that.

Mr. Anderson asked if the "seed trade" could obtain copies and share the expense.

Mr. Bruijning: "Not all seed-dealers can be trusted."

Mr. Dorph-Petersen asked Professor Voigt and Professor Johannsen to help with proof reading and hoped the report would be ready by January next.

Dr. Buchholz

asked if "after" copies can be obtained. fragte, ob es möglich wäre, später Nachbestellungen zu machen.

Professor Johannsen:

"If the supply is large enough."

„Ja, wenn die Auflage groß genug ist.“

Dr. v. Degen: "The papers should be printed in the language of the speaker. Also the discussions. All shall be as brief as possible."

Professor Johannsen

suggested that exchange be reckoned at normal pari rate.

schlug vor, daß der Bericht nach dem alten Pari Kurs bezahlt werden sollte.

Approval from all.

Adjourned the meeting until after luncheon.

Der Vorschlag wurde einstimmig angenommen.

Schließt die Sitzung bis um 2 Uhr.

Professor Johannsen:

"The first matter to be considered this afternoon is the place of meeting of the next conference. Sir Lawrence Weaver has extended the hospitality of England. Is this official?"

„Die erste Frage, die wir heute Nachmittag diskutieren sollen, ist, wo wir den nächsten Kongreß abhalten sollen. Sir Lawrence Weaver hat angedeutet, daß England uns einladen will. Dürfen wir diese Einladung als offiziell betrachten?“

Sir Lawrence Weaver

stated that he has been empowered by his Government to invite the delegates to a Seed Testing Conference to meet in 1924, partly in London and partly in Cambridge.

bestätigte, daß die Einladung offiziell ist, und ladet zu einem Kongreß teils in London teils in Cambridge im Jahre 1924 ein.

Approval.

The English delegates would consider it a compliment if the invitation is accepted, and they will do all in their power to make the conference in 1924 a success. The end of June or beginning of July would be the best time.

Beifall.

Ende Juni oder Anfang Juli wird am zweckmäßigsten sein.

Professor Johannsen

thanked in the name of all present for the invitation. All were agreed that the next conference is to be held at end of June 1924 in London and Cambridge.

dankte im Namen der Anwesenden für die Einladung; alle waren einig, den Kongreß Ende Juni 1924 teils in London, teils in Cambridge abzuhalten.

Sir Lawrence Weaver: "In co-operation with Professor Johannsen and others, I have drawn up two resolutions each in 2 parts to form the basis for the afternoons discussion. It is important to have closer relationship than a meeting every 3 years. I propose:

1. That an association of official seed-analysts and seed control organisations of Europe be formed.
2. That a committee consisting of Dr. Volkart, Mr. Bruijning and Mr. Dorph-Petersen consider the constitution of the association, rules of its membership and work, and circulate their recommendations to the members of this conference.

Mr. Clark has suggested that an international society be formed now, but I think this cannot be decided at once. It is better to appoint a committee to bring up points to lay before the various stations. There are many questions for discussion, such as membership. What language shall be used &c.?

This European Association can eventually join up with the American Association forming a world-wide association."

Professor Johannsen

asked Dr. Volkart, Mr. Bruijning and Mr. Dorph-Petersen whether they are willing to act in this committee.

fragte, ob Dr. Volkart, Direktor Bruijning und Direktor Dorph-Petersen einwilligen, und ob sie diese Arbeit übernehmen wollen.

Dr. Volkart:

expressed appreciation and willingness.

„Ich danke für den mich sehr ehrenden Vorschlag bestens, und wenn Sie finden, daß ich helfen kann, die vom Kongresse beschlossenen Arbeiten zu fördern, werde ich mich gern zur Verfügung stellen.“

Mr. Dorph-Petersen:

expressed appreciation and willingness. Mr. Bruijning was not present at the meeting, but he was known to be willing.

„Ich danke auch und will mein Bestes tun. Direktor Bruijning ist nicht anwesend; man weiß aber, daß er einwilligt.“

Professor Johannsen:

“Discussion on Proposition 1 is now in order.”

„Die Diskussion des 1. Vorschlages ist jetzt eröffnet.“

Mr. Dorph-Petersen requested Mr. Clark to work in America for the same results as those for which Europe is working so that the ultimate result will be a world association.

Mr. Clark thanked the delegates for their trust in him and stated that America had learned seed-testing from Europe. Young as yet, she hoped to continue to learn. Canada and the United States of America had individual problems and would make individual researches. The work is not in all cases proceeding as rapidly as is desirable. Hoped that the results of this conference would be published in time that they may be presented at the annual meeting of American Seed Analysts to be held in Toronto next December, so that they may revise their regulations in accordance with the opinions of the experts expressed here.

Professor Johannsen:

“If there is no further discussion Proposition 1 is to be put to vote by roll-call.”

„Wenn nichts weiteres zu diskutieren ist, können wir vielleicht über den ersten Antrag abstimmen.“

The following will join into the common work:

Zur Mitarbeit sind folgende Herren bereit:

Professor Dr. A. Voigt, Mr. Douven, Mr. Clark, Dr. Simola, Professor Bussard, Mr. French, Mr. Saunders, Mr. Anderson, Hofrat v. Degen, Dr. Buchholz, Frøkontrollør Tryti, Direktor Bruijning, Konsul Bilinski, Direktor Enesco, Ingenieur Bogdan Ferlinc, Generaldirektor Insulander, Bureauchef v. Zweigbergh, Direktor Widén, Adjunkt Vilke, Staatskonsulent Elofson, Vorstand Vitek, Dr. Chmelar, Direktor Volkart und Direktor Dorph-Petersen.

Sir Lawrence Weaver wished to bring his second proposition before the meeting.

Proposition 2. To appoint a committee consisting of Mr. Dorph-Petersen, Mr. Bruijning and Dr. Volkart to consider

- a) the unification of seed-testing methods in Europe keeping in view the possibility of ultimate unification with North America,
- b) the method of expressing the results of analysis and the quality of the seeds analyzed and to present a report at the next international conference.

The good work begun here in Copenhagen must not be dropped during the next 3 years. A machine is under construction, and by the skill of the 3 colleagues, from Denmark, Holland and Switzerland, it should soon begin to function. Methods should be codified with a view to having them considered in London in 1924; it is therefore formally proposed that the same committee consider the 2 points of the second proposition.

Dr. Volkart übersetzte den 2. Vorschlag von Sir Lawrence Weaver:

„Sir Lawrence Weaver schlägt vor, ein Komitee zu ernennen, bestehend aus den Herren Dorph-Petersen, Bruijning und Volkart, um zu beraten über:

- a) Die Vereinheitlichung der Samenuntersuchungsmethoden in Europa unter Berücksichtigung der Möglichkeit einer später herbeizuführenden Übereinstimmung auch mit Nordamerika.
- b) Die Art der Begutachtung der Qualität des untersuchten Saatgutes und der Darstellung der Untersuchungsergebnisse, und dem nächsten Kongreß einen Bericht hierüber zu erstatten.“

Professor Johannsen

The second proposal voted upon.

Passed unanimously.

The question of dodder is now opened for discussion.

Dodder committee appointed consisting of Dr. v. Degen, Director Vitek, Professor Bussard, Professor Voigt and Director Enesco, from countries where dodder appears in a considerable degree.

fragte, ob die Herren mit dem zweiten Vorschlag von Sir Lawrence Weaver einverstanden wären.

Der Vorschlag wurde einstimmig angenommen.

„Dann haben wir noch die Frage der Kleeseide zu berücksichtigen. Hinsichtlich dieser Frage müssen wir ein kleines Komitee, das freie Hand hat, wählen. In dieses Komitee sollen nur Mitglieder von den Ländern, wo die Kleeseide eine Rolle spielt, gewählt werden. Ich schlage vor, daß dieses Komitee aus dem Dr. v. Degen, Vorstand Vitek, Professor Bussard, Professor Voigt und Direktor Enesco bestehen soll.“

Das Komitee wurde aufgefordert, einen Bericht auf dem Kongreß 1924 abzugeben.

Anfrage an die Herren, ob sie die Wahl annehmen.

Alle vorgeschlagenen Herren waren anwesend und erklärten sich bereit, die Wahl anzunehmen.

Professor Johannsen fragte, ob die Delegierten mit der Wahl einverstanden wären.

Einstimmig angenommen.

Sodann wurde beschlossen, daß jedes Komitee seinen Vorsitzenden selbst zu wählen habe.

Adjunkt Vilke: „Es ist nur noch eine Frage, die ich gerne zur Sprache bringen möchte. Diese fällt zusammen mit dem Punkt 6 und 7 des Vorschlages Professor Voigts. Wenn man eine Probe von *Trifolium hybridum* auf Keimkraft untersucht, bekommt man z. B. folgende Resultate:

Gekeimte	Gequollene nicht gekeimte	Harte	Gefaulte
70	24	4	2

Wenn man aber die Probe in einem Magazin, das sehr trocken ist, lagert, bekommt man vielleicht bei der nach einer Zeit wiederholten Keimung ein anderes Resultat:

Gekeimte	Gequollene nicht gekeimte	Harte	Gefaulte
70	2	20	8

Wie soll man den Ersatz berechnen? Es ist eine Frage von großer Bedeutung. Es kommt auch bei *Trifolium pratense* vor, aber nicht mit so großem Unterschied.“

Professor Johannsen: „Es ist dies eine Frage, die von dem gewählten Komitee behandelt werden soll.“

Mr. Dorph-Petersen

made announcements in regards to the excursions to Tystofte June 11 and to Amagergaard June 13.	machte einige Bemerkungen betreffend die Exkursion nach Tystofte und Amagergaard.
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Professor Johannsen:

“The program for the meetings is now completed. Are there any questions?”	„Das Programm der Sitzung ist jetzt beendet. Hat jemand noch etwas zu bemerken?“
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Dr. Buchholz fragte, ob jemand beobachtet hätte, ob das niedrige Körnergewicht Einfluß auf die Keimfähigkeit hat.

Direktor Douven fragte, ob es wünschenswert sei, die Magdeburger Normen zu gebrauchen.

Professor Johannsen:

These questions should be referred to the elected committee. A motion to adjourn was now in order, but before it is made wished to express his appreciation of the courteous form in which the discussions had been carried on and hoped that the conference had not been held in vain. Wished to thank each delegate for coming and to extend a special thank to Mr. Clark for coming “d’outre mer”.	„Dies sind spezielle Fragen, deren Behandlung nun dem gewählten Komitee zufällt. Ich muß jetzt diese Sitzung und damit den Kongreß schließen, und ich tue das mit großer Befriedigung. Herzlichen Dank allen für die Teilnahme und das kollegiale Zusammenwirken. Ich hoffe, daß der Kongreß nicht umsonst gewesen ist.“
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Professor Dr. A Voigt:

"International conference is like a germination test with sprouted seed. The seed sprouted in 1906 and in 1910 and then began to dry up. Had it not been for the energy and initiative of Professor Johannsen, Mr. Dorph-Petersen and Sir Lawrence Weaver it would never have come to live again. Hearty thanks must be expressed to these three by a 3 fold Hurrah!"

„Die internationale Verständigung über die Bewertung landwirtschaftlicher Sämereien entspricht einem allgemeinen Bedürfnis. Der Dank für diesen 3. Kongreß gebührt Sir Lawrence Weaver. Das Gelingen des Kongresses verdanken wir aber in erster Linie und überhaupt der vorbereitenden Tätigkeit unseres lieben Freundes Dorph-Petersen, dessen mustergültige Anstalt und dessen segensreiches Wirken für die dänische Landwirtschaft und den dänischen Saathandel hierfür die besten Garantien boten, und der ebenso sachkundigen wie lebenswürdigen Geschäftsführung unseres allverehrtesten Präsidenten, Professor Johannsen. Ich spreche hiermit beiden den Dank des Kongresses aus und bitte Sie, meine Herren, dies durch ein dreifaches Hoch zu bestätigen.“

Sir Lawrence Weaver wished to claim a father's privilege of speaking to his children and could not leave the room without thanking Professor Johannsen and Mr. Dorph-Petersen. Professor Johannsen combined the charm of a patriotic Dane with that of a citizen of the world and his sweetness of temper is apparent in both roles. Would return to England and try to emulate Johannsen's skill and tact and Dorph-Petersen's energy and modesty. Expressed his thanks to the staff of assistants.

Mr. Insulander wished to express his thanks to Professor Johannsen and Mr. Dorph-Petersen and added the thanks of his government to what had been said before.

Professeur Bussard s'est associé à ces déclarations.

Professor Johannsen

expressed his appreciation of the friendly words that had been said. The meeting was now adjourned.

dankte für alle die freundlichen Worte und schloß den Kongreß.

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REPORT
OF THE
FOURTH INTERNATIONAL SEED TESTING CONGRESS.

**COMPTE RENDU DU 4^{me}. CONGRÈS INTERNATIONAL
D'ESSAIS DE SEMENCES.**

**BERICHT ÜBER DEN IV. INTERNATIONALEN
KONGRESS FÜR SAMENPRÜFUNG.**

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DELEGATES PRESENT ON THE 7TH JULY.

1. Prof. Stapledon (England & Wales). 2. M^r S. P. Mercer (Northern Ireland). 3. M^r Constantinidi (Greece). 4. M^r Eastham (England & Wales). 5. Prof. Voigt (Germany).
6. Prof. Bussard (France). 7. D^r von Degen (Hungary). 8. M^r Dorph-Petersen (Denmark). 9. Sir L. Weaver (England & Wales). 10. Prof. Johannsen (Denmark).
11. M^r Insulander (Sweden). 12. D^r Volkart (Switzerland). 13. D^r Andronescu (Roumania). 14. Sir D. Hall (Int. Agricultural Institute). 15. D^r Buchholz (Norway). 16. Prof. Zaleski (Poland).
17. Prof. Munn (U.S.A.). 18. M^r Devoto (Argentina). 19. D^r Franck (Holland). 20. M^r Wieringa (Holland). 21. Prof. Showky Bakir (Egypt). 22. Prof. Kuleschhoff (Ukraine).
23. D^r Pavlosak (Czechoslovakia). 24. D^r Chmelar (Czechoslovakia). 25. D^r Gentner (Germany). 26. M^r Main (Scotland). 27. M^r Naceritch (Lithuania). 28. M^r Clark (Canada).
29. M^r Lafferty (Irish Free State). 30. M. Douven (Belgium). 31. M^r Anderson (Scotland). Others present include representatives of the British Ministry of Agriculture, the Stockholm Institute, the Agricultural Institute, the Int. Agricultural Institute, and members of the Staff of various official seed testing stations.

FOREWORD.

The First International Seed-Testing Congress was held in Hamburg from the 10th to 14th September, 1906, and the Second took place in Munster and Wageningen from the 13th to 15th May, 1910.

Professor A. Voigt of Hamburg was the leading spirit of both these Conferences, and the papers were read and the discussions were held in German. The object of these congresses was, amongst others, to obtain uniform rules of analysis for the various seed-testing stations, but no Association was formed and no co-operative investigations or research took place during the period between the Conferences. Reports of the proceedings will be found in "Jahresbericht für angewandte Botanik," viz., in Vierter Jahrgang 1906, pp. 211-347, and in Achter Jahrgang 1910, pp. 209-273, respectively.

As a result of suggestions emanating from the English Ministry of Agriculture and Fisheries, the Third Congress was held in Copenhagen in June, 1921. Delegates from sixteen countries took part in that Conference, at which many seed-testing questions of international importance were discussed. The Congress resulted in the formation of the European Seed Testing Association, the principal aim of which was to obtain greater uniformity than had hitherto been the case in respect of analysis results at the various seed-testing stations. The report of the Conference in question, "Discussions at the International Seed Testing Conference in Copenhagen, 6-10 June, 1921," may be obtained upon application to the Director of the Danish State Seed Testing Station at Copenhagen, price 3s. 9d. a copy. At that Conference an invitation from the British Government that the Fourth International Seed Testing Congress should be held in England in 1924 was accepted.

The following is a report of the proceedings of that Congress, held at Cambridge from the 7th to the 12th July, 1924, at which twenty-six countries were represented. In addition to the discussion of many important matters relating to seed testing, it was decided to enlarge the scope of the European Seed Testing Association formed at the Copenhagen Congress, to extend its activities to all the countries of the world in which the testing of seeds is practised, and to re-constitute it under the name of the International Seed Testing Association.

The object of this new Association is that of "advancing all questions connected with the testing and judgment of seeds," which is to be attained by comparative tests and research at the various seed-testing establishments throughout the world, by standardising the methods and terms used in connection with seed testing, and by the organisation of Congresses, publication of technical papers, &c. Full particulars of its methods of procedure will be seen in the Constitution of the Association which is printed in English, German and French in this Report (*see* pp. 115-117, pp. 217-220, and pp. 171-174, respectively).

MINISTRY OF AGRICULTURE AND FISHERIES,

LONDON,

March, 1925.

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FOURTH INTERNATIONAL SEED TESTING CONGRESS.

CAMBRIDGE, 7TH-12TH JULY, 1924.

Monday, 7th July.

Morning Session.

On Monday, 7th July, 1924, at 11.30 a.m., the Fourth International Seed Testing Congress assembled in the Council Room of the National Institute of Agricultural Botany, Cambridge.

Sir Lawrence Weaver (Chairman of the Council of the Institute), on behalf of the British Government, the Minister of Agriculture and Fisheries and the Council of the Institute, welcomed the Delegates, and expressed the great pleasure it gave him to renew the very pleasing friendships which had commenced in Copenhagen on the occasion of the 3rd International Congress held in 1921. He expressed sorrow at the death of Mr. Bruijning, referred in glowing terms to his services in connection with seed testing, and welcomed Dr. Franck who had succeeded Mr. Bruijning as Director of the State Seed Testing Station at Wageningen.

He thought that the venue of the Congress was appropriate, and that there was some advantage in being able to carry out their deliberations in the atmosphere of a University town. The fact that parties of the Delegates were housed together would enable them to exchange ideas and to discuss together the business done at the meetings.

Sir Lawrence Weaver then proceeded to read the names of the Official Delegates, as follows, and asked each Delegate to make himself known to the Conference by rising :—

Country.	Name of Delegate.	Particulars.
Argentina	Sr. Don Franco Devoto	Buenos Aires.
Belgium	Mr. M. Douven	Director, Seed Testing Station, Louvain.
Brazil	Sr. Francisco de Assis Iglesias (unable to attend).	Rio de Janeiro.
Canada	Mr. G. H. Clark	Seed Commissioner, Department of Agriculture, Ottawa.
Chile	Sr. Don Charles Videla Lastra (unable to attend).	Head of Chilean Ethnological Laboratories, Santiago.
Czecho-Slovakia	Dr. F. Pavlasek	Consul, Czecho-Slovak Republic, London.
	Dr. F. Chmelař	Director, Seed Testing Station, Brunn.

Country.	Name of Delegate.	Particulars.
Denmark	Mr. K. Dorph-Petersen	Director, State Seed Testing Station, Copenhagen.
	Professor W. Johannsen	Professor, University of Copenhagen, President of the Seed Testing Board, Copenhagen.
Egypt	Prof. Mohammed Showky	Professor, Higher School of Agriculture, Giza.
	Bakir Effendi.	
England & Wales	Sir Lawrence Weaver	Chairman of Council, N.I.A.B. Cambridge.
	Mr. A. Eastham	Chief Officer, Official Seed Testing Station, Cambridge.
	Prof. R. G. Stapledon	Director, Welsh Plant Breeding Station, Aberystwyth.
Esthonia	Mr. J. Juhans (unable to attend).	Director, State Seed Testing Station, Tallinn (Reval).
	Mr. E. Kirotar (attended on the 10th July only).	Secretary to the Esthonian Legation, London.
Finland	Dr. Emil Kitunen	Director, State Seed Testing Institution, Helsingfors.
France	Prof. Leon Bussard	Assistant Director, Seed Testing Station, Paris.
Germany	Prof. A. Voigt	Director, Institute of Applied Botany, Hamburg.
	Dr. G. Gentner	Director, Official Seed Testing Station, Munich.
Greece	Mr. S. X. Constantinidi (attended on the 7th July only).	Consul General, Greek Legation, London.
Holland	Dr. W. J. Franck	Director, State Seed Testing Station, Wageningen.
	Mr. G. Wieringa	Botanist, Chief of Division, State Seed Testing Station, Wageningen.
Hunga	Dr. Arpad von Degen	Director, Royal Hungarian Seed Control Station, Budapest.
Irish Free State	Mr. H. A. Lafferty	Head of the Seed Testing and Economic Botany Division of the Department of Agriculture, Dublin.
Ireland (North)	Mr. S. P. Mercer	Chief Officer, Official Seed Testing Station, Govt. of Northern Ireland, Belfast.
Italy	Prof. Nazareno Strampelli (unable to attend).	Director, Royal Station of Grain Culture, Risti.
Latvia	Prof. Varsberg (unable to attend).	Riga.
Lithuania	Prof. S. Nacevitch	Professor, Agrarian School, Dotnava.
Norway	Dr. Yngve Buchholz	Director, State Agricultural Chemical Control Station and Seed Control Institution of Christiania.
Poland	Prof. Ed. Zaleski	Director, Agricultural Experimental Institute, Jagellonian University, Cracow.
Roumania	Dr. D. I. Andronescu	Ministry of Agriculture, Bucarest.

Country.	Name of Delegate.	Particulars.
Russia -	Prof. B. Issatchenko	Director, Seed Testing Station, Botanical Garden, Leningrad.
Scotland -	Mr. T. Anderson	Director, Seed Testing Station, Board of Agriculture for Scotland, Edinburgh.
	Mr. A. Main	Chief Inspector, Board of Agriculture for Scotland, Edinburgh.
Spain -	Don Antonio Garcia Romero (unable to attend).	Director, Central Seed Testing Station, La Moncloa, Madrid.
Sweden -	Mr. P. E. G. Insulander -	Director General and Chief of the Swedish Directorate General of Agriculture, Stockholm.
	Mr. 'M. de Wachenfelt (Supplementary).	Agricultural Adviser, Swedish Legation, London.
Switzerland	Dr. A. Volkart	Director, Institute for Agricultural Experiments, Oerlikon-Zürich.
Ukraine -	Prof. N. Kuleschhoff	Director, Kharkow Seed Testing and Control Station.
International Agricultural Institute, Rome.	Sir A. Daniel Hall	Chief Scientific Adviser, Ministry of Agriculture, London.

Secretary to the Congress. Mr. H. Chambers (Ministry of Agriculture and Fisheries).

Sir Lawrence Weaver expressed regret that, for administrative reasons, the Government of the United States of America had not appointed official delegates, but stated that the Congress had the advantage of the presence of Professor M. T. Munn, President of the Association of Official Seed Analysts of North America.

(At a subsequent stage in the proceedings the Congress also welcomed Mr. Edgar Brown, Botanist in Charge, United States Department of Agriculture, Washington.)

Sir Lawrence Weaver also welcomed the following additional observers :—

Mr. Peter Krosby	} Norway.	
Miss Astri Frisak		
Miss M. L. Yeo		- Representing the International Agricultural Institute, Rome.
Miss K. Sjelby		Who had assisted Mr. Dorph-Petersen with the great burden of work which had fallen upon him since the 3rd International Congress met in Copenhagen in 1921.

(Dr. J. M. Saulnier, Chief of the French Phytopathological Service, Paris, also attended as an observer during the last days of the Congress.)

Continuing, Sir Lawrence Weaver said that all those present were immensely indebted to the European Seed Testing Associa-

tion, which was formed at the 1921 Congress. That Association and Mr. Dorph-Petersen were one, and but for him there would have been no Association and no Congress. Both Mr. Dorph-Petersen and Dr. Volkart had done extremely valuable work. Those present would look forward with the greatest possible interest to Mr. Dorph-Petersen's report on the past activities of the Association, and to his proposals for continuing its admirable work. There was, he thought, a feeling in the minds of some delegates that the Association should be made international. Whether that could be achieved, or whether contact could be established between Europe and America, would be discussed later. The keynote of the work of the Association during the past three years had been "efficiency and uniformity," and he thought that the closer they got to the goal of uniformity in seed testing methods the better it would be, both for those working at seed testing stations and for the seed trade, which was looking to that goal for the smooth working of the industry.

Sir Lawrence Weaver then formally declared the Congress open, and the meeting proceeded to elect a Chairman.

Mr. Dorph-Petersen thanked Sir Lawrence Weaver for his kindly words to him as Chairman of the European Seed Testing Association, and on behalf of the delegates present he thanked Sir Lawrence, as representative of the British Government, and Mr. Chambers, Organising Secretary, for the admirable arrangements which they had made for the holding of the Congress. He said that the delegates who attended the 3rd International Congress at Copenhagen regarded Sir Lawrence as the "father" of that Congress, and he proposed that he be elected Chairman.

This proposal having been received with acclamation, *Sir Lawrence Weaver* intimated that he was proud to accept the office of Chairman, but he suggested that Professor Johannsen should act as Joint-Chairman. This proposal was unanimously accepted.

It should be stated that throughout the meetings Professor Johannsen rendered admirable and invaluable service to the Congress by his brilliant renderings, in English, French and German, of summaries of the speeches made by the delegates.

The programme of business (which had previously been circulated to the delegates) and particulars of various excursions and functions having been announced, *Mr. A. Eastham* read the following paper :—

The Work of the Official Seed Testing Station for England and Wales.

BY

A. EASTHAM,
Chief Officer.

The work of the Official Seed Testing Station for England and Wales may be divided broadly into four main divisions, namely :—

1. Testing for Trade purposes.

2. Testing of samples taken from Licensed Private Stations.
3. Testing of Control samples taken by Inspectors in accordance with the regulations issued under the Seeds Act, 1920.
4. Investigational work.

Testing for Trade Purposes.

Under this heading may be included all tests made on samples from merchants, farmers or other interested parties, either for their own information or for the purposes of declarations under the provisions of the Seeds Act. Such samples are classified into four main groups or sections, namely, Clovers, Grasses, Cereals and Pulses, Roots and Vegetables, each group being handled separately in the laboratories set aside for that purpose. Furthermore, the whole of the record system of the Official Station is based upon this grouping, which will be explained in detail during the inspection of the Station.

Although the staff of the Station is divided into sections, each dealing with one of the four groups mentioned, yet each individual analyst is trained in the work of all sections, so that analysts can be transferred from one section to another as occasion demands. In addition to being so trained, each analyst, before having her permanent appointment confirmed, is required to qualify in all branches of seed testing at one of the examinations annually held by the Station.

The methods employed at Cambridge follow very closely those in use at the Continental stations, with some minor exceptions. Statements as to the methods employed for each kind of seed have been prepared and placed in each laboratory for the information of the delegates. Some idea of the number of trade samples dealt with may be gathered from the following figures for the years 1921-23. The figures for the past season are not yet available, but in all probability will be somewhat less than those quoted below for the two previous seasons.

1922-23.	1921-22.
19,829	23,865

Testing of Samples taken from Licensed Private Stations.

As, no doubt, most of you are aware, many of the seed firms in this country are licensed to test seeds in their own private stations. Such licenses are granted by the Ministry of Agriculture and may be granted for one or more classes of seeds. Licenses are granted only to such firms as the Ministry are satisfied will carry out tests in a satisfactory manner and provided that an analyst approved by the Ministry is placed in charge. Furthermore, suitable apparatus is required to be installed and the methods of testing prescribed by the Ministry must be followed. Each licensed station is required to keep a complete record of all tests made, and the samples tested must be preserved for at least three months. Periodically, inspectors visit such stations and take samples of the seeds that have been tested. These samples, or "licensed station reserve portions" as they are called, are then forwarded to the Official Station where tests are made and the results obtained by the licensed stations checked. Just as it is the aim of the Official Analysts' Associations to promote greater uniformity of methods and results amongst official stations, so it is the endeavour of the Official Station to develop greater uniformity between the Official Station and the licensed stations of England and Wales. With a view to increasing such uniformity, a series of "referee samples" has been sent to the various licensed stations during the past season, the results of which are proving of much interest. Each year also the Official Station conducts a seed-testing course of about one month's duration for the training of commercial analysts. In this way they become familiar with the methods employed at the Official Station. At the end of this course examinations are held and certificates in seed testing issued to the successful candidates. Each year also it is proposed to hold, at the close of the course, a conference to which will be invited, not only analysts from the

Official Stations of Great Britain and Ireland, but also those in charge of licensed stations throughout the country. The first of such conferences was held last year with satisfactory results. The holding of such an annual conference is in our opinion very desirable as it brings the analysts together for the discussion of common problems. At the same time the analysts become acquainted with each other and familiarise themselves with the work of the Official Station. The development of uniformity is very much in the interests both of the trade and of the official stations, and it is the intention of the Official Station to develop it in every possible way. It is hoped to bring the Official Station and the licensed stations still closer together by the means of a news-letter which will be issued at regular intervals to such stations. This will make known the results of investigations conducted at the Official Station and will also supply such other information as may be of interest to the trade analysts.

Testing of Control samples taken by Inspectors in accordance with the Regulations issued under the Seeds Act, 1920.

These are samples which are taken by Inspectors in the manner prescribed under the Seeds Act. Such samples are forwarded to the Official Station by the Inspectors. Upon the completion of the tests the results are reported to the Ministry of Agriculture, by whom the results are then communicated to the person or firm concerned. In this way a check is kept upon the sale of seed throughout the country, and infringement of the provisions of the Seeds Act detected. The sole function of the Official Station in connection with Control samples is the furnishing of an official report as to the purity and germination of such samples for the information of the officials charged with the administration of the Seeds Act. In the case of legal action being taken, the necessary proceedings are undertaken by the Ministry. Such proceedings, of course, are in most cases based upon the report issued by the Official Station.

Investigational Work.

Since its establishment a considerable amount of investigational work has been carried out by the Official Station, and it is hoped to extend such work in the future.

Amongst the more important problems which are under investigation at the present time may be mentioned the following:—

Very extensive experiments in respect to loss of vitality in seeds stored under varying conditions.

Study of delayed germination with special reference to cereals.

Hard seeds and the determination of their real value when present in leguminous seeds.

The relation between the germination of peas in the laboratory and the germination in the field.

The germination of Sainfoin with special reference to Broken Growths.

A study of the plumular growths in grasses.

The delegates then visited the laboratories and other parts of the Official Seed Testing Station, and were subsequently entertained at lunch by the Council of the Institute.

Afternoon Session.

The Congress resumed at 3 p.m.

Mr. Dorph-Petersen referred with emotion to the regretted death of their admirable and revered colleague Mr. Bruijning, and the delegates stood in silence as a tribute to his memory.

Mr. Dorph-Petersen then read his report on the activities of the European Seed Testing Association which was inaugurated at the Copenhagen Congress

The Work of the European Seed Testing Association 1921-24.

BY

K. DORPH-PETERSEN,

Director of the Danish State Seed Testing Station.

After the European Seed Testing Association was formed at the International Seed Testing Congress at Copenhagen in 1921, a Committee, consisting of Director F. F. Bruijning, Wageningen, Director Dr. A. Volkart, Zürich, and myself, was elected to direct the work of the Association. Unfortunately, Dr. Bruijning passed away very shortly after this, and the Association lost thereby a valuable supporter. Dr. Bruijning carried out a very remarkable and self-dependent work of organisation at the Seed Testing Station in Wageningen, a work with which I have several times had the opportunity of familiarising myself. We will remember him and his work on this occasion. At a meeting held in Prague in September, 1921, the remaining members constituted themselves a committee of the whole, with Dr. Volkart as secretary. At the urgent request of Dr. Volkart I assumed the chairmanship. We agreed to endeavour to carry on the work until the Conference in England in 1924, and to leave it to this Conference to elect a new Committee.

Planning of the Work.

At the meeting in Prague the Committee agreed on the object of the work, its lines of direction and its division. In the proposition submitted by Sir Lawrence Weaver at the Congress in 1921 it is laid down that the object of the Association should be a unification of the seed testing methods in Europe and of the methods of expressing the results of analysis and the quality of the seed analysed. Dr. Volkart and I agreed not to go too far in the first-mentioned direction, as specially binding instructions would scarcely be maintained, and also as it would be necessary to take into consideration local conditions and the available power and means. It might suffice to give the lines of direction for future work, supposing these to be followed, the principal object being the attainment of uniform results. The steps to be taken to obtain this should be left to the various heads to choose; the Committee should confine itself to giving information when desired. In order to limit the work, this should comprise, provisionally, only official seed testing stations.

It was decided to divide the work so that Dr. Volkart should undertake the execution of comparative investigations of provenance, whereas I should undertake comparative purity and germination tests, &c., and carry on the correspondence with those Institutions which were, or intended to be, members of the European Seed Testing Association.

Provenance Determinations.

These are the lines mainly followed since the meeting in Prague. Being most experienced in respect to the question of provenance, Dr. Volkart—whose station has for a number of years played an important part in respect to the determination of the origin of seed—has carried into effect comparative provenance determinations. This question is recognised as being one of the most difficult in connection with seed testing and is one that requires considerable study and intense co-operation if positive results are to be obtained. Dr. Volkart will read a paper on these determinations on Wednesday, 9th July.

Comparative Tests.

Even before the Congress at Copenhagen, a series of "Referee" seed samples (25) was distributed for analysis. In the report of this Congress,

a summary is given of the results received from 19 stations in Europe, 4 in America and 1 in Japan.*

Immediately after the Congress I wrote to these stations and drew attention to those of their results which differed by more than a reasonable latitude from the average figures of the results obtained at the large stations, and which results agree generally within the latitudes fixed in the Rules of the Danish State Seed Testing Station.

After the Congress, a new series of samples was sent out, consisting of 24 seed samples, and a correspondence, similar to that mentioned above, was carried on with the 43 stations (37 European, 4 American, 1 New Zealand and 1 Japan), which sent in results. From Table 1 (*see* pp. 21-26) it will be seen that these results agree, as a rule, within reasonable latitudes, as far as a series of stations is concerned. Many of those stations which arrived at similar results have rules for seed testing which differ in many particulars; some have very brief rules and others have no official rules at all. On the other hand, one cannot help noticing that results from stations which have somewhat detailed common rules for seed testing are, in many cases, rather different.

The main points are that the lines of direction for seed testing are similar and that the staffs are well-trained and experienced. It is, therefore, unfortunate when the seed testing work in a country is divided up between many small stations, as, for instance, in Germany and Sweden, where the seed testing stations are frequently offshoots of chemical institutions. A centralisation of the work, with one, or a few, well equipped seed testing stations, would undoubtedly be the best way to attain more uniform results.

A comprehensive correspondence has been carried on with the stations partaking in the enquiry and also with others. I have endeavoured to point out the main causes of the greatest discrepancies and have found that, for instance, seeds attacked by larvæ, or poorly developed seeds, shrivelled and injured seeds in the leguminous species, "hard seeds," and especially "broken seedlings," &c., have been subject to very different valuations. The drawing of pure seed for the germination test, differences in temperature and moisture, and, possibly in one case only, conditions of light, &c., are all factors that have occasioned discrepancies. It must, however, be noticed that the samples in question were difficult to test; for example, they contained many "doubtful" seeds, which have been judged very differently. In one case the samples were not considered satisfactory because of this; but, in my opinion, it is best to send samples of this kind for comparative analysis, as it is easy enough to obtain corresponding results with samples which do not present any difficulties in testing. Most of these and other questions will be referred to in other papers read at this Conference, and an opportunity will be given for discussing them. All seed testing stations have adopted the so-called "Continental method," with the exception of the station in Dublin, where the so-called "Irish method" is still used for grass species. The Dublin station has made the comparative analysis according to both methods.

In November, 1923, new "Referee" seed samples (21 samples of 19 species) were sent out to 54 stations. The results obtained at 45 stations (38 European, 6 American and 1 Japan) appear in Table 2 (*see* pp. 27-32). It is a pleasure to see that they agree, generally, better than was the case with the two former series, although the last series of samples was the most difficult to test. Great differences still exist, however, between the results of some of the stations.

"Other Crop Seeds" and Weed Seeds.

In earlier comparative investigations the contents of "other crop seed" and weed seed have not been quoted in percentage by weight. Many

* *See* pp. 76-83, "Discussions at the International Seed Testing Conference in Copenhagen, 6-10 June 1921," by K. Dorph-Petersen.

stations have not specified at all the species found in the tests. In Table 4 (see pp. 34-37) a summary is given containing the percentages by weight of "other crop seed" and weed seed found at the various stations together with the quantity of seed examined. Some of the results agree very well, but, in the case of several seed testing stations, considerable differences exist. One of the reasons for this is that species such as *Bromus mollis*, *Setaria* sp. and *Melilotus* sp. are at some stations considered crop seed, at others weed seeds. As an opportunity of discussing the question of weed seeds will be given later, I will not enter into it now at greater length.

Another source of different results is that the quantity tested for content of "other crop seed" and of weed seed has in many cases been too small. At the Copenhagen Station the average samples used for this purpose, when maximum figures are guaranteed for contents of "other crop seed" or weed seed, are ten times as large as those which are usually examined for purity.

In a few cases the discrepancies are due to the stations not having separated, or only partly separated, certain seed species from the pure seed. This is, for instance, true as to the content of *Lolium* sp. in the sample of *Festuca pratensis* No. 73A (see p. 36).

Besides the examinations of the samples of agricultural seed, a few stations have made comparative tests of forest seed samples. As Table 3 shows (see p. 33), some results agree rather well, whereas others are very different. As it is desirable to continue these examinations, I ask those heads of seed testing stations interested in the matter to agree to participate in new tests.

With regard to garden seeds, comparative tests have been made at the stations at Zürich, Wageningen and Copenhagen. I have requested Dr. Franck at Wageningen, to execute new comparative tests on garden seeds at Stations which are interested in such examinations.

In respect to agricultural seeds, I consider it advisable in the future to omit some of the species tested in the earlier enquiries and admit others. I ask that proposals with regard to this be made during the discussion.

Although there is good reason to say much more about this principle work of the Association during the three years, I dare not tire my colleagues, but must leave the matter for subsequent discussion at the meeting, or, if it is preferred, later on between ourselves. I have welcomed the arrangement by which we are accommodated at Colleges, because I consider it a great advantage to live together in this nice, quiet University town, rather than to be scattered, as would have been the case in London.

At the Conference in Copenhagen it was agreed that the European Seed Testing Association should keep in view the possibility of a union with North America. Correspondence with the leading seed testing authorities in North America, where a similar referee work is carried out, has therefore been active during the last three years. The heads of the seed testing stations in America, with whom we have corresponded, have shown great interest in the matter. I was invited to attend the annual meeting of the North American Association of Official Seed Analysts held on 27th December, 1923, in Cincinnati, to read a paper on our common work. I was unable to go myself, but I sent a report of the work of the European Seed Testing Association to be read at the Conference.

In connection with the comparative tests, I beg to draw attention to the suggestions submitted by Professor Schribaux and Dr. von Degen at the two former Seed Testing Conferences (see pp. 120-121 in the Report of the Congress at Copenhagen in 1921). Comparative tests, as suggested in paragraphs 1 to 5 of that Report, have been carried out. Before tabulating the results, I asked the various stations whether they objected to their names being published in connection with the results received from them, but no one has objected to such publication.

It has been impossible for me, on the basis of the results obtained, to suggest anything with regard to *international latitudes* for all the stations which have participated in the work, as the results obtained are too

variable for this purpose. If it were possible to select the results from certain stations, there would probably be no difficulty in proposing suitable latitudes.

It was also desired that suggestions for *common rules for seed testing*, based on the various existing rules, should be submitted to this Conference. It has, however, been impossible for me to work these out on account of the present conditions. I consider it desirable that a Committee be appointed, consisting of the heads of the most important seed testing stations, to draw up a suggested scale of international latitudes and eventually of common rules of analysis. The proposals should be circulated to members of the Association for their observations, final decisions being made at the next international seed testing conference.

Dodder Committee.

At the Congress in Copenhagen it was emphasised that it would be of significance, in connection with the stipulation of a dodder latitude, if those areas within which dodder ripens and is able to do damage could be definitely fixed. The matter was referred to a Committee consisting of five members from those European countries where dodder is prevalent. For several reasons, particulars of which Dr. von Degen will give to-morrow, the work of this Committee is not yet accomplished.

Correspondence with, and Visits to, Foreign Seed Testing Stations.

The work of the Committee has occasioned an extensive correspondence which has resulted in our getting into touch with numerous colleagues, some outside Europe, many of whom proposed subjects for discussion at the Congress. Several of these subjects will be discussed in the course of the following days, but, as the time is strictly limited, it has been necessary to omit some of them.

I have made a few journeys in order to discuss the work of the Association with several colleagues. This forms an important link in the work of the Association as it contributes to the understanding of the significance of co-operation. In Copenhagen, in 1921, it was proposed that principals and assistants at the various stations should have the opportunity of seeing and participating in the work for short periods at the large, well-equipped seed testing stations. Preliminary steps have been taken in that direction. Two assistants and later on the head of the English Official Seed Testing Station, National Institute of Agricultural Botany, Cambridge, paid a visit of several days to the Danish State Seed Testing Station. Norwegian, Swedish and Finnish visitors have also been to the Copenhagen Station in order to familiarise themselves with our methods and short visits have been paid by heads of seed testing stations all over the world. Two of our lady assistants, who have carried out useful work at the Danish State Seed Testing Station during periods of eighteen and thirteen years respectively, were selected two years ago to take charge one of the purity and the other of the germination laboratories when the present elderly assistants resign their positions. After having studied systematic botany, plant physiology, heredity and microbiology, the two assistants passed an examination in these subjects at the Royal Danish Agricultural High School. They have further shown that they are able to use the German and English languages in connection with seed testing. They must, moreover, have read the most important literature on seed testing in these languages. These two assistants, Miss Lassen and Miss Suell, have now commenced a journey to some of the principal European seed testing stations and are at present working here, at Cambridge. I hope they will get the opportunity of making themselves familiar with the work in the purity and germination laboratories of the various stations. In my opinion the best way to attain uniform results is to be personally acquainted with the seed testing methods. This is more valuable than getting the information merely from printed rules, where details, which often seem unessential but are, nevertheless, of the greatest significance to the work, cannot be described. If it is so desired, these

two assistants will give information with regard to the work of the Danish State Seed Testing Station. I am hopeful that they, as well as the stations they visit, will derive advantage from this arrangement.

Common Journal.

Since 1921 the question of publishing a common organ for the members of the Association has been under consideration. Articles on seed testing and related subjects have hitherto been scattered in a great many periodicals all over the world. The common organ would contain partly original articles, and partly short summaries of articles appearing elsewhere. The main reason why the idea of this journal has not yet materialised is lack of funds, as no station has yet contributed pecuniary assistance to the work of the Association. One of the main objects of a journey I made abroad in the autumn of 1923 was to discuss with the International Institute of Agriculture in Rome the possibility of obtaining support from that Institute for this Journal. The Secretary General, Dr. Dragoni, and the Chief of the Information Office for Agriculture, Dr. Saulnier, agreed to suggest to the permanent Committee of the Institute that the Institute's *Bulletin* should take articles on seed testing, &c., provisionally up to 100 pages annually. The *Bulletin* is printed in four languages: English, French, Italian and Spanish. It was at one time also printed in German, but as those countries where the German language is used are not at present contributing to the *Bulletin*, this language is now omitted. It is to be hoped that the countries concerned will soon again be able to contribute, because the German language is used by many who are interested in seed testing. Reprints of the articles, in whichever of the four languages is desired, will be distributed to members of the Association, which will only have to pay the cost of postage. This proposition has been passed by the permanent Committee, provisionally for a year. In my opinion the Association has thus obtained a common organ on favourable conditions. The article "How long do the various seed species retain their germinating capacity?" distributed to all those present, will be embodied in the *Bulletin* which is published in July.

At the Congress in Copenhagen it was expressed by Sir Lawrence Weaver that a machine was under construction and should soon begin to function. It can now be said that a commencement is made but the end is still far off. It is hoped that a new impulse will be given here in Cambridge.

Means for the Work.

Whether it will be possible to continue the work depends among other things on economic conditions. Since 1921, Denmark has met most of the not unimportant expenses (above £400) connected with the work of the European Seed Testing Association. The State Seed Testing Station is empowered by our Ministry of Agriculture to meet the expenses caused by this work, but this cannot be continued indefinitely. I am, therefore, hopeful that many of the delegates at this Congress have come empowered to bind their Governments to contribute in the future to the funds of the Association.

Statutes.

In September, 1923, Dr. Volkart and I met in Zürich and discussed a draft of statutes of the Association, which had been compiled by Dr. Volkart. The draft—copies of which are distributed—contain clauses as to the object, membership, means, meetings, course of business, election of committee members, voting, &c. These draft statutes will be submitted to the Conference by Dr. Volkart to-morrow for consideration.

Seed Dealers' Congress.

The desirability of holding a seed dealers' congress simultaneously with the seed testing congress has been expressed by Seed Trade Associations in several countries. A joint meeting has therefore been arranged for

Wednesday afternoon at which matters of interest to both parties will be brought up for discussion.

It is to be hoped that the present conditions will not hinder the co-operation which—in order to be really international and of real significance—must take place between experts in all countries where official seed testing stations exist or are planned.

You are now welcome to make any remarks you wish as to my paper, and I earnestly request you to criticise anything with which you disagree. Dr. Volkart and I have carried out the work alone during the past three years; we are aware that much more ought to have been done, but the conditions have been difficult. Each of us has been very busy with our official duties. We have, therefore, not been able to devote as much time to the co-operative work as we should have wished, nor have we had the means for obtaining the necessary assistance.

I thank the English Government for having invited us to this Conference, and also those gentlemen, especially Sir Lawrence Weaver and Mr. Chambers, who have had the trouble of making the necessary arrangements. My best thanks also to those who have agreed to read papers, and to those colleagues who have contributed to the work during the past three years.

As Chairman of the Association I beg to extend to all those present a hearty welcome to the Congress. Especially I address this welcome to those colleagues who did not take part in the Conference at Copenhagen. I was very sorry when Professor Munn and Dr. Brown wrote me that the United States of America would not be officially represented at the Conference, as I had hitherto derived so much benefit from the co-operation of our American colleagues and had, consequently, looked forward with much pleasure to meeting them here. I telegraphed at once to both Professor Munn and Dr. Brown inviting them to attend the Congress in an unofficial capacity, and to my great pleasure Professor Munn has been able to come. We bid him, as President of the Association of Official Seed Analysts of North America, special welcome. We also thank Mr. Clark, from Canada, very much for taking such a long journey in order to take part in the Congress. We take it as an indication that our colleagues on the other side of the Atlantic Ocean desire to co-operate with us. To this co-operation I extend a hand on behalf of the European Seed Testing Association.

I am hopeful that we shall now have some very instructive and successful days together.

Resultate vergleichender Untersuchungen der Samenproben von 24 Arten von der dänischen Staatssamenkontrolle am 24. März 1922 versandt.

The situation of the station. Die Lage der Anstalt.	The results sent off from the station concerned. (1)	TRIFOLIUM PRATENSE 26.						TRIFOLIUM REPENS 27.						TRIFOLIUM HYBRIDUM 28.					
		Purity (%)	Germinating speed (%)	Germinating capacity (%)	Broken growths (%)	Without hard seeds (%)	Pure germinating seed (%)	Purity	Germinating speed	Germinating capacity	Broken growths	Without hard seeds	Pure germinating seed	Purity	Germinating speed	Germinating capacity	Broken growths	Without hard seeds	Pure germinating seed
1. Oerlikon-Zürich, Schweiz	25/5/22	31.8	43	45 + 0	8	36.8	36.8	93.4	54	64 + 21	0.3	59.8	79.4	90.7	77	80 + 9	3	72.6	80.7
2. København, Denmark	-/5/22	32.9	48	54 + 0	8	44.8	44.8	94.4	59	66 + 15	—	62.3	76.5	91.3	75	80 + 6	6	73.0	78.5
3. Wageningen, Holland	12/5/22	33.6	46	47 + 1	25	39.3	40.1	94.7	57	62 + 22	—	58.7	79.5	91.7	76	83 + 6	4	76.1	81.6
4. Paris, France	27/5/22	38.1	43	47 + 0	—	41.4	41.4	96.8	56	64 + 14	—	62.0	75.5	91.6	80	82 + 6	4	75.1	80.6
5. Cambridge, England	21/6/22	38.2	42	48 + 0	—	42.3	42.3	96.9	53	63 + 14	—	61.0	74.6	92.3	80	78 + 5	—	71.3	79.9
6. Edinburgh, Scotland	29/6/22	39.7	43	45 + 1	13	40.4	41.3	96.2	44	59 + 17	1	56.8	74.1	92.3	76	79 + 8	5	72.9	80.3
7. Dublin, Ireland	20/6/22	37.2	31.5	39.5 + 0.5	—	34.4	34.9	95.6	58	60.5 + 17	—	66.1	74.1	92.5	74	75.5 + 5.5	—	69.8	74.9
8. München, Deutschland	15/10/22	36.0	48	49 + 0	9	42.1	42.1	95.8	67	69 + 12	—	67.8	77.6	92.0	82	83 + 6	2	75.0	80.5
9. Hamburg, Deutschland	25/6/22	35.8	46	43 + 1	—	54.1	54.1	96.5	55	66 + 18	—	63.7	81.1	92.0	77	84 + 6	—	77.9	83.3
10. Halle a/S., Deutschland	16/10/22	33.0	44	53 + 1	12	44.0	44.8	96.5	55	64 + 17	2	61.1	77.4	92.5	72	83 + 8	4	75.9	83.8
11. Breslau, Deutschland	16/10/22	37.0	35	47 + 0	—	40.9	40.9	95.7	49	60 + 18	—	57.4	74.6	92.4	72	80 + 6	4	76.7	82.1
12. Rostock, Deutschland	16/10/22	31.8	47	59 + 1	—	48.3	49.1	95.7	59	66 + 17	—	61.8	77.8	95.1	63	76 + 5	7	69.7	74.4
13. Rostock, Deutschland	26/10/22	79.6	28	42 + 1	15	33.3	34.2	93.7	55	65 + 16	—	60.2	75.9	92.1	75	76.5 + 6	—	70.5	76.0
14. Wien, Österreich	-/6/22	74.7	58	53.5 + 0.5	—	40.7	41.1	93.1	43.5	56 + 17	—	52.5	67.5	92.1	83	76.5 + 6	—	70.5	76.0
15. Graz, Österreich	-/6/22	74.7	58	53.5 + 0.5	—	40.7	41.1	93.1	43.5	56 + 17	—	52.5	67.5	92.1	83	76.5 + 6	—	70.5	76.0
16. Budapest, Hungary	-/6/22	82.0	62	71 + 0	—	58.2	58.2	96.2	52	72 + 19.7	—	67.0	79.8	92.1	79	85 + 5.3	—	77.4	84.7
17. Praha, Czechoslovakia	11/16/22	83.6	56	60 + 1	—	52.0	51.0	95.3	64	68 + 14	—	64.8	78.1	91.2	82	85 + 9	—	77.5	85.7
18. Brunn, Czechoslovakia	17/6/22	86.1	58	64 + 0	—	52.4	52.4	95.6	60	65 + 15	—	62.1	76.5	90.5	85	87 + 7	—	78.7	85.1
19. Stockholm, Sweden	15/6/22	82.2	66	64 + 0	16	52.6	52.6	93.6	61	75 + 12	1	71.3	82.7	91.2	80	86 + 5	—	77.5	82.1
20. Örebro, Sweden	30/6/22	82.5	47	49 + 0	8	40.4	40.4	93.2	60	64 + 22	—	58.6	80.2	91.4	70	74 + 7	11	67.6	74.0
21. Lund, Sweden	25/6/22	89.4	34.5	39 + 1	17	34.9	35.8	96.6	54.5	66 + 13	2.5	63.8	78.3	93.0	71.5	81 + 7.5	10	68.8	75.8
22. Linköping, Sweden	16/6/22	77.9	54	56 + 1	—	43.6	44.4	94.6	59	64 + 19	—	60.5	80.6	91.6	77	81 + 8	4	74.2	82.5
23. Skara, Sweden	8/6/22	87.3	45	55 + 1	6.4	48.9	48.9	95.9	54	66 + 18	—	63.3	80.6	91.6	79	85 + 8	2	78.1	85.0
24. Hemsöand, Sweden	17/6/22	85.7	52	51.9 + 0.8	—	44.5	45.2	—	—	—	—	—	—	91.8	—	79.4 + 7.8	—	72.9	82.6
25. Kristiania, Norway	12/6/22	51.7	52	56	—	44.8	—	93.7	61	65 + 18	—	60.9	77.8	91.8	81	84 + 6	—	77.1	82.6
26. Trondheim, Norway	14/11/22	84.2	49	58 + 0	—	48.8	48.1	97.1	62	68 + 17	—	59.2	74.0	95.0	76	81 + 7	—	72.1	78.3
27. Bergen, Norway	31/5/22	85.7	51	59 + 0.5	—	50.6	51.0	96.6	55	60 + 20	—	58.0	77.3	95.0	76	85 + 7	—	81.4	88.1
28. Dikursby, Finland	29/5/22	80.6	15	40	—	32.2	—	93.7	22	60 + 17	—	56.2	72.1	91.5	84	81 + 3	—	65.9	72.7
29. Petrograd, Russia	25/9/22	—	—	—	—	—	—	90.6	55.5	64.9 + 16.1	—	62.7	78.2	90.8	75.7	81.3 + 13.6	—	73.8	86.2
30. Riga, Lettonia	22/6/22	84.0	44.3	61.3 + 1	—	51.5	52.3	95.6	56.3	70.7 + 16.7	—	67.6	83.6	93.3	70.5	82 + 7.7	—	76.5	83.7
31. Warszawa, Poland	9/6/22	86.0	71	77	—	66.2	—	98.0	63	72 + 2	—	70.6	82.5	92.0	83	89 + 5	—	81.9	86.5
32. Leuven, Belgique	24/5/22	88.0	72	76 + 0	—	66.9	66.9	96.7	60	69 + 16	—	66.7	82.2	95.1	83	86 + 8	—	81.8	89.4
33. Modena, Italy	26/5/22	82.3	—	51	—	31.8	31.8	—	—	61	—	54.8	78.2	92.9	80	80	—	74.3	—
34. Bologna, Italy	-/7/22	79.6	49.8	63.5	—	42.6	—	93.3	62.5	67.5 + 16.3	—	63.0	78.2	91.1	79.8	84.8 + 5.7	—	77.3	82.5
35. Madrid, Spain	28/7/22	—	—	—	—	—	—	—	—	63.5	—	—	—	—	—	90	—	—	—
36. Bucarest, Roumania	17/11/22	87.0	31.6	42.6 + 7.5	—	37.1	43.6	96.5	38.5	51.8 + 12.1	—	50	61.7	93.5	65	75.1 + 6.8	—	70.2	76.6
37. New York, U.S.A.	3/6/22	88.5	35	44 + 1	—	38.9	39.8	97.8	44	43 + 22	—	42.1	63.6	92.7	77	81 + 4	—	74.8	78.5
38. Virginia, U.S.A.	19/6/22	90.8	21	32 + 1	—	29.0	30.0	97.8	43	60 + 16	—	58.7	74.3	92.2	64	76 + 7	—	70.1	76.3
39. Kentucky, U.S.A.	26/6/22	80.4	58.5	67.5 + 0.5	—	54.3	54.7	96.5	51.5	66.3 + 18.5	—	64.0	81.8	92.6	69.3	81.5 + 8.5	—	75.5	83.3
40. Kuraishi, Canada	25/8/22	86.1	58.5	63.2 + 6.6	—	54.4	60.1	94.6	62.3	66.5 + 24.8	—	57.2	86.6	92.0	84.3	86.6 + 9.8	—	79.7	88.7
41. Kuraishi, Japan	30/8/22	79.8	36.3	68	—	40.7	—	92.4	21	61.9	—	57.2	86.6	92.0	84.3	86.6 + 9.8	—	79.7	88.7
42. Wellington, New Zealand	15/6/23	—	60	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
43. Reval, Esthonia	20/11/23	72.9	43.5	54 + 0	—	39.3	39.3	90.6	63.2	68.7 + 18.5	—	62.2	79.0	96.4	84.2	86 + 5.5	—	82.9	88.2

(1) Die Resultate von der betreffenden Anstalt abgesandt am.

(2) Reinheit.

(3) Keimsehnelligkeit.

(4) Keimfähigkeit.

(5) Gebrochene Keimlinge.

(6) Reine keimfähige Samen.

(7) Ohne harte Körner.

(8) Mit harten Körnern.

TABLE I—continued.

Results of comparative tests of seed samples of 24 species mailed March 24th, 1922, from the Danish State Seed Testing Station—continued.

The situation of the station.	The results sent off from the station concerned.	MEDIQAO SARYA 29.					MEDIQAO LUPULINA 30.					LOTUS CORNICULATUS 31.								
		Purity.	Germi- nating speed.	Germi- nating capacity.	Broken growths.	Without nating seeds.	Pure germi- nating seed.	Purity.	Germi- nating speed.	Germi- nating capacity.	Broken growths.	Without nating seeds.	Pure germi- nating seed.	Purity.	Germi- nating speed.	Germi- nating capacity.	Broken growths.	Without nating seeds.	Pure germi- nating seed.	
1. Oerlikon-Zürich, Schweiz -	26/5/22	34.3	55	62 + 23	5	58.5	84.9	38.7	90	91 + 3	5	89.8	92.8	97.4	48	54 + 38	—	—	52.6	87.7
2. København, Denmark -	5/22	38.2	45	71 + 25	1	69.3	93.7	39.4	86	89 + 3	7.5	88.5	91.4	97.5	30	57 + 36	—	—	55.6	90.7
3. Wägeningen, Holland -	12/5/22	38.2	45	69 + 27	0	57.8	92.0	39.0	86	90 + 2	—	89.1	91.4	97.8	48	57 + 36	—	—	55.6	90.7
4. Paris, France -	27/5/22	37.6	39	67 + 21	—	65.4	85.9	39.6	80	87 + 2	—	86.7	88.6	97.5	56	60 + 28	—	—	58.5	85.8
5. Cambridge, England -	21/6/22	36.0	53	64 + 22	—	62.7	84.3	39.5	80	87 + 2	—	86.6	88.6	97.6	—	—	—	—	58.5	85.8
6. Edinburgh, Scotland -	29/6/22	38.0	53	65 + 24	3	67.6	91.1	39.7	77	88.5 + 2	4	91.7	93.7	98.0	51	60 + 29	—	—	58.8	87.2
7. Dublin, Ireland -	20/6/22	36.2	81	69.5 + 22.5	—	66.9	88.5	39.2	70	88.5 + 2	—	87.8	90.8	98.0	—	—	—	—	58.8	87.2
8. München, Deutschland -	16/10/22	36.8	50	72 + 25	5	80.5	91.1	39.4	89	91 + 3	5	90.5	92.4	97.5	59	61 + 30	—	—	59.6	88.9
9. Hamburg, Deutschland -	25/6/22	36.0	53	71 + 24	9	69.1	92.6	39.9	84	96 + 3	—	95.1	98.1	98.5	46	60 + 29	—	—	59.0	89.9
10. Halle s/S, Deutschland -	16/10/22	37.3	53	70 + 20	7	69.3	88.5	39.4	76	89 + 2	8	94.0	96.8	97.5	43	62 + 30	—	—	60.5	89.7
11. Breslau, Deutschland -	16/10/22	35.9	50	66 + 27	2	64.8	89.2	38.6	71	92 + 2	9	92.5	94.5	97.5	52	64 + 28	—	—	62.4	89.7
12. Hohenheim, Deutschland -	16/10/22	36.7	58	67 + 25	—	64.1	89.2	39.5	75	90 + 2	—	92.5	94.5	97.7	61	64 + 30	—	—	62.5	91.8
13. Rostock, Deutschland -	26/10/22	34.2	47	68 + 22	9	68.2	84.8	39.5	79	88.5 + 1	4	92.4	94.3	97.4	55	62 + 29	—	—	60.4	88.6
14. Wien, Oesterreich -	2/6/22	34.0	56	72.5 + 21.5	—	68.2	84.8	39.5	79	88.5 + 1	—	92.7	94.3	97.4	55	62 + 29	—	—	60.4	88.6
15. Graz, Oesterreich -	—/6/22	37.7	60	70.5 + 21.5	—	68.2	84.8	39.5	79	88.5 + 1	—	92.7	94.3	97.4	55	62 + 29	—	—	60.4	88.6
16. Budapest, Hungary -	17/8/22	36.4	60	74 + 23	—	71.3	90.1	39.8	83	93 + 2	—	93.3	96.1	97.7	52.5	63.5 + 25.5	—	—	61.6	92.8
17. Praha, Czechoslovakia -	11-16/8/22	33.8	64	80 + 16	—	71.3	90.1	39.8	83	93 + 2	—	93.3	96.1	97.7	52.5	63.5 + 25.5	—	—	61.6	92.8
18. Brünn, Czechoslovakia -	17/8/22	34.4	54	77 + 14	1	73.6	87.7	39.6	81	96 + 2	—	96.9	98.9	97.3	46	59 + 34	—	—	57.5	90.6
19. Stockholm, Sweden -	1/5/22	36.4	54	77 + 14	1	74.2	87.7	39.6	81	96 + 2	—	96.9	98.9	97.3	46	59 + 34	—	—	57.5	90.6
20. Örebro, Sweden -	30/6/22	35.1	64	72 + 21	—	68.5	88.4	39.0	81	89 + 2	2	93.6	95.5	97.1	56	67 + 27	—	—	65.2	91.5
21. Lund, Sweden -	25/6/22	37.0	62.5	68.5 + 23	2.5	66.4	88.0	39.3	66	90 + 2	3	89.4	91.4	97.5	48.5	56.5 + 24.5	—	—	59.8	88.2
22. Linköping, Sweden -	16/5/22	31.7	62.5	72 + 24	1	66.0	88.0	39.0	89	94 + 1	3	93.1	94.1	97.6	60	58 + 33	—	—	54.1	87.9
23. Skara, Sweden -	8/6/22	37.2	55	72 + 23	—	70.0	92.8	39.6	72	93 + 2	—	92.6	94.6	98.0	32	64 + 30	—	—	62.7	92.1
24. Hernostrand, Sweden -	7/6/22	—	—	—	—	84.0	87.8	39.5	46	93 + 2	—	92.5	94.5	97.7	51	61 + 28	—	—	59.6	87.0
25. Kristiania, Norway -	12/6/22	36.5	50	80 + 4	—	84.0	87.8	39.5	46	93 + 2	—	92.5	94.5	97.7	51	61 + 28	—	—	59.6	87.0
26. Trondheim, Norway -	14/11/22	33.2	65	80 + 15	—	74.6	88.5	39.6	90	95 + 2	—	93.7	95.6	97.2	52	65 + 26	—	—	63.2	86.5
27. Bergen, Norway -	31/5/22	36.2	60	72 + 23	—	69.3	91.4	39.6	92	96 + 3	—	95.6	98.6	97.5	57	63 + 31	—	—	61.4	91.7
28. Dickursby, Finland -	29/5/22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29. Petrograd, Russia -	25/9/22	37.3	65.2	72.1 + 22.4	—	70.2	91.9	39.8	58.3	94.9 + 1.7	—	93.7	95.3	98.0	42.2	80.2 + 27.2	—	—	58.0	84.3
30. Riga, Lettonia -	22/6/22	38.5	64.7	86 + 11.1	—	84.7	95.6	39.8	91.7	95.8 + 3	—	95.6	98.6	98.6	14.2	67.3 + 25	—	—	66.4	91.0
31. Warszawa, Poland -	9/6/22	38.0	72	86 + 12	—	84.3	96.0	39.8	97	99 + 1	—	98.2	99.2	98.0	61	69 + 24	—	—	67.6	91.1
32. Leuven, Belgique -	24/5/22	36.9	70	74 + 24	—	71.7	95.0	39.8	88	94 + 4	—	93.8	97.8	97.5	52	64 + 28	—	—	62.4	89.7
33. Modena, Italy -	26/5/22	34.5	—	67	—	63.3	98.1	—	—	39	—	38.3	93.4	93.4	—	68	—	—	63.5	—
34. Bologna, Italy -	7/22	34.9	62.3	68.3 + 25.8	—	64.9	89.4	39.4	88.2	92 + 1.8	—	91.5	93.3	97.1	51	59.7 + 13.8	—	—	57.9	71.4
35. Madrid, Spain -	28/7/22	—	—	80	—	—	—	—	—	94	—	—	—	—	—	—	—	—	—	—
36. Bucaresti, Roumania -	17/11/22	36.6	56.6	83.3 + 9.5	—	80.5	89.6	39.8	35.8	65.4 + 2.9	—	64.6	93.3	97.0	40.4	65 + 16.6	—	—	63.1	78.6
37. New York, U.S.A. -	9/6/22	39.2	66	75 + 19	—	74.4	93.2	39.6	82	97 + 3	—	96.6	99.6	97.8	35	57 + 126	—	—	55.7	81.2
38. Virginia, U.S.A. -	19/6/22	39.5	67	64 + 19	—	63.7	82.6	39.9	74	86 + 3	—	85.9	88.9	97.5	35	60 + 31	—	—	58.7	88.7
39. Kentucky, U.S.A. -	26/6/22	36.1	61.5	65 + 25	—	64.1	88.7	39.6	51.3	94.5 + 1	—	94.2	95.2	97.8	42.5	64.5 + 30.5	—	—	63.1	92.9
40. Ottawa, Canada -	25/8/22	35.6	61.5	75.3 + 20.2	—	71.6	90.9	39.4	50	97 + 1.0	—	96.0	97.6	97.6	49.8	65.5 + 27.2	—	—	63.9	90.4
41. Kuraikiti, Japan -	30/8/22	38.5	83.7	78	—	69.0	—	39.4	27.8	93	—	92.4	—	96.2	38	62.5	—	—	60.1	—
42. Wellington, New Zealand -	15/6/23	88.5	83	99	—	—	—	—	90	—	—	—	—	—	66	76 + 22	—	—	—	—
43. Reval, Esthonia -	20/11/23	95.2	82.5	89.2 + 9	—	84.9	93.5	—	—	—	—	—	—	—	—	—	—	—	—	—

TABLE 1.—continued.

Results of comparative tests of seed samples of 24 species mailed March 24th, 1922, from the Danish State Seed Testing Station—continued.

The situation of the station.	The results sent off from the station concerned.	ANTHYLLIS VULNERARIA 32.				PHLEUM PRATENSE 33.				LOLIUM ITALICUM 35.				DACTYLIS GLOMERATA 36.			
		Purity.	Germinating speed.	Germinating capacity.	Broken growths.	Without hard seeds.	With seeds.	Purity.	Germinating speed.	Germinating capacity.	Pure germi- nating seed.	Purity.	Germinating speed.	Germinating capacity.	Pure germi- nating seed.	Purity.	Germinating speed.
1. Oerlikon-Zürich, Schweiz -	26/5/22	96.7	21	95+12	—	21.7	32.1	99.0	87	91	90.1	96.6	67	84	56.5	47.5	55.1
2. København, Denmark -	5/22	91.9	21	36+11	—	31.2	41.4	97.8	83	88	86.1	96.8	67	93	55.1	55.1	55.1
3. Wageningen, Holland -	12/5/22	83.4	27	46+18	—	40.9	55.9	98.8	86	88	86.9	96.9	62	80	59.8	59.8	59.8
4. Paris, France -	27/5/22	90.5	30	36+8	—	31.7	38.9	99.9	83	89	88.1	96.5	61	88	59.4	59.4	59.4
5. Cambridge, England -	21/6/22	88.1	20	31+11	—	27.3	37.0	98.9	83	89	88.7	96.5	61	88	59.4	59.4	59.4
6. Edinburgh, Scotland -	29/6/22	88.1	20	31+11	—	27.3	37.0	98.9	83	89	88.7	96.5	61	88	59.4	59.4	59.4
7. Dublin, Ireland -	20/6/22	—	—	—	—	—	—	98.9	83	89	88.7	96.5	61	88	59.4	59.4	59.4
8. München, Deutschland -	16/10/22	87.9	41	42+9	—	36.9	44.8	97.6	59	90.5	88.3	97.5	65	84	68.7	71.2	72.5
9. Hamburg, Deutschland -	25/6/22	90.3	39	36+10	—	32.5	47.9	98.9	83	86	84.5	97.3	60	88.5	66.5	66.5	66.5
10. Halle a/S, Deutschland -	16/10/22	90.7	23	37+10	—	30.8	39.9	98.9	83	86	84.5	97.3	60	88.5	66.5	66.5	66.5
11. Breslau, Deutschland -	16/10/22	87.4	23	37+14	—	32.8	44.6	98.5	83	88	86.1	96.9	67	73	67.1	67.1	67.1
12. Rohnheim, Deutschland -	16/10/22	91.8	23	36+14	—	31.9	38.6	98.5	83	88	86.1	96.9	67	73	67.1	67.1	67.1
13. Rostock, Deutschland -	26/10/22	86.4	25	36+14	—	33.7	45.8	98.5	83	88	86.1	96.9	67	73	67.1	67.1	67.1
14. Wien, Oesterreich -	2/6/22	87.9	12.5	14.5+12.5	—	12.7	23.7	97.0	83	92	90.9	97.6	32	72	68.9	68.9	68.9
15. Graz, Oesterreich -	17/6/22	88.4	25	41+11	—	36.2	46.0	98.0	81	87.7	86.8	97.9	63	69.6	68.1	68.1	68.1
16. Budapest, Hungary -	11/16/22	86.2	21	28+13	—	25.0	36.2	98.0	83	89	86.8	97.1	70	77	74.8	74.8	74.8
17. Praha, Czechoslovakia -	17/6/22	83.2	20	28+13	—	28.3	34.1	97.9	83	93	91.9	96.7	64	81	72.5	72.5	72.5
18. Brunn, Czechoslovakia -	1/5/22	93.1	28	33+11	—	45.6	52.0	98.1	83	92	91.9	96.7	64	81	72.5	72.5	72.5
19. Stockholm, Sweden -	30/6/22	87.2	28	33+11	—	30.5	39.2	98.0	83	92	91.9	96.7	64	81	72.5	72.5	72.5
20. Örebro, Sweden -	25/6/22	89.5	28	33+11	—	29.5	43.2	98.0	83	92	91.9	96.7	64	81	72.5	72.5	72.5
21. Lund, Sweden -	16/5/22	81.9	37	39+13	—	31.9	48.7	98.0	83	92	91.9	96.7	64	81	72.5	72.5	72.5
22. Linköping, Sweden -	8/6/22	92.0	—	40+13	—	36.8	48.8	98.9	83	92	91.9	96.7	64	81	72.5	72.5	72.5
23. Skara, Sweden -	7/6/22	90.6	27	30+12	—	27.9	33.5	98.8	86	88	86.4	97.4	66	71	69.2	69.2	69.2
24. Hemsö, Sweden -	14/11/22	85.6	17	20+12	—	25.7	36.0	98.3	86	88	86.4	97.4	66	71	69.2	69.2	69.2
25. Kristiania, Norway -	14/11/22	93.7	19	24+11	—	22.5	32.8	99.0	77	84	83.2	95.7	44	72	68.9	68.9	68.9
26. Trondheim, Norway -	23/5/22	90.9	16	9+6	—	8.2	13.6	98.0	66.5	85.3	84.4	99.4	24.2	—	—	—	—
27. Bergen, Norway -	25/9/22	90.9	2	45+16	—	32.0	38.8	98.0	66.5	85.3	84.4	99.4	24.2	—	—	—	—
28. Dickursby, Finland -	22/6/22	94.0	10.3	45+16	—	32.0	38.8	98.0	66.5	85.3	84.4	99.4	24.2	—	—	—	—
29. Petrograd, Russia -	9/6/22	77.2	30	43.0	—	40.7	40.7	99.8	84	87	86.0	98.5	65	73	71.9	71.9	71.9
30. Riga, Lettonia -	24/5/22	94.7	30	43.0	—	17.1	23.8	99.8	83	83	82.4	96.2	—	—	—	—	—
31. Warszawa, Poland -	26/5/22	89.4	16.2	16.5+10.2	—	14.7	23.8	98.9	79.8	83	82.1	96.6	65.3	—	—	—	—
32. Leuven, Belgique -	25/7/22	85.1	16.2	16.5+10.2	—	14.7	23.8	98.9	79.8	83	82.1	96.6	65.3	—	—	—	—
33. Modena, Italy -	25/7/22	85.1	16.2	16.5+10.2	—	14.7	23.8	98.9	79.8	83	82.1	96.6	65.3	—	—	—	—
34. Bologna, Italy -	17/11/22	91.6	16	20.3+7	—	26.8	33.3	99.0	74.6	82.1	81.3	96.2	60	68.2	65.7	65.7	65.7
35. Madrid, Spain -	3/6/22	84.4	10	31+14	—	29.8	42.5	99.0	81	83	81.9	99.2	64	72	71.4	71.4	71.4
36. Bucarest, Roumania -	20/6/22	83.6	16	20+10	—	28.1	37.0	98.6	80	85	83.8	96.9	53	70	67.9	67.9	67.9
37. New York, U.S.A. -	20/6/22	84.1	10.5	25+10	—	23.5	30.5	98.6	82	86.8	85.8	97.6	59.5	63.3	61.7	61.7	61.7
38. Virginia, U.S.A. -	25/8/22	89.6	23	38.2+6.8	—	24.2	43.0	98.0	79	82	80.4	94.0	51.1	58.2	63.6	63.6	63.6
39. Kentucky, U.S.A. -	30/8/22	87.1	23	38.2+6.8	—	24.2	43.0	98.0	79	82	80.4	94.0	51.1	58.2	63.6	63.6	63.6
40. Ottawa, Canada -	16/6/22	87.1	23	38.2+6.8	—	24.2	43.0	98.0	79	82	80.4	94.0	51.1	58.2	63.6	63.6	63.6
41. Kurashiki, Japan -	16/6/22	87.1	23	38.2+6.8	—	24.2	43.0	98.0	79	82	80.4	94.0	51.1	58.2	63.6	63.6	63.6
42. Wellington, New Zealand -	20/11/23	—	—	—	—	—	—	98.6	78	84.7	83.5	96.3	56.2	—	—	—	—
43. Reval, Estonia -	—	—	—	—	—	—	—	98.6	78	84.7	83.5	96.3	56.2	—	—	—	—

* The tests are made by the Irish method.
 * Die Untersuchungen sind nach der Irischen Methode ausgeführt.

† The tests are made by the Continental method.
 † Die Untersuchungen sind nach der Continentalen Methode ausgeführt.

TABLE 1—continued.

Results of comparative tests of seed samples of 24 species mailed March 24th, 1922, from the Danish State Seed Testing Station—continued.

The results sent off from the station concerned.	AVENA ELATOR 37.				FESTUCA PRATENSIS 38.				FESTUCA OVINA DURIUSCULA 39.				ALOPECURUS PRATENSIS 40.				POA TRIVIALIS 41.			
	Purity.	Germinating speed.	Germinating capacity.	Pure germ.-nating seed.	Purity.	Germinating speed.	Germinating capacity.	Pure germ.-nating seed.	Purity.	Germinating speed.	Germinating capacity.	Pure germ.-nating seed.	Purity.	Germinating speed.	Germinating capacity.	Pure germ.-nating seed.	Purity.	Germinating speed.	Germinating capacity.	Pure germ.-nating seed.
1. Oerlikon-Zürich, Schweiz -	88-2	12	71	83-5	88-4	78	87	74-3	63-7	80	86	58-0	3	51	71	39-3	70-8	46	76	53-8
2. København, Denmark -	89-5	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
3. Wexhoej, Denmark -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
4. Wageningen, Holland -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
5. Paris, France -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
6. Cambridge, England -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
7. Edinburgh, Scotland -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
8. Dublin, Ireland -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
9. München, Deutschland -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
10. Hamburg, Deutschland -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
11. Halle a/S, Deutschland -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
12. Breslau, Deutschland -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
13. Rostock, Deutschland -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
14. Wien, Österreich -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
15. Graz, Österreich -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
16. Budapest, Hungary -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
17. Praha, Czechoslovakia -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
18. Bräun, Czechoslovakia -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
19. Stockholm, Sweden -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
20. Örebro, Sweden -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
21. Lund, Sweden -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
22. Linköping, Sweden -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
23. Skara, Sweden -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
24. Hertsåand, Sweden -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
25. Kristiania, Norway -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
26. Trondheim, Norway -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
27. Bergen, Norway -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
28. Dikursky, Finland -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
29. Petrograd, Russia -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
30. Riga, Lettonia -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
31. Warszawa, Poland -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
32. Leuven, Belgium -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
33. Modena, Italy -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
34. Bologna, Italy -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
35. Madrid, Spain -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
36. Bucuresht, Roumania -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
37. New York, U.S.A. -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
38. Virginia, U.S.A. -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
39. Kentucky, U.S.A. -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
40. Ottawa, Canada -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
41. Kurashiki, Japan -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
42. Wellington, New Zealand -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8
43. Reval, Esthonia -	88-2	82	85	95-0	84-4	78	87	74-3	67-0	80	86	57-6	3	51	71	43-3	73-4	58	72	52-8

* The tests are made by the Irish method.

† The tests are made by the Continental method.

TABLE 1—continued.

Results of comparative tests of seed samples of 24 species mailed March 24th, 1922, from the Danish State Seed Testing Station—continued.

The situation of the station.	The results sent off from the station concerned.	POA PRATENSIS 42.				HOLCUS LANATUS 43.				BETA VULGARIS 44.						BETA VULGARIS SACHARIFERA 45.															
		Purity.		Germinating speed.		Germinating capacity.		Pure germi-nating seed.		Purity.		Germinating speed.		Germinating capacity.		Pure germi-nating seed.		Purity.		Germinating speed.		Germinating capacity.		Number of growths per 100 clusters.		Number of growths per 100 clusters.		Weight of 1,000 seeds.		Weight of 1,000 seeds.	
		68-7	34	74	50-8	45-0	69	81	36-5	60	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	
1. Oerlikon-Zürich, Schweiz -	26/5/22	68-7	34	74	50-8	45-0	69	81	36-5	60	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	
2. København, Denmark -	—/5/22	67-6	42	74	50-8	43-8	70	76	33-3	39-3	70	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	
3. Wageningen, Holland -	12/5/22	68-6	41	78	53-5	46-8	70	78	38-5	38-5	69	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	
4. Paris, France -	27/5/22	68-6	42	82	52-3	43-0	75	84	36-1	38-0	69	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	
5. Cambridge, England -	21/6/22	62-0	46	74	45-8	—	60	65	32-5	38-5	67	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	
6. Edinburgh, Scotland -	29/6/22	63-0	43	79	49-8	50-5	60	65	32-5	38-5	67	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	
7. Dublin, Ireland -	20/6/22	72-6	25	77	55-5	50-4	54	69	34-8	39-0	65	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	
8. München, Deutschland -	16/10/22	63-3	25	77	55-5	50-4	54	69	34-8	39-0	65	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	
9. Hamburg, Deutschland -	25/6/22	63-3	25	77	55-5	50-4	54	69	34-8	39-0	65	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	
10. Halle a/S., Deutschland -	16/10/22	62-6	35	77	55-5	50-4	54	69	34-8	39-0	65	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	
11. Breslau, Deutschland -	16/10/22	68-5	57	76	52-1	57-2	61	71	40-6	43-0	68	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	
12. Hohenheim, Deutschland -	16/10/22	69-0	56	77	51-8	47-0	66	69	32-4	39-2	68	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	
13. Rostock, Deutschland -	26/10/22	71-2	61	87	47-7	50-3	40	65	32-7	39-2	68	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	
14. Wien, Oesterreich -	2/6/22	70-6	61	85-5	60-4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
15. Graz, Oesterreich -	—/6/22	76-9	1-8	4	3-1	52-1	28-7	33-8	17-6	39-1	62	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	
16. Budapest, Hungary -	17/8/22	67-5	17	32	21-6	52-0	59	76	35-7	38-1	72	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	
17. Praha, Czechoslovakia -	11-16/8/22	67-2	51	68	45-7	51-0	58	70	35-7	38-1	71	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	
18. Brünn, Czechoslovakia -	17/8/22	69-1	26	67	46-3	49-9	49	63	31-4	38-7	61	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	
19. Stockholm, Sweden -	1/5/22	78-5	43	68	53-4	46-7	57	77	36-0	39-1	44	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	
20. Örebro, Sweden -	30/6/22	70-2	55	71	49-8	53-7	65	68	36-5	38-2	64	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	
21. Lund, Sweden -	25/6/22	69-4	61	87	60-4	48-5	79-5	85	41-2	39-9	65	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	
22. Linköping, Sweden -	16/5/22	65-4	45	80	52-3	48-7	73	80	35-4	39-0	70	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	
23. Skara, Sweden -	8/6/22	78-8	39	69	54-4	48-2	73	76	36-6	39-6	74	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	
24. Hørnøsand, Sweden -	7/6/22	68-0	23	48	32-6	48-2	79	81	39-0	38-9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
25. Kristiania, Norway -	12/6/22	68-0	23	48	32-6	48-2	79	81	39-0	38-9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
26. Trondhjem, Norway -	14/11/22	64-7	41	67	43-3	49-3	53	62	30-6	38-8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
27. Bergen, Norway -	31/5/22	73-3	13-8	43-5	31-9	48-7	47-5	55-5	27-0	39-5	52	62-8	97-1	107-6	107-6	107-6	107-6	107-6	107-6	107-6	107-6	107-6	107-6	107-6	107-6	107-6	107-6	107-6	107-6	107-6	
28. Dickursby, Finland -	29/5/22	73-3	13-8	43-5	31-9	48-7	47-5	55-5	27-0	39-5	52	62-8	97-1	107-6	107-6	107-6	107-6	107-6	107-6	107-6	107-6	107-6	107-6	107-6	107-6	107-6	107-6	107-6	107-6	107-6	
29. Petrograd, Russia -	22/6/22	93-0	—	68	30-4	56-0	55	72	40-3	39-0	68	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	
30. Riga, Lettonia -	9/6/22	86-0	47	68	58-5	56-0	55	72	40-3	39-0	68	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	
31. Warszawa, Poland -	24/5/22	88-4	—	14	12-4	52-5	—	50	36-3	39-7	58	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	
32. Leuven, Belgique -	26/5/22	88-4	—	14	12-4	52-5	—	50	36-3	39-7	58	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	
33. Modena, Italy -	—/7/22	69-2	25	56-2	38-5	50-1	64-2	76-7	26-8	39-0	68	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	
34. Bologna, Italy -	—/7/22	69-2	25	56-2	38-5	50-1	64-2	76-7	26-8	39-0	68	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	
35. Madrid, Spain -	28/7/22	67-0	13-8	24-1	16-1	49-0	42-5	61-6	30-2	39-1	45-1	63-3	71-8	108-5	108-5	108-5	108-5	108-5	108-5	108-5	108-5	108-5	108-5	108-5	108-5	108-5	108-5	108-5	108-5	108-5	
36. Bucaresti, Roumania -	17/11/22	64-7	23	58	37-5	49-5	61	78	40-1	39-1	74	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	
37. New York, U.S.A. -	3/6/22	70-9	41	69	48-9	42-5	62	81	32-2	39-6	64	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	
38. Virginia, U.S.A. -	19/6/22	70-9	41	69	48-9	42-5	62	81	32-2	39-6	64	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	
39. Kentucky, U.S.A. -	26/6/22	70-8	45	79	55-9	48-7	60-3	73-3	35-7	39-6	71	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	
40. Ottawa, Canada -	25/8/22	74-5	35-5	65-8	49-0	56-3	49	58-0	32-7	39-6	61	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	
41. Kurashiki, Japan -	30/8/22	80-7	3-5	13	10-5	53-8	46-5	53-2	28-6	39-6	57-8	61-2	166	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	
42. Wellington, New Zealand -	15/6/23	72-1	60	72	51-9	—	46	59	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
43. Reval, Esthonia -	20/11/23	72-1	60	72	51-9	—	46	59	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	

(*) Anzahl der Keime von 100 Knäuden.

(*) Anzahl der Keime pr. kg.

(*) Gewicht v. 1.000 Körnern.

(1) Anzahl der Keime von 100 Keulen.

(2) Anzahl der Keime pr. kg.

(3) Gewicht v. 1,000 Körnern.

Results of comparative tests of seed samples of 24 species mailed March 24th, 1922, from the Danish State Seed Testing Station—continued.

The situation of the station.	The results sent off from the station concerned.	DAUCUS CAROTA 46.				BRASSICA NAPUS RAPIFERA 47.				SECALE CEREALE 48.				AVENA SATIVA 49.				HORDEUM DISTICHUM 50.			
		Purity.	Germinating speed.	Germinating capacity.	Pure germi-nating seed.	Purity.	Germinating speed.	Germinating capacity.	Pure germi-nating seed.	Purity.	Germinating speed.	Germinating capacity.	Pure germi-nating seed.	Purity.	Germinating speed.	Germinating capacity.	Pure germi-nating seed.	Purity.	Germinating speed.	Germinating capacity.	Pure germi-nating seed.
1. Oerlikon-Zürich, Schweiz -	26/5/22	75.7	14	27	20.4	95.6	88	96	91.8	93.3	85	86	80.2	97.1	97	98	98.6	99.8	95	98	95.8
2. København, Denmark -	—/5/22	75.5	20	32	24.2	97.8	92	96	88.9	97.6	87	90	89.4	99.6	97	99	98.6	99.9	97	98	97.9
3. Wageningen, Holland -	12/5/22	78.8	14	32	25.2	97.4	89	96	94.6	99.3	81	85	89.4	99.8	97	99	97.8	99.8	97	98	98.0
4. Paris, France -	27/5/22	83.5	17	26	20.0	98.5	86	91	88.7	98.7	88	90	89.8	99.8	97	99	97.9	99.8	97	98	98.5
5. Edinburgh, Scotland -	29/6/22	82.9	22	36	29.3	96.3	88	94	90.5	98.7	89	91	89.9	99.8	97	99	97.9	99.8	97	98	98.0
6. Dublin, Ireland -	20/6/22	82.9	14.5	26	21.6	97.6	90	94.5	91.9	98.3	78	79	77.7	99.8	97	99	98.7	99.7	96.5	99	97.6
7. München, Deutschland -	16/10/22	86.1	18	36	31.0	97.6	91	94	91.7	98.3	84	84	83.1	99.8	97	99	98.7	99.7	96.5	99	97.6
8. Hamburg, Deutschland -	25/6/22	78.5	22	33	25.9	97.9	87	95	93.0	98.9	85	85	84.4	99.8	97	99	98.7	99.7	96.5	99	97.6
9. Halle a/S., Deutschland -	16/10/22	81.2	22	30	24.4	98.3	92	94	92.4	98.1	83	86	84.4	99.8	97	99	98.7	99.7	96.5	99	97.6
10. Breslau, Deutschland -	10/10/22	80.5	19	32	25.8	97.4	86	88	85.7	98.7	80	81	80.6	99.8	97	99	98.7	99.7	96.5	99	97.6
11. Hohenheim, Deutschland -	16/10/22	81.5	23	40	32.6	98.5	88	93	91.6	98.7	78	88	86.9	99.8	97	99	98.7	99.7	96.5	99	97.6
12. Rastock, Deutschland -	26/10/22	79.5	19	34	27.0	97.0	82	86	83.4	98.3	87	81	81.3	99.8	97	99	98.7	99.7	96.5	99	97.6
13. Wien, Oesterreich -	2/6/22	79.1	16.5	26	20.6	98.8	84	90.3	89.2	99.1	81	87	86.2	99.8	97	99	98.7	99.7	96.5	99	97.6
14. Graz, Oesterreich -	—/6/22	83.3	18	34	27.2	97.6	89	94	91.7	98.6	70	84	83.1	99.8	97	99	98.7	99.7	96.5	99	97.6
15. Budapest, Hungary -	17/8/22	80.1	18	34	27.2	97.6	89	94	91.7	98.6	70	84	83.1	99.8	97	99	98.7	99.7	96.5	99	97.6
16. Praha, Czechoslovakia -	11-16/8/22	82.3	18	33	27.2	94.8	91	95	90.0	97.7	83	88	86.0	99.8	97	99	98.7	99.7	96.5	99	97.6
17. Brunn, Czechoslovakia -	17/8/22	78.1	22	37	28.9	95.8	91	95	90.0	97.7	83	88	86.0	99.8	97	99	98.7	99.7	96.5	99	97.6
18. Brunn, Czechoslovakia -	1/15/22	82.0	12	32	26.2	97.0	87	96	93.1	98.7	89	87	87.0	99.8	97	99	98.7	99.7	96.5	99	97.6
19. Stockholm, Sweden -	30/6/22	79.9	22	32	24.0	96.9	89	94	91.1	95.2	80	86	81.9	99.8	97	99	98.7	99.7	96.5	99	97.6
20. Umeå, Sweden -	25/6/22	83.4	34	32	26.7	98.6	92.5	97.5	96.1	97.7	84	87	85.5	99.8	97	99	98.7	99.7	96.5	99	97.6
21. Linköping, Sweden -	16/5/22	79.0	27	34	24.8	95.5	88	94	89.8	98.6	91	92	90.7	99.8	97	99	98.7	99.7	96.5	99	97.6
22. Skara, Sweden -	7/6/22	81.8	17	33	27.0	98.1	89	98	96.1	99.1	91	92	91.2	99.8	97	99	98.7	99.7	96.5	99	97.6
23. Hørnsand, Sweden -	7/6/22	83.6	2	2	1.7	96.4	85	95	91.6	98.8	32	83	82.0	99.1	83	97	96.1	99.1	83	98	97.9
24. Kristiania, Norway -	19/6/22	83.7	15	27	25.6	95.2	88	94	89.5	98.9	74	83	80.4	99.1	83	97	96.6	99.1	83	98	98.1
25. Trondhjem, Norway -	14/11/22	84.7	13	26	22.0	97.4	90	95	93.5	98.7	78	79	78.0	99.9	93	97	96.6	99.9	93	98	98.1
26. Bergen, Norway -	31/5/22	78.5	13	29	22.1	97.5	85	94	91.7	99.0	55	88	85.4	99.7	97	98	97.7	99.8	96	98	96.8
27. Dickursby, Russia -	29/5/22	83.4	18.7	25.5	21.3	98.5	82.1	86.1	82.2	97.0	87.5	88.7	88.7	98.8	98.3	95	98.8	98.8	95	98.8	94.7
28. Petrograd, Russia -	25/9/22	83.4	13	25	21.3	98.5	82.1	86.1	82.2	97.0	87.5	88.7	88.7	98.8	98.3	95	98.8	98.8	95	98.8	94.7
29. Riga, Lettonia -	22/6/22	86.1	6.5	20.2	17.4	98.0	92	94	97.0	98.8	88	85	84.3	99.9	97	99	98.8	99.9	98	99	98.9
30. Warszawa, Poland -	9/6/22	98.4	31	41	40.5	98.2	75	90	92.3	99.2	84	84	83.1	99.9	97	99	98.8	99.9	98	99	98.9
31. Leuven, Belgique -	24/5/22	83.3	—	24	20.0	96.5	88	93	90.1	98.6	83	84	83.6	99.9	95.7	98.2	98.2	99.9	95.3	97	97.2
32. Modena, Italy -	26/5/22	78.4	26.3	31.7	24.8	96.8	75	89	90.3	98.0	83	84	83.6	99.9	95.7	98.2	98.2	99.9	95.3	97	97.2
33. Bologna, Italy -	—/7/22	84.4	14.3	25	21.1	96.8	86	93	90.1	98.9	77	80	79.1	99.8	88.3	98.1	97.9	100.0	94.5	98.6	96.6
34. Madrid, Spain -	28/7/22	83.7	22	31	23.9	98.8	87	93	91.9	99.3	70	81	79.2	99.8	97	99	98.8	99.8	94	98	96.8
35. Bucuresti, Roumania -	17/11/22	79.4	22	31	23.9	98.8	87	93	91.9	99.3	70	81	79.2	99.8	97	99	98.8	99.8	94	98	96.8
36. New York, U.S.A. -	3/6/22	83.4	22	30	23.8	98.8	87	93	91.9	99.3	70	81	79.2	99.8	97	99	98.8	99.8	94	98	96.8
37. Virginia, U.S.A. -	19/6/22	83.4	18.3	25.5	21.3	98.5	82.1	86.1	82.2	97.0	87.5	88.7	88.7	98.8	98.3	95	98.8	98.8	95	98.8	94.7
38. Kentucky, U.S.A. -	20/6/22	80.9	17.6	27.7	22.2	94.5	81	88.8	87.5	98.3	79	83	82.6	99.9	97.9	98.1	97.9	100.0	90.2	98.8	96.0
39. Ottawa, Canada -	25/8/22	85.0	14.3	21	18.5	94.5	81	88.7	87.5	98.3	79	83	82.6	99.9	97.9	98.1	97.9	100.0	90.2	98.8	96.0
40. Krasaki, Japan -	30/8/22	85.0	14.3	21	18.5	94.5	81	88.7	87.5	98.3	79	83	82.6	99.9	97.9	98.1	97.9	100.0	90.2	98.8	96.0
41. Wellington, New Zealand -	15/6/23	79.6	17.5	20.5	16.3	97.8	87.7	95.7	93.6	93.6	59.7	74.5	69.7	99.6	86.5	98.5	96.1	99.7	90.5	97	96.7
42. Reval, Estonia -	20/11/23	79.6	17.5	20.5	16.3	97.8	87.7	95.7	93.6	93.6	59.7	74.5	69.7	99.6	86.5	98.5	96.1	99.7	90.5	97	96.7
43. Reval, Estonia -	20/11/23	79.6	17.5	20.5	16.3	97.8	87.7	95.7	93.6	93.6	59.7	74.5	69.7	99.6	86.5	98.5	96.1	99.7	90.5	97	96.7

Results of comparative tests of seed samples of 19 species mailed November, 1923, from the Danish State Seed Testing Station.
 Resultate vergleichender Untersuchungen der Samenproben von 19 Arten von der dänischen Staatssamenkontrolle im November, 1923, versandt.

The situation of the station. Die Lage der Anstalt.	The results received in Copenhagen. Die Resultate in Kopenhagen eingegangen.	TRIFOLIUM PRATENSE 64.					TRIFOLIUM PRATENSE 64A.					TRIFOLIUM REPENS 65.				
		Purity (%)	Germinating speed (%)	Germinating capacity (%)	Broken growths (%)	Pure germinating seed (%)	Purity	Germinating speed	Germinating capacity	Broken growths	Without seeds	With seeds	Pure germinating seed	Broken growths	Germinating speed	Germinating capacity
1. Oerlikon-Zürich, Schweiz -	10/11/23	93.7	89	83+8	0	86.1	89.4	64	65+4	1	58.1	61.7	83.0	0	63.0	83.3
2. København, Denmark -	97.5	89	92+6	8	0	89.7	89.8	68	74+5	1	66.5	70.9	88.6	0	68.6	87.9
3. Wageningen, Holland -	2/12/24	97.1	92	94+2	0	91.8	88.8	59	76+6	0	67.5	72.8	89.7	0	68.4	89.7
4. Paris, France -	7/12/24	97.7	92	94+2	0	91.8	88.8	59	76+6	0	67.5	72.8	89.7	0	68.4	89.7
5. Cambridge, England -	7/12/24	98.0	88	91+3	1	88.5	89.9	47	57+2	10	51.2	53.0	86.0	0	73.8	87.6
6. Edinburgh, Scotland -	15/1/24	98.3	89	91+6	0	89.2	91.2	58	71+4	3	64.8	68.4	86.7	1	69.2	86.3
7. Ath Chalmers (Dublin) Ireland -	11/1/24	98.1	82	91+6	0	89.9	91.9	58	64+5	3	58.8	63.4	84.1	1	69.4	84.1
8. München, Deutschland -	28/1/24	98.1	85	93+5	1	91.2	91.9	55	65+5	4	59.7	64.3	87.9	1	68.5	88.1
9. Hamburg, Deutschland -	24/1/24	98.3	86	91+6	1	89.6	91.9	53	65+5	3	58.8	63.3	87.3	1	68.5	87.3
10. Halle a/S., Deutschland -	21/1/24	97.5	91	94+5	1	91.5	90.5	54	64+5	5	61.2	64.0	86.6	1	73.6	90.1
11. Breslau, Deutschland -	4/12/24	97.9	56	90+7	1	88.7	90.5	54	64+5	3	57.9	62.4	86.6	1	66.2	86.6
12. Rostock, Deutschland -	15/12/24	96.4	88	93+5	1	88.7	85.3	59	72+5	2	61.4	65.7	85.7	1	65.9	85.7
13. Wien, Österreich -	28/3/24	98.4	81	90+5	1	88.2	86.6	52	67+3	18	58.0	60.6	80.3	2	72.9	80.3
14. Graz, Österreich -	15/4/24	97.8	86	89+7	1	87.0	89.0	52	72+10	3	60.3	63.9	88.1	2	72.9	88.1
15. Budapest, Hungary -	26/4/24	97.7	92	96+3	1	93.8	88.5	59	70+5	5	62.0	66.4	89.1	2	71.5	89.1
16. V. Brné (Brum), Czechoslovakia -	25/4/24	97.6	93	94+5	1	91.7	86.3	61	69+5	3	59.5	63.9	87.4	1	70.9	87.4
17. Stockholm, Sweden -	11/3/24	96.9	91	92+5	1	89.1	89.9	63	66+6	3	59.3	64.7	89.2	1	66.9	89.2
18. Örebro, Sweden -	29/12/24	98.0	88	90+5	1	88.2	93.1	56	59+4	2	55.2	59.0	88.5	1	68.8	88.5
19. Lund, Sweden -	24/1/24	97.3	87	91+7	1	88.5	89.6	50	63+5	2	56.4	60.9	84.5	0	63.1	84.5
20. Linköping, Sweden -	7/1/24	97.3	87	91+7	1	88.5	89.6	50	63+5	2	56.4	60.9	84.5	0	63.1	84.5
21. Skara, Sweden -	30/1/24	98.3	85	93+5	1	90.9	91.3	54	68+6	3	62.1	67.6	89.2	2	62.7	89.2
22. Hernösand, Sweden -	29/2/24	98.3	85	93+5	1	89.9	92.7	44	66+7	9	61.2	67.7	88.4	2	64.9	88.4
23. Kristiansund, Norway -	22/3/24	97.1	91	92+5	0	88.9	91.4	62	71+4	3	65.8	70.4	87.5	0	73.3	87.5
24. Trondheim, Norway -	31/1/24	97.3	89	90+7	1	88.3	84.1	62	71+4	3	59.7	63.1	87.5	1	72.9	87.5
25. Bergen, Norway -	31/1/24	97.3	89	90+7	1	88.5	88.1	55	70+5	6	61.7	66.1	88.9	1	72.5	88.9
26. Helsingfors, Finland -	7/12/24	97.2	81	88+8	0	89.4	83.3	61	67+4	10	41.3	43.7	78.8	0	70.0	78.8
27. Leningrad, Russia -	7/12/24	97.3	82	92+4	4	87.3	85.1	60	74+6	3	62.3	66.5	89.1	4	70.0	89.1
28. Tallinn (Reval), Estonian -	4/12/24	97.0	89	96+7	1	87.3	83.3	73	75+5	2	68.2	69.9	89.1	1	70.0	89.1
29. Riga, Letonia -	4/12/24	97.0	89	96+7	1	87.3	83.3	73	75+5	2	68.2	69.9	89.1	1	70.0	89.1
30. Warszawa, Poland -	9/12/24	98.1	94	94+4	1	91.1	85.3	83	80+2	2	68.2	69.9	89.1	1	70.0	89.1
31. Lwow (Lemberg), Poland -	25/1/24	98.1	91	94+4	1	90.2	89.7	69	77+2	2	69.1	70.9	86.7	1	75.4	86.7
32. Lausanne, Schweiz -	2/12/24	97.6	83	93+2	1	90.8	90.7	60	63+2	2	57.1	59.0	86.7	1	70.0	86.7
33. Lausanne, Belgique -	25/1/24	98.2	88	94+3	1	92.3	90.0	83	68+4	3	61.2	64.8	85.1	2	68.7	85.1
34. Leuven, Belgien -	18/1/24	96.2	83	92+5	1	89.5	86.0	59	66+5	1	56.8	61.1	85.4	0	70.9	85.4
35. Bologna, Italy -	1/12/24	97.3	89	93+5	1	92.1	97.0	85	74+10	3	70.3	79.8	88.2	0	73.4	88.2
36. Bucarest, Roumania -	11/3/24	99.0	84	80+7	1	88.1	92.9	52	53+5	49	49.2	53.9	86.1	0	73.4	86.1
37. Washington D.C., U.S.A. -	7/4/24	97.9	88	91+5	0	89.3	94.6	62	52+5	2	49.2	53.9	86.1	0	73.4	86.1
38. Virginia, U.S.A. -	14/2/24	98.1	73	91+5	0	89.3	94.6	62	52+5	2	49.2	53.9	86.1	0	73.4	86.1
39. Kentucky, U.S.A. -	7/3/24	98.1	83	87+5	3	85.4	92.4	51	64+5	1	59.1	63.8	86.7	2	67.8	86.7
40. Wisconsin, U.S.A. -	14/2/24	98.2	81	86+7	1	86.3	92.4	59	59+4	1	59.1	63.8	86.7	2	67.8	86.7
41. New York, U.S.A. -	-	97.6	82	89+2	1	86.3	93.0	56	69+3	2	64.4	67.2	83.5	0	74.4	83.5
42. Kurashiki, Japan -	12/5/24	97.6	83	89+2	1	86.3	93.0	56	69+3	2	64.4	67.2	83.5	0	74.4	83.5
43. Praha, Czechoslovakia -	10/6/24	97.4	83	89+2	1	86.3	93.0	56	69+3	2	64.4	67.2	83.5	0	74.4	83.5
44. Ottawa, Canada -	21/6/24	97.7	90	93+4	1	89.9	88.5	47	63+8	2	55.1	57.8	87.9	1	73.4	87.9

(*) Keimfähigkeit. (†) Keimnähigkeit. (‡) Keimnähigkeit.

(*) Reine keimfähige Samen. (†) Gebrochene Keimlinge.

(*) Ohne harte Körner. (†) Mit harten Körnern.

(*) Ohne harte Körner. (†) Mit harten Körnern.

TABLE 2—continued.

Results of comparative tests of seed samples of 19 species mailed November, 1923, from the Danish State Seed Testing Station—continued.

The situation of the station.	The results received in Copenhagen.	TRIFOLIUM HYBRIDUM 66.						MEDICAGO LUPULINA 67.						MEDICAGO SATIVA 68.					
		Purity.	Germinating speed.	Germinating capacity.	Broken growths.	Without hard seeds.	Pure germinating seed.	Purity.	Germinating speed.	Germinating capacity.	Broken growths.	Without hard seeds.	Pure germinating seed.	Purity.	Germinating speed.	Germinating capacity.	Broken growths.	Without hard seeds.	Pure germinating seed.
1. Oerlikon-Zürich, Schweiz -	10/11/23	94.4	89	90	6	0	90.1	90.9	96	90	3	64.0	61.5	94.6	68	70	9	68.3	74.2
2. København, Denmark -		94.9	89	91	2	0	90.6	97.9	66	68	2	66.5	68.2	79.7	64	74	13	72.3	83.2
3. Wageningen, Holland -	2/1/24	95.5	86	92	4	0	86.4	97.4	65	68	2	66.5	68.2	79.7	64	74	13	72.3	83.2
4. Paris, France -	7/2/24	95.0	87	92	4	0	87.4	98.2	73	73	4	72.7	72.7	86.9	73	80	16	76.9	86.5
5. Cambridge, England -	7/2/24	94.4	83	90	4	0	85.0	98.2	47	63	1	66.8	67.8	76.9	55	69	15	62.1	73.7
6. Edinburgh, Scotland -	15/1/24	95.4	89	91	4	0	86.8	98.2	63	63	2	65.8	65.5	86.3	63	73	11	72.3	83.6
7. An Chlad, Dublin, Ireland -	15/1/24	94.7	86	80	5	0	84.3	98.2	56	67	1	65.8	65.8	86.3	63	73	11	72.3	83.6
8. München, Deutschland -	28/1/24	96.3	82	88	7	0	84.7	97.7	69	71	3	72.3	74.3	86.3	64	73	13	73.1	85.9
9. Hamburg, Deutschland -	21/1/24	95.4	82	88	7	0	84.7	97.7	69	71	3	72.3	74.3	86.3	64	73	13	73.1	85.9
10. Braunschweig, Deutschland -	21/1/24	95.4	82	88	7	0	84.7	97.7	69	71	3	72.3	74.3	86.3	64	73	13	73.1	85.9
11. Halle, Deutschland -	4/2/24	96.3	85	88	7	0	82.1	98.6	67	70	2	65.8	65.8	86.3	63	73	11	73.1	85.9
12. Rostock, Deutschland -	4/2/24	96.3	85	88	7	0	82.1	98.6	67	70	2	65.8	65.8	86.3	63	73	11	73.1	85.9
13. Rostock, Deutschland -	4/2/24	96.3	85	88	7	0	82.1	98.6	67	70	2	65.8	65.8	86.3	63	73	11	73.1	85.9
14. Wien, Österreich -	15/4/24	93.7	83	89	6	2	83.4	98.0	61	62	3	67.4	67.5	88.5	59	79	13	68.7	73.5
15. Graz, Österreich -	28/3/24	95.4	80	87	6	2	83.0	98.4	53	63	4	62.0	65.9	96.9	57	77	11	74.6	85.3
16. Budapest, Hungary -	16/4/24	93.3	71	88	8	2	82.1	98.6	67	73	2	71.1	73.1	93.8	57	78	14	73.9	86.3
17. V. Brno, (Brunn), Czechoslovakia -	25/4/24	95.0	85	91	6	2	86.5	97.4	75	77	3	75.0	77.9	94.6	49	74	13	70.0	82.3
18. Stockholm, Sweden -	11/3/24	94.5	90	94	4	2	88.5	92.6	70	72	2	70.4	72.4	95.5	59	75	10	71.6	81.2
19. Örebro, Sweden -	29/2/24	94.9	85	90	5	0	84.5	91.1	63	63	2	64.7	66.6	94.4	56	75	14	70.8	84.0
20. Lund, Sweden -	24/1/24	95.4	87	90	5	0	85.9	97.7	63	63	2	63.5	65.5	95.0	72	80	7	77.4	84.1
21. Linköping, Sweden -	7/1/24	94.2	86	90	5	0	83.8	98.5	62	63	2	61.3	63.5	96.7	54	69	13	65.6	77.9
22. Skara, Sweden -	30/1/24	94.9	89	90	5	0	85.4	90.2	65	71	2	69.6	71.5	96.6	71	80	12	77.3	88.9
23. Herrisand, Sweden -	22/3/24	95.5	78	90	9	0	86.0	94.5	59	76	3	74.5	77.4	94.1	30	79	14	74.3	87.5
24. Kristiania, Norway -	22/3/24	94.9	86	91	4	0	86.4	90.2	67	68	4	72.4	73.4	95.6	72	83	8	79.3	87.0
25. Trondheim, Norway -	31/1/24	94.0	85	88	5	0	82.7	97.2	68	72	4	72.4	74.3	94.1	62	74	11	74.3	85.1
26. Bergen, Norway -	31/1/24	98.9	84	87	6	1	81.7	98.6	55	64	2	63.1	65.1	93.9	58	74	13	66.7	77.9
27. Helsingfors, Finland -	7/2/24	94.7	85	90	5	1	85.2	90.0	66	66	4	64.0	64.9	93.9	61	71	11	74.3	85.1
28. Leningrad, Russia -	7/3/24	94.5	74	88	6	2	83.6	88.8	63	62	3	67.4	69.3	93.9	58	74	13	74.3	85.1
29. Riga, Lettonia -	4/4/24	95.0	87	88	6	2	83.6	88.8	63	62	3	67.4	69.3	93.9	58	74	13	74.3	85.1
30. Tallinn (Reval) Esthonia -	4/2/24	95.0	87	88	6	2	83.6	88.8	63	62	3	67.4	69.3	93.9	58	74	13	74.3	85.1
31. Warszawa, Poland -	4/2/24	95.0	87	88	6	2	83.6	88.8	63	62	3	67.4	69.3	93.9	58	74	13	74.3	85.1
32. Lwow (Lemberg), Poland -	9/2/24	93.1	85	90	6	0	85.6	91.1	83	83	1	75.0	75.9	94.6	71	81	13	76.6	88.9
33. Lausanne, Schweiz -	25/1/24	94.7	90	92	4	0	87.1	96.0	76	76	3	79.7	81.6	94.9	76	90	5	85.4	90.2
34. Leuven, Belgique -	2/2/24	94.3	90	91	4	0	87.1	96.0	76	76	3	79.7	81.6	94.9	76	90	5	85.4	90.2
35. Modena, Italy -	25/1/24	94.0	85	89	7	1	83.7	90.2	67	67	1	74.5	75.4	94.7	90	94	5	89.0	93.8
36. Bologna, Italy -	15/1/24	98.8	94	95	7	1	83.7	90.2	67	67	1	74.5	75.4	94.7	90	94	5	89.0	93.8
37. Bucarest, Roumania -	1/2/24	94.7	84	86	7	0	88.1	97.4	66	69	1	84.2	88.2	98.4	71	75	11	81.1	81.1
38. Washington D.C., U.S.A. -	11/3/24	98.4	59	74	10	0	72.8	82.7	99	67	4	84.2	88.1	98.4	58	75	10	73.8	83.6
39. Virginia, U.S.A. -	7/4/24	94.6	87	89	6	0	84.2	89.9	61	66	2	65.0	67.0	97.9	56	67	13	65.6	78.3
40. Kentucky, U.S.A. -	14/2/24	94.4	78	86	9	0	81.2	89.7	88	62	1	60.8	61.7	98.1	58	65	14	63.4	77.5
41. Wisconsin, U.S.A. -	7/3/24	95.2	43	79	5	0	85.2	82.9	53	72	1	70.3	71.3	96.9	40	68	6	65.9	77.5
42. New York, U.S.A. -	14/2/24	94.6	88	90	5	0	85.2	82.9	53	72	1	70.3	71.3	96.9	40	68	6	65.9	77.5
43. Kurashiki, Japan -	12/5/24	94.8	87	88	9	0	83.4	92.0	98	54	2	61.0	63.0	97.8	64	67	12	73.3	77.3
44. Praha, Czechoslovakia -	12/5/24	94.8	83	89	9	0	83.4	92.0	98	54	2	61.0	63.0	97.8	64	67	12	73.3	77.3
45. Ottawa, Canada -	21/6/24	95.6	84	91	5	0	86.0	90.8	78	79	2	77.6	77.7	94.1	69	80	11	75.3	84.8
	21/6/24	95.6	84	91	5	0	86.0	90.8	78	79	2	77.6	77.7	94.1	69	80	11	75.3	84.8

Results of comparative tests of seed samples of 19 species mailed November, 1923, from the Danish State Seed Testing Station—continued.

The situation of the station.	The results received in Copenhagen.	ANTHYLLIS VULNERARIA 69.					LOTUS CORNICULATUS 70.					PHLEUM PRATENSE 71.			
		Purity.	Germinating speed.	Germinating capacity.	Broken growths.	Pure germinating seed.	Purity.	Germinating speed.	Germinating capacity.	Broken growths.	Pure germinating seed.	Purity.	Germinating speed.	Germinating capacity.	Pure germinating seed.
1. Oerlikon-Zürich, Schweiz -	10/11/23	90.4	68	69 + 6	—	62.4	67.8	78	73 + 0	—	76.4	97.9	84	86	84.9
2. København, Denmark -	—	91.4	61	75 + 6	—	68.6	74.0	70	82 + 0	—	80.8	98.5	84	88	85.2
3. Wagnen, Denmark -	2/1/24	86.2	62	75 + 6	—	64.7	71.5	71	83 + 0	—	83.6	98.5	86	88	86.9
4. Paris, France -	2/2/24	91.6	63	70 + 5	—	66.5	71.8	81	84 + 0	—	83.1	98.9	87	90	89.2
5. Cambridge, England -	7/2/24	88.7	62	75 + 6	—	61.4	68.6	52	73 + 0	—	74.1	96.5	86	89	88.2
6. Edinburgh, Scotland -	15/1/24	90.3	61	68 + 8	—	61.4	68.6	78	83 + 0	—	81.6	99.1	85	88	85.1
7. Ath Claián (Dublin), Ireland -	11/1/24	91.9	59	72 + 8	—	66.2	73.5	66	79 + 0	—	78.1	98.9	81	86	84.2
8. München, Deutschland -	24/1/24	90.6	47	65 + 11	—	58.9	68.9	66	80 + 0	—	80.6	99.1	72	85	83.2
9. Hamburg, Deutschland -	24/1/24	90.6	60	71 + 12	—	64.2	75.0	81	84 + 0	—	83.1	99.2	87	89	88.1
10. Halle a/S, Deutschland -	21/1/24	90.7	57	70 + 6	—	63.3	69.2	75	79 + 0	—	80.5	98.5	80	83	80.3
11. Breslau, Deutschland -	2/1/24	88.7	56	68 + 10	—	60.3	68.2	65	84 + 0	—	81.5	97.5	82	85	83.2
12. Rostock, Deutschland -	1/2/24	91.8	61	70 + 8	—	64.3	69.2	69	84 + 0	—	83.1	98.5	86	91	90.1
13. Hohenheim, Deutschland -	1/2/24	88.5	42	67 + 13	—	59.3	70.8	57	86 + 2	—	80.0	98.1	83	84	83.2
14. Wien, Oesterreich -	15/4/24	86.6	59	60 + 8	—	62.0	68.9	73	77 + 0	—	83.8	99.3	76	85	84.4
15. Graz, Oesterreich -	28/3/24	93.5	60	71 + 6	—	66.4	72.0	78	88 + 0	—	87.0	98.3	80	80	79.0
16. Budapest, Hungary -	28/3/24	89.2	66	71 + 10	—	63.3	72.3	60	86 + 1	—	86.5	98.6	73	80	79.0
17. V. Brnë (Brunn), Czechoslovakia.	25/4/24	88.1	59	65 + 7	—	57.3	63.4	78	89 + 0	—	88.7	98.1	87	93	92.2
18. Stockholm, Sweden -	11/3/24	94.0	61	69 + 8	—	64.9	72.4	73	84 + 0	—	82.6	98.3	86	90	89.4
19. Örebro, Sweden -	29/2/24	89.3	62	67 + 11	—	59.8	69.7	80	86 + 0	—	83.6	98.2	82	87	86.2
20. Lund, Sweden -	29/2/24	89.3	66	70 + 7	—	63.6	70.0	77	83 + 0	—	82.0	99.0	84	86	85.7
21. Linköping, Sweden -	24/1/24	88.2	65	73 + 8	—	64.4	71.4	76	86 + 1	—	82.8	98.4	76	80	82.7
22. Skara, Sweden -	7/1/24	90.6	66	69 + 9	—	62.5	70.7	74	86 + 1	—	84.7	98.3	85	87	86.1
23. Hérnäsand, Sweden -	29/2/24	91.3	32	73 + 12	—	66.6	77.6	81	86 + 1	—	88.3	98.9	81	84	83.1
24. Kristiania, Norway -	22/3/24	90.6	57	68 + 3	—	61.6	64.3	86	92 + 0	—	80.8	98.9	88	90	88.1
25. Trondheim, Norway -	31/1/24	91.0	60	65 + 8	—	59.2	66.4	81	92 + 0	—	84.6	98.8	86	86	85.0
26. Bergen, Norway -	31/1/24	95.3	41	63 + 5	—	60.0	64.8	83	84 + 1	—	83.6	98.3	84	86	85.0
27. Helsingfors, Finland -	7/2/24	86.0	55	68 + 12	—	58.5	68.8	87	86 + 0	—	82.6	98.2	79	84	83.4
28. Leningrad, Russia -	7/2/24	91.8	33	67 + 9	—	61.5	69.8	65	80 + 0	—	83.6	98.2	82	86	84.4
29. Riga, Lettonia -	4/2/24	92.0	54	59 + 10	—	54.3	63.5	15	86 + 1	—	78.2	98.2	74	80	80.1
30. Tallinn (Reval), Esthonia -	4/2/24	90.1	67	75 + 15	—	67.6	72.1	81	80 + 0	—	76.4	99.3	82	86	85.4
31. Warszawa, Poland -	4/2/24	90.7	79	86 + 8	—	67.6	72.1	81	80 + 0	—	88.1	99.0	83	86	85.4
32. Lwow (Lemberg), Poland -	25/1/24	91.9	67	79 + 3	—	77.1	84.3	90	86 + 0	—	91.2	99.1	86	91	90.2
33. Lausanne, Schweiz -	2/2/24	87.6	62	67 + 1	—	72.6	75.4	84	93 + 0	—	83.3	98.8	86	88	86.9
34. Louvain, Belgique -	25/1/24	84.8	63	67 + 1	—	58.7	59.6	98	83 + 3	—	83.3	98.8	81	86	85.9
35. Modena, Italy -	18/1/24	93.7	72	74 + 10	—	71.1	80.6	97	88 + 1	—	85.8	99.2	81	90	89.2
36. Bologna, Italy -	1/2/24	89.6	55	63 + 8	—	69.3	78.7	94	88 + 1	—	84.3	99.0	83	88	86.3
37. Brest, Roumania -	11/3/24	98.2	62	75 + 9	—	56.4	63.6	87	81 + 5	—	79.4	98.4	85	90	88.6
38. Washington, D.C., U.S.A. -	7/4/24	94.0	49	59 + 11	—	73.7	82.5	84	87 + 5	—	84.9	98.4	81	90	88.6
39. Virginia, U.S.A. -	14/2/24	94.1	55	66 + 8	—	55.5	65.8	68	75 + 1	—	74.6	98.5	75	78	77.4
40. Kentucky, U.S.A. -	7/3/24	92.8	47	69 + 13	—	62.1	69.6	59	80 + 0	—	74.6	98.5	75	81	80.0
41. Wisconsin, U.S.A. -	14/2/24	93.0	53	58 + 5	—	57.5	69.6	68	86 + 0	—	78.2	98.2	65	81	80.4
42. New Zealand, U.S.A. -	15/5/24	96.4	67	61 + 10	—	53.8	58.6	73	81 + 1	—	80.0	98.8	90	90	88.9
43. Krasnodar, Japan -	12/6/24	88.7	62	75 + 3	—	68.8	68.4	71	78 + 0	—	77.2	97.2	78	82	81.3
44. Praha, Czechoslovakia -	10/6/24	88.7	72	75 + 7	—	66.5	72.7	98	88 + 0	—	91.8	97.8	89	92	90.9
45. Ottawa, Canada -	21/6/24	90.1	66	71 + 4	—	64.0	67.6	65	85 + 3	—	83.7	98.8	77	88	86.9

TABLE 2—continued.

Results of comparative tests of seed samples of 19 species mailed November, 1923, from the Danish State Seed Testing Station—continued.

The results received in Copenhagen.	The situation of the station.	LOLIUM PERENNE 72.			DACTYLIS GLOMERATA 73.			FESTUCA PRATENSIS 73A.			Avena ELATOR 74.			POA PRATENSIS 75.		
		Purity.	Germminating speed.	Germminating capacity.	Purity.	Germminating speed.	Germminating capacity.	Purity.	Germminating speed.	Germminating capacity.	Purity.	Germminating speed.	Germminating capacity.	Purity.	Germminating speed.	Germminating capacity.
10/11/23	1. Oerlikon-Zürich, Schweiz -	80.7	88	75.1	81.8	94	97	79.3	75.7	83	88.2	62	74	65.3	87.2	88
79-82	2. København, Denmark -	78.2	82	87	77.7	80	91	70.7	78.1	85	91.9	66	73	66.0	95.4	71
21/1/24	3. København, Denmark -	78.2	82	87	77.7	80	91	70.7	78.1	85	91.9	66	73	66.0	95.4	71
21/1/24	4. Wageningen, Holland -	79-82	88	73.3	78.4	92	98	76.1	75.0	82	88.2	62	74	65.3	87.2	88
2/2/24	5. Paris, France -	79-82	88	73.3	78.4	92	98	76.1	75.0	82	88.2	62	74	65.3	87.2	88
7/2/24	6. Cambridge, England -	81.6	89	75.1	79.9	89	92	71.7	72.8	81	87.3	62	74	65.3	87.2	88
15/1/24	7. Edinburgh, Scotland -	83.6	91	77.7	83.8	87	93	77.9	75.5	83	87.3	62	74	65.3	87.2	88
11/1/24	8. Ath Cliath (Dublin), Ireland -	85.0	86	74.0	88.9	84	90	74.7	72.0	81	87.3	62	74	65.3	87.2	88
28/1/24	9. München, Deutschland -	86.4*	87	52.1*	97.6*	73	70*	68.3*	84.5*	74*	89.8*	62	74	65.3	87.2	88
28/1/24	10. Halle a/S, Deutschland -	83.3	82	91	79.7	73	91	72.5	77.6	83	87.3	62	74	65.3	87.2	88
24/1/24	11. Hamburg, Deutschland -	84.8	88	91	75.2	82	96	79.5	78.0	86	87.3	62	74	65.3	87.2	88
21/1/24	12. Halle a/S, Deutschland -	80.8	83	77.1	83.8	88	94	68.1	75.5	80	87.3	62	74	65.3	87.2	88
21/1/24	13. Breslau, Deutschland -	79.7	89	71.7	78.1	79	88	68.7	76.0	81	87.3	62	74	65.3	87.2	88
4/2/24	14. Hohenheim, Deutschland -	78.7	90	73.2	72.7	92	96	69.8	76.1	82	87.3	62	74	65.3	87.2	88
12/2/24	15. Rostock, Deutschland -	82.3	86	90	81.8	86	94	74.9	74.7	81	87.3	62	74	65.3	87.2	88
15/4/24	16. Wien, Oesterreich -	76.9	83	89	80.8	84	93	77.8	76.3	83	87.3	62	74	65.3	87.2	88
28/3/24	17. Graz, Oesterreich -	74.9	89	91	79.2	85	96	76.0	76.0	83	87.3	62	74	65.3	87.2	88
16/4/24	18. Budapest, Ungarn -	81.0	86	92	74.5	85	96	76.0	76.0	83	87.3	62	74	65.3	87.2	88
25/4/24	19. V. Brně (Brunn), Czechoslovakia.	83.5	92	79.3	81.3	83	96	78.0	76.8	80	87.3	62	74	65.3	87.2	88
11/3/24	20. Stockholm, Sweden -	78.2	82	87	77.7	80	91	70.7	78.1	85	91.9	66	73	66.0	95.4	71
29/2/24	21. Örebro, Sweden -	78.2	82	87	77.7	80	91	70.7	78.1	85	91.9	66	73	66.0	95.4	71
24/1/24	22. Lund, Sweden -	77.0	85	96	73.3	79	91	75.3	76.6	87	91.9	66	73	66.0	95.4	71
7/1/24	23. Linköping, Sweden -	78.5	88	93	72.4	88	92	72.1	72.9	80	87.3	62	74	65.3	87.2	88
30/1/24	24. Skara, Sweden -	84.4	87	89	75.1	80	91	75.0	75.9	80	87.3	62	74	65.3	87.2	88
29/2/24	25. Hørsholm, Sweden -	82.2	74	84	77.4	88	90	75.0	75.9	80	87.3	62	74	65.3	87.2	88
22/3/24	26. Kristiania, Norway -	81.3	90	93	73.6	78.1	88	73.6	73.6	80	87.3	62	74	65.3	87.2	88
31/1/24	27. Trondheim, Norway -	79.9	88	92	73.6	78.1	88	73.6	73.6	80	87.3	62	74	65.3	87.2	88
7/2/24	28. Bergen, Norway -	80.5	80	86	69.2	74.1	74	70.3	72.5	80	87.3	62	74	65.3	87.2	88
7/2/24	29. Helsingfors, Finland -	80.2	80	94	73.4	74	84	70.3	72.5	80	87.3	62	74	65.3	87.2	88
7/3/24	30. Leningrad, Russia -	81.8	87	90	73.6	69.4	84	69.1	73.5	81	87.3	62	74	65.3	87.2	88
4/4/24	31. Riga, Lettonia -	76.9	88	91	70.7	87	97	68.5	73.5	86	87.3	62	74	65.3	87.2	88
4/2/24	32. Tallinn (Reval) Estonia -	—	91	93	84	92	96	68.5	73.5	86	87.3	62	74	65.3	87.2	88
9/2/24	33. Warszawa, Poland -	91.4	88	91	83.2	86	92	85.6	85.0	90	87.3	62	74	65.3	87.2	88
25/1/24	34. Lwow (Lemberg), Poland -	81.6	84	91	74.3	87	93	75.6	85.0	90	87.3	62	74	65.3	87.2	88
2/2/24	35. Lausanne, Schweiz -	81.7	86	69	72.7	88	95	68.5	82.4	88	87.3	62	74	65.3	87.2	88
25/1/24	36. Leuven, Belgique -	74.5	89	96	71.5	82	79	69.2	81.7	90	87.3	62	74	65.3	87.2	88
18/1/24	37. Modena, Italy -	78.0	88	68.6	79.7	71	77	76.9	81.5	80	87.3	62	74	65.3	87.2	88
1/2/24	38. Bologna, Italy -	82.8	85	86	69.1	89	94	72.2	79.0	87	87.3	62	74	65.3	87.2	88
11/3/24	39. Bucarest, Roumanie -	80.3	89	93	77.0	82	86	72.2	79.0	87	87.3	62	74	65.3	87.2	88
7/4/24	40. Washington D.C., U.S.A. -	79.0	77	86	67.9	73.1	79	76.9	81.5	80	87.3	62	74	65.3	87.2	88
14/2/24	41. Virginia, U.S.A. -	83.2	82	84	69.9	83	91	75.7	76.9	87	87.3	62	74	65.3	87.2	88
7/3/24	42. Kentucky, U.S.A. -	85.7	72	80	70.3	84	95	74.8	76.5	83	87.3	62	74	65.3	87.2	88
14/2/24	43. Wisconsin, U.S.A. -	80.8	70	92	61.7	72	83	57.9	70.7	73	87.3	62	74	65.3	87.2	88
1/5/24	44. New York, U.S.A. -	84.4	72	81	72.8	78	84	72.8	76.9	83	87.3	62	74	65.3	87.2	88
12/5/24	45. Kurashiki, Japan -	83.1	83	90	70.1	80	97	70.9	85.8	90	87.3	62	74	65.3	87.2	88
21/6/24	46. Praha, Czechoslovakia -	81.5	88	93	73.8	76	91	72.5	73.0	82	87.3	62	74	65.3	87.2	88
10/6/24	47. Ottawa, Canada -	76.0	87	87	79.7	78	91	72.5	73.0	82	87.3	62	74	65.3	87.2	88

* Die Untersuchungen sind nach der Irishen Methode ausgeführt.

* The tests are made by the Irish method.

TABLE 2—continued.
Results of comparative tests of seed samples of 19 species mailed November, 1923, from the Danish State Seed Testing Station—continued.

The situation of the station.	The results received in Copenhagen.	POA TRIVIALIS 76.						BETA VULGARIS 77.						BETA VULGARIS SACCHARIFERA 77A.						
		Purity.	Germinating speed.	Germinating capacity.	Pure germinating seed.	Purity.	Weight of 1,000 pure seed (c).	Number of growths per 100 clusters.	6 days.	12-14 days.	Tag.	Purity.	Germinating speed.	Germinating capacity.	Pure germinating seed.	Number of growths per 100 clusters.	6 days.	12-14 days.	How many 100 growths in 1 kg.	Weight of 1,000 clusters.
1. Oerlikon-Zürich, Schweiz -	10/11/23	64.0	—	84	53.8	89.2	11	9.8	14	16	—	98.8	—	64	63.2	97	109	—	—	18.1
2. København, Denmark -	2/1/24	64.0	67	77	49.3	91.6	13	16	14.7	23	218	98.2	13	73	71.7	128	141	779	—	18.1
3. Wazungen, Holland -	2/1/24	62.0	70	84	52.9	89.8	9	12	10.8	22	34	286	11.9	97.3	66	78	113	831	18.3	18.3
4. Paris, France -	7/2/24	63.0	72	85	53.0	90.1	9	12	10.8	17	123	97.8	16	66	69	67.5	106	618	17.8	17.8
5. Cambridge, England -	7/2/24	64.0	77	84	53.8	95.9	9	15	14.4	18	—	99.4	—	65	74	73.6	106	136	—	—
6. Edinburgh, Scotland -	15/1/24	60.8	69	82	49.9	95.9	17	19	18.2	26	29	271	10.7	98.7	77	80	177	1,000	17.0	17.0
7. Ath Clisli (Dublin), Ireland	11/1/24	67.6	48	63	42.6	97.5	—	—	—	13	15	139	10.8	99.1	—	94	115	639	18.0	18.0
8. München, Deutschland -	28/1/24	61.2	70	84	50.4	95.6	8	9	8.6	14	15	127	11.8	98.0	58	62	121	708	17.1	17.1
9. Hamburg, Deutschland -	24/1/24	63.5	66	80	51.3	92.9	13	18	19.7	15	24	189	12.7	98.9	58	64	122	646	18.9	18.9
10. Halle a/S., Deutschland -	21/1/24	58.3	67	84	49.0	95.4	16	17	19.2	20	178	98.5	13.5	98.5	66	70	123	731	18.6	18.6
11. Breslau, Deutschland -	21/1/24	60.4	56	79	47.7	92.8	9	13	11.1	10	112	98.2	11.7	98.2	78	82	143	796	19.1	19.1
12. Hohenheim, Deutschland -	4/2/24	54.5	71	84	45.8	93.6	20	21	20.1	26	30	221	13.6	99.0	70	71	140	829	16.9	16.9
13. Rostock, Deutschland -	1/2/24	60.2	67	88	46.0	98.7	20	23	22.7	29	40	303	13.2	99.0	68	69	107	649	17.7	17.7
14. Wien, Oesterreich -	13/4/24	52.7	66	85	44.8	98.7	20	23	22.7	29	40	303	13.5	99.0	68	69	107	649	17.7	17.7
15. Graz, Oesterreich -	28/3/24	57.1	67	83	47.4	92.9	9	8.5	25	39	340	99.0	11.5	96.9	59	57	189	1,082	16.5	16.5
16. Budapest, Hungary -	16/7/24	59.0	78	88	51.9	93.9	7	9	8.5	8	12	104	11.8	98.4	50	53	100	556	18.0	18.0
17. V. Brnë (Brum), Ozecho-slovakia -	25/4/24	65.9	66	85	56.0	95.0	10	11	10.5	15	116	98.4	13.0	98.1	59	63	110	636	17.3	17.3
18. Stockholm, Sweden -	11/3/24	63.6	72	76	48.3	98.1	6	12	11.8	9	140	98.8	13.6	98.8	53	66	123	735	19.6	19.6
19. Örebro, Sweden -	29/2/24	61.4	44	67	41.1	95.4	10	12	11.4	—	—	98.9	13.6	97.8	62	70	130	735	21.5	21.5
20. Lund, Sweden -	24/1/24	59.0	81	87	51.3	96.4	8	19	18.3	—	—	98.9	12.0	98.9	59	67	100	674	17.2	17.2
21. Linköping, Sweden -	7/1/24	65.7	66	80	52.6	93.6	14	21	19.7	—	—	98.9	12.0	98.9	59	67	100	674	17.2	17.2
22. Skara, Sweden -	30/1/24	60.7	64	80	48.6	91.7	18	20	18.3	19	28	244	11.5	96.7	60	66.7	114	733	17.6	17.6
23. Hernösand, Sweden -	29/2/24	64.6	62	65	42.0	94.6	7	15	14.2	8	21	178	11.8	97.4	50	74	130	708+	16.4	16.4
24. Kristianstad, Norway -	22/3/24	56.0	82	87	48.7	93.4	—	—	—	9	64	97.3	11.8	97.4	50	74	130	708+	16.4	16.4
25. Trondheim, Norway -	31/1/24	62.5	61	81	50.6	94.9	—	—	—	15	20	164	12.0	98.7	—	—	133	612	28.2	28.2
26. Bergen, Norway -	31/1/24	73.6	48	57	42.0	94.6	—	—	—	20	22	187	11.8	98.4	—	—	110	592	16.6	16.6
27. Helsingfors, Finland -	7/2/24	61.2	62	79	48.3	97.2	11	13	11.3	14	19	152	12.5	98.1	64	68	124	733	17.1	17.1
28. Leningrad, Russia -	7/3/24	59.1	57	73	43.1	96.6	—	—	—	5	37	99.0	13.4	99.0	—	—	77	543	18.0	18.0
29. Riga, Lettonia -	4/4/24	52.1	4	80	41.7	92.3	—	—	—	0	—	99.7	—	—	—	—	67	382	20.4	20.4
30. Tallinn (Reval), Estonia -	4/2/24	70.0	75	85	—	92.1	14	19	17.5	19	28	228	12.3	99.6	65	78	145	697	20.8	20.8
31. Warszawa, Poland -	9/2/24	64.1	50	76	48.7	97.9	14	21	20.1	25	33	282	11.7	98.4	69	76	162	876	18.5	18.5
32. Lwow (Lemberg), Poland -	25/1/24	64.1	50	76	48.7	97.9	14	21	20.1	25	33	282	11.7	98.4	69	76	162	876	18.5	18.5
33. Lausanne, Schweiz -	2/2/24	60.7	13	34	20.6	98.3	19	20	19.7	33	35	247	14.2	99.6	76	78	136	736	18.9	18.9
34. Leuven, Belgique -	25/1/24	82.5	60	71	58.6	95.7	13	20	18.8	15	17	138	12.3	99.1	74	76	128	894	22.6	22.6
35. Modena, Italy -	18/1/24	64.8	66	82	53.1	98.2	9	8.4	17	16	17	138	15.3	99.7	75	80	72	894	18.4	18.4
36. Bologna, Italy -	11/2/24	61.8	71	77	48.1	98.2	8	20	18.8	25	30	223	13.4	99.5	75	80	111	702	19.1	19.1
37. Bucarest, Roumania -	7/4/24	61.6	21	63	38.8	96.3	9	13	12.6	13	16	128	12.5	99.5	57	56.7	98	533	18.4	18.4
38. Washington D.C., U.S.A. -	14/2/24	60.0	0	80	43.0	96.3	12	16	15.0	15	19	152	12.5	99.1	61	69	106	692	18.2	18.2
39. Virginia, U.S.A. -	14/2/24	55.1	71	75	41.3	97.6	10	25	24.4	—	—	147	9.1	98.5	59	64	100	549	18.2	18.2
40. Kentucky, U.S.A. -	14/2/24	59.3	43	73	43.3	96.0	9	12	11.2	—	—	98.8	9.1	98.3	73	75	—	—	18.9	18.9
41. Wisconsin, U.S.A. -	12/2/24	58.2	50	69	43.2	93.1	9	12	11.2	—	—	98.8	9.1	98.3	73	75	—	—	18.9	18.9
42. New York, U.S.A. -	12/2/24	58.2	50	69	43.2	93.1	9	12	11.2	—	—	98.8	9.1	98.3	73	75	—	—	18.9	18.9
43. Kurashiki, Japan -	10/6/24	98.4	86	93	69.6	92.0	16	19	17.6	23	28	98.2	11.0	98.2	68	74	136	751	17.6	17.6
44. Praha, Czechoslovakia -	21/6/24	44.8	58	88	39.4	91.0	9	19	17.3	11	32	98.7	12.6	98.0	69	74	126	—	18.1	18.1
45. Ottawa, Canada -	21/6/24	44.8	58	88	39.4	91.0	9	19	17.3	11	32	98.7	12.6	98.0	69	74	126	—	18.1	18.1

* The tests are made by the Irish method.

† The weight is dry weight, the figure for growths per kg. is therefore too high.

‡ Das Gewicht ist Trockengewicht, weshalb die Zahl für Keime pro kg. zu hoch ist.

(*) Anzahl der Keime von 100 Körnern.

† The weight is dry weight, the figure for growths per kg. is therefore too high.

‡ Das Gewicht ist Trockengewicht, weshalb die Zahl für Keime pro kg. zu hoch ist.

(*) Gewicht von 1,000 Körnern.

Results of comparative tests of seed samples of 19 species mailed November, 1923, from the Danish State Seed Testing Station—continued.

The situation of the station.	The results received in Copenhagen.	DAUCUS CAROTA 78.				DAUCUS CAROTA 78A.				BRASSICA NAPUS RAPIFERA 79.				BRASSICA CAMPESTRIS RAPIFERA 80.			
		Purity.	Germinating speed.	Germinating capacity.	Pure seed.	Purity.	Germinating speed.	Germinating capacity.	Pure seed.	Purity.	Germinating speed.	Germinating capacity.	Pure seed.	Purity.	Germinating speed.	Germinating capacity.	Pure seed.
1. Oerlikon-Zürich, Schweiz -	10/11/23	91.9	43	52	47.8	91.5	11	19	17.4	99.7	74	84	81.7	99.7	83	88	85.1
2. København, Denmark -	—	92.5	42	52	48.1	84.2	5	13	10.9	98.5	59	80	81.7	97.9	82	90	88.1
3. Wagnen, Holland -	2/1/24	92.6	40	53	49.1	91.3	2	9	8.2	98.5	59	80	81.7	97.9	82	90	88.1
4. Paris, France -	7/2/24	91.1	50	53	48.3	90.9	2	16	10.5	98.3	50	75	83.7	98.0	81	93	92.0
5. Cambridge, England -	7/2/24	93.2	21	49	45.7	92.0	9	11	14.1	97.3	43	80	77.6	98.6	53	84	82.8
6. Edinburgh, Scotland -	15/1/24	92.8	45	54	50.0	92.8	8	13	10.1	97.3	43	74	77.6	98.6	53	84	82.8
7. Ath Cliath (Dublin), Ireland -	11/1/24	94.7	39	56	53.1	94.6	3	9	37.1	96.7	51	86	85.4	98.5	42	97	88.7
8. München, Deutschland -	28/1/24	92.4	36	53	49.0	88.3	4	11	7.9	96.2	43	79	76.1	97.8	35	87	85.1
9. Hamburg, Deutschland -	24/1/24	93.8	43	57	53.5	91.0	3	11	10.0	97.6	44	86	83.1	98.1	25	95	83.1
10. Halle a/S., Deutschland -	21/1/24	92.4	35	52	48.0	91.9	4	11	10.1	98.6	53	83	83.1	98.1	25	95	83.1
11. Breslau, Deutschland -	2/1/24	91.1	41	54	49.2	91.8	3	9	8.3	94.5	43	80	83.1	97.8	21	89	87.0
12. Rostock, Deutschland -	4/2/24	92.3	27	47	43.0	92.0	3	11	10.1	96.7	43	78	77.6	97.1	21	89	87.0
13. Rostock, Deutschland -	1/2/24	90.6	31	53	48.4	83.6	4	13	10.9	96.7	44	78	77.6	97.1	21	89	87.0
14. Wien, Oesterreich -	15/2/24	90.9	39	48	43.6	88.9	3	17	6.3	94.4	51	82	77.6	95.0	18	87	73.8
15. Graz, Oesterreich -	28/2/24	92.5	27	48	44.4	88.9	3	13	11.6	97.0	49	81	79.5	98.1	18	87	73.8
16. Budapest, Hungary -	16/2/24	91.8	19	44	40.4	90.9	1	6	5.5	96.5	53	81	78.2	97.1	18	87	73.8
17. V. Brně (Brunn), Czechoslovakia.	25/2/24	91.3	30	58	53.0	88.0	5	18	15.8	96.5	45	81	76.0	96.5	18	87	73.8
18. Stockholm, Sweden -	11/3/24	93.0	19	51	47.4	82.0	2	17	15.6	97.5	51	69	87.3	97.9	66	78	76.4
19. Örebro, Sweden -	29/2/24	92.6	46	50	46.3	90.8	5	10	9.4	97.1	73	88	85.7	97.7	66	78	76.4
20. Lund, Sweden -	24/1/24	94.3	47	58	54.7	94.2	9	15	14.1	97.1	71	80	87.5	98.0	63	90	87.0
21. Linköping, Sweden -	7/1/24	91.8	37	49	45.0	82.0	0	11	10.1	97.2	58	84	81.3	97.3	43	93	80.8
22. Skara, Sweden -	36/1/24	92.0	41	56	51.5	89.6	5	13	11.6	97.9	55	83	81.3	97.3	43	93	80.8
23. Kristiansand, Sweden -	28/2/24	92.8	37	53	49.2	94.7	1	8	7.6	97.5	30	62	80.7	98.5	31	73	71.9
24. Kristiania, Norway -	22/3/24	93.0	34	40	37.2	83.7	5	13	12.0	97.2	49	81	78.0	97.1	33	88	86.3
25. Trondhjem, Norway -	31/1/24	93.0	37	50	46.5	92.5	5	13	12.0	97.2	49	81	78.0	97.1	33	88	86.3
26. Bergen, Norway -	31/1/24	92.3	39	50	46.5	92.0	2	14	12.8	98.0	38	59	86.3	97.1	25	80	87.0
27. Helsingfors, Finland -	7/2/24	91.7	39	55	50.4	91.1	1	11	7.4	98.0	38	59	86.3	97.1	25	80	87.0
28. Leningrad, Russia -	7/3/24	89.3	20	51	45.5	91.7	1	11	9.9	96.4	94	85	86.3	98.7	25	80	87.0
29. Riga, Lettonia -	4/2/24	90.1	36	46	41.4	90.1	5	11	14.4	97.6	94	85	86.3	98.7	25	80	87.0
30. Tallinn (Reval) Estonia -	4/2/24	90.1	36	46	41.4	90.1	5	11	14.4	97.6	94	85	86.3	98.7	25	80	87.0
31. Warszawa, Poland -	9/2/24	95.6	32	60	57.4	90.0	6	16	9.2	96.9	94	85	86.3	98.7	25	80	87.0
32. Lwow (Lemberg), Poland -	25/1/24	92.0	39	52	47.8	92.6	4	19	17.6	96.6	97	84	80.3	98.8	21	91	89.2
33. Lausanne, Schweiz -	2/2/24	93.9	42	51	47.9	91.1	4	11	7.3	96.0	96	90	88.9	98.3	15	81	78.2
34. Leuven, Belgique -	25/1/24	—	—	—	—	91.5	—	8	10.3	97.8	97	84	88.9	98.3	20	97	85.7
35. Modena, Italy -	18/1/24	94.4	37	57	53.8	91.5	9	17	10.3	95.3	55	71	78.7	97.5	20	97	85.7
36. Bologna, Italy -	1/2/24	92.3	40	52	48.0	90.9	5	9	8.2	97.1	57	81	78.7	97.5	20	97	85.7
37. Bucuresti, Roumania -	11/3/24	94.0	39	51	47.9	94.0	5	20	18.3	98.2	58	76	73.4	98.0	20	97	85.7
38. Washington D.C., U.S.A. -	7/4/24	93.1	32	42	39.1	95.2	9	12	11.4	98.8	55	74	73.4	98.0	20	97	85.7
39. Virginia, U.S.A. -	14/2/24	93.2	44	48	44.7	92.6	3	16	14.8	98.9	50	76	75.2	99.0	21	83	67.8
40. Kentucky, U.S.A. -	7/3/24	93.3	19	51	47.6	92.4	3	16	14.8	98.9	50	76	75.2	99.0	21	83	67.8
41. Wisconsin, U.S.A. -	14/2/24	92.5	—	—	—	93.4	—	—	—	96.5	47	54	53.8	98.6	73	93	91.8
42. New York, U.S.A. -	1/5/24	96.3	33	49	47.2	92.3	4	14	12.9	96.5	47	54	53.8	98.6	73	93	91.8
43. Kurashiki, Japan -	12/5/24	94.0	23	49	45.3	82.2	1	6	7.6	96.5	43	72	68.5	98.4	50	80	76.2
44. Praha, Czechoslovakia -	10/6/24	90.3	36	49	45.3	82.2	1	6	7.6	96.5	43	72	68.5	98.4	50	80	76.2
45. Ottawa, Canada -	21/6/24	91.3	35	49	44.8	93.4	5	12	11.2	96.2	51	66	68.5	97.9	74	91	78.5

TABLE 3.

Results of comparative tests of forest seed samples mailed May, 1922, from the Danish State Seed Testing Station.

Resultate vergleichender Untersuchungen von Forstsaamenproben von der dänischen Staatssamenkontrolle im Mai, 1922, versandt.

The situation of the station.	ABIES GRANDIS 59.										PICEA SITKAENSIS 57.										PINUS SILVESTIS 60.										PINUS SILVESTIS 61.									
	Weight of 1,000 seeds. (°)		Purity. (°)		Germi- nating speed. (°)		Germi- nating capacity. (°)		Pure germinating seed. (°)		Weight of 1,000 seeds.		Purity.		Germi- nating speed.		Germi- nating capacity.		Pure germinating seed.		Weight of 1,000 seeds.		Purity.		Germi- nating speed.		Germi- nating capacity.		Pure germinating seed.											
							14 days.		7 days.						14 days.		7 days.		14 days.						7 days.		14 days.		7 days.											
	7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.							
Oerlikon-Zürich -	20.984.3	0	2	22	20.7	2.0795.0	11	63	71	67.5	7.4298.7	58	65	66+1	65.9+1	65.9+1	65.9+1	65.9+1	65.9+1	65.9+1	65.9+1	65.9+1	65.9+1	65.9+1	65.9+1	65.9+1	65.9+1	65.9+1	65.9+1	65.9+1	65.9+1									
København -	19.791.4	0	7	9+0	8.2	2.0097.9	10	52	65+1	63.6+1	7.5199.9	57	72	75+0	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74									
Wageningen -	19.793.2	0	10	28+0	26	1.8796.0	13	56	67+0	64	7.3999.2	54	75	70	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75									
Edinburgh -	20.091.1	1	8	20+1	18+1	1.9396.2	18	40	59+0	57	7.5198.9	60	65	67+4	66+4	66+4	66+4	66+4	66+4	66+4	66+4	66+4	66+4	66+4	66+4	66+4	66+4	66+4	66+4	66+4	66+4									
Hamburg -	20.786.5	0	3	9	7.8	2.1391.8	5	51	69	63.3	7.4899.2	54	71	71	70.4	70.4	70.4	70.4	70.4	70.4	70.4	70.4	70.4	70.4	70.4	70.4	70.4	70.4	70.4	70.4	70.4									
Wien -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
Budapest -	19.891.0	0	3	6+0	5.5	1.8596.6	5	35	47+8	45.4	7.4798.4	27	50	58+14	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5									
Örebro -	19.394.2	0	10	17+1	16.0+0.9	2.0096.2	25	57	66+6	63.5+5.8	7.3198.9	40	54	61+10	60.3+9.9	60.3+9.9	60.3+9.9	60.3+9.9	60.3+9.9	60.3+9.9	60.3+9.9	60.3+9.9	60.3+9.9	60.3+9.9	60.3+9.9	60.3+9.9	60.3+9.9	60.3+9.9	60.3+9.9	60.3+9.9	60.3+9.9									
Kristiania -	20.396.0	0	3	10+0	9.6	1.9097.8	14	52	56+0	54.8	7.4599.7	50	62	63+0	62.8	62.8	62.8	62.8	62.8	62.8	62.8	62.8	62.8	62.8	62.8	62.8	62.8	62.8	62.8	62.8	62.8									

The situation of the station.	PINUS SILVESTIS 62.										PINUS SILVESTIS 63.										PINUS STROBUS.										PSEUDOTSUGA DOUGLASSI.																																																																																																																																																																																																																																																																																																																																																																																																			
	Weight of 1,000 seeds.		Purity.		Germi- nating speed.		Germi- nating capacity.		Pure germinating seed.		Weight of 1,000 seeds.		Purity.		Germi- nating speed.		Germi- nating capacity.		Pure germinating seed.		Weight of 1,000 seeds.		Purity.		Germi- nating speed.		Germi- nating capacity.		Pure germinating seed.																																																																																																																																																																																																																																																																																																																																																																																																					
					7 days.		14 days.		7 days.						14 days.		7 days.		14 days.						7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.		14 days.		7 days.	

* The sample germinated 83 per cent. in 830 days.

* Die Probe keimte in 830 Tagen mit 83 %.

(°) Tausendkorngewicht.

(°) Reinheit.

(°) Keimschnelligkeit.

(°) Tage.

(°) Keimfähigkeit.

† The number of days are stated in parentheses.

† Die Anzahl von Tagen sind eingeklammert angeführt.

(°) Reine keimfähige Samen.

TABLE 4.

Number of g. tested and content of "other crop seed" and weed seed found in the tests recorded in Table 2.
 Anzahl von g. untersucht und Gehalt an fremde Kultursamen samt Unkrautsamen bei den in Tabelle 2 angeführten Untersuchungen gefunden.

The situation of the station.	TRIFOLIUM PRATENSE 64A			TRIFOLIUM REPENS 65.			TRIFOLIUM HYBRIDUM 66.			MEDICAGO LUPULINA 67.		
	Number of g. tested. (c)	Other crop seed. (c)	Weed seed. (c)	Number of g. tested.	Other crop seed.	Weed seed.	Number of g. tested.	Other crop seed.	Weed seed.	Number of g. tested.	Other crop seed.	Weed seed.
1. Oertikon-Zürich -	4 × 2	1.64	0.73	4 × 2	1.7	2.55	4 × 1	1.12	0.82	4 × 2	0.15	0.51
2. København -	10	0.5	0.3	15	0.20	2.0	4	0.21	0.4	10	0.04	0.4
3. Wageningen -	5	0.40	0.60	5	0.15	1.45	4	0.06	0.50	5	0.15	0.15
4. Paris -	4	0.9	0.7	4	0.4	2.3	4	0.4	0.9	4	0.1	0.3
5. Cambridge -	c. 9	0.4	0.6	c. 9	0.3	2.4	c. 5	0.3	0.9	c. 9	—	0.6
6. Edinburgh -	c. 9	0.25	0.25	c. 9	0.35	1.25	c. 5	0.1	0.6	c. 9	—	0.25
7. Ath. Clith (Dublin)	2 × c. 5	0.5	0.4	2 × c. 5	0.2	2.2	2 × c. 2	0.7	0.5	2 × c. 2	0.1	0.5
8. München -	2 × 2	0.2	0.2	2 × 2	0.1	1.4	2 × 1	0.2	1.0	2 × 2	Traces	0.2
9. Hamburg -	2 × 5	0.62	0.53	2 × 5	0.1	2.24	2 × 3	0.32	1.03	2 × 5	0.03	0.57
10. Halle a/S.	10	0.5	0.3	10	1.0	2.0	5	0.4	0.9	10	Traces	0.5
11. Breslau -	3	0.5	0.6	3	0.5	2.6	c. 7	0.2	0.8	2	—	—
12. Hohenheim -	5	0.5	0.5	5	—	—	c. 7	0.2	0.6	c. 11	0.0	0.5
13. Rostock -	5	0.5	0.5	5	—	—	c. 7	0.2	0.6	c. 11	0.0	0.4
14. Wien -	c. 11	0.5	0.5	c. 11	0.3	2.05	c. 16	0.1	0.77	c. 25	0	0.28
15. Graz -	c. 25	0.57	0.57	c. 25	0.3	2.1	5	0.1	0.5	c. 25	0	0.3
16. Budapest -	10	0.6	0.5	10	0.26	2.18	2 × 2	0.23	0.52	10	0.14	0.27
17. V. Brné (Brunn)	2 × 5	0.59	0.52	2 × 5	0.4	2.1	5	0.2	0.5	2 × 5	0.1	0.4
18. Stockholm -	5	0.6	0.5	5	0.4	2.1	5	0.2	0.5	5	0.1	0.4
19. Örebro -	2 × 2	0.8	0.7	2 × 2	0.3	2.0	2 × 2	0.4	0.8	2 × 2	0.1	0.4
20. Lund -	c. 15	0.6	0.5	c. 15	0.3	2.2	13	0.2	0.7	c. 10	0.1	0.4
21. Linköping -	2 × 2	0.7	0.4	2 × 2	0.3	2.6	2 × 2	0.4	0.8	2 × 2	0.1	0.4
22. Skara -	2 × c. 3	0.7	0.6	c. 16	0.3	1.9	c. 15	0.1	0.7	2 × c. 6	0.1	0.4
23. Hernösand -	c. 4	0.2	0.4	c. 5	0.1	2.4	c. 3	0.3	0.5	c. 4	0.0	0.2
24. Kristiania -	4	0.82	0.32	4	0.08	2.31	2	0.38	0.65	c. 6	0.03	0.29
25. Trondhjem -	2 × 2	0.43	0.52	2 × 2	0.44	2.14	2 × 1	0.10	0.65	2 × 2	0.11	0.38
26. Bergen -	2 × 2	1.30	0.52	2 × 2	0.65	1.99	2 × 2	1.32	0.45	2 × 2	0.01	0.45
27. Helsingfors -	2 × 2	0.7	0.6	2 × 2	0.2	2.2	2	0.6	0.6	2 × 2	0.1	0.6
28. Leningrad -	5	0.63	0.98	5	1.05	2.28	2	0.97	0.56	5	0.22	0.60
29. Riga -	5	—	—	5	—	—	2	—	—	5	—	—
30. Tallinn (Reval)	—	—	—	—	—	—	—	—	—	—	—	—
31. Warszawa -	20	0.45	0.70	20	0.30	2.32	20	0.70	0.20	20	0.03	0.70
32. Lwow (Lemberg)	10	1.1	2.8	19	0.9	2.8	20	0.7	0.27	10	1.5	—
33. Lausanne -	c. 4	0.2	0.3	c. 4	0.4	1.8	10	0.2	0.4	10	0.1	0.2
34. Leuven -	2 × 5	0.46	0.50	2 × 5	—	1.60	2 × 5	0.06	0.68	2 × 5	0	0.30
35. Modena -	5	—	—	5	—	—	5	—	—	5	—	—
36. Bologna -	4	0.50	0.62	4	0.12	2.36	1.5	0.53	0.80	4	0.03	0.65
37. Bucuresti -	5	0.2	0.4	5	—	2.2	2.5	—	—	5	—	0.02
38. Washington -	c. 6	0.69	0.49	c. 5	0.02	3.03	c. 2	0.32	0.98	c. 6	0.02	0.44
39. Virginia -	c. 5	0.56	0.69	c. 5	0.13	1.77	c. 2	0.13	0.79	c. 5	0.40	0.43
40. Kentucky -	5	0.44	0.40	5	0.20	2.24	2	0.10	0.60	5	0.06	0.58
41. Wisconsin -	5	0.80	0.5	c. 6	0.10	3.18	c. 2	0.10	1.18	c. 5	0.10	0.70
42. New York -	24 ×	0.53	0.57	5 ×	0.04	2.76	3 ×	0.06	0.83	6	0.08	0.45
43. Kurashiki -	—	—	—	—	—	—	—	—	—	—	—	—
44. Rade -	—	—	—	—	—	—	—	—	—	—	—	—
45. Odawa -	c. 13	0.54	0.47	c. 10	2.59	0.97	c. 8	0.82	0.76	c. 13	0.15	0.44
	5	0.53	0.53	5	0.27	1.90	c. 2	0.09	0.51	c. 5	0.24	0.63

* Traces = Spuren.

(c) Unkrautsamen.

(c) Fremde Kultursamen.

(c) Anzahl g. untersucht.

Number of g. tested and content of "other crop seed" and weed seed found in the tests recorded in Table 2—continued.

The situation of the station.	MEDICAGO SATIVA 68.			ANTHRYLIS VULNERARIA 69.			LOTUS CORNICULATUS 70.			PHEIUM PRATENSE 71.			LOLIUM PERENNE 72.		
	Number of g. tested.	Other crop seed.	Weed seed.	Number of g. tested.	Other crop seed.	Weed seed.	Number of g. tested.	Other crop seed.	Weed seed.	Number of g. tested.	Other crop seed.	Weed seed.	Number of g. tested.	Other crop seed.	Weed seed.
1. Oerlikon-Zürich -	4 × 2	1.17	0.32	4 × 3	5.2	1.03	4 × 1	0.05	0.4	4 × 1	0.38	0.16	5 × 2	1.97	0.08
2. København -	15	0.9	0.2	20	4.37	0.9	6	0.05	0.32	4	0.38	0.1	10	2.3	0.6
3. Wagnungen -	5	1.00	0.20	5	4.5	0.9	4	0.00	0.30	4	0.37	0.12	3	0.66	0.50
4. Paris -	4	1.5	0.4	4	4.6	1.07	4	—	0.5	4	0.4	0.1	4	2.4	0.8
5. Cambridge -	c. 5	1.0	0.3	c. 8	4.3	1.0	c. 5	—	0.5	3	0.4	0.9	4	2.4	0.8
6. Edinburgh -	2	1.35	0.15	2	3.4	0.6	2	—	0.2	2	0.2	0.1	2	1.55	0.30
7. Ath Cliath (Dublin) -	2 × c. 5	1.2	0.3	2 × c. 5	4.1	0.7	2 × c. 2	0.0	0.5	2 × c. 1	0.2	0.1	2	1.70	0.35
8. München -	2 × 2	0.2	0.1	2 × 3	3.7	0.4	2 × 3	0.0	0.2	2 × 1	0.5	Traces	2 × c. 5	1.0	0.0
9. Hamburg -	2 × 5	1.19	0.34	2 × 5	4.14	1.01	2 × 3	Traces	0.15	2 × 3	0.34	Traces	2 × 3	1.0	Traces
10. Halle a/S. -	10	1.2	0.7	10	4.1	0.8	2	Traces	0.5	2 × 2	0.3	0.4	2	2.7	0.2
11. Breslau -	3	1.7	0.3	3	2.7	1.0	2	0	0.2	2	0.3	0.1	2	1.5	0.3
12. Hohenheim -	5	1.3	0.1	5	4.5	0.5	2	0	0.2	c. 4.5	0.4	Traces	2	1.2	0.3
13. Rostock -	c. 12	1.1	0.3	c. 11.5	3.9	0.9	c. 6	0.2	0.3	c. 10	0.27	0.05	c. 6	1.74	0.4
14. Wien -	c. 26	1.02	0.28	c. 18	2.41	0.92	c. 13	0	0.25	2 × 5	0.3	0.1	c. 8	1.9	0.4
15. Graz -	10	1.0	0.4	10	4.1	1.0	10	0.08	0.23	2 × 1	0.23	0.04	2 × 5	1.33	0.37
16. Budapest -	2 × 5	1.09	0.37	2 × 5	5.44	0.93	2 × 5	0.1	0.2	2 × 1	0.3	0.1	2	6.1	0
17. V. Brnë (Brunn) -	5	0.8	0.3	5	2.6	1.0	5	0.1	0.2	2 × 2	0.3	0.1	2	3.5	0
18. Stockholm -	2 × 2	1.3	0.5	2 × 2	4.4	0.8	c. 13	0.1	0.2	c. 9	0.4	0.1	c. 4	1.7	0.1
19. Örebro -	14	1.0	0.3	17	4.2	0.8	2 × 2	0.2	0.4	2 × 2	0.6	0.2	2 × 2	2.4	0.1
20. Lund -	2 × 2	0.7	0.4	2 × 2	3.9	1.1	2 × c. 6	0.1	0.3	2 × c. 2	0.2	0.1	2 × 3	1.5	0
21. Linköping -	—	1.0	0.4	c. 24	4.3	1.0	2 × c. 4	0.1	0.2	c. 3	0.2	0.2	2 × c. 2	1.3	0.0
22. Skara -	c. 5	1.7	0.4	c. 7	4.5	0.8	c. 4.5	0.1	0.2	2	0.2	0.2	4	0.54	0.30
23. Hemsås -	4	0.36	0.10	6	3.42	0.80	2	0.05	0.24	2	0.25	0.13	2 × 2	0.53	0.61
24. Kristiania -	2 × 2	1.43	0.19	2 × 2	3.42	0.85	2 × 1	0.08	0.20	2 × 1	0.25	0.06	2 × 2	2.55	—
25. Trondhjem -	3 × 2	0.85	0.37	3 × 2	1.61	0.87	2 × 2	0.10	0.14	1 × 2	0.22	0.02	2 × 2	2.5	0.2
26. Bergen -	2 × 2	1.2	0.3	2 × 2	3.5	0.6	2 × 1	0.1	0.2	2	0.2	—	2 × 2	2.23	0.23
27. Helsingfors -	5	0.59	0.49	5	1.57	2.58	5	0.06	0.32	2	0.18	0.22	5	—	—
28. Leinograd -	—	—	—	—	—	—	2	—	—	1	—	—	—	—	—
29. Riga -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30. Tallinn (Reval) -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
31. Warszawa -	20	1.2	1.4	20	4.10	0.80	20	0.12	0.36	10	0.30	0.17	10	0.8	0.1
32. Lwow (Lemberg) -	10	1.3	0.2	10	5.2	4.6	10	0.4	2.0	10	0.4	1.4	10	0.12	0.7
33. Lausanne -	c. 5	1.2	0.2	c. 5	4.9	0.6	c. 4.5	0.1	0.2	2	0.4	0.1	c. 3	1.1	0
34. Leuven -	2 × 10	0.40	0.40	2 × 10	1.88	0.40	2 × 5	0	0.34	c. 3	0.32	0.04	2 × 5	0.30	0
35. Modena -	5	—	—	5	—	—	5	—	—	5	—	—	5	—	—
36. Bologna -	5	1.24	0.48	5	5.07	1.10	3	0.07	0.26	1	0.60	0.05	3	2.30	0.40
37. Bucarest -	5	0.8	0.4	5	—	0.6	2.5	0.0	0.24	2.5	0.4	0.4	2.5	1.6	0.4
38. Washington -	c. 5	1.04	0.27	c. 10	2.56	2.25	c. 2.5	0.0	0.31	c. 2	0.37	0.09	c. 5	0.75	0.28
39. Virginia -	c. 5	1.02	0.20	c. 10	2.50	2.26	c. 2	0.00	0.35	c. 3	0.51	0.14	c. 4.5	0.47	0.58
40. Kentucky -	c. 5	0.50	0.30	5	3.90	0.90	2	0.0	0.35	2	0.30	0	2	0.1	Traces
41. Wisconsin -	c. 5	0.79	0.71	5	2.70	2.80	3	0.00	0.17	2	0.42	0.12	3	1.03	0.14
42. New York -	6	1.26	0.20	6 +	0.60	1.80	3 +	Traces	0.23	3 +	0.25	0.10	2 +	0.80	0.30
43. Kurashiki -	10	1.19	0.43	10	2.41	0.88	10	0.05	0.20	1	0.41	0.1	5	0.12	0.57
44. Praha -	c. 15	1.04	0.34	c. 15	4.65	2.83	c. 12	0.05	0.17	c. 9	0.09	0.51	c. 12	1.20	0.24
45. Ottawa -	5	1.01	0.43	5	3.10	2.83	5	0.02	0.17	5	0.48	0.10	5	2.74	0.24

TABLE 4—continued.
Number of g. tested and content of "other crop seed" and weed seed found in the tests recorded in Table 2—continued.

The situation of the station.	DACTYLIS GLOMERATA 73.			FESTUCA PRATENSIS 73A.			AVENA ELATIOR 74.			POA PRATENSIS 75.			POA TRIVIALIS 76.		
	Number of g. tested.	Other seed.	Weed seed.	Number of g. tested.	Other crop seed.	Weed seed.	Number of g. tested.	Other crop seed.	Weed seed.	Number of g. tested.	Other crop seed.	Weed seed.	Number of g. tested.	Other crop seed.	Weed seed.
1. Oerlikon-Zürich -	4 × 1	1-19	0-08	5 × 2	14 92	0-92	4 × 3	0-17	0-17	4 × 025	0-08	0-07	4 + 0-25	4-59	2-16
2. København -	4	0-74	0-6	10	7-70	8-45	10	0-18	0-1	1	—	0-3	1	9-0	1-5
3. Wagnungen -	4	0-25	0-7	3	7-4	8-45	4	0-2	0-1	1	—	0-0	1	2-04	5-71
4. Paris -	4	0-7	0-7	3	7-4	9-7	4	0-2	0-1	4	0-1	Traces	4	0-3	8-7
5. Cambridge -	4	0-5	0-3	3	7-55	6-85	8	0-4	0-0	c. 0-6	0-25	0-05	c. 0-6	0-1	12-5
6. Edinburgh -	2	0-2	0-5	2	3-5	9-3	2	0-4	0-0	1	0-15	0-10	1	0-5	10-8
7. Ath Clutha (Dublin) -	2 × 2	0-30	Traces	2 × 2	13-3	1-3	2 × 6-5	0-2	0-05	2 × 0-5	0	0	2 × 0-5	2-3	1-7
8. München -	2 × 1	1-3	0-75	9-5	6-85	6-72	3 × 5	0-3	Traces	2 × 0-5	0	Traces	2 × 0-9	0-44	4-44
9. Halle a/S. -	2 × 2	0-30	0-3	5	14-5	7-3	10	0-1	Traces	2 × 0-7	0	0	2	0-8	8-6
10. Breslau -	2	0-6	0-5	2	8-2	7-3	2	0-1	0-1	5	0	—	2	8-0	2-0
11. Hohenheim -	5	0-3	0-5	2	17-2	7-9	5	0-2	0-1	0-5	0	0-4	0-5	1-0	10-4
12. Rostock -	3-5	1-20	0-5	c. 3	7-44	0-68	6-8	0-2	0-1	c. 2	0-5	0-6	c. 1-5	0-7	2-8
13. Wien -	c. 5	1-30	0-7	c. 8	7-44	7-20	10	0-7	0	c. 5	0	Traces	2	10-29	1-53
14. Graz -	2 × 2	1-0	1-0	2 × 5	7-40	7-20	2 × 5	0-32	0-08	2	0-5	0-2	2 × 0-5	0-43	9-63
15. Budapest -	1	1-3	0	2	12-5	0-9	2	0-1	0-1	1	0-2	0-2	1	8-2	0-9
16. V. Brnë (Brunn) -	2 × 2	1-0	0	2	12-5	0-9	2	0-1	0-1	1	0-2	0-2	2 × 0-5	0-43	9-63
17. Stockholm -	2 × 2	1-0	0	2	12-5	0-9	2	0-1	0-1	1	0-2	0-2	2 × 0-5	0-43	9-63
18. Örebro -	2 × 2	1-0	0	2 × 2	13-1	1-5	2 × 2	0-4	0	1 × 0-5	0-1	0-1	2 × 0-5	2-3	2-3
19. Lund -	2 × 2	1-0	0	2 × 2	13-1	1-5	2 × 2	0-4	0	1 × 0-5	0-1	0-1	2 × 0-5	2-3	2-3
20. Linköping -	2 × 2	1-0	0	2 × 2	13-1	1-5	2 × 2	0-4	0	1 × 0-5	0-1	0-1	2 × 0-5	2-3	2-3
21. Skara -	4 × 1-2	1-7	0	2 × 2	13-1	1-5	2 × 2	0-4	0	1 × 0-5	0-1	0-1	2 × 0-5	2-3	2-3
22. Hemsö -	2 × 2	1-0	0	2 × 2	13-1	1-5	2 × 2	0-4	0	1 × 0-5	0-1	0-1	2 × 0-5	2-3	2-3
23. Kristiania -	2	0-76	0	4	7-81	6-11	4-5	0-33	0	1	0-12	0	1	0-22	2-13
24. Trondhjem -	2 × 1	0-71	1-01	2 × 2	6-70	8-69	2 × 3	0-31	—	2 × 0-25	0-40	0	2 × 0-5	1-20	4-31
25. Bergen -	1 × 2	0-85	0-10	2 × 2	13-39	1-06	3 × 2	0-08	—	2 × 0-5	—	0-10	2 × 0-5	8-00	1-88
26. Helingsfors -	2 × 1	0-85	0-2	2 × 2	13-9	1-06	2 × 2	0-20	0-1	2 × 0-5	—	0-2	2 × 0-5	1-0	4-3
27. Riga -	2	0-95	0-49	5	7-76	2-37	5	0-20	0-22	0-5	0-10	0-2	0-5	8-50	3-80
28. Tallinn (Reval) -	2	—	—	5	8-20	7-76	5	—	—	0-5	—	—	0-5	—	—
29. Warszawa -	10	0-5	0-2	10	4-2	3-8	?	0-4	0	?	0-6	0	2	7-0	1-0
30. Lwow (Lemberg) -	5	0-6	1-6	10	4-2	3-8	10	0-3	0-3	1	0-1	0-2	c. 0-4	0-5	4-7
31. Lausanne -	c. 1-5	0-15	—	5	0	0-92	5	—	—	0-75	—	—	—	—	—
32. Leven -	2	0-45	1-15	5	7-40	7-37	5	—	0-20	5	—	—	5	—	—
33. Modena -	2	0-45	1-15	5	7-40	7-37	5	—	0-20	5	—	—	5	—	—
34. Bologna -	2	0-45	1-15	5	7-40	7-37	5	—	0-20	5	—	—	5	—	—
35. Bucuresti -	2 × 5	0-10	0-20	2 × 5	1-6	7-9	2-5	0-18	0-30	0-5	0-30	0-10	0-5	0-20	11-10
36. Washington -	c. 2	0-09	0-80	c. 5	8-15	7-24	c. 5	0-14	0-10	—	0-09	0-10	—	0-09	5-21
37. Virginia -	c. 2	0-09	0-80	c. 5	8-15	7-24	c. 5	0-14	0-10	c. 1	0-09	0-10	c. 1	0-09	5-21
38. Kentucky -	c. 2	0-09	0-80	c. 5	8-15	7-24	c. 5	0-14	0-10	c. 1	0-09	0-10	c. 1	0-09	5-21
39. Wisconsin -	c. 2	0-09	0-80	c. 5	8-15	7-24	c. 5	0-14	0-10	c. 1	0-09	0-10	c. 1	0-09	5-21
40. New York -	c. 2	0-09	0-80	c. 5	8-15	7-24	c. 5	0-14	0-10	c. 1	0-09	0-10	c. 1	0-09	5-21
41. Ottawa -	c. 2	0-09	0-80	c. 5	8-15	7-24	c. 5	0-14	0-10	c. 1	0-09	0-10	c. 1	0-09	5-21
42. New York -	c. 2	0-09	0-80	c. 5	8-15	7-24	c. 5	0-14	0-10	c. 1	0-09	0-10	c. 1	0-09	5-21
43. Nirasaki -	c. 2	0-09	0-80	c. 5	8-15	7-24	c. 5	0-14	0-10	c. 1	0-09	0-10	c. 1	0-09	5-21
44. P. J. -	c. 2	0-09	0-80	c. 5	8-15	7-24	c. 5	0-14	0-10	c. 1	0-09	0-10	c. 1	0-09	5-21
45. Ottawa -	c. 2	0-09	0-80	c. 5	8-15	7-24	c. 5	0-14	0-10	c. 1	0-09	0-10	c. 1	0-09	5-21

Number of g. tested and content of "other crop seed" and weed seed found in the tests recorded in Table 2—continued.

The situation of the station.	BETA VULGARIS 77.			BETA VULG. SACH. 77A.			DAUCUS CAROTA 78.			DAUCUS CAROTA 78A.			BRASSICA NAPUS RAPIFERA 79.			BRASSICA CAMPESTRIS RAPIFERA 80.		
	Number of g. tested.	Other crop seed.	Weed seed.	Number of g. tested.	Other crop seed.	Weed seed.	Number of g. tested.	Other crop seed.	Weed seed.	Number of g. tested.	Other crop seed.	Weed seed.	Number of g. tested.	Other crop seed.	Weed seed.	Number of g. tested.	Other crop seed.	Weed seed.
1. Oertikon Zürich	—	—	0.07	4×15	0.15	0.07	4×1	0.71	0.9	0.43	0.14	0.43	4×3	0.04	0.26	4×2	—	—
2. København	32.5	0.2	0.2	44.5	0.1	0.1	3	1.2	0.1	0.6	0.6	0.6	6	0.00	0.4	6	0	0.01
3. Wagnungen	—	—	—	—	—	—	4	0.6	0.17	0.50	0.09	0.50	6	0.00	0.20	6	0	0.00
4. Paris	c. 25	0.24	—	c. 25	0.11	0.1	4	0.6	0.17	0.50	0.09	0.50	6	0.00	0.20	6	0	0.00
5. Cambridge	20	—	—	—	—	—	4	—	0.9	—	—	—	4	—	—	4	0	0
6. Edinburgh	33	0.3	0.1	c. 44	0	0.9	4	—	0.9	0.5	—	0.5	8	0.03	0.2	8	0	0
7. Ath Clahk (Dublin)	20	0.24	0.07	20	0.29	0.15	2	0.85	0.20	0.35	0.45	0.35	2×c. 5	0.00	0.03	5	0	0
8. Minehen	c. 21	0.3	0.2	c. 20	0.1	0.5	2	0.5	0.20	0.5	0.45	0.5	2×c. 5	0.00	0.4	5	0	0
9. Hamburg	2×15	0.0	0.0	2×20	0.0	0.0	2×1	0.5	0.5	0.5	0.4	0.5	2×5	Traces	0.4	5	0	Traces
10. Halle	2×10	0	0.0	2×10	0.0	0.0	2×3	0.80	0.17	0.5	0.0	0.5	10	0	0.28	10	0	0
11. Breslau	30	Traces	2.0	30	0	0	2	0.9	0.4	0.4	Traces	0.4	3	0	0.3	3	0	0
12. Hohenheim	30	0.2	0.1	30	0.2	0.0	2	1.0	0.2	0.3	0.1	0.3	5	0.1	0.1	5	0	0
13. Rosstock	c. 12	—	—	c. 14	0	0.0	2	0.8	0.2	0.1	0.3	0.1	c. 13	0.1	0.2	c. 13	0	0
14. Wien	c. 34	—	—	c. 45	0	0	2	0.72	0.2	0.1	0.3	0.1	c. 18	0.1	0.2	c. 18	0	0
15. Graz	95	0.15	0.15	40	0.15	0	10	0.8	0.2	0	0	0	20	0.05	0.3	20	0	0
16. Budapest	2×25	0.35	0.08	2×25	0.15	0.13	2×2	0.8	0.2	0.24	0.08	0.24	2×5	—	0.3	5	0	0.1
17. Brn (Brunn)	20	0.1	0.1	20	0.5	0.5	2.5	0.8	0.2	0.4	0.2	0.4	5	—	0.3	5	0	0
18. Stockholm	1×10	0.1	0.2	2×20	0	0.1	2×2	0.7	0.2	0.1	0.3	0.1	2×2	0.2	0	2×2	0.1	0
19. Orebro	1×40	0.1	0.2	c. 33	0.2	0.0	6	0.7	0.2	0.4	0.3	0.1	c. 15	0.1	0.1	c. 15	0.0	0.0
20. Lund	c. 24	0.1	0.2	2×10	0.1	0.1	2×2	0.9	0.3	0.3	0.1	0.3	2×5	0.1	0.4	2×2	0.1	0.1
21. Linköping	2×10	0.2	0.3	—	—	—	1×3	0.7	0.4	0.6	0.6	0.6	2×c. 7	0.1	0.2	2×c. 6	0	0.1
22. Skara	7	0.1	0.3	40	0.1	0.1	c. 2.5	0.4	0.5	0.5	0.5	0.5	7	0.0	0.1	7	0.0	0.0
23. Herösand	c. 20	0.1	0.3	c. 23	0.3	0.1	2	0.69	0.16	0.15	0.05	0.15	6	0.0	0.1	6	0.0	0.0
24. Kristiania	10	0.38	0.14	10	0.12	0.12	2	0.69	0.16	0.15	0.05	0.15	6	0.0	0.1	6	0.0	0.0
25. Trondhjem	2×15	0.33	0.14	2×15	0.0	0.06	2	0.69	0.16	0.15	0.05	0.15	2×4	0.05	0.01	2×4	0.0	0.04
26. Bergen	1×20	0.17	0.09	1×20	0.03	0.03	1×2	0.63	0.29	0.29	0.40	0.29	1×3	2.00	0.01	1×2	0.0	0.02
27. Helsingfors	33	0.2	0.2	44	0.1	1.2	2×1	0.63	0.29	0.29	0.40	0.29	2×4	0.1	0.2	2×4	0.0	0.08
28. Leningrad	10	0.02	0.07	10	0.01	0.01	2	0.05	1.27	0.43	0.31	0.43	5	0.01	0.19	5	0.0	0.08
29. Riga	20	—	—	20	—	—	2	—	1.27	0.43	0.31	0.43	5	0.01	0.19	5	0.0	0.08
30. Tallinn (Reval)	—	—	—	—	—	—	2	—	1.27	0.43	0.31	0.43	5	0.01	0.19	5	0.0	0.08
31. Warszawa	20	0.3	0.4	20	0.18	0.26	10	0.4	0.8	0.60	0	0.60	10	0.6	0.2	10	0	0.02
32. Lwów (Lemberg)	2×20	—	0.4	2×20	0.4	0.3	10	0.4	0.8	0.60	0	0.60	10	0.6	0.2	10	0	0.02
33. Lausanne	c. 8	0.1	0.1	c. 12	0	0.05	5	0.8	0.1	0.4	0	0.4	10	0.6	0.2	10	0	0
34. Leaven	25	0.46	0.11	25	0	0.06	2.3	0.8	0.1	0.4	0	0.4	6.7	0.1	0.2	6.5	0	0
35. Modena	25	—	—	25	—	—	5	—	—	0.40	—	0.40	10	—	0.16	10	—	0
36. Bologna	30	0.31	0.22	30	0.14	0.05	2.5	—	—	0.44	0.20	0.44	5	0.28	0.40	5	0	0
37. Bucuresti	30	0.4	0.3	30	0.06	0.06	2.5	0.4	0.36	0.44	0.20	0.44	5	0.28	0.40	5	0	0
38. Washington D.C.	c. 30	0.20	0.13	c. 30	0.10	0.02	2.5	0.4	0.36	0.44	0.20	0.44	5	0.28	0.40	5	0	0
39. Virginia	c. 32	0.46	0.14	c. 43	0.19	0.04	c. 2	0.09	0.83	0.17	0.14	0.17	c. 10	0.03	0.24	c. 10	0.00	0.01
40. Kentucky	10	0.0	0.0	10	0.0	0.1	5	0.80	0.30	0.13	0.13	0.13	10	0.26	0.15	5	0.1	0.1
41. Wisconsin	30	0.38	0.20	30	0.20	0.03	5	0.10	1.55	0.40	0.40	0.40	10	0.26	0.15	5	0.1	0.1
42. New York	9+	0.54	0.10	11+	0.40	0	5×	0	0.90	0.40	0.25	0.40	10	0	0.20	10	0	0
43. Kura-shiki	20	0.45	0.10	20	0.45	0.10	5	0	0.79	0.40	0.25	0.40	10	0	0.20	10	0	0
44. Praha	c. 32	—	—	c. 43	—	—	c. 10	0.95	0.16	0.32	0.38	0.32	c. 18	—	0.24	c. 21	—	0.02
45. Ottawa	50	0	0.58	50	0.30	0.20	5	0	1.15	0.30	0	0.30	10	—	0.55	10	—	0

In commenting on his report, Mr. Dorph-Petersen thanked Professor Munn warmly for the assistance which North America had given him. He laid stress on the necessity for close study of the tables embodied in his report and, with reference to the paragraph relating to the Dodder Committee, he expressed the view that there was now a prospect of the work of this Committee proving successful.

Professor Johannsen described the Report as very interesting and laid stress on the fact that whereas stations whose methods were similar often obtained different results, those whose methods differed sometimes arrived at the same results.

Professor Zaleski expressed the view that stations which were not fully equipped with modern apparatus should also be allowed to take part in the work of conducting comparative tests. Those stations whose staffs were efficient could do the work even if the apparatus were not modern. In this connection he referred to the Paris Station. He also suggested that some stations should be asked to specialise; for instance, Egypt, which was mainly concerned with cotton, should not be expected to test seeds in which they were not specially interested.

Professor Bussard intimated that the staff at the Paris Station had been trained for many years and that in his opinion tradition counted for something, as did also the *esprit de corps* which animated the staff. *Dr. von Degen* concurred in the opinion expressed by Professor Bussard. At his station apparatus was used as little as possible as he considered that hands and eyes were more dependable than apparatus.

Professor Showky Bakir appealed to the Association to take up the question of testing cotton seeds, pointing out that the annual value of the Egyptian cotton crop was as much as £80,000,000.

Dr. Andronesco stated that the differences in results shown in the tables embodied in Mr. Dorph-Petersen's report were to be expected. The seed was a living organism, and as such was affected by all external agents. They could not expect the results obtained in countries where the circumstances—atmospheric pressure, humidity of the air, and methods of testing—were different, to be the same as those obtained in Denmark. He accepted the differences with equanimity.

Dr. Buchholz was of the opinion that apparatus and human skill were equally important and that the importance of apparatus increased when the work was heavy.

Dr. Chmelář suggested that the differences shown in the tables might be due to the fact that the preparation of samples was not an easy matter; that samples were sometimes too small; and that the various stations held different views as to the value of seeds, for instance, broken seeds, which in Czecho-Slovakia were regarded very seriously. He suggested that stations should

specialise in various questions, *e.g.*, what constituted weed seeds, pure seeds, &c.

Mr. Devoto attached much importance to the size and number of seeds in a sample and also to the temperature to which the seeds are subjected during analysis.

Mr. Dorph-Petersen, in summing up the discussion, emphasised the importance of remembering that in dealing with seeds they were dealing with living organisms. It was to be expected, therefore, that differing results would be obtained. He suggested, with regard to *Dr. Chmelař's* remarks, that all those who were interested in comparative analyses should meet at 9 o'clock on Wednesday morning, when his assistants would demonstrate how the samples distributed for comparative tests were drawn at the Copenhagen Station.

In conclusion, *Mr. Dorph-Petersen* asked that Seed Testing Stations would inform the new Executive Committee, which would be appointed on Thursday, what varieties of seeds were of particular interest to them, *e.g.*, cotton to Egypt.

In the evening a number of the delegates were conducted round Emmanuel College and its grounds by the Bursar.

Tuesday, 8th July.

Morning Session.

The Congress assembled at 9.30 a.m.

Dr. Volkart submitted for consideration the draft Constitution of the European Seed Testing Association, copies of which had previously been circulated to the delegates, and made explanatory comments. (The approved Constitution appears in the report of Thursday afternoon session.) He suggested that a special provisional committee should be appointed to consider his draft and any suggestions made by the delegates, and to place the results of their deliberations before the Congress at a later session.

Dr. Chmelař expressed the view that the title of the Association should be identical in the three languages, viz., English, French and German. He further suggested the desirability of appointing a vice-president, which was not provided for in the draft Constitution. He enquired what would happen to the assets of the Association in the event of its dissolution, and suggested that in such an eventuality they might be handed over to the International Agricultural Institute, Rome.

Mr. Clark enquired whether the question of extending the Association so as to make it international had been considered, and if so whether the basis for admitting members from North America had been provisionally settled. *Sir Lawrence Weaver* stated that when the proposal was made at Copenhagen for the formation of an Association they had no cognisance of any definite desire on the part of American Governments to participate, but, in view of the apparent demand for an Association of a truly

international nature, the admission as members not only of the United States of America and Canada, but also of other parts of the world, would be heartily welcomed. *Mr. Dorph-Petersen* expressed pleasure at Sir Lawrence Weaver's remarks, especially in view of the fact that the seed trade was truly international.

Mr. Devoto intimated that not only did the Argentine Government desire to become a member of an International Association, but they had already decided to contribute whatever might be fixed as their subscription to the funds of the Association.

Mr. Insulander pointed out that the proposed constitution of the Association admitted as members only official seed testing stations and corporations managing such stations under Government control. If this were so, no scientific man, even if he had made researches of greatest value to the seed-testing work, could be a member of the Association unless he was connected with such a station; nor could a Government which pays an annual contribution to the Association nominate a special delegate to the Congresses with power to control the way in which the means are used and to propose improvements in the work of the Association if there seems eventually to be room for such. He considered that such rules could not, in the long run, be useful for the work of the new Association. *Mr. Dorph-Petersen* replied that where the Government of a country itself contributed to the Association, it would, of course, be entitled to representation at Congresses, but not otherwise. He proposed that this should be made clear in the Constitution.

Mr. Devoto thought that there should be close relationship between the Association and the International Agricultural Institute, Rome, and that arrangements should be made for the issue of reports regarding the activities of the Association through the medium of the Institute.

Mr. Main enquired whether it was the intention to make the new Association an integral part of the International Agricultural Institute. He pointed out that several Governments were already contributing to the Institute and might object to further expenditure. He suggested that a committee should be appointed to settle as soon as possible the basis of contributions and other necessary details, so that delegates would be in a position to obtain a decision from their Governments and thus enable the International Association to become a *fait accompli* with the least possible delay.

Sir Lawrence Weaver, after intimating that he thought he was correctly interpreting the views of *Mr. Dorph-Petersen* and *Dr. Volkart*, stated that it was the intention that the Association should affiliate with, but not form an integral part of, the International Agricultural Institute. The association with the Institute would not, however, be so close that there would be any confusion regarding contributions. He agreed that it was necessary that a committee should be appointed immediately

to consider the elaboration of the proposals made by Dr. Volkart. When definite agreement had been reached regarding these proposals, the delegates could then go back to their Governments to ascertain whether or not they were prepared to become members. The subscription to the Association would probably be so modest that it was unlikely that any Government would refuse to join.

Professor Johannsen then submitted to the Congress the names of the following Delegates to serve on a Provisional Committee, whose duty it should be to consider Dr. Volkart's draft Constitution and the foregoing suggestions, and to submit the results of their deliberations to the full Congress on Thursday afternoon.

Provisional Committee.—Professor Mohammed Showky Bakir Effendi, Professor Bussard, Mr. Clark, Mr. Devoto, Mr. Dorph-Petersen, Professor Munn, Professor Voigt, Dr. Volkart, Sir Lawrence Weaver.

The Congress unanimously approved Professor Johannsen's proposal.

At the Chairman's invitation, *Miss Yeo* then addressed the Congress regarding the International Agricultural Institute, Rome. She stated that in view of the recent collaboration between the Institute and the European Seed Testing Association, and of the fact that the Institute had undertaken to reserve at least 100 pages per annum in its *Quarterly Review* for reports on seed testing work, the Institute had sent to the Congress copies of the latest monographs and reviews which it had published. It was hoped more and more to centralise all information bearing on agricultural subjects at the Institute and to use the *Review* as a common organ for the Association.

Mr. Anderson then read the following paper :—

Uniformity in Seed Testing Reports.

BY

T. ANDERSON.

Director, Seed Testing Station, Board of Agriculture for Scotland.

The need for a uniform method of expressing results of analyses of seed samples which would be valid for international trade, and which would, at the same time, indicate the relative intrinsic value of any parcel of seed to the cultivator more truly than does the present conventional form of report, has doubtless presented itself at some time or another to all those engaged in the profession of Seed Testing.

The late Dr. Bruijning, at the International Seed Testing Congress at Copenhagen in 1921, made a proposal to meet this need by applying an arbitrary factor or factors to the ascertained percentage of injurious ingredients in a sample for the purpose of arriving at a figure by which the ascertained percentage of pure germinating seed $\frac{(P. \times G.)}{100}$ should be reduced to make it represent the intrinsic or use value.

The objections to an artificial method of determining the value of a parcel of seed are as follows :—

(1) Noxious or objectionable impurities cannot be arbitrarily evaluated in terms of their degree of noxiousness as this varies from country to country; *e.g.*, *Cuscuta*, *Salsola* Kali, *Plantago lanceolata*, *Medicago lupulina*. The introduction of a factor for depreciating value relatively to the content of specified weed seeds would have a local rather than an international significance.

(2) It has not been determined how far seed supplies are responsible in distributing weed impurities to the detriment of agriculture. Weeds do not grow on soil which does not suit them; on soil which suits them, they are in abundance in any case.

The operations of a Seed Testing Station are largely concerned with grass and clover seeds whose ultimate use is the production of hay crop and animal pasture, frequently in combination.

The success of these crops depends practically entirely on efficient cultivation, manuring and management.

If land is covered with vigorous growing crops no heed need be taken of weeds.

On the other hand, where there is negligent cultivation and management, no amount of propaganda or control of seeds will prevent the land from becoming infested with weeds.

(3) The ultimate profit arising out of sowing seed depends so much on the efficacy of soil cultivation and on seasonal influences that it appears gratuitous to attempt to estimate the detrimental effect of weed seeds.

(4) Account must also be taken of the fact that origin and strain are frequently of so great importance that, provided samples are tolerably pure, the fact that impurities (even so-called noxious impurities) are present may count for little or nothing in comparison.

The use of an arbitrary formula for estimating the cultural value of a sample is only applicable, even if it were valid in other respects, when applied to differentiate between varietal stocks from the same district of origin.

One may cite the example of Wild White Clover, the market value of which has been seven times and is still three times as great as that of ordinary White Clover seed, notwithstanding the fact that it frequently contains 15 per cent. to 20 per cent. of impurity, and 20 per cent. to 30 per cent. of hard seeds.

One may also cite the fact of the much greater cultural value for pastoral purposes under British conditions—established by experiment by Professors Gilchrist, Stapledon and others—of New Zealand quasi-indigenous Cocksfoot as against that of Danish *Olsgaard*, notwithstanding that the former contains considerable quantities of *Holcus lanatus*, commonly regarded as a noxious weed.

The operations of Seed Testing and Seed Control Stations have brought the trade in seeds to a very high level, and the continuance of their labours is necessary to maintain the present standard.

For international trade purposes, however, their effective operations cannot very well be extended beyond the limit of providing a report on the quantity of pure germinating seed in any parcel.

The method generally adopted by Seed Testing Stations of reporting results of tests might, however, be modified with advantage in such a way as to meet the requirements of the grower of the seed product, the cultivator of pasture and the trade intermediaries.

The conventional method is useful for the trade, and suits those handling seeds, probably mainly because they have become accustomed to it by use and wont.

The weakness of the conventional method is that the percentage of germination stated in the report *does not denote the actual weight of living*

seed of the species of which the parcel purports to consist, in terms of a percentage of the total weight, and it is this figure which the consumer is entitled to know. Members of the seed trade are perfectly aware of the significance of the terms of the conventional report, but there is widespread ignorance amongst consumers as to the actual meaning of the figures therein provided.

There is little virtue in the adoption of the pedantic attitude that reports are only reports of experiments and should be understood as such. Especially when a Station is a "Control" Station, it must be prepared to substantiate its findings as facts.

It is, therefore, here proposed that reports should be framed with a view to suppressing the figure for germination,—which, being based on an experiment carried out on the selected pure seed means nothing in itself and is only of significance when considered with the ascertained purity,—and introducing a form of report in terms of percentage of pure germinating seed and percentage of impurities.

I. One advantage of such a procedure is that the report would show at first glance the actual percentage weight, as nearly as can be calculated, of the live seed of the kind supplied, in contra-distinction to the figure for germination which has a certain falsity.

Individual seeds of the same species in the same sample differ in size, weight and condition.

The selection of seeds of different weight and germinating values in their due proportions from any sample is assumed to be subject only to the limits of mathematical variation. This has been examined by Rodewald and by Stevens, who have shown that the probable error in selection is not, in general, large.

But, if a sample consists of seeds which can be graded into different weight sizes, and if there is any difference in the capacity for germination of the various portions of the sample thus graded, then the proposition that the estimate of the percentage of pure germinating seed is a true weight percentage is not truly valid.

Critical examples which might seem to invalidate the proposition fall into two classes:—

(1) "Seeds," which are normally at Seed Testing Stations excluded from the germination test, *i.e.* —

Broken seeds of leguminosæ.

Damaged seeds.

"Deaf" or "light" seeds of grasses.

Seedless clusters of *Beta*.

(2) "Seeds," the germination value of which can only be satisfactorily established by reference to a germinating test, *i.e.* :—

Small mature seeds.

Shrivelled or unripe seeds.

Shelled caryopses.

Weakly germinating seeds.

Broken and damaged Seeds.—The difference in weight between 1,000 broken seeds of Red Clover as usually excluded in analysis and 1,000 whole seeds varies greatly in different samples—from 2 per cent. to 20 per cent. of the weight of whole seeds. But some of the broken seeds, as defined in Seed Testing literature and as customarily excluded from the germination test, are capable of germination if germination be determined according to accepted rules, *viz.*, that all seedlings which possess two cotyledons attached and which have, at the end of 10 days, thrown a secondary or an adventitious rootlet, are to be reckoned as germinated.

Broken seeds should, however, only be considered as equivalent to inert matter when it is absolutely certain that the cotyledons are separated and that the plumule has been lost.

As a general rule, it is waste time on the part of Seed Testing Station assistants to try to identify "broken" seeds, unless the term be reserved for chips which can be segregated without special examinations. In

actual practice a difference of opinion as to the percentage of broken seeds, even to the extent of 10 per cent. in a sample, would not affect uniformity of result if expressed in terms of pure germinating seed only, and if, in the report, broken seeds and broken seedlings are classified together, as they ought to be.

Small Seeds.—The ratio of the weight of seeds of Red Clover sieved through a mesh of 1.25 mm. to those retained over this mesh varies with the sample from 50 to 70: 100.

Small seeds of Red Clover contain a larger proportion of hard seeds than do large seeds, but the proportion is not such as, in actual practice, to make any great difference to the result, whether taken by weight or numerically.

Shriveled (dead) seeds and immature seeds may be conveniently considered together, as in general it is quite impossible to separate these with any accuracy into germinable and ungerminable without reference to a germination test. In Red Clover, the weight of a definite number of shriveled seeds is, approximately, 20 per cent. less than the weight of the same number of good seeds.

Empty glumes—dead seeds—shelled caryopses.—In samples of Cocksfoot, the weight of a definite number of dead seeds may vary from $\frac{1}{3}$ to $\frac{1}{2}$ of the same number of full seeds, and in samples of Lolium from $\frac{1}{4}$ to $\frac{1}{5}$.

For the purpose of obtaining a true estimate of pure germinating seed, which shall be a sufficient approximation to a weight percentage of live seed, it is imperative that the "light seed" of grasses should be excluded from the germination test.

This is the more so because it is quite possible that a sample of Cocksfoot, for example, may contain both the shelled kernels and the husks from which they have fallen, and it is absurd to test both of these for germination.

The division of spikelets may, however, be carried to an unnecessary degree of exactness, and it is here suggested that the conventional method of treating a species such as Cocksfoot should, in order to reduce the work per sample, be modified to the extent of leaving intact the ultimate dead seed where it occurs along with a full seed.

The difference between the percentage of pure germinating seed calculated by weight, and the percentage of pure germinating seed calculated by number (presuming that the first mentioned calculation could in effect be accurately made) reaches 5 per cent. only when either 20 per cent. of the sample is ungerminable and the average ungerminable seed is 30 per cent. less in weight than the average germinable one, or when 30 per cent. of the sample is ungerminable and the weight of the average ungerminable seed is 20 per cent. less than that of the average germinable one.

This difference only exceeds the usual latitudes for germination when the germination is less than 70 per cent. and, at the same time, the average weight of an ungerminable seed is less than 60 per cent. of a germinable one.

In actual practice, samples which would show a difference of 5 per cent. between a determination by weight and a determination by number are never met with except where the so-called Irish method is practised on samples of species such as *Dactylis*, *Lolium*, *Poa* and *Alopecurus*.

The following is an account of calculations applied to a fairly normal sample of Red Clover which had an ascertained purity of 99.3 per cent. (broken seeds being reckoned pure seeds). The sample contained:—

By Weight. Numerically.

Broken seeds	-	-	3.3%	3.7%
Small seeds	-	-	4.7%	8.6%
Large sound seeds	-	-	91.3%	87.0%
			99.3%	99.3%
Impurities	-	-	0.7%	

100.0

The broken seeds when tested for germination, germinated 12.5 per cent. The small seeds contained 11.5 per cent. hard seeds, as against a content of 4.5 per cent. hard seeds in the large grained seeds.

The percentage of pure germinating seed, if taken according to number, was :—

Broken seeds	-	-	-	-	0.45%
Small seeds	-	-	-	-	7.60% and 1% hard.
Large seeds	-	-	-	-	83.00% and 4% hard.

91.00% and 5% hard.

and calculated according to weight—assuming each seed in any of the three grades to have equal average weight—

Broken seeds	-	-	-	-	0.40%
Small seeds	-	-	-	-	4.16% and 0.54% hard.
Large seeds	-	-	-	-	87.09% and 4.21% hard.

91.29% and 4.75% hard.

When germination was taken according to number, and broken seeds according to weight, as is customary, the percentage of pure germinating seed was—

$$96\% \times (95\% + 5\% \text{ hard}) = 91.2\% + 4.8\% \text{ hard seeds.}$$

The following account of determinations made on the sample of Red Clover circulated by Dorph-Petersen in 1923 (No. 64a) is also pertinent. Portions of this sample after purity determination (which was $92\% \pm 0.75\%$) were divided into brown shrivelled seeds and full round seeds in a ratio of $33\% \pm 3\%$ brown seeds to $67\% \pm 3\%$ round seed by weight, the numerical ratio for the same sample or any portion of it taken for the germination test being approximately $37\% \pm 4\%$ and $63\% \pm 4\%$ respectively. The numerical ratio of the germinating capacities of the two portions was $42\% \pm 0\% : 80\% \pm 1\%$. The difference between the weight of the same number of shrivelled seeds and of full seeds was 17 per cent. of the weight of the full seeds. If it be assumed that the individual seeds in either of the two portions were equal in weight, then these percentages of germination may be taken as equivalent to weight percentages.

Thus, the pure germinating seed, neglecting hard seeds—the ascertained purity being $92\% \pm 0.75\%$,—would be :—

$$\left\{ \begin{array}{l} (33\% \pm 3\%) \times (42\% \pm 0\%) \\ (67\% \pm 3\%) \times (80\% \pm 1\%) \end{array} \right\} \times (92\% \pm 0.75\%) = 62\% \pm 2\% \text{ by weight and, numerically,}$$

$$\left\{ \begin{array}{l} (37\% \pm 4\%) \times (42\% \pm 0\%) \\ (63\% \pm 4\%) \times (80\% \pm 1\%) \end{array} \right\} \times (92\% \pm 0.75\%) = 60.7\% \pm 2.5\%.$$

Were it possible to separate this sample accurately into germinable and ungerminable seed, the difference in the average weight of the germinable and ungerminable would be found to be less than 10 per cent., and, by calculation, the difference between pure germinating seed by weight and pure germinating seed by number would be less than 2.5 per cent.

II. The adoption of the proposal here suggested would lead to greater uniformity in reports.

Evidence of this is provided by reference to the results reported by various Stations on samples circulated by Dorph-Petersen in 1921 and 1922, and by M. T. Munn in 1923.

If certain European Stations which are obviously, from the nature of results reported, working according to a fairly uniform routine be selected and results of the three complete series compared, it will be found that the variation in the determination of the percentage of pure germinating seed is smaller than that in the percentage of germination in the case of over 60 per cent. of the samples. It, therefore, follows that the latitude of variation in germination at present in use could be adopted for the pure germinating seed.

III. Another advantage of the form of report suggested is that the purity report would afford a fairer index of foreign ingredients.

Conventional impurities are not in accordance with the real meaning of the term.

Seeds should be taken in their commercial sense to designate that which is sold as representing the portion of the plant which is utilised for sowing to reproduce the species. The term should be accepted as descriptive of the whole or any portion of a seed of any species as commercially understood and as commonly collected and marketed. Thus, broken seeds, shrivelled seeds, deaf seeds, immature seeds, seedless clusters of Beta should not be regarded as impurities. They are of the species they presume to represent and, moreover, they are the commercial article which they are represented to be, and, consequently, should not be designated impurities.

Conversely the "purity" of a sample which is determined by subtracting these from the total is somewhat misleading.

It is to be deprecated that any special or arbitrary significance should attach to a word which has a commonly accepted meaning.

The issue of partial reports, whether of purity only or germination only, is to be deprecated and certainly a report on germination only should never be issued.

SUGGESTED FORM OF REPORT.

							%
Pure Germinating Seed	-	-	-	-	-	-	_____
Hard Seeds	-	-	-	-	-	-	_____
Broken seeds, broken seedlings	-	-	-	-	-	-	_____
Dead seeds	-	-	-	-	-	-	_____
Empty glumes	-	-	-	-	-	-	_____
Impurities (Foreign ingredients)	-	-	-	-	-	-	_____
including—							
Chaff, inert matter	-	-	-	-	-	-	_____
Weed seeds	-	-	-	-	-	-	_____
Useful seeds	-	-	-	-	-	-	_____
Adapted for a purity separation only.							
Pure seed	-	-	-	-	-	-	_____
excluding—							
Broken seed	-	-	-	-	-	-	_____
Shrivelled seeds	-	-	-	-	-	-	_____
Empty glumes	-	-	-	-	-	-	_____
Impurities (Foreign ingredients)	-	-	-	-	-	-	_____
including—							
Chaff, inert matter, &c.	-	-	-	-	-	-	_____
Weed seeds	-	-	-	-	-	-	_____
Useful seeds	-	-	-	-	-	-	_____

In commenting on his paper, *Mr. Anderson* stated that his point of view represented that of the consumer who was engaged in the production of pastures and whose interests, he thought, had been insufficiently considered by Seed Testing Stations. His proposal, which should be regarded as tentative because the evidence was incomplete, might conflict with established regulations, and did, in fact, conflict with the official regulations in force in Great Britain. He suggested, however, that the proposal might be useful to any Committee which might be appointed to draw up a scale of international latitudes and common rules of analysis. If the main general principle embodied in his proposal were accepted, he was prepared to collect complete evidence

regarding its application to all species individually and to furnish such evidence to any Committee that might be appointed.

An interesting discussion followed and finally *Mr. Dorph-Petersen* intimated that he considered it desirable that on Thursday afternoon the Congress should appoint a Committee to consider *Mr. Anderson's* proposal and the views expressed by the various delegates. He thought that it was not essential that all the members of the Committee should meet together, as they might carry out the work by correspondence.

The Congress accepted *Mr. Dorph-Petersen's* suggestion and proceeded to the next business.

Dr. Buchholz then read the following paper :—

The Determination of Moisture in Seeds.

BY

DR. YNGVE BUCHHOLZ, CHRISTIANIA.

The determination of moisture in seeds often has great value both in order to gain knowledge of the water content in the sample, and also with regard to the "1,000 grain" weight of the dry seed.

The determination of moisture—as is probably known—is carried out by estimating the loss of weight in a known quantity of the substance through heating to a certain temperature for a fixed time. Purely technically, this analysis is so simple that it is commonly one of the first tests a beginner is given to carry out in the chemical laboratory.

In practice, however, it is anything but easy to determine the actual moisture content in organic substances, e.g., seeds, because the result is largely dependent upon the conditions under which the analysis is carried out. This is accounted for by the fact that it is not easy to remove all water through heating without other processes taking place simultaneously, both those causing a loss of weight and also those causing an increase in weight (e.g., certain processes of oxidation). The first will lead to too high and the latter to too low analysis figures for the moisture.

Purely theoretically we may say that in an analysis of the loss of weight it is impossible to decide the moisture content absolutely correctly, and the methods that satisfy the purely theoretical claims more closely are so difficult that to tackle this problem must be excluded from practical seed testing.

The only way would be to work so that the effect of the extraneous processes is made as small as possible, provided that, at the same time, one takes care to expel all water as quantitatively as possible. The conditions that have a special influence here are :—

- (1) The preparation of the sample (the degree of grinding).
- (2) The temperature at which the estimation takes place.
- (3) The time, i.e., the duration of the drying process.

These conditions must be chosen so that one gets—as far as possible—corresponding results through parallel determinations, whilst permitting the easiest possible methods of working.

At the seed-testing stations of Scandinavia, and probably also in most other countries, the preparation for this estimation is simple; large-seeded samples (such as cereals, etc.) are coarsely ground, and all small-seeded samples are used whole. 2½ gr. of the coarsely ground, or 1 gr. of the whole small seed is used.

The material is heated for 5 hours at about 98° C. (steam drying oven).

It must be noted that coarse grinding or the use of whole seeds hinders the escape of steam evolved; this is also the case when using a temperature of 98° C., which is under boiling point.

For this reason a slightly higher temperature, viz., 103° C. to 105° C. (electric drying oven) is being adopted in chemical laboratories in the estimation of moisture in organic substances.

A more thorough preparation of the sample, namely, grinding until the whole sample passes through a sieve with a mesh of 1 mm. has previously been used in these laboratories. A drawback to this more thorough preparation is that it takes more time, which may allow the moisture of the sample to alter during the work.

In order to get an appreciable basis for the discussion of these questions I have carried out several tests as to the influence on the results of the analysis of various methods of preparation, temperature and time. Owing to lack of time, I have been compelled to limit the analysis material, and have consequently selected some of the most important kinds of seed, viz., two of oats (*avena sativa*), two of barley (*hordeum vulgare*), two of rye (*secale cereale*), two of timothy (*phleum pratense*), one of red clover (*trifolium pratense*), one of alsike clover (*trifolium hybridum*), two of turnip (*brassica camp. rap.*) and two of meadow foxtail (*alopecurus pratensis*).

These 14 samples were prepared in two different ways, namely, (1) as usual in seed testing, by rough grinding the large seeds, and leaving whole seeds of the small kinds, and (2) in the same way as for chemical analysis, by grinding and sifting the large seeds and crushing the small seeds in a mortar. These 28 samples were dried at 98° C. and at 103° C., and in both cases the drying was done first for 4 hours and then for an additional hour. The parallel determination was carried out as far as possible, and in each case 5 gr. of the substance was used. The results are shown together in Table I (*see page 50*). In Table I, are shown the differences between the parallel determinations. In Table II (*see page 51*) is given the difference in the results for various methods of procedure.

From Table I it will be seen that the conformity between two parallel analyses is, generally speaking, good in all methods, but it is decidedly better at 103° C. than it is at 98° C.; further that the more careful preparation also gives rather more closely corresponding results; and that it does not make much difference when one dries for the additional hour.

From Table II it will be seen that the more careful preparation gives about $\frac{1}{2}$ per cent. more moisture than the usual method. *Alopecurus* is an exception, giving a lower result from the careful preparation, a fact that is probably due to a displacement of the moisture content during the preparation. Further, drying at 103° C. gives about $\frac{1}{4}$ per cent. higher result than drying at 98° C. Drying for the additional hour, after four hours, varies the result only by a small fraction of one per cent.

The main point is the utilisation of a method that permits of different stations getting the same result. Having regard to the above experimental results and to my experience as a scientific chemist and considering the importance of making the method as practical and simple as possible for different kinds of seed, I beg to propose that the following method be adopted as international, and that it be used in all cases of international transactions in seeds.

The estimation of moisture in seeds should be carried out as follows:—

(a) *For cereals and other large seeds* (dry weight of 1,000 grains more than 10 gr.) 5 gr. of roughly ground substance is heated for from 4 to 5 hours in a drying oven to 103° C.

Parallel determination must be carried out.

(b) *For small seeds* (dry weight of 1,000 grains less than 10 gr.) $2\frac{1}{2}$ gr. whole seeds are heated for from 4 to 5 hours to 103° C. Parallel determination as above.

† *Remarks.*—It is evident that the sample—when the estimation of moisture is to be carried out with the object of a guarantee (and preferably

also with all samples)—must be forwarded in an air-tight glass container or in a close fitting tin box. The sample selected must be a good average sample and must weigh at least 100 gr. for large seeds and 50 gr. for small seeds. The sample must be well mixed before grinding and before weighing off for analysis. When using 103° C. instead of 98° C., it must be remembered that the moisture content obtained at 103° C. will be from $\frac{1}{2}$ per cent. to 1 per cent. higher than that obtained at the lower temperature.

Mr. Devoto stated that the paper would be of great interest to farmers in the Argentine who lose a large sum of money annually because of the moisture content of maize. The Brown-Duval apparatus for the estimation of moisture was introduced into his country five years ago. The machine saved time but the results obtained were not very exact. *Mr. Brown* stated that this apparatus (which bears his name) was first developed with the view of its application to the grain trade, especially corn. The apparatus was simple and the test took only 15 minutes. It was necessary to vary the times and temperatures according to the different seeds to be tested, and provided this was done the results obtained were satisfactory and tallied with those obtained by chemical methods. He claimed that in using the machine errors of grinding and weighing were eliminated.

Professor Voigt said that in Germany two different methods were employed—for certain seeds a temperature of 98° C. was used, and for others 103° C. The seeds were put in a cold oven and heated to the required temperature. The period of heating was counted from the time that temperature was reached.

Dr. Volkart stated that at the Zürich Station they refused to make determinations of moisture unless the samples were sent in air-tight containers. *Mr. Dorph-Petersen* intimated that the same condition applied in Denmark. The method used at his station was to dry the samples in a copper apparatus surrounded by water jackets containing water kept at boiling point. The temperature in the apparatus was then about 98° C. Investigations showed that the moisture content of samples stored in heated rooms decreased.

Further discussion followed regarding the different degrees of temperature employed in the determination of the moisture content of various seeds and the danger of oxidation during the process. The Argentine Delegate laid stress on the necessity for tests to be made from the commercial as well as the scientific standpoint.

(It will be observed from the report of the session on Thursday afternoon that a Committee was appointed to deal with the question of moisture content.)

Afternoon Session.

The Congress resumed at 2 p.m.

Professor Bussard read a paper on the subject of weed seeds, a summary of which is given on page 52.

TABLE I.
Determination of Moisture in Seeds. (Per cent.)
(Feuchtigkeitsbestimmung in Saatwaren.)

Seed. Saatware.	No.	Common Preparation. Gewöhnliche Vorbereitung.				Thorough Preparation. Gründliche Vorbereitung.				Differences of Parallel Analyses.							
		98° C.		103° C.		98° C.		103° C.		Common Preparation.		Thorough Preparation.					
										98° C.		103° C.		98° C.		103° C.	
		4 hours. Stund.	+ 1 hour.	4 hours. Stund.	+ 1 hour.	4 hours. Stund.	+ 1 hour.	4 hours. Stund.	+ 1 hour.	4 hours. Stund.	+ 1 hour.	4 hours. Stund.	+ 1 hour.	4 hours. Stund.	+ 1 hour.	4 hours. Stund.	+ 1 hour.
		a.	b.	c.	d.	e.	f.	g.	h.	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Avena	1	10.06	10.10	10.97	10.97	10.91	10.91	11.63	11.64	0.00	0.08	0.02	0.02	0.04	0.04	0.04	0.06
"	2	9.52	9.61	10.41	10.42	10.14	10.22	10.96	10.96	3	0	3	4	4	0	8	8
Hordeum	3	9.52	9.53	10.62	10.64	10.31	10.34	11.28	11.28	0	3	7	7	4	12	14	8
"	4	9.60	9.69	10.63	10.64	10.05	10.12	11.20	11.24	19	5	2	2	2	8	8	8
Secale	5	9.94	10.04	11.18	11.18	10.19	10.26	11.42	11.44	11	16	2	1	6	10	8	4
"	6	9.57	9.58	10.46	10.48	9.90	9.90	10.96	11.01	12	10	12	12	9	9	4	2
Pleum	7	8.53	8.61	9.31	9.44	9.16	9.18	10.00	10.12	22	19	3	4	4	0	4	4
"	8	8.90	8.91	9.49	9.61	9.52	9.54	10.27	10.37	3	6	7	8	0	2	2	2
Trifolium p.	9	7.53	7.61	8.04	8.08	7.96	8.07	8.80	8.82	—	—	—	—	12	20	1	4
"	10	8.11	8.17	8.66	8.74	8.75	8.75	9.60	9.60	—	—	—	—	6	5	8	8
Brassica camp.	11	5.51	5.53	5.67	5.69	5.71	5.76	6.21	6.28	—	—	—	—	2	1	7	7
"	12	6.04	6.04	6.52	6.54	6.11	6.11	6.70	6.72	—	—	—	—	7	6	5	1
Alopecurus	13	10.40	10.42	10.85	10.86	10.16	10.16	10.74	10.82	—	—	—	—	—	—	—	—
"	14	10.44	10.46	11.32	11.32	10.40	10.40	10.99	11.00	—	—	—	—	—	—	—	—
Average	—	—	—	—	—	—	—	—	—	9	8	5	5	7	6	6	5
Durchschnitt.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Largest difference	:	:	:	:	:	:	:	:	:	22	19	12	12	14	20	14	8
Grösster Unterschied	:	:	:	:	:	:	:	:	:	22	19	12	12	14	20	14	8

TABLE II.
Differences of Results of Different Methods in the Determination of Moisture.
(Analysenunterschiede bei verschiedenen Methoden der Feuchtigkeitsbestimmung.)

Seed. Saatware.	No.	Different Preparation. Verschiedene Vorbereitung.			Different Temperature. Verschiedene Temperatur.				Different Duration of Drying. Verschiedene Trocknungsdauer.				
		98° C.		103° C.	Common Preparation.		Thorough Preparation.	Common Preparation.		Thorough Preparation.			
		4 hours. e - a.	+ 1 hour. f - b.	4 hours. g - c.	+ 1 hour. h - d.	4 hours. c - a.	+ 1 hour. d - b.	4 hours. g - e.	+ 1 hour. h - f.	98° C. b - a.	103° C. d - c.	98° C. f - e.	103° C. h - g.
Avena -	1	0.85	0.81	0.66	0.67	0.91	0.87	0.72	0.73	0.04	0.00	0.00	0.01
" -	2	62	61	55	54	89	81	82	74	9	1	8	0
Hordeum -	3	79	81	63	64	1.10	1.11	84	94	1	2	3	3
" -	4	45	43	57	60	1.03	0.95	1.15	1.12	9	1	7	4
Secale -	5	25	22	24	26	1.24	1.14	1.23	1.18	10	0	7	2
" -	6	33	32	50	53	0.89	0.90	1.06	1.11	1	2	0	5
Phleum -	7	63	57	69	68	78	83	0.84	0.94	8	13	2	12
" -	8	62	63	78	76	59	70	75	83	1	12	2	10
Trifolium p. -	9	43	46	76	74	51	47	84	75	8	4	11	2
" h. -	10	64	58	94	86	55	57	85	85	6	8	0	0
Brassica camp.	11	20	23	54	59	16	16	50	52	2	2	5	7
" "	12	6	7	18	18	48	50	60	61	0	2	1	2
Alopecurus -	13	-24	-26	-11	-4	45	44	58	66	2	1	0	8
" -	14	-4	-6	-33	-32	88	86	59	60	2	0	0	1
Average Durchschnitt.	-	0.40	0.39	0.47	0.48	0.75	0.74	0.81	0.83	5	3	3	4

ENGLISH SUMMARY.

Should not the reports on the purity of seeds indicate expressly the percentage by weight of weed seeds and the names of those most plentiful in the samples analysed; and what species are to be described as weeds?

BY

PROF. LÉON BUSSARD,

Assistant Director, Seed-Testing Station, Paris.

Three years ago, at the Copenhagen Congress, Director Bruijning, of the Wageningen station, after demanding that the term "grade" should be substituted for "cultural value" or "real value," suggested the following formula:

$$\text{Grade} = \frac{\text{Purity} \times \text{Germinating power}}{100} - \text{Percentage of weeds} \times 3.$$

taking as a base the incontrovertible fact that the presence of weeds in a parcel of seeds is more harmful than that of inert matter, because crops become contaminated through their introduction into the soil.

The result of the discussion on Director Bruijning's proposal showed that most of those present were not in agreement with it. There are, in fact, several objections to be made.

The co-efficient 3 for weeds is arbitrary.

In deducting the percentage of weeds from the

$$\frac{\text{Purity} \times \text{Germinating power}}{100}$$

this percentage is reckoned twice, coming, as it also does, into the test for purity.

Harmless and noxious weeds cannot be given the same importance in the calculations.

The discrepancy between the figures under the old method and under the new grade one, appears excessive when due to the presence of harmless weeds.

The latter is difficult of comprehension for growers and seedsmen, and might give rise to mistaken interpretations.

To avoid confusion, stations should keep to the simple formula:

$$\text{Grade} = \frac{\text{Purity} \times \text{Germinating power}}{100}$$

Director Bruijning was, however, quite justified in stating that it is necessary to let the growers and seedsmen know the quantities and kinds of weeds in the analysed samples.

What rules are to be applied?

If only a few weeds are in the samples it would be easy and useful to enumerate them. If they are numerous it is useless to name them separately, and no notice need be taken of those of which only 1-2 seeds are found.

The percentage of weed seeds can be determined by taking the total of all kinds when the percentage of each kind is less than 0.30 per cent. of small seeds and 0.50 per cent. of large seeds, and by taking the separate percentage of each when in excess of these figures.

An important question with regard to these rules is: What are to be considered as weeds?

In our opinion every extraneous plant in a crop is a weed, such as barley among oats, etc. But the term "weeds" can be restricted to meaning only plants of no cultural value, distinguishing between useful and noxious seeds, this being the interpretation we shall adopt, and the most generally admitted one.

The limits between useful seeds and noxious seeds is not always strictly defined, for in the U.S. Seed Importation Act of 1912, forage plants such as *Medicago lupulina* and *Anthyllis vulneraria* are counted as weeds.

What kind of seeds must be given as weeds in the reports of the testing stations?

To enable this question to be answered, Mr. Dorph-Petersen initiated an enquiry by sending to the various European and American stations a questionnaire including the names of 206 wild plants, belonging to 40 families, requesting them to strike out those not met with at each station, to add those not named, underlining the noxious plants and to number the species 1-5, No. 1 to include the most frequent kinds.

Thirty stations returned the questionnaire duly annotated.

These stations, in their replies, added species peculiar to their regions, so that, besides the elucidation of the question of weeds, we have information as to the determination of the origin of seeds.

From the reports sent in, it can be seen that very few kinds of weeds are to be met with equally frequently at the different points of the temperate zone, which is, for us, the most important one.

The following species were most frequently and abundantly found in North and Central Europe (including S. France and N. Italy) and even in America :—

Sinapis arvensis
Chenopodium album.
Plantago lanceolata.
Rumex acetosella.

Specially in Europe, but less uniformly :—

Daucus carota.
Sherardia arvensis.
Centaurea cyanus.
Stellaria media.
Brunella vulgaris.

and variable in different countries :—

Ranunculus.
Vicia.
Galium.

It would, therefore, appear that these weeds should always be named in the reports, and perhaps their quantities given also.

As for the other species, even when a more restricted geographical area is in question, there are such great discrepancies in their respective frequency that it would be impossible to require all stations to include them in their reports. But, nevertheless, such weeds may have special importance for some one region or other, and it would be requisite in such cases, in the interest of the growers, to name these weeds in the reports. For example, the large-seeded Dodder, so unimportant for Northern lands and so noxious for leguminous forage plants in Central and Southern Europe.

Is it possible to state precisely what categories of weed seeds should be pointed out by the testing stations?

Every country with a distinct climate has its own noxious plants. Their propagation can only be avoided if the grower is made aware, by analysis, of their presence in the seed to be employed. In France, *Bromus mollis* in Gramineae and *Melilotus officinalis* among leguminous seeds must always be notified.

The names of certain weeds which are specially prescribed are given in some Acts, as in the regulations attached to the U.S. Seed Importation Act of August 24th, 1912, where 105 species are given.

In the explanatory regulations of the Canadian Seed Act of 1923, four categories of extraneous plants are grouped as under :—

(1) Primary noxious weeds	-	-	-	-	-	8 species.
(2) Secondary noxious weeds	-	-	-	-	-	22 „
(3) Useless weeds	-	-	-	-	-	8 „
(4) Harmful weeds, include all species not named above.						

These species clearly specially concern Canada. The national stations, and perhaps foreign ones, must pay them the greatest attention.

Finally, when any one kind of weed seed is present in appreciable quantities in a sample of seed it should figure in the report with its name and weight. As the proportion of extraneous useful seeds is of interest, it is advisable to give the results of analysis as follows, a complicated example having been selected purposely :

Pure Seeds	-	-	-	95.54 per cent.
Extraneous Seeds—				
(Useful seeds)				
a	-	-	-	0.60
b	-	-	-	0.36
				0.96 per cent.
(Weed seeds)				
c	-	-	-	1.10
d	-	-	-	0.40
e	-	-	-	0.32
various	-	-	-	0.18
				2.00 per cent.
Inert Matter—				
Earth and stones	-	-	-	0.80
Vegetable debris (leaves, stems, broken seeds, etc.).	-	-	-	0.70
				1.50 per cent.
				100.00

If wished, a and b, or c, d and e can come under one weight. In the case of seeds of parasitic plants like Dodder, the number and not the weight should be stated.

This method will not be new to some stations, which for a long time have given a more or less complete list of the impurities contained in the samples tested.

(A full copy of this paper in French will be found on pp. 154–158.)

Mr. Dorph-Petersen called attention to a paper, “Examinations of the occurrence and vitality of various weed seed species under different conditions, made at the Danish State Seed Testing Station during the years 1896–1923,” copies of which were circulated. These examinations confirm fully the truth of the old saying : “Evil weeds never wither,” as many species of weed seed have proved able to retain their germinating capacity in the soil for many years. They pass partly uninjured through the digestive system of animals as well as through the mill. This shows the necessity of recording on the analysis certificates the percentage of weed seed and the number per kg. of noxious weed seeds occurring in the samples sent in for testing (*see* paper on pp. 124–138).

The Delegates from Egypt, the Argentine, Hungary, and the Ukraine, took part in the discussion which followed. The suggestion was made that each country should submit to the European Seed Testing Association (now the International Seed Testing Association—*see* later) a list of the noxious weeds in which it is specially interested. It was agreed that this and similar questions discussed should be considered by the appropriate Committee of the Association to be appointed on Thursday afternoon.

Dr. von Degen presented, but did not read his Report (copy of which is appended) on the work of the Dodder Committee, of which he was appointed Chairman at the Copenhagen Conference in 1921.

Report of the Dodder Committee.

BY

DR. A. VON DEGEN,
Director, Royal Hungarian Seed Control Station, Budapest.

On the occasion of the Copenhagen Congress a Committee was appointed to study the question of dodder. As members of this Committee were elected Director Vitek, Professors Bussard and Voigt, Director Enescu and myself, who are all representatives of European countries where the cultivation of clover and alfalfa is of very great importance. The Congress having decided that the Committee should choose its own Chairman, I accepted this position in accordance with the wishes of my colleagues, and I have since taken all those initial steps necessary for approaching the solution of the main problem assigned for the Committee's investigation.

This problem was to determine, at least approximately, and for the present only for Europe, the bounds within which the dodder plant produces its noxious effects, distinguishing, so far as possible, the scope of the so-called large-seeded dodder and that of the common dodder.

Experience had already taught us that certain parts of Europe—for instance, the northern regions and such parts as are situated at a greater height above the sea-level—are immune, or almost immune, against dodder infection, since the plant, when introduced to these parts, fails to become acclimatised and disappears after a brief period.

On the other hand, we knew, also from experience, that there were certain regions in Europe where acclimatisation of the dodder was indeed possible, but was neither certain nor constant; regions in which the plant might or might not develop and produce ripe seed according as the weather, during the period of vegetation, was warm and dry, or cool and wet; therefore regions which, under certain circumstances, could become infected, and would, at all events, be exposed to danger by the importation of seeds infected with dodder.

It was clear from the outset that here the climatic influences were of primary effect.

Even the use to which the red clover and alfalfa are applied—whether these plants are cultivated only for the purpose of obtaining fodder or also for the purpose of procuring seed—is of some importance in the development of the dodder, in so far as in the case of plants cultivated exclusively for the production of fodder, the more frequent mowing unfavourably affects the development of the dodder and, indeed, often renders seed formation impossible, while in districts where clover seeds are also harvested, the clover plants have a longer period of rest during which the dodder has also time for development. Still, the use to which the plants are applied is also closely connected with climatic factors, for in the districts which are warm and dry there is also invariably a harvest of clover seeds, while, in cooler districts with a more abundant rainfall, the clover serves only as a fodder crop. Thus the question here also is one of climatic limits.

Now, while the countries which only produce fodder are constantly obliged to import seed, the seed-producing countries export from year to year a certain quantity which is, to some extent, infected with dodder seeds.

In addition to the influence exercised by the use to which the plants are applied, another influence on the propagation of dodder is found in the conditions of cultivation in the different countries, notably in the more or less strict adherence to the regulations designed to combat the evil. However, as these regulations are by no means strictly enforced in Europe, we may well leave them out of consideration. The methods of extirpation involve great expense, and therefore the different countries much prefer to confine themselves to regulations for the prevention of the importation

of dodder—that is, they prescribe certain grades of purity for imported seed; and precisely for this reason, it would be of the greatest importance to know the limits within which dodder exercises its damaging effect.

Thus, the growers of fodder, the merchants and the Seed Control Stations have a common interest in determining these limits. I believe I do not err in assuming that a similar interest in this question also exists in America and that interest in it will also arise in Asia.

In view of the importance of the question, I must regret how relatively small is the interest evinced in the work of the Dodder Committee. This may perhaps be due to the fact that the solution of the question is sought during a period when the political and financial confusion in East and Middle Europe has greatly increased the difficulties of such work.

With Russia, a country which, in respect to dodder, is of peculiar interest and has, according to supposition, a limit of noxious effect stretching across the country from West to East, we were unable to establish contact.

From Germany, with its mosaic of districts differing in climatic character, we could obtain no positive information, obviously in consequence of the political confusion which has prevailed there in recent years. All the efforts which Professor Voigt devoted to investigation were unavailing.

In France, according to Professor Bussard's report, there is no limit for the common dodder (*Cuscuta Trifolii*), this weed being met with in all parts of the country; on the other hand, the large-seeded dodder (*Cuscuta racemosa* or *suaveolens*) is limited to certain districts which are greater or smaller in number according to the climatic conditions prevailing in any particular year, and as these districts are distributed irregularly, it is very difficult to determine their boundaries. According to Professor Bussard, more extensive research would be required to establish the limits of dodder growth in France.

From Roumania I have received no data. I have informed Director Enescu of our system of question sheets for ascertaining the limits of dodder effects, but hitherto I have received no reply.

From Czecho-Slovakia also there are no data, for I have not succeeded in establishing correspondence with Director Vitek.

The most important details I have received exhibiting the correct method of procedure in this question, came from Dr. A. Volkart, of Switzerland. In Switzerland, on the north side of the Alps, only the common dodder (*C. Trifolii*) plays any sort of rôle, and here also, according to the observations made, the growth appears with injurious effect only within the rainfall curve of 1,000 mm. In districts with a greater rainfall, the growth is not injurious. In warm, dry years the dodder does more damage and also develops many ripe seeds, which again infect the soil for a series of years: in wet years the damage is of small extent.

Nevertheless, there are to be found everywhere spots of dodder infection, even in the districts where the rotation system of crops prevails, where pastures of mixed clovers and grasses are made to last for 4–6 years; but the damage from dodder is nowhere very great. In Switzerland the clover plant grows very luxuriantly, and this impedes the development of the dodder. In the Cantons of Vaud and Geneva, and also in Wallis (Valais) dodder is undoubtedly more injurious than in the other cantons; in Canton Tessin the more abundant rainfall promotes the growth of the fodder, and this prevents the extension of dodder. In Tessin there is no zone which has a lower rainfall than 1,000 mm. The large-seeded dodder, *C. racemosa*, appears only spasmodically in Switzerland, and *C. arvensis* Beyr. is not known to have appeared at all.

In this isohyete of 1,000 mm. we should, therefore, have a line of great importance, since it denotes, in all probability, a boundary line of dodder growth.

Another boundary line is the isohypse of 800 m. This boundary line was first mentioned by Dr. J. v. Szyszyłowicz, of Lemberg, on the occasion of the Hamburg Conference for Seed-Testing (*Jahresb. der Ver. f. angew. Bot.* W. 1906: 298). Without a doubt this also is connected

with the climatic conditions prevailing at this height. This is corroborated by our experiences before the war in the North-East of Great Hungary, in the Carpathian Forest district, with a plentiful rainfall. Although large quantities of dodder-infected clover were seeded, the crop of clover seed harvested was relatively pure.

Towards the end of the war, considerable quantities of clover seed heavily infected with large-seeded dodder were exported from Hungary to Bavaria. So far as my experience extends, the large-seeded dodder has not become assimilated to the soil of Bavaria, no doubt because the districts in which this clover seed was planted lie above the boundary line of the noxious effect of dodder. The conditions in present day Austria are probably similar to those in Switzerland and Bavaria.

As for the limits of dodder effect within the contracted boundaries of present day Hungary, the whole territory must be regarded as being infected. The whole territory lies within the limits of dodder growth, so that this noxious weed may appear in any part of the country, and if it does not actually appear in all parts this is to be attributed to the efficiency of the preventive measures and the methods of extirpation.

Within this territory there are, indeed, districts, in West Hungary near to the frontier of Styria and Austria, which, in contrast with the 500 mm. rainfall of the Lowlands, have an average annual rainfall of 800 mm., and here also the clover fields are less infected. The region east of these districts, as far as the Danube, has a rainfall of 700 mm., and still farther east the rainfall decreases to 600 mm. and 500 mm. All these districts lie within the general dodder limit, and also within the limit of the large-seeded dodder.

Consequently, if I summarise the experiences collected in Hungary, I must say that here the limit of dodder seems to be somewhat below the 1,000 mm. rainfall line.

With regard to the limit of dodder in England, the *Journal of the Ministry of Agriculture*, Vol. 30, 1923: 38-41, contains the important information, that *C. Trifolii* is not found in Scotland, and its appearance in England north of the Trent up to the boundary of Scotland is of little importance, but becomes more frequent in the more southern and eastern counties.

Here also, it is impossible not to recognise the connection between the extension of dodder-growth and the condition of the rainfall. The south and east of England have large areas with a rainfall of 7-800 mm., the more western parts have a rainfall of 8-900-1,000, while north of the Trent there are districts with a still higher annual rainfall. The large-seeded dodder appears to have become nowhere acclimatised to the soil in Great Britain.

All in all, what I can report to you of the operations of the Committee is but little, and that, unfortunately, is lacking in precision. Yet I believe that the question can be brought nearer to a solution by the determination of the climatic boundary-lines, and that even this boundary line, reported to-day as conjectural, may afford us a handle in estimating the danger of dodder, until we shall have determined a more precise instrument.

I beg to conclude my report with the following proposals:—

(1) The Congress shall renew the appointment of the Dodder Committee;

(2) In the first place the Committee shall be recommended to undertake further investigation of the above-mentioned Climatic Lines, the isohyetes, isohypes and, so far as possible, also the isotherms;

(3) The Committee should also be recommended to approach the question of the limit of dodder havoc from the experimental side.

It would be of the greatest interest to observe the behaviour of the plant by way of experiment, first in the districts which are believed to be immune and then in the districts which are almost immune.

The three proposals embodied in Dr. von Degen's Report were unanimously agreed to by the Congress.

Professor Johannsen proposed, and the Congress unanimously agreed, that Messrs. Brown, Devoto and Kuleschoff should be appointed additional members of the Dodder Committee. He intimated that it was not essential that these three gentlemen should travel to meetings of the Committee, but that they might act as consulting members.

The business for the day having concluded, the Delegates then travelled to St. Ives in order to inspect Sir Fred Hiam's farm, where some fine wheat, especially Professor Biffen's "Yeoman II" Wheat, is grown.

Wednesday, 9th July.

Morning Session.

The Congress assembled at 10 a.m.

Professor Voigt read a paper on "Germination methods," a summary of which is given below.

English Summary.

Since our meeting at Copenhagen in 1921 remarkable work has been done concerning the physiology of the germination of seeds, especially on chemical and physico-chemical influences retarding or accelerating germination. Mr. Popoff has carried out experiments on similar lines and has had good results in getting higher yield from grain by soaking it in $MgCl_2$; similar results have also been obtained by the use of the fungicides Germisan and Uspulun.

Nevertheless I am of opinion that it is not yet time to introduce these matters into practical seed testing. It is necessary to study the whole material for a longer time.

The two enquiries made under the direction of the Copenhagen Station have given, for the main stations, such consistent results that it does not seem useful to change the methods to-day.

On the other hand good work has been done on special questions by Zürich in collaboration with Hohenheim (*Pinus Strobus*), Copenhagen (*Pinus Strobus*), Hamburg (*Anthoxanthum Puellii*, *Festuca ovina*, *Aira flexuosa*, *Cynosurus cristatus*) and others, which are directly useful for practical seed testing.

(A full copy of this paper in German will be found on pp. 192-194.)

Professor Voigt submitted for discussion and adoption the "General Directions for Germinating Tests" which he proposed at the Copenhagen Congress in 1921.*

After a prolonged discussion *Professor Johannsen* intimated that all outstanding matters connected with these "Directions" would be dealt with by the appropriate Committee of the Association to be appointed on Thursday afternoon.

* See pp. 86-88 of "Discussions at the International Seed Testing Conference, Copenhagen, 1921."

Dr. Franck then read the following paper :

**Germination Tests at Low Temperature, with particular reference to
Seeds which are not fully after-ripened.**

BY

Dr. W. J. FRANCK,

Director, State Seed Testing Station, Wageningen.

When, last winter, one of the members of the Committee asked me to deliver a lecture on germination tests at low temperature, I felt that I had to comply with that request, though our investigations into this subject cannot certainly be considered at present as being complete; on the contrary, they are still in their early stages.

However, I felt that it would be useful if I were to give you a brief survey—as well of the positive as of the negative results—attained at Wageningen by germination tests at lower temperatures than are, to my knowledge, in general use in the various seed testing stations, and also with regard to the manner in which we conduct these experiments at lower temperatures.

I should have liked to experiment a great deal more in order to be able to give you a more complete outline of this subject, but neither time nor room could be put at my disposal for such a purpose, owing to a great rush during the winter and spring campaign and a continued decrease of staff as a necessary result of the difficult economic conditions existing at present.

So I beg beforehand the clemency of the meeting if that which I shall read to you here does not contain much news for some of you who have also made a study of this subject.

When we come to the treatment of the subject of germination at low temperatures, a division must immediately be made into two chief groups, *i.e.*, physiologically unripe seeds, and seeds which are fully after-ripened.

It is especially the first of these groups mentioned in which appears the phenomenon of delayed germination which has formed a subject of study for various investigators, but so far the essential point has not been revealed.

In consideration of the great importance that this phenomenon of delayed germination possesses in the practice of seed control, I may, perhaps, be allowed to give as short an explanation as possible of the diverse theories and opinions of the chief investigators who have studied this subject. An additional list of literature will, perhaps, be of convenience to those of you who may desire to increase their knowledge. A short description, following upon this, of the methods of quickening the after-ripening process practised at Wageningen may give you an idea of our work there.

By after-ripening is understood the complex of changes, either metabolic, chemical or mechanical, which are able to bring about germination in seeds that are dormant, *i.e.*, in a condition in which they are unable to germinate under usual germination conditions. This state of dormancy is shown by the circumstance that the seeds, though swollen, do not germinate and still remain undecayed. During the period of after-ripening, certain changes, preceding the growing processes, must occur. Seeds, showing the phenomenon of dormancy, lose this property in the course of a longer or shorter period of time and become fit to germinate under quite the same conditions as those under which, a short time before, none, or only a very small percentage of them, would germinate readily. It is well known everywhere that this phenomenon of delayed

germination occurs in freshly harvested or newly threshed seeds, especially after cold and moist summers.

From the inquiries made by various investigators on this subject, it has become clear that the seeds showing this phenomenon of dormancy can be arranged into two groups:—

(1) Seeds in which the delayed germination is due to characters of the embryo. Harrington (1) defines it as follows:—"Embryos which, though morphologically mature, are physiologically incapable of germination, even when freed from all external restrictions, until fundamental changes have taken place in the embryos themselves."

(2) Seeds in which the delayed germination is not inherent in the embryos, but is due to seed coat characters, "to partial or complete coat restrictions to embryos in themselves germinable," as Harrington describes it.

In regard to the cases in which delayed germination is due to characters of the embryo, which must go through fundamental changes preceding growth, such changes generally require considerable time, and different conceptions of them exist, due to the various kinds of seeds which the different investigators have made their particular study. Some express themselves vaguely; for instance, Davis and Rose (2) who write "the term after-ripening may be made to include the necessary protoplasmic changes, antecedent to germination, changes involving the release of digestive and respiratory enzymes, this leading to rapid metabolism, to embryonic changes, whether protoplasmic or metabolic."

Others have more defined conceptions about the chief factors which take part in the phenomenon of after-ripening.

Fischer (3), Zaleski (4), Lehmann and Ottenwalder (5), Eckerson (6), Harrington (7) and others bring the chemical side of the problem more to the foreground. They consider embryonic after-ripening as a chemical process, in which divers purely chemical changes take place, as, for example, hydrolysis of the proteins, alterations in the acidity and water-holding power of the embryo, metabolism of the fats, fluctuations in the sugars and amide nitrogen compounds, increase of oxygen, the rendering active of dormant embryonic protoplasm by (H) and (OH) ions, &c. Becker (8) believes that oxygen exercises a chemical stimulus which causes germination. Eckerson compares the after-ripening process with common germination and states that the chemical changes during the 90 days of after-ripening of *Crataegus* are the same as those of the first eight days of germination of *Ricinus*. Other investigators, as Detmer (9), Brown and Morris (10), Green (11), Hotter (12), Mazé (13), Abderhalden and Dammhahn (14), Appelman (15) and Crocker and Harrington (16), consider it more as a process of ferments; for instance, by the presence of peptolytic ferments, by the liberation of enzymes, by the development of acidity, by increased catalase, oxydase and peroxidase-activity, by increased diastatic contents, &c. The germination studies dealing with chemical and enzymatical relations include a large number of researches, the enumeration of which would lead me too far.

Some ascribe the after-ripening to chemical as well as to enzymatical processes. Pack (17) expresses it as follows "the changes accompanying the after-ripening in Juniper seeds are represented by the accumulation of cell building materials, acids, phosphatides, active reducing substances, soluble sugars, pentoses, aminoacids, soluble proteins and other nitrogenous compounds, the accumulation of enzymes, the dispersion of materials and the transformation of storage materials. This accumulation of cell-building and cell active materials, together with the culmination of enzymes, probably leads to the after-ripening of dormant organs."

Kinzel (18), Heinricher (19) and Gassner (20) have shown that light can be a factor in the protoplasm changes in delayed germination, whilst Shull (21) has suggested that the character of the ovule, the origin,

character and age of the fertilizing pollen; the nutrition of the parent plant, accidents of sun and shade, moisture and dryness of soil, high and low altitude, weather conditions during ripening, the time of harvesting and subsequent handling of seeds, are influential factors.

Various other investigators attribute delayed germination in seeds, tested by them, to characters of the embryo, but they leave further details about the essential point out of account.

We may mention Nobbe and Haenlein (22, 23), Kienitz (24), Wiesner (25), Lakon (26), Püchner (27), Crocker and Harrington (28, 29).

The conception that delayed germination is a result of seed coat characters has also many advocates. The following cases are distinguished by them:—

(1) Seeds in which delayed germination is due to the impermeability of the seed coat to water. Nobbe and Haenlein (22) assume that the cause of the resistance of clover seeds to water must be considered to originate in the outer cell layer, the palisade layer. Hiltner (30) suggests: "Nicht der hohe Wassergehalt der Nachreife bedürftige Getreide, sondern im Gegenteil deren Unfähigkeit das zum Auslösung des Keimungsactes notwendiges Wasser in sich aufzunehmen, bedingt ihre Trägheit in der Keimung."

(2) Seeds in which the non-germination is simply due to the fact that only a subminimal quantity of oxygen can reach the embryo. Crocker (31) found that in the seeds of various water plants the protoplasm is not dormant but that the delay is caused by the seed coats. He readily found germination if the coats were broken or removed.

Crocker asserts that delayed germination, or failure to germinate, is more generally due to seed coat effect (limiting or entirely excluding water or oxygen supply) than to embryo characters as has generally been assumed. Kieszling (32), Shull (33), Atwood (34) and Hoffmann (35) have the same conception about this aspect of delayed germination. According to Atwood, it is possible to accept either that the embryo in the course of after-ripening decreases its demands for oxygen, whereby the seeds become able to grow in gases poor in oxygen, or that there is no decrease in oxygen demands but rather an increased permeability of the coat to oxygen.

(3) Seeds in which an inhibitory partial pressure of carbon dioxide in the tissues of the embryo is the cause of delayed germination. Kidd (36) considers the resting condition of the seed in apparently suitable conditions of temperature, moisture and oxygen supply, as a phase of auto-narcosis under the action of the carbon dioxide produced by the seed itself. Kidd and West (37) interpret the phenomenon of secondary dormancy as a decreased power of the embryo, during the primary period of inhibition in the presence of carbon dioxide, to respond to growth conditions and to germinate under the limitation of the seed-coat.

(4) Seeds in which the presence of acetic aldehyde inhibits the germination, as is demonstrated by Mazé (38).

(5) Seeds in which the expanding embryo meets at the seed coat a mechanical resistance greater than the growing force of the embryo. Crocker and Harrington (28) mention the case that an initial rapid water absorption ceases, before the imbibitional and osmotic forces of the embryo are satisfied, because the swelling of the seed contents is not sufficient to break the seed-coats.

(6) Seeds in which the coat may exclude chemical compounds necessary for germination, as is supposed by Crocker (31c). Brown (39) has found in this connection that the grains of cereals are inclosed within a semi-permeable or selective covering, which permits the passage of water to the interior of the grain, but which prevents the passage of various acids and salts of metals, when they are in aqueous solutions.

As I did not try any experiments regarding the nature of the after-ripening or the changes during that period, I must refrain from giving an opinion of my own about it. The delayed germination of cereals, though, seems to be caused not by changes in the embryo itself, but by checking influences of the seed-coat. The independence of ferments as to ripeness has indeed been shown already at Wageningen by my predecessor, the late Mr. F. F. Bruijning (40), who concluded that the favourable influence of artificial after-ripening on the germinative power was not accompanied by a rising of the fermental capacity. Wieringa, too, having done some provisional tests, arrives, for the present, at the conclusion that the catalase-figure of barley need not rise in consequence of the after-ripening. Through want of after-ripened material these tests could not be continued.

Literature recommends different methods to quicken the delayed germination, such as—

- (1) Cutting the seeds or clipping them off. Hiltner (30), Crocker (31a), Grüss (41), Keisling (32), Atwood (34), and others.
- (2) Hot water treatment. Kiesling (42), Lakon (43).
- (3) Soaking the seeds in solutions of various enzymes. Crocker (31a).
- (4) Addition of (H) and (OH) ions. Fischer (3).
- (5) Addition of dilute acids. Eckerson (6), Harrington (44).
- (6) Effects of light. Kinzel (18), Heinricher (19), Gassner (20).

I shall not dwell on the above-mentioned expedients, because they are hardly ever or never employed at Wageningen. I may, however, specially mention two other ways which are regularly employed with us :—

- (1) Artificial after-ripening by intensive drying.
- (2) Germination at a low temperature.

Artificial after-ripening at a raised temperature has already very often been recommended, approved, and accordingly rather generally used. Hiltner (30, 45), Hoffmann (35), Atterberg (46), Kiesling (32), Mazé (38), Gümbel (47), Kidd (37), Harrington (44) and Hile (48) showed the favourable effect of drying. Mostly temperatures of 35—40° were recommended. Hoffman supposes that the high water percentage of freshly harvested seed hinders the penetration of oxygen and, because of this, at the same time, the after-ripening process. When drying, canals and clefts are formed in the seeds by their shrivelling up and the oxygen out of the air is easily admitted. Hoffmann, too, considers this drying a checking of the counteracting influences, which the absorption of oxygen suffers, caused by the internal forming of carbon dioxide, as the respiration and carbonic acid production are both decreased by drying. Kolkwitz (49) and Mazé regard the transformation, occurring when the seeds are dried, as an evaporation of volatile stuffs, the presence of which hinders the evolution of the embryo. The aldehyde, which accumulate in seeds that are not after-ripened, does not, according to Mazé, kill the embryo, but it prevents diastase activity and, with it, germination. According to Kidd "redrying of fully swollen seeds, which are in secondary dormancy, breaks up this dormant condition and also causes acceleration of germination."

This artificial after-ripening method by means of drying was applied regularly at Wageningen until some years ago. It takes place there in a double-walled drying stove (Figure 1), specially made for that purpose. The space between the two walls is heated by gas, till the temperature in the drying space proper is 35 degrees Centigrade. A warm air-current also passes through this space, previously heated by burners, causing and keeping the right temperature. By this combination of heating and conducting warm dry air all through the seed, a very intensive drying is obtained which often has its effect in a few days, but, as a rule, in from six to eight days.

This method was always found best for rye, wheat and oats, and for barley also, except in a few cases in which the time of drying had to be somewhat lengthened. Under these conditions the after-ripening process in barley does not apparently take place so soon, perhaps in consequence of the glumes and the seed coat being tightly joined to the seed. This

method, however, has one important drawback; it takes more time than can often be allowed for the germination test, especially in the case of winter rye, wheat and barley. Some experts therefore advise that after-ripening should be done at a low temperature. This can be brought about by putting the seed, previous to germination, in an ice-box at a temperature of 3° to 6° Centigrade, and by germination at a temperature varying between 8° and 15° ; see Whitcomb (50), Toole (51), Harrington (7), Rose (52). Whitcomb observes, *e.g.*, "this method is especially well adapted to testing newly threshed grains; a germination test by the ice-chest method of winter wheat and other grains immediately after threshing will indicate the percentage of seeds, in a given lot, which will produce healthy plants under

FIGURE 1.

normal field conditions." Toole advises: "When a sample has failed to give a good germination, the remainder may be transferred to the cold for five days; if the poor results have been due to dormancy, germination will be completed after they are returned to the warm germinator." Atterberg (46) and Qvam (53) recommend a germination temperature of 10° to 15° ; the "Technische Vorschriften für die Prüfung von Saatgut" (54) recommend one of 8° to 12° . Hiltner (45) thinks a temperature of 13° to 15° best and, if it fails to cause speedy germination, previous drying at 40° . Heinrich (56) observes that low temperatures quicken the germination of poorly after-ripened seeds, but have a delaying influence when full ripeness has been obtained. Harrington states the same thing and so recommends removing any seed remaining ungerminated at the end of some days at a low temperature into germinating chambers at a higher temperature. In the new "Rules for seed testing of the New York State Agricultural Experiment Station" (58) we read: "in the case of cereals and timothy grown under such conditions that they are frosted or exposed to cold weather before harvest, the germination tests should be made at lower temperatures,

15° to 20° Centigrade, and continued for longer periods than for normal seed."

At Wageningen the best means for the germination of newly harvested or newly threshed grains was a temperature of 10° C. during five days and afterwards a higher one of 20° C. A large series of comparative tests was made during the last three years and extraordinarily favourable results were obtained by the use of this method with poorly after-ripened wheat, rye and oats. The following tables I, II and III, each consisting of ten examples, will give an idea of this. Practically a delayed germination did not occur in the case of the three above-mentioned kinds. With barley samples, however, it was somewhat different. The results in most cases were satisfactory (table IV), but cases occur in which the favourable influence, while obvious, is not quite complete (table V). In such cases, however, the highest figure for the germinative power could be reached by an artificial after-ripening at a raised temperature. In the case of barley, the success of the W_{10} method, as we call it at Wageningen, depends apparently on the degree of after-ripening; some years there will be more difficulties than in others. Last winter, for example, when delayed germination did not often occur, the W_{10} method turned out absolutely satisfactory for barley.

Lettuce (*Lactuca sativa*) seems to show an analogous phenomenon. Considerably better results are often obtained with a low temperature than with one of 20° C. In many other cases, however, the W_{20} method yields higher germination figures.

Although I have not yet arrived at any definite conclusion, I believe this difference of behaviour to be caused by different degrees of ripeness, so that for insufficiently ripened lettuce-seeds the low temperature is recommended, but for the well-ripened ones the W_{20} method is the best. The figures in table VI, demonstrating the behaviour of some six samples of seed not fully after-ripened, support this opinion. Probably a method exposing the after-ripened seed to a regular temperature, alternating between 10° C. and 20° C, will give better results than a constant one of 10° C. The data, which I have at my disposal at present are, however, not sufficient to enable me to give a definite judgment on this question.

The same is the case with corn salad (*Valerianella olitoria*) which, being after-ripened, germinates well at an even temperature, but, until it is after-ripened, prefers a low alternating germination temperature.

Comparative tests. Methods W_{10} and W_{20} .

I.—Wheat.				II.—Rye.				III.—Oats.			
Energy, 5 days.		Power, 9 days.		Energy, 5 days.		Power, 9 days.		Energy, 7 days.		Power, 11 days.	
W_{20}	W_{10}	W_{20}	W_{10}	W_{20}	W_{10}	W_{20}	W_{10}	W_{20}	W_{10}	W_{20}	W_{10}
53	76	88	96	67	92	88	100	40	76	69	91
72	91	88	99	73	97	91	100	82	98	93	99
55	38	84	97	74	95	89	99	69	81	82	94
44	98	56	99	66	92	84	99	78	95	86	97
6	27	70	94	82	98	89	99	74	74	87	96
53	96	88	99	75	79	83	94	31	72	60	76
55	38	84	97	83	99	92	99	67	51	73	86
44	98	56	99	82	98	94	100	80	69	85	89
56	86	89	95	62	97	91	99	70	—	84	94
63	76	88	94	81	98	90	99	79	91	93	98

IV.—Barley.				V.—Barley.					
Energy, 5 days.		Power, 9 days.		Energy, 5 days.		Power, 9 days.		After-ripened Power, 9 days.	
W ₂₀ .	W ₁₀ .	W ₂₀ .	W ₁₀ .	W ₂₀ .	W ₁₀ .	W ₂₀ .	W ₁₀ .	W ₂₀ .	W ₁₀ .
6	20	10	93	9	40	16	50	100	100
32	76	49	93	22	52	33	58	100	—
69	89	88	99	43	84	56	87	99	99
54	86	63	90	44	77	63	85	100	—
58	95	66	97	62	89	70	90	98	94
53	89	59	93	59	81	77	85	97	—
76	93	81	99	81	92	82	92	96	—
55	92	58	96	8	93	10	93	100	100
74	91	80	95	78	95	84	97	100	100
35	83	79	97	7	17	16	50	100	100

VI.—Lettuce.			
Original seeds not after-ripened.		After-ripened seeds after some months.	
W ₂₀ .	W ₁₀ .	W ₂₀ .	W ₁₀ .
66	85	93	90
80	94	90	90
83	93	91	86
88	96	94	94
68	91	95	91
78	91	93	91

I will now pass on and describe to you briefly the manner in which the low temperature, required in the incubators, is obtained. This cooling is caused by a pickle-dilution, which, in its turn, is cooled in a refrigerator (Figure 2) and is led through insulated pipes to four well insulated incubators, after which it flows into special chambers of a measurement of about three-tenths of a cubic metre placed within these cupboards. By means of a tap the supply can be regulated. In addition to this process there is also a formation of iceblocks, which are placed nightly in special basins in the incubators, to retain an approximately constant temperature during the hours of the night, during which time the machine is at a stand-still and consequently does not produce cold.

The cooling machine used at Wageningen consists of two absolutely closed bronzed spheres, connected by a hollow steel shaft, which shaft is resting on two bearings and is provided with a driving pulley. By revolving this machine, cold or ice can be immediately obtained. By this means a chemical process is set up within the spheres, of which one attracts warmth from its surroundings (the brine) and thus causes the desired cooling, while the other one imparts the attracted warmth to the supplied cooling water, which flows from the main tap.

The principle upon which this cooling is based is the repeated evaporation of a dilution of sulphurous acid and its renewed condensation.

The diagram shows in transverse section the construction of the machine. Round the hollow axle are fixed two balls *C* and *R* of bronze material. The axle is supported by two bearings *S*. The ball *C* turns in a cooling water basin *D*, the ball *R* in a reservoir *E*, which is filled with a pickle dilution. In the ball *C* a compressor is built in, which, when the shaft is turning, is kept in a vertical position by a counterweight *B*, whilst the piston is moved to and fro by means of eccentrics on the shaft. The compressor-cylinder is revolvable round two taps, and so it can follow the oscillating motion of the piston. The machine is filled in the factory with sulphur dioxide as a cold medium and after this it is closed hermetically. When the machine is brought into revolutionary motion the compressor exhausts the sulphur dioxide gas out of the ball *R* and presses it in the condenser *C*, whose wall is cooled by the water from the main tap, so that the sulphur dioxide condenses.

FIGURE 2.

By the difference in pressure that exists between the contents of the balls, the liquid is forced back through a little pipe, within the hollow shaft to the sphere *R*, the evaporator, and is quickly evaporated there. The expansion of the gas cools the evaporator, which in its turn cools the brine in which it revolves.

The compressor is built within a chamber in the centre of *C*, which chamber is filled with oil, so that the moving parts are excellently lubricated. The oil is gathered at the bottom of the condenser and is taken up by the turning movement of the ball, in order to be brought back into the compressor chamber by a receptacle. In this manner a very good lubrication takes place, whilst the oil, in consequence of the closed construction of the machine, cannot come into contact with the air, so that oxidation of the oil by the oxygen in the air is prevented, and the oil continually preserves its good qualities.

The incubators used for germinations at low temperatures consist of spacious zinc double-walled cupboards, which are screened against temperature changes by an insulation of two layers of air, one layer of cement-asbestos, and finally a wooden covering (Figure 3). The inner chamber of each of the two compartments of such an incubator is about three-tenths of a cubic metre and contains 24 loose perforated zinc trays on which seed beds are placed. It also holds a zinc basin at the

top for taking up the blocks of ice during the night. Between the two chambers is placed the cooling cell which causes the required cold in the cupboard.

The system described above has satisfied us that it is relatively simple to keep the temperature constant at about 10° Centigrade, and that great temperature fluctuations cannot take place.

Now we come to the discussion of the second principal group, that of the thoroughly ripe seeds. According to their reaction when germinating at a reduced temperature they can be divided into two sub-sections:—

Firstly, seeds germinating better when subjected to an alternating temperature than to a constantly low one.

FIGURE 3.

Secondly, seeds requiring a constant low temperature.

Consulting the existing literature, we generally find suggested an alternation between 20° and 30° Centigrade. This is likewise used for many seeds at Wageningen because it really seems to us the best method for their germinating, for instance for the seeds of *Anethum graveolens*, *Agrostis stolonifera*, *Brassica oleracea* and *Rapa*, *Carum Carvi*, *Festuca pratensis*, *Phleum pratense*, *Raphanus sativus* and other kinds. For 18 hours a temperature of 20° C. is maintained, which is raised during the remaining six.

It appeared, however, to us, that instead of an upward alternation, a lower one is advantageous for various seeds, and that this alternation yields the best results when using Jacobsen's method. Consequently our method, "Copenhagen alternating," came into use with us, in which the seeds are brought to, and kept for four hours at, the temperature of 25–28°C., by heating the apparatus, after which the warm water at 32° C. is quickly substituted by cold water, from the main tap, at 11–14° C. According to Dorph Petersen's (55) description, an alternating temperature of 18–26° C. on the Jacobsen's incubator is also used at Copenhagen. Moreover, I will

draw your attention to the fact of Hiltner's (45) pointing out in 1906, that lowering the temperature in alternating might be preferable to raising it. Heinrich (56) also recommends temperatures between 5° C. and 20° C. for *Anthoxanthum odoratum*. Honcamp (57) exceeds them, suggesting, for that special grass, a constant temperature of 5° C. Harrington likewise applies lower temperatures than are generally used, but not, however, lower than 15° C.

Without unnecessarily wearying you with long lists of the results of comparative germination tests carried out at Wageningen, I may mention this method as a very suitable one, especially for the following seeds:—*Alopecurus pratensis*, *Apium graveolens*, *Arrhenatherum elatior* (husked,) *Avena flavescens*, *Cichorium Endivia*, *Dactylis glomerata*, *Lepidium sativum*, *Nasturtium officinale*, *Poa species* (*Poa compressa* excepted), *Solanum Lycopersicum*, &c. Very suitable, too, though not yielding specially higher results, is this method for *Agrostis stolonifera*, *Cichorium Intybus*, *Petroselinum sativum*, *Daucus Carota* and *Festuca pratensis*. It may be observed besides, that (with the "Copenhagen alternating" method) the germinating seeds are always exposed to the diffuse light of a northern room. Comparative tests, exposed to direct sunlight, did not offer any better results, even for the Poas (with the exception of *Poa compressa*).

To those of the audience who have not yet tried the alternation of temperature between 11° C. and 25–28° C., I may strongly recommend the comparative testing on the Jacobsen incubator. In many cases, better results will be obtained than with other germination methods in use.

I shall dwell a little longer on the second subsection, the seeds requiring a constant low temperature as the best means for a most favourable germination, because a temperature of 10° C. for normally ripened seeds, so far as I am aware, is not yet recommended as a normal germinating method. Here the seeds remain during the first five days at a temperature of 10° C. in the incubators already mentioned (cooled by brine). After that time they can be placed in a 20° C. incubator. One word as to why a temperature of 10° C. has been chosen. In this choice, on the one hand, it was necessary to reckon with the evident inclination of some seeds for germinating at a low temperature; on the other hand, it had to be kept in mind that the germinating temperature should not be chosen so low as to lose all the advantage obtained from it, on account of too great a slowness in the course of the germinating process. It was for these reasons, after some preliminary experiments, that the temperature of 10° C. was chosen. For various kinds of seed this method, compared with other methods, was not always successful, as undoubtedly it was not the best method for *Allium Cepa*, *Phaseolus pratensis* and *Pastinaca sativa*, though all these are seeds which germinate well at 20° and are badly influenced by higher temperatures. *Ornithopus sativus* and *Lepidium sativum* did not show any difference. With some kinds, however, the new germinating temperature proved to yield a considerable and almost constant rising of the germination percentage. Spinach may be taken as first and principal among them. For the greater part of the comparative tests, the temperature of 10° C. proved to be better for this seed than that of 20° C. used up till now.

In view of the great importance that the testing of spinach seed possesses for us (at Wageningen some hundreds of samples of spinach seed are investigated yearly), the comparative experiment between 10 and 20° C. was continued with a great number of samples. 293, or 94 per cent. of the 310 samples tested, showed better or equal results, 17, or 6 per cent., were only slightly lower. In this last case the difference only amounted to one or two per cent., some cases excepted, and so the result was not much inferior to the one obtained by the 20° method. The differences in favour of the 10° method were of much more importance as the following list will show.

GERMINATION TEST, SPINACH.

Comparison Method W_{10} and W_{20} .—310 samples. W_{20} higher results than W_{10} .

6 %	in 1 sample	} 6 %.
5 %	" 1 "	
4 %	" 1 "	
3 %	" 1 "	
2 %	" 3 samples	
1 %	" 10 "	

 W_{20} same results as W_{10} .

In 14 samples, 4 %.

 W_{20} lower results than W_{10} .

1 %	in 33 samples	} 90 %.
2 %	" 35 "	
3 %	" 32 "	
4 %	" 44 "	
5 %	" 26 "	
6 %	" 25 "	
7 %	" 21 "	
8 %	" 20 "	
9 %	" 14 "	
10 %	" 7 "	
11 %	" 4 "	
12 %	" 6 "	
13 %	" 5 "	
14 %	" 3 "	
15 %	" 1 sample	
16 %	" 2 samples	
19 %	" 1 sample	

The better results obtained by the 10° method are, in the case of spinach seed, clearly evident.

The question then arose whether these results with spinach seeds originated in their being not quite ripe. Considering the advanced season, this was *a priori* improbable, but, notwithstanding, a number of samples was controlled by us in order to obtain information on this point.

A set of 30 samples was tested in three different ways at both 10° C. and 20° Centigrade:—

1. the test was begun immediately.
2. " " " " after an artificial ripening during one week.
3. " " " " " a natural ripening for some months.

With equally conditioned seed, W_{10} nearly always offered higher results than W_{20} . Artificial and natural drying had about the same results, and so one could arrive at the conclusion that it is one of the qualities of normally ripened seed to germinate better at a low temperature. A second question had to be answered, namely, whether an alternating temperature of 10 to 20° C. would be preferable, even, to a constant one of 10 degrees. Consequently, a series of tests was begun, some seeds germinating at 10° C., and others at an alternating temperature. We concluded that the 10 degrees method always offered better germination results (at an average of 4 per cent. higher) than those obtained by alternating temperature, whose only advantage is that of giving, after 7 days, a higher percentage for the energy (about 5 per cent. on an average). The constant 10° method, however, regularly overtakes and surpasses it in most cases between the 7th and 21st day.

Therefore, we draw the conclusion that for spinach seeds a constant temperature of 10° C. is preferable to a constant one of 20° C. or to an alternating one between 10 and 20° Centigrade.

Further examples of the good influence exercised by the 10° temperature are *Allium Porrum*, *Papaver somniferum* and various flower seeds.

Comparative tests were carried out last year with various flower seeds. Four to six different germinating methods were tried at the same time. The 10 degrees method proved to be the best method for several sorts, but for several others, on the contrary, it appeared useless. By after-ripening these seeds for some months, and then repeating the germination tests, we learned that it was not a question of insufficient after-ripening, but that it is a characteristic of some flower seeds to germinate better at a lower temperature. Here can also be distinguished seeds which prefer a constant low temperature of 10°, such as *Chrysanthemum carinatum*, *Delphinium ajacis*, *Eschscholtzia* spp., *Matthiola incana*, and *Nemophila*, and seeds with which an alternating low temperature between 10 and 20 degrees gives the best results. To this last category belong, e.g.: *Clarkia elegans* and *pulchella*, *Lobelia erinus*, *Nigella damascena*, *Viola tricolor*, etc.

Ladies and gentlemen, I have come to the end of my paper, and will conclude by giving a short summary of the results obtained:—

Firstly.—An alternating method between 11 and 26° C. tested on a Jacobsen incubator, placed in a northern room, gave, in comparison with the ordinary alternating one between 20 and 30° C. and with other methods, higher and more constant germination figures for various kinds of seeds;

Secondly.—A temperature of about 10 degrees Centigrade is a perfect one and nearly always sufficient to get the highest germination results possible for Dutch-grown cereals (barley excepted) which are not fully ripe, and for some other kinds of seed.

It occurs but seldom, relatively, that the germination is delayed, notwithstanding the low temperature applied, but, where it does occur, an intensive desiccation at about 35° C. for 5 to 7 days always proves sufficient (barley excepted) to cancel the phenomenon of delayed germination.

Thirdly.—A low temperature either constant at 10° C. or alternating between 10 and 20° C. is most favourable for the germination of various agricultural, horticultural and flower seeds. By means of an A.S. refrigerating machine, well insulated thermostats can keep a sufficiently constant temperature of 10 degrees Centigrade.

ZUSAMMENFASSUNG.

1. Eine intermittierende Methode zwischen 11 und 26° C. ausgeführt auf einem Jacobsen Keimapparat, aufgestellt in einem gegen Norden gelegenen Raum, ergibt, im Vergleich mit der üblichen Intermittierung zwischen 20 und 30° C. und mit anderen Methoden verschiedener Samen-sorten bessere und mehr konstante Keimresultate.

2. Eine Temperatur von 10° C. ist ausgezeichnet und fast immer hinreichend zum Erhalten der möglichst hohen Keimergebnisse für noch nicht ganz nachgereifte niederländische Getreidearten und für einige andere Samensorten.

Eine verzögerte Keimung kommt bei dieser niedrigen Temperatur verhältnismässig nur selten vor; in diesem letzten Falle war eine intensive Trocknung bei 35° C. während 5—7 Tage immer genügend (ausnahmsweise bei Gerste) um eine normale Keimung zu Stande zu bringen.

3. Eine niedrige Temperatur von entweder 10° C. konstant oder intermittierend zwischen 10 und 20° C. hat sich als sehr günstig für die Keimung verschiedener landwirtschaftlichen-, Gartenbau- und Blumen-samen erwiesen. Mittels einer A.S. Kühlmaschine können richtig isolierte Keimthermostaten auf diese Temperatur gebracht und genügend konstant gehalten werden.

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Dr. von Degen expressed the view that *Dr. Franck's* methods would not be suitable for grains grown in countries where the climatic conditions were different from those obtaining in Holland. In Hungary, for instance, fully matured seeds were obtained because of the dry weather experienced during the period of ripening. The method of alternating temperatures was, however, necessary in the case of Beta seeds obtained from Germany.

Professor Bussard pointed out that humidity was a factor to be borne in mind in the case of seeds from northern countries. Tests of grain from these countries which had a low germinating power gave excellent results when the seed had been dried.

Mr. Anderson was of the opinion that the term "after-ripened" (or "incomplete maturation") did not adequately cover the condition, as it appeared to be a characteristic of certain varieties of seeds that they did not germinate well under artificial conditions. At his Station (Edinburgh) they had adopted, chiefly for commercial reasons, the practice of "shelling" those seeds in oat samples which did not germinate well in a sterile medium (sand). This practice generally induced rapid germination and gave a result more in accordance with that obtained when a natural medium (soil) was utilised as a seed bed. He congratulated *Dr. Franck* on his excellent paper, both as regards material and the manner in which it was presented. The information contained in the paper would be of great assistance to those who had a considerable number of cereals to germinate and who experienced difficulty in obtaining good results.

Mr. Clark also expressed appreciation of the excellence of the paper which entered into some of the most difficult problems experienced in Canada. They had frequently to deal with grain which had "frosted" before it matured, and had found it useful under certain conditions to dry the seed under glass exposed to the sun for as long as 10 days.

In order to test whether the seed is or is not viable they plant it in rich soil of the prairies which has been carefully sterilised. In some cases in order to ascertain whether the seed has been killed by the frost they feed it with a 1 per cent. solution of cane sugar during the first few days when germination is due to commence.

Mr. Dorph-Petersen referred to his paper on the subject of seeds which are not "germinating-ripe," which had previously been circulated to the Delegates, and which was due to be read on Thursday, the 10th July. Time did not, however, permit of the reading of this paper, which is appended.

Germination Tests in the Laboratory and in Soil of Cereal Seed which is not "Germinating-Ripe."

By

K. DORPH-PETERSEN.

When, last Autumn, Dr. Volkart and I prepared the draft Agenda for the Congress, it was decided that the head of the Seed Testing Station at Örebro, Sweden, *Director J. Widén*, and I should read papers on "Investigations of seeds which are not 'germinating-ripe' and determination of the germinating power of such seeds in the soil." My respected colleague Mr. Widén informed me, however, at the beginning of the winter, that he would not be able to attend the Congress as he was unwell, and unfortunately he died a little more than a month ago. I have known Mr. Widén and co-operated with him for more than 20 years. We were both members of the Committee which, in 1912, revised the common rules for seed testing in force for the three northern countries. Mr. Widén was a very fine, sympathetic and clever personality with whom it was a pleasure to co-operate. Those among you who were present at the Seed Testing Conference in Copenhagen in 1921 will recollect his courtesy and kindness. We shall remember him as an excellent colleague.

Mr. Widén would certainly have been able to have given interesting information regarding the matter which is to be considered now, as that part of Sweden where his station is situated suffers greatly because cereal seed cannot be "germinating-ripe," but germinates, therefore, slowly and poorly. We agreed that Mr. Widén should undertake experiments in regard to the matter, and that similar tests should be made simultaneously at the Danish State Seed Testing Station. Illness, however, prevented Widén from beginning this work. As Dr. Franck touched on the matter yesterday, and gave a long, very interesting list of the detailed literature on the subject in question, I shall confine myself to mentioning some Swedish experiments on the same lines and to give an account of the experimental work at the Danish State Seed Testing Station.

The question is of special interest to Sweden, Scotland, Norway and Finland, where numbers of examinations of cereal seed which is not "germinating-ripe" have likewise been made. Particulars of some Swedish experiments are published in "*Eftermognad hos Spanmålsvaror*" ("After-ripening of Cereal Seed")* by Mr. Walldén, the head of "*Svalöfs Utsädesförening's*" Seed Testing Station. He has described in this work the phenomena associated with seed which is not "germinating-

* "*Sveriges Utsädesförenings Tidskrift*," 1910, No. 2, 3 and 6.

ripe," phenomena that are now widely known through existing literature. As has been recognised for some time, cereal seeds that have been to some extent damaged, germinate, as a rule, better than do the other seeds in a bulk which is not "germinating-ripe." Purchasers of malting barley, who wished to ascertain whether those seeds which did not germinate under normal conditions could be made to do so, shook the seeds so vigorously in a bottle that they became damaged. Mr. Walldén utilised this experience. He cut off that end of the cereal seeds which is opposite the embryo, and then placed the seeds in test. After this treatment, many of them germinated normally during the usual number of days (10-12).

In addition to the normal tests of the germinating capacity of cereal seeds (in damp sand in earthenware bowls), tests of small numbers of grains (50 or 100) which were cut as described above, have been carried out at the Danish State Seed Testing Station. When it appeared that those seeds which were not treated in this way germinated slowly and poorly, whereas the cut seeds germinated normally, the following statement was made on the analysis certificates: "The low germinating capacity suggests that the sample is not 'germinating-ripe'; if it be stored for a period in a dry place it will probably attain a higher germinating capacity." The senders of the samples thus knew that there was no reason to reject the goods for seed purpose.

In our rules for seed testing it is laid down that the seeds shall not be subjected to any physical or chemical treatment before the test. It has, therefore, been possible to use the method of cutting the ends of the seeds only for the purpose of obtaining information as to whether or not seeds would attain a greater germinating capacity later on; the method is, for this reason, used only where the seed is not "germinating-ripe." Under normal conditions, barley and oats generally become "germinating-ripe" in Denmark in October or November. Recent summers have, however, been comparatively moist and cool, and this has prevented cereal seed generally from becoming "germinating-ripe" until towards the sowing season, while oats were frequently not "germinating-ripe" even at that time. In the Report of the Danish State Seed Testing Station for 1922/23,* the results of a series of examinations of cereal seeds which were not "germinating-ripe" are recorded.

In order to ascertain whether a sample of cereal seed has sufficient germinating energy (the term "germinating speed" is used in this paper when speaking of germination *in the laboratory* during about one-third of the whole time fixed for germination tests of the species in question, whereas the term "germinating energy" is employed when speaking of germination *in soil*, where the seeds have resistance to overcome), we make a special examination when it is desired. The cereal seed is then sown in mould in flower-pots and covered to the normal depth of about $2\frac{1}{2}$ cm. The results shown in Table 1 (*see* page 81) indicate how important it is that seed which is about to be sown should have a high "germinating speed" and a large capacity for germination.

A series of comparative germination tests, at temperatures of from 17 to 20° C., as hitherto used in tests of cereal seed, and 11-14° C., respectively, have been carried out on samples of cereal seed received at the Danish State Seed Testing Station during the latter part of 1922 and the early months of 1923. Some of the results arrived at are recorded in Table 2 (*see* page 81).

It appears from this Table that in each case the largest germinating capacity and, in seven out of the eight samples, the highest "germinating speed" also, was found at the low temperature. Only in the case of sample "h." was the highest germinating speed found at the high temperature. For a few other samples which germinated normally, something similar was found to hold good; but, in consideration of the small number of samples for which a better germinating speed was

* *Tidskrift for Planteavl*, vol. 30, pp. 329-337.

obtained at the high temperature, it was decided to test cereal seed, in future, at a temperature of 11-14° C. When 9-10° C. was used, the germination of the "germinating ripe" cereal seed went on more slowly than when 11-14° C. was used, whereas the seed which was not "germinating-ripe" germinated more rapidly at the lower temperature. Low temperatures, however, may possibly also favour germination of "germinating-ripe" seeds if the samples are exposed to them at periodic intervals. The examinations will be continued during the coming year.

At the end of the germination test there was, in the case of almost all the samples of barley and oats, a remainder of swollen and fresh, but ungerminated, grains. When the cereal seed had been stored for some time in our heated rooms, and was thereafter retested, more seeds germinated, as a rule, than in the first test. As the object was, as previously mentioned, to give the senders of the samples information as to whether the samples of cereal seed sent in for testing might be expected to germinate better later on, the examination of the cut seeds, described on page 77, was made in addition to the usual test. Corresponding examinations had been made in the preceding years. The figures quoted in Table 3 (*see* page 82) show that, in the case of samples of cereal seed which germinated slowly, a considerably larger germinating capacity was found in the cut seeds than in those untreated.

The examinations conducted in 1922-23 showed that the wheat samples did not reach their normal germinating capacity until November; six-rowed barley not until February or March; two-rowed barley in April or May; and that oat samples, even at the sowing season, germinated, on an average, only 90 per cent. In ordinary circumstances, oats become "germinating-ripe" later than other species of cereal seeds. In 1920-21, many of the oat samples tested had not become "germinating-ripe" even by the spring. Especially the inner-grains germinated slowly; in the examination later in the summer they germinated normally.

It was, of course, of interest to see how the samples of cereal seed, which had generally germinated slowly in the laboratory, behaved in the field. In the spring of 1920 an incrustation formed on many clayey fields following very heavy showers. It became apparent that cereal seed with a comparatively low "germinating speed" germinated poorly and irregularly in such fields. There was, therefore, considerable anxiety as to the consequences that might ensue if something similar happened in the spring of 1923, as much more seed sown that year had a low germinating power than was the case in 1920. As the spring, however, came early, most of the seed was sown at the end of March or the beginning of April. The following period was so cool that the seed did not germinate until the end of April or the beginning of May. During this cold period, after-ripening took place and the cereal seed germinated slowly, but regularly, at the low temperature. As incrustations were not common, the seed had comparatively few difficulties to overcome when germinating.

On account of the slow germination of the seed in the laboratory, many farmers sowed 20-30 per cent. more than usual. From the field-trials conducted by the Danish State Seed Testing Station, however, it appeared that cereal seed germinated, in general, normally, and the additional seed sown was, therefore, under the favourable conditions for germination, as a rule, superfluous. On account of the cool spring, too, barley tillered in 1923 better than usual. Germination in the field and the further development of the plants were thus unusually vigorous in the said year; but if the conditions for germination had been as in 1920, it would certainly have proved necessary to give the farmers a warning with regard to the germination of the cereal seed from the 1922 crop. The results prove the truth of the old Danish proverb: "A Seedsman never becomes wise."

The summer of 1923 was again cold and moist, and many samples of cereal seed grown that year were no more "germinating-ripe" than the crop of the preceding year had been, although they improved considerably

more rapidly. Further, in 1923 oats were again the last to become "germinating-ripe," and some samples had not attained that state by the sowing season. In 1924, however, conditions for germination were again especially good, so that the number of plants is, in general, abundant.

In order to learn the relationship between the germinating capacity of the cut seeds and the germinating energy, in the field, of corresponding untreated seeds, 20 samples of oats, the germinating capacity of which had been ascertained earlier in the season, were, on the 24th May, placed in test under usual conditions at a temperature of 11-14° C.; simultaneously, cut seeds were put in test, and six lots of 100 seeds of each sample were sown the same day in our trial field and covered with a layer of soil 2½ cm. in depth. The soil was very suitable and sufficiently moist. The germination results originally obtained in the laboratory and those obtained for the samples placed in test on the 24th May in the laboratory, and also the results of the tests carried out in the field, are to be found in Table 4 (see page 82).

On comparing the results of the first and the second laboratory tests it will be seen that the "germinating speed" as well as the capacity for germination, as regards almost all the samples, is larger in the second test, and that the differences are most marked where the germinating capacity was small at the time of the first test. The sample numbered 17, which germinated very poorly, had, however, a smaller germinating capacity at the second than at the first examination which shows that the sample in question does not lack "germinating-ripeness" but that the non-germinated seeds were dead.

The germination results for the cut seeds are almost identical with those for the last test of the untreated seeds, and by that time it may reasonably be supposed all seeds would have been "germinating-ripe." This shows that the first test of the cut seeds affords an immediate general indication of the germinating capacity which may be expected of the samples when they become "germinating-ripe."

The results of the field experiments show that, in most cases, the germination in the field was high in proportion to the germinating power found in the laboratory. Numerous examinations in our control fields have shown that, on an average, about two-thirds of the seed which would have germinated in the laboratory will germinate in the field under normal conditions. The germination in the field last spring was, however, better than usual, as almost four-fifths of the number of seeds germinable in the laboratory germinated in the field. It appears, moreover, that the germination results obtained in the field are proportionate to those obtained for the cut seeds in the first and second laboratory tests, as well as to the germinating capacity of the untreated seeds in the second laboratory test. It is thus possible, immediately after the first examination of the cut seeds, to decide whether or not the bulk is suitable for sowing in the field.

The Danish State Seed Testing Station intends, therefore, to continue, in future, to make examinations of cut seeds in addition to the usual tests, and to state on the analysis certificates, in cases where the usual test shows that the bulk is not "germinating-ripe," that, after having been stored, or, if necessary, dried or stirred, the seed will probably reach a germinating capacity corresponding to that found in the cut seeds.

In order to obtain some information as to when cereal seeds become "germinating-ripe," and how the matter is affected by the degree of ripeness reached by the crop at the time of harvesting, some tests have been carried out on samples of cereals harvested at varying stages of maturity. The samples were taken from two varieties of wheat, three of barley (two two-rowed and one six-rowed) and two of oats, all of which are commonly grown in Denmark, and represented each of these varieties at three different stages of maturity, viz., "green-ripe" (the glumes and pales still greenish, the albumen at the transitional stage from milky to tough), "yellow-ripe" (the glumes and pales almost yellow, albumen of a

tough consistence), and "fully ripe" (the glumes and pales quite yellow, albumen almost firm). The samples, which had been harvested on three different experimental plots, were placed in test immediately after harvesting, during the period 10-22 August, and again about 10th September and the 10th October. Further, portions of some of the samples were again put in test at the beginning of November, and some few at the end of November. They were tested at three different temperatures, viz., 18-22° C., 14-16° C., and 10-14° C. The "germinating speed" was determined after 5 days for all three species, and the germinating capacity after 10 days for wheat and barley, and 12 days for oats. At the beginning of each germination test, the moisture content was determined. The weight of 1,000 seeds of those tested was determined the first and second time. The germinating capacity of cut grains was also ascertained at the time of the first and second tests.

The mass of figures obtained from these experiments is too extensive to record here, but it is, of course, at the disposal of those interested in the matter. The main results, however, may be summarised as follows: With the exception of two "fully ripe" samples of barley, none of the samples had obtained normal speed and capacity for germination when placed to test immediately after harvesting. The "green-ripe" and "yellow-ripe" samples attained a germinating speed of only a few per cent., and the "fully ripe" a little more. The highest results were obtained at the lowest temperature.

The moisture content of the samples when they were put in test for the first time was much higher than the normal (13-15 per cent.). That of the "green-ripe" samples was 35-50 per cent., that of the "yellow-ripe" 25-40 per cent. and that of the "fully ripe" 18-28 per cent. When the samples were tested for germination for the second time, after they had been stored in the laboratories, their water content was almost normal. The drying had had the same effect on most of the samples as if an after-ripening had taken place. At the second test the samples still had a comparatively low germinating speed, though most samples of wheat and barley showed a normal germinating capacity; but, in the case of the oats, the "green-ripe" seeds obtained, as a rule, the largest germinating capacity, and those "fully ripe" the smallest. The "fully ripe" seeds of one of the oat varieties were, at the third examination, still not "germinating ripe," whereas both the "green-ripe" and the "yellow-ripe" seeds had reached that condition. At the fourth test, all the samples were fully "germinating-ripe."

The results of the examinations show that cereal seed which is not "germinating-ripe" germinates best at the lowest of the three temperatures used, whereas "germinating-ripe" seeds germinate almost equally at all three temperatures, but generally most rapidly at the highest.

With regard to the cut seeds, those tested directly after harvesting in some cases also germinated more slowly than normally. Nevertheless, with a few exceptions, they attained a germinating capacity within the usual time equal to the highest reached by the "germinating-ripe" seeds. In the examination conducted one month after harvesting, the germinating capacity of the cut seeds was, allowing a little latitude, as good as the largest germinating capacity arrived at in later experiments of the untreated, "germinating-ripe" seeds. As tests of cereal seed are never, in practice, made just after it has been harvested, but after it has been dried on the field, threshed and cleaned, these investigations confirm those previously mentioned in respect of cut seeds.

The experiments have shown—

(1) That the fact of cereal seed not being "germinating-ripe" is not due to the seed having been harvested before it was fully matured.

(2) That germination results obtained for cereal seeds, which are not "germinating-ripe," but of which that end opposite the embryo

is cut off, give reliable information as to the germinating capacity which is to be expected of the bulk when it becomes "germinating-ripe."

As the cutting of the seeds does not touch the embryo, the lack of "germinating-ripeness" can scarcely be due to a latent condition of the embryo, but may be the result of a condition of the seed-coat in which, probably, oxygen, carbonic acid and other products are unable, or only partially able, to force their way through the seed coat.

Table 1.—Tabelle 1.

No.	Barley sown in sand (uncovered). Gerste in Sand ausgesät (unbedeckt).		Sown in soil (covered 2½ cm.). In Erde ausgesät (2½ cm. bedeckt).	
	Germinating speed. Keimschnelligkeit.	Germinating capacity. Keimfähigkeit.	Germinating energy in Keimkraft in	
	4 days. 4 Tage.	10 days. 10 Tage.	7 days. 7 Tage.	12 days. 12 Tage.
1	% 99	% 100	% 70	% 95
2	85	95	50	72
3	52	59	0	9

Table 2.—Tabelle 2.

Species. Art.		Germination at Keimung bei			
		17–20° C.		11–14° C.	
		4 days. 4 Tage.	10 days. 10 Tage.	4 days. 4 Tage.	10 days. 10 Tage.
a } b } c } d }	Two-rowed barley Zweizeilige Gerste	% 46	% 55	% 68	% 81
		45	78	55	95
		62	78	92	95
		82	88	94	97
e } f } g } h }	Oats - - - Hafer - - -	5 days. 5 Tage.	12 days. 12 Tage.	5 days. 5 Tage.	12 days. 12 Tage.
		% 20	% 33	% 23	% 63
		26	39	28	63
		54	63	61	90
		70	93	64	98

Table 3.—Tabelle 3.

Species. Art.	Untreated. Unbehandelte.		Cut. Angeschnittene.	
	4-6 days. 4-6 Tage.	10 days. 10 Tage.	4-6 days. 4-6 Tage.	10 days. 10 Tage.
	%	%	%	%
a } Wheat -	7	51	32	96
b } Weizen -	33	77	82	98
c } Two-rowed barley	62	87	100	100
d } Zweizeilige Gerste	32	44	52	94
e } -	50	61	72	94
f } -	65	79	86	98
		5 days. 5 Tage.	5 days. 5 Tage.	12 days. 12 Tage.
		%	%	%
g } Oats -	19	59	56	96
h } Hafer -	57	87	92	98
i } -	29	62	60	100
k } -	67	86	86	100

Table 4.—Germinating capacity in the Laboratory and in the Field of Oats.

Tabelle 4.—Keimfähigkeit im Laboratorium und im Felde von Hafer.

No.	Germination in the Laboratory. Keimung in dem Laboratorium.							Germinating capacity in the Field. Keimfähigkeit im Felde. Sown 24/5, '24. Ausgesät 24/5, '24.	
	1. Test. 1. Prüfung.				2. Test, put to test the 24/5 1924. 2. Prüfung, zum Keimen am 24/5 1924 gelegt.			In 9 days. In 9 Tagen.	In 11 days. In 11 Tagen.
	Date put to test. Datum zum Keimen gelegt.	Germinating speed in 6 days. Keimgeschwindigkeit in 6 Tagen.	Germinating capacity in 12 days. Keimfähigkeit in 12 Tagen.	Germinating capacity of cut seeds. Keimfähigkeit von angeschnittenen Samen.	Germinating speed. Keimgeschwindigkeit.	Germinating capacity. Keimfähigkeit.	Germinating capacity of cut seeds. Keimfähigkeit von angeschnittenen Samen.		
1	9/4	64	77	92	85	89	92	64	67.5
2	4/4	79	89	100	96	96	94	76.5	78
3	1/4	78	84	96	96	96	94	68	73
4	27/3	38	78	100	96	99	100	75	80
5	„	93.5	96.5	94	96	97	98	77	81
6	22/3	79	97	96	94	96	96	79	83
7	18/3	94	97.5	—	98	99	100	79.5	82
8	7/5	87	95	96	98	99	96	76	81
9	6/5	85.5	90	82	87	89	88	71	76
10	„	82.5	90	98	92	93	98	71.5	79
11	„	84	92	100	93	95	94	80.5	84.5
12	7/5	84	92	98	91	95	96	72	78
13	„	74	80	92	85	87	92	64	69
14	„	82	92	94	94	96	96	80.5	85
15	3/5	68	71	80	71	74	80	55	61
16	„	72.5	81	76	79	83	90	65	69
17	22/4	48	50.5	50	44	48	52	33	36
18	„	76	80	80	81	83	76	62	64
19	„	63.5	66	72	66	68	66	48	50
20	„	87	93	90	93	95	100	78	82

Afternoon Session.

The Delegates assembled at 2.30 p.m. in the University School of Agriculture, where they were joined by Delegates to the First International Seed Trade Conference which was being held in London concurrently with the Fourth International Seed Testing Congress.

Sir Lawrence Weaver said that, as Chairman of the Fourth International Seed Testing Congress, it gave him great pleasure to welcome Mr. E. G. Bell (President of the Agricultural Seed Trade Association of the United Kingdom and also President of the First International Seed Trade Conference) and the other visitors from the Seed Trade Conference. He, and those associated with him, realised that there must necessarily be the closest possible contact between those concerned with seed testing and the great seed trade, and he welcomed, therefore, the opportunity of a joint meeting, believing that they would derive much benefit from listening to the papers to be read by Dr. Volkart and Mr. Edgar Brown.

Mr. Dorph-Petersen, as Chairman of the European Seed Testing Association, also welcomed the visitors very heartily. He intimated that all those engaged in seed testing were delighted to have this opportunity of meeting the seed dealers and emphasised the great significance of a reciprocal understanding between the seed trade and those institutions testing seeds. It was probable that at their meeting on the following day the Seed Testing Congress would approve the formation of an International Seed Testing Association. He expressed the hope that the seed traders would form a similar international association and that the two associations would co-operate.

Mr. E. G. Bell on behalf of the Seed Trade Conference and his own Association (The Seed Trade Association of the United Kingdom) thanked Sir Lawrence Weaver and Mr. Dorph-Petersen very much for their welcoming words. It gave him and his colleagues great pleasure to meet the Delegates to the Seed Testing Congress and he was sure they would glean information which would be of importance to their trade.

Dr. Volkart then read the following report :—

Report on the Determination of Provenance of Clover and Grass Seeds.

By

DR. A. VOLKART, Zürich.

The Third International Seed Testing Congress at Copenhagen asked me to make proposals for a uniform enquiry into the different origins of commercial clover and grass seeds, and to inaugurate joint investigations into this subject. The proposals for these investigations were submitted to the representatives of the different countries taking part in the Congress, in the spring of 1922. I had proposed at Copenhagen, that in

these investigations into origin stress should be laid, not exclusively on the so-called "determining species" among the weed seeds mixed with the seed,—that is to say, not only on species which occur only in a given provenance and are characteristic thereof,—but regard should also be paid to all "secondary species," i.e., the other less characteristic species. In fact all the characteristics of a seed should be taken into consideration, as these may materially help us in the definition of origin. I, therefore, proposed a comprehensive and thorough examination of the different provenances, based on authentic specimen samples, and intended that the investigation should be confined in the first place to the most important of the seeds, namely, red clover.

The investigation should extend to:—

(a) *The seeds of weeds.*—It was laid down as essential, that all the different kinds thereof should be accurately ascertained numerically, since indications like "common," "very frequent," "frequent" cannot suffice for the determination of the finer distinctions in the weed-flora of the seeds of the different countries. To facilitate this work, I proposed a special system for the examinations, whereby it is made possible to count the more frequent species in only a small part of the sample.

(b) *The other impurities.*—It was recommended that special attention should be paid to the remaining impurities in seeds, since, as was pointed out in the lecture at Copenhagen, it is also possible to arrive at conclusions as to the origin of a seed from the mineral impurities found therein, and it is often possible, as was shown by G. Tryti in particular, to determine the origin by fragments of leaves found in seed.

(c) *The colour.*—Here, too, we find differences. We proposed to fix these into five different grades:—violet, predominating violet, mixed, predominating yellow and yellow. Thus, only the distribution of the colour was considered, not the tone. To determine the tone of violet and yellow it would have been necessary to use colour standards. The French "Code des couleurs" by Klinksieck and Valette is out of print, and the American "Color Standards" by Ridgway is too little known, besides being out of reach of many stations owing to the present monetary conditions.

(d) *The "Thousand grain weight."*—This weight-test by itself will never suffice to determine origin of red clover, but, together with other tests, it may strengthen an opinion as to the origin of a seed.

Special stress was laid upon the necessity of using absolutely authentic seed for the purposes of the investigation. The specimen samples should be obtained exclusively from absolutely reliable sources, and comprise samples already commercially cleaned. In the investigations also those countries should take part which produce red clover for their own consumption only—i.e., those which do not export such seed—as the result of such investigation may help to supplement conclusions as to the geographical distribution of weeds.

Within a country the different producing districts should be kept separate, if, on examination, appreciable marks of distinction should be found. It was also recommended that records of the different sub-species of red clover (as for instance, common and late flowering red clover) should be kept separately.

The publication of the results was left to the option of each participant, but it was recommended that a uniform method of report should be adopted. By this procedure, results become comparable and their utilisation is much facilitated. It was also contemplated that statistics as to the size of the crops of red clover seed in each country and their variations from year to year should be collected. In addition, we should have particulars as to exports and also as to the approximate distribution of the red clover seed crops in the different growing districts within each country. It was assumed that such information might be obtained by

best methods of an enquiry, should the proposed Association decide on their continuation. I shall take the liberty of submitting to you my recommendations in this respect at the end of my report.

A.—Conclusions for the practice of Examinations into Origin.

(a) *Weed seeds*.—The number of new characteristic species, so-called determining species, which occur in these four investigations is very small. We are struck by the frequent occurrence of *Trifolium striatum* L. in Danish red clover. This is a xerophytic species which needs considerable heat, and which one would hardly expect to thrive and produce ripe seeds in fields of clover, especially in Denmark. A typical Northern species is the *Rumex domesticus* L. which was found in Swedish seed, but the seed of which can hardly be distinguished from other *Rumex* species. From the examinations of Roumanian red clover, we further find that in it occurs *Centaurea micrantha* Gmel, a sub-species of *C. maculosa* Lam., which is confined to the Crimea, Bessarabia and Transylvania. It might be profitable to investigate at some time the group of the *Centaurea paniculata* L. as to species proving provenance. *Centaurea pannonica* Heuf. is a sub-species of *C. Jacea*, and will hardly ever be distinguishable, in its seed, from the main species. Similarly, it will prove difficult to recognize *Rumex difformis* Menyhardt, a good Eastern species. In fact, the examinations of Roumanian red clover have proved the occurrence of a number of species which, up to now, were unknown to us as weeds in red clover; for instance, *Falcaria vulgaris* and *Passerina annua*. It is true, however, that neither of these can be looked upon as characteristic of seeds of Roumanian origin. More important is the result of the establishment of the secondary seeds.

1. The Danish seed.—The whole weed flora bears the stamp of the cool and rather moist climate, which is indicated by the predominance of the two *Trifolium* species and of the grasses (*Dactylis*, *Lolium*, *Phleum*, *Agropyron*) and the absence of all species indicating a warmer climate, like *Medicago sativa*, *Verbena officinalis*, *Thrinicia hirta*, and also of the *Panicum* and *Setaria* species. Certainly there occur such species as *Lotus*, *Daucus* and *Crepis tectorum*, which indicate a locally somewhat warmer climate, but they are not important. The same applies to *Cichorium*; moreover, it is striking that *Plantago lanceolata* occurs not nearly as frequently (dominancy) as in seed which comes from more southern districts. The occurrence of *Matricaria inodora* and *Sherardia arvensis* would merit further investigation. They are both found in Danish seed, but are missing in Roumanian.

2. The Dutch seed.—Here too the *Panicum* and *Setaria* species, which are so frequent in East European seeds, recede into the background, both as regards constancy and dominancy. On the other hand, species which occur in Eastern Europe, but more rarely than in Western Europe, like *Alopecurus agrestis*, *Rumex acetosa*, *Geranium* spp., *Stachys arvensis*, *Centaurea Jacea* and *Arnoseris*, are frequently found. A somewhat warmer climate than the Danish is indicated by *Teucrium botrys* and *Thrinicia hirta*. But, here too, *Medicago sativa* and *Cichorium Intybus* are totally missing and *Daucus* occurs very rarely. Compared with Danish seed, *Plantago lanceolata* stands out strongly (dominancy) and species missing in the Danish seed, *Rumex acetosa* and *Polygonum convolvulus* are frequent in Dutch red clover. The absence of *Lampisana* and the receding of *Sherardia* are striking factors. In the seeds from the three Dutch fields of production it was found impossible to arrive at even moderately accurate marks of distinction, even by most careful comparison. However, the complete absence of the small *Gerania* (*Geranium molle* L. and *pusillum* L.) in the six samples from the Meuse districts, and the rareness of *Daucus* in the Roosendaal clover, is striking. These three Dutch fields are presented as one in the appendix.

3. The Roumanian red clover.—It is well-known that it is not always easy to separate the seeds from the East, especially those from the environs of the Black Sea, from the provenances of the Mediterranean field. The warm and dry summer is responsible for many common species in the two areas. Thus we come across in Roumanian red clover, in addition to species which indicate exclusively a warm climate, like *Medicago sativa*, *Coronilla varia*, *Galega officinalis*, *Cuscuta suaveolens*, *Galeopsis ladanum* and *angustifolium*, *Marrubium vulgare*, *Chaiturus marrubiastrum*, *Cichorium intybus* and *Lactuca scariola*, also species which must be considered predominantly Continental, and others which we know chiefly as seeds of the Mediterranean territory. As predominantly Continental species we consider, apart from *Panicum* and *Setaria* species (which are not rare in Mediterranean seeds either) *Melandrium album*, *Delphinium consolida*, *Nigella arvensis*, *Berteroa incana*, *Lathyrus hirsutus*, *Hibiscus trionum*, *Conium maculatum*, *Cerinthe minor*, *Ballota nigra*, *Centaurea* spp. ex sectione *Paniculatarum*, *Carduus acanthoides* and *Cirsium canum*; whilst *Torilis nodosa* and *Linaria elatine* are more frequent in West Mediterranean and Atlantic seeds. The occurrence of *Petroselinum* (*Carum*) *segetum*, however, requires confirmation, as, up to the present, we have looked upon this as typically West European (England, Flanders, North and Central France and Portugal). Further, other pronouncedly West Mediterranean and Atlantic species frequently found there in red clover, such as *Sanguisorba minor*, *Malva crispa*, *Arthrolobium scorpioides*, *Verbena officinalis*, *Helminthia*, *Xeranthemum cylindraceum*, are missing in the Roumanian clover. The absence of *Matricaria inodora* and *Sherardia arvensis* is striking, as is also the unimportance of the grasses (*Lolium*, *Dactylis*, *Arrhenatherum*, *Alopecurus agrestis*) which are represented strongly in French red clover.

4. The Roumanian Lucerne.—In its weed flora this so nearly resembles the Roumanian red clover that it is not necessary to refer to it here.

5. Swedish red clover from Stockholms Län.—The composition of the weed flora resembles very closely that of the Danish. *Plantago lanceolata* occurs even more rarely, and the weeds of a somewhat warmer local climate, which we found in Danish clover (*Lotus*, *Daucus*, *Crepis tectorum*) are totally absent. The perennial species predominate strongly, as would be expected in the Northern climate, where a pronounced summer drought is absent.

(b) Other impurities.—The mineral impurities do not give us much clue in the four provenances we have before us. Nevertheless, distinct differences show themselves.

(c) Colour.—Danish, Dutch and Swedish clovers show a pronounced predominance of the yellow colour, and in this they differ from the German, Austrian, French and American provenances.

(d) Thousand-grain weights.—The Swedish red clover shows a small, the Danish a medium, and the Dutch red clover a fairly large thousand-grain weight.

B. Methodical Results.

It is very desirable that in future all weed seeds which cannot be identified should be grown on for this purpose. It is absolutely necessary to obtain a complete picture of the whole of the weed flora of a sample. The investigations made up to now have proved conclusively that the seed control station of the country of origin is best able to conduct these analyses, as the flora of the clover fields of its country is better known to it than to a foreign station. These investigations should, therefore, be left to the local station in future. In cases where the local station does not find time to conduct the investigations itself, it should confine itself to collecting authentic samples, and leave the examination to a central station to be selected by the Association. The designation of the species should in future be uniform, and for this

purpose the resolutions of the International Botanical Congress of Vienna should be followed. I refer to the publication: "Règles internationales de la nomenclature botanique adoptées par le congrès international de Botanique." Jena. Gustav Fischer, 1912.

The method of examination which we proposed (*i.e.*, division of the sample into tenths) has apparently proved sound, and should, therefore, be followed in future. It is important that the actual number of all species of weed seeds should always be ascertained.

The method of examination of the mineral and organic impurities of seeds should be further developed. For the present, however, this question must be relegated to the background, and every endeavour should be made to obtain as comprehensive a definition of the weed seeds as possible.

The definition of colour is clearly unsatisfactory. Although specimen samples graded as to colour were sent out, the separation into the five classes is still too much subject to the individual judgment of the analyst. Exact instructions in this respect must be issued with the samples.

As regards the examination of the thousand-grain weight, the Swedish definitions have shown that it is necessary, at any rate for the Northern countries, to leave the samples for a sufficiently long time in a dry room before they are examined, so that they may lose their excess moisture.

A method will have to be found for condensing the results which will obviate particular samples containing an abnormal quantity of a single given species of weed too strongly influencing the average of that particular species.

The speaker very much regrets that he is unable to continue to conduct these investigations. However, he recommends to you the acceptance of the following conclusions and proposals:—

1. The results so far obtained of the examination of red clover seed of different origin, conducted according to the uniform method decided on by the conference at Copenhagen, show that, in this manner, exact and reliable descriptions of individual sources of origin can be obtained. These investigations are, therefore, to be continued.

2. It is of the utmost importance that the examinations shall continue to be conducted in a uniform manner, and that the results of examinations shall be published in such a manner that they are comparable one with another, and can be made use of easily.

3. The particular examinations are to be left in the hands of the Institutes of the different countries, as hitherto. These Institutes collect the samples and examine them according to uniform regulations. The detailed results are to be published by the respective Institutes.

4. The 4th Seed Testing Congress nominates as the Central Station for this purpose a station which has distinguished itself in connection with these examinations. The duties of this Central Station are:—

- (a) The further improvement and standardisation of the methods of examination.

- (b) Instruction and assistance for the Institutes taking part in the inquiry.

- (c) The preparation of short summaries of the results of the examinations, their interpretation and circulation to the members of the Association.

- (d) The carrying out of the inquiry for countries which are unable to do it themselves.

- (e) Examination of particular groups of species which are of special importance in the definition of origin and publication of the distinctive marks of their seeds. Distribution of genuine samples of seeds of these species to the different stations.

- (f) Creation of a record-office where the results of every single examination are to be entered.

5. The Association votes a fixed sum to be paid annually to the Central Station as remuneration for the work done by it. The Committee of the Association also grants sufficient subsidies for such special examination as may prove necessary.

APPENDIX I.

Danish Red Clover.

Examinations by Dir. K. Dorph-Petersen.

	Frequency (con- stancy).	Number of seeds found (dominancy).	
		Greatest number in 1000 gr.	Average number in 1000 gr.
<i>Very frequent species</i>			
1. Trifolium hybridum L. .	14	17,080	1,470
2. Trifolium repens L. .	14	2,020	361
3. Dactylis glomerata L. . .	13	4,720	781
4. Lolium perenne L. & italicum A. Br.	13	236	76
5. Chenopodium album L. . .	13	2,120	219
6. Medicago lupulina L. .	13	7,520	742
7. Plantago lanceolata L. .	13	416	67
8. Rumex spec.	12	1,840	618
9. Geranium dissectum L. .	12	424	90
10. Anthemis arvensis L. .	12	6,960	723
11. Cirsium arvense (L.) Scop.	12	337	65
12. Phleum pratense L. . .	11	107	22
13. Sinapis arvensis L. . .	11	1,380	258
14. Matricaria inodora L. . .	11	880	131
<i>Frequent species</i>			
15. Rumex Acetosella L. . .	10	12,720	1,366
16. Brunella vulgaris L. . .	10	100	38
17. Agropyron repens (L.) P.B.	8	213	55
<i>Less frequent species :</i>			
18. Polygonum lapathifolium L.	5	323	303
19. Geranium molle L. . . .	8	488	118
20. Daucus Carota L.	7	144	45
21. Sherardia arvensis L. . .	7	133	47
22. Poa spec.	6	1,220	208
23. Ranunculus repens L. . .	6	184	45
24. Trifolium striatum L. . .	6	84	29
25. Stellaria media Cyrillo . .	5	250	63
26. Geranium pusillum L. . .	5	32	6
27. Festuca pratensis Huds. .	4	4	4
28. Atriplex spec.	4	16	8
29. Spergula arvensis L. . . .	4	440	153
30. Lotus corniculatus L. . .	4	26	14
31. Viola tricolor L.	4	22	12
32. Galium spec.	4	52	17
33. Lamprana communis L. . .	4	32	11

Unimportant species Moreover there were found in *three* instances *Agrostis alba* L. (17,388), *Secale cereale* L. (4), *Polygonum aviculare* L. (8), *Lychnis spec.* (37), *Silene vulgaris* (Mönch) Garcke (19), *Medicago sativa* L. (78), *Plantago major* L. (4), *Centaurea cyanus* L. (4).

Twice : *Alopecurus geniculatus* L. (11), *Agrostis spica venti* L. (60), *Bromus arvensis* L. (94) *Carex spec.* (552), *Scleranthus annuus* L. (26),

Melilotus spec. (14), *Trifolium procumbens* L. (6), *Trifolium arvense* L. (6), *Myosotis* spec. (300), *Veronica* spec. (282), *Chrysanthemum Leucanthemum* L. (7), *Cichorium Intybus* L. (4), *Cirsium lanceolatum* (L.) Scop. (6), *Crepis tectorum* L. (4).

Once: *Setaria* spec. (4), *Alopecurus pratensis* L. (8), *Deschampsia caespitosa* (L.) P.B. (13), *Aiopsis* spec. (1), *Festuca ovina* L. *duriuscula* Koch. (4), *Lolium italicum* A.Br. (8), *Holcus lanatus* L. (22), *Triticum vulgare* Vill. (4), *Rumex Acetosa* L. (4), *Polygonum lapathifolium* L. (4), *Urtica dioica* L. (8), *Reseda* spec. (4), *Arenaria* spec. (8), *Sinapis alba* L. (35), *Thlaspi arvense* L. (4), *Capsella Bursa pastoris* (L.) Medikus (496), *Trifolium dubium* Sibth. (8), *Alchemilla* spec. (71), *Potentilla* spec. (4), *Rubus* spec. (4), *Anagallis arvensis* L. (18), *Echium vulgare* L. (8), *Anchusa officinalis* L. (16), *Euphrasia odontites* L. (4), *Lamium* spec. (4), *Lamium amplexicaule* L. (4), *Galium aparine* L. (8), *Stachys silvaticus* L. (36), *Bellis perennis* L. (4), *Chrysanthemum segetum* L. (8), *Achillea* spec. (373), *Senecio* spec. (360), *Sonchus* spec. (4), *Taraxacum officinale* Web. (8), *Leontodon autumnalis* L. (13).

(b) *Other impurities*.—The samples contain:—

0.068–1.396 on average	0.383 %	earthy matter.
0.132–2.308 on average	0.414 %	small stones.
0.064–5.224 on average	0.548 %	particles of leaves and stalks.
0.011–1.266 on average	0.321 %	other matter (broken and undefinable seeds, and animal matter).

In addition the following impurities were found in the samples, in each of four cases—*Claviceps purpurea* (Fr.) Tul. (average 45) and *Typhula trifolii* Rostr. (average 10) and in 3 cases *Sclerotinia trifoliorum* Erickss.

(c) *Colour*.—The colour is, on an average, distributed as follows:—

violet	-	-	-	-	-	140
predominating violet	-	-	-	-	-	313
mixed	-	-	-	-	-	112
predominating yellow	-	-	-	-	-	179
yellow	-	-	-	-	-	256

The figures show such great fluctuations in each case, that it would serve no purpose to give maxima and minima.

(d) 1,000 *grain weights*.—These alternate between 1.422 and 1.911, and the average is 1.733.

Of the 14 samples examined, one each came from Bornholm, South-Jutland, and from the island of Möen. All the rest came from Sealand, i.e., three from East Sealand, two from Middle Sealand, two from North Sealand, one from West Sealand, and two from Southeast Sealand.

APPENDIX II.

Dutch Red Clover.

Examinations by Dir. A. W. Franck.

	Frequency (con- stancy).	Number of seeds found (dominancy).	
		Greatest number in 1,000gr.	Average number in 1,000gr.
<i>Very frequent species :</i>			
1. <i>Plantago lanceolata</i> L.	- - 29	72,100	5,199
2. <i>Trifolium repens</i> L.	26	16,972	1,134
3. <i>Rumex acetosa</i> L.	- - 26	2,080	249
4. <i>Rumex acetosella</i> L.	23	4,252	820
5. <i>Chenopodium album</i> L.	22	721	63

	Frequency (con- stancy).	Number of seeds found (dominancy).	
		Greatest number in 1,000 gr.	Average number. in 1,000 gr.
<i>Frequent species .</i>			
6. Polygonum aviculare L.	21	108	24
7. Polygonum convolvulus L.	18	360	33
8. Spergula arvensis L.	17	1,750	170
9. Lolium italicum A.Br. and perenne L.	15	7,580	563
10. Viola tricolor L.	15	260	34
11. Geranium molle L. and pusil- lum L.	15	130,000	8,821
<i>Less frequent species :</i>			
12. Stellaria media Cyrillo	14	248	42
13. Polygonum Hydropiper L.	14	649	96
14. Trifolium hybridum L.	13	1,032	166
15. Agrostis spica venti L.	12	84	20
16. Polygonum Persicaria L.	12	185	28
17. Brunella vulgaris L.	12	308	67
18. Polygonum lapathifolium L.	11	88	20
19. Sinapis arvensis L.	11	60	14
20. Holcus lanatus L.	10	1,632	195
21. Vicia spec.	10	150	25
22. Poa spec.	9	24	12
23. Cerastium caespitosum Gilib	9	64	16
24. Ornithopus sativus Brot.	9	40	15
25. Plantago major L.	9	976	146
26. Trifolium dubium Sibth.	8	10	7
27. Geranium dissectum L.	8	382	58
28. Scleranthus annuus L.	7	18	5
29. Medicago sativa L.	7	1,298	217
30. Daucus Carota L.	7	5,614	847
31. Galium Aparine L.	7	8	3
<i>Unimportant species :</i>			
32. Anthoxanthum odoratum L.	6	28	8
33. Agrostis alba L.	6	147	28
34. Atriplex patulum L.	6	10	5
35. Erodium cicutarium (L.) L'Hérit	6	6	2
36. Myosotis micrantha Pall	6	20	8
37. Panicum Crus galli L.	5	67	16
38. Phleum pratense L.	5	2,290	487
39. Arnoseris minima (L.) Schw. and Kört.	5	14	8
40. Centaurea Jacea L.	5	4	3
41. Chrysanthemum segetum L.	5	169	41
42. Hypochaeris radicata L.	5	21	7

Moreover there were found in *four* instances : *Setaria viridis* (L.) P.B. (8)*, *Alopecurus agrestis* Huds. (21), *Avena sativa* L. (6), *Silene* spec. (2), *Medicago lupulina* L. (21), *Lotus uliginosus* Schkuhr (48), *Crepis virens* L. (16).

* Average of the seeds found in the 4 samples.

In *three* instances : *Secale cereale* L. (18), *Carex spec.* (8), *Saponaria officinalis* L. (2), *Thlaspi arvense* L. (5), *Capsella bursa pastoris* (L.) Mönch (10), *Trifolium procumbens* L. (3), *Anthemis arvensis* L. (83).

Twice : *Aira praecox* L. (7), *Urtica urens* L. (3), *Cerastium arvense* L. (10), *Ranunculus repens* L. (28), *Papaver somniferum* L. (116), *Galeopsis tetrahit* L. (1), *Stachys arvensis* L. (135), *Veronica arvensis* L. (6), *Veronica hederæfolia* L. (3), *Rhinanthus major* Ehrh., *Sherardia arvensis* L. (3), *Achillea millefolium* L. (3), *Cirsium lanceolatum* (L.) Scop. (11), *Centaurea Cyanus* L. (15), *Lamprana communis* L. (5), *Thrinicia hirta* Roth (2), *Leontodon autumnalis* L. (2).

Once : *Phalaris canariensis* L. (4), *Panicum sanguinale* L. (2), *Alopecurus pratensis* L. (4), *Deschampsia caespitosa* (L.) P.B. (4), *Avena elatior* L. (4), *Dactylis glomerata* L. (4), *Bromus hordeaceus* L. (7), *Triticum aestivum* L. (8), *Luzula campestris* (L.) D.C. (5), *Arenaria serpyllifolia* L. (3), *Ranunculus acer* L. (4), *R. spec.* (1), *Glaucium spec.* (4), *Raphanus sativus* L. *radicula Pers.* (1), *Sisymbrium officinale* (L.) Scop. (7), *Camelina sativa* (L.) Crtz. (5), *Lepidium sativum* L. (1), *Melilotus spec.* (2), *Lotus corniculatus* L. (4), *Geranium columbinum* L. (76), *Petroselinum sativum* (L.) Hoffm. (4), *Chaerophyllum temulum* L. (3), *Anagallis arvensis* L. (4), *Solanum Dulcamara* L. (1), *Teucrium botrys* L. (8), *Lamium amplexicaule* L. (2), *Galium Mollugo* L. (10), *Campanula spec.* (7), *Calendula officinalis* L. (93).

(b) *Other impurities.*—The mineral impurities correspond with the nature of the soil, i.e., they are sandy for the Roosendaal clovers, and consist of brown earth in the samples from Gröningen and the districts of the Meuse.

(c) *Colour.*—The colour-test, made with 1,000 grains of each sample, gave the following average results :—

—	Violet.	Predomi- nating Violet.	Mixed.	Predomi- nating Yellow.	Yellow.	In addition Brown.
						Per cent.
Gröningen, 1921 -	10	120	184	212	474	18.1
Meuse districts, 1921	2	190	140	201	467	5.3
Roosendaal, 1921	12	186	183	212	407	15.1
„ 1922 -	11	193	162	200	434	22.4
„ 1923 -	3	224	335	384	54	26.7
Average of the whole.	8	182	201	242	367	17.5

(d) *1,000 grain-weights.*—The samples gave the following weights :—

—	Year.	Samples.	Minima.	Maxima.	Average.
Gröningen -	1921	3	1.44	1.85	1.64
Meuse districts	1921	6	1.64	1.95	1.82
Roosendaal	1921	6	1.66	2.12	1.97
„ -	1922	8	1.45	2.25	1.93
„ -	1923	6	2.06	2.34	2.15

From the above it would appear that the Roosendaal clover is the heaviest in grain; the collective average is 1.87 grammes.

(e) *Purity and Ability to Germinate*.—This test gave the following average figures :—

—	Purity.	Foreign Seeds.	Ability to germinate.	Grains remained hard.
Gröningen, 1921	97·73	0·8	83	13
Meuse districts, 1921	91·25	1·30	83·8	13
Roosendaal, 1921	93·63	3·15	81·7	14·5
„ 1922	96·25	0·40	87·5	4·5
„ 1923	95·51	0·41	82·5	21·6

Production of Red Clover Seed in Holland.—In Holland we have three districts for the production of red clover seed : Roosendaal and surrounding district (Province of North Brabant), districts of the Meuse (Province of Limburg) and Gröningen. The Roosendaal or Brabant clover is so much in demand that practically all the seed remains in the country and none is exported. On the other hand, much red clover seed went formerly from the Meuse districts to Germany. Whilst the Roosendaal clover comes from good sandy soil, the Meuse clover and that from Gröningen is produced on clay soil. Exact figures for the production of red clover seed, which fluctuates considerably in different years, cannot be given.

The samples, the results of examination of which form the basis for the table given above, come from the Province of Gröningen (3 of the year 1921), from the Meuse districts (6 of 1921) and from Roosendaal (6 of 1921, 8 of 1922 and 6 of 1923).

APPENDIX III.

Roumanian Red Clover.

Examinations by Dir. Jon Enescu.

	Frequency (con- stancy).	Number of seeds found (dominancy).	
		Greatest number in 1,000 gr.	Average number in 1,000 gr.
<i>Very frequent species :—</i>			
1. <i>Chenopodium album</i> L.	18	45,200	3,620
2. <i>Daucus Carota</i> L. -	18	7,800	1,842
3. <i>Plantago lanceolata</i> L. -	18	62,200	12,941
4. <i>Cichorium Intybus</i> L.	18	8,600	1,352
5. <i>Setaria viridis</i> (L.) P.B.	17	4,960	986
6. <i>Anagallis arvensis</i> L. -	17	3,200	277
7. <i>Cirsium arvense</i> (L.) Scop.	17	787	90
8. <i>Polygonum aviculare</i> L. -	15	1,540	146
<i>Frequent species :—</i>			
9. <i>Setaria glauca</i> (L.) P.B. -	13	1,540	134
10. <i>Cuscuta Trifolii</i> Bbg.	13	667	230
11. „ <i>suaveolens</i> Sér. (syn. <i>racemosa</i> Mart.)	12	3,600	589
12. <i>Atriplex patulum</i> L. -	12	7,600	810
13. <i>Medicago lupulina</i> L. -	11	240	76
14. „ <i>sativa</i> L.	11	103,200	9,382
15. <i>Brunella vulgaris</i> L.	11	309	74

	Frequency (con- stancy).	Number of seeds found (dominancy).	
		Greatest number in 1,000 gr.	Average number in 1,000 gr.
<i>Less frequent species :—</i>			
16. <i>Panicum Crus galli</i> L. -	9	60	13
17. <i>Melandrium album</i> Garcke -	9	760	115
18. <i>Trifolium hybridum</i> L. -	9	1,540	265
19. <i>Anthemis arvensis</i> L. -	9	520	81
20. <i>Echium vulgare</i> L.	8	20	9
21. <i>Delphinium Consolida</i> L.	7	52	7
22. <i>Stachys annuus</i> L. -	7	40	18
23. <i>Veronica polita</i> Fr. -	7	76	19
24. <i>Panicum humifusum</i> Kunth. -	6	76	31
25. <i>Lolium perenne</i> L. -	6	40	13
26. <i>Sinapis arvensis</i> L. -	6	224	73
27. <i>Thlaspi arvense</i> L. -	6	76	31
28. <i>Valerianella dentata</i> Poll. -	6	250	85
29. <i>Panicum sanguinale</i> L. -	5	16	8
30. <i>Trifolium repens</i> L. -	5	827	185
31. <i>Córonilla varia</i> L. -	5	164	39
32. <i>Galeopsis angustifolia</i> Ehrh. -	5	244	58
33. <i>Linaria Elatine</i> L. -	5	8	5
34. <i>Galium infestum</i> W.K. -	5	60	16
35. <i>Picris hieracioides</i> L. -	5	100	23
<i>Unimportant species :—</i>			
36. <i>Rumex acetosella</i> L. -	4	48	33
37. <i>Polygonum persicaria</i> L.	4	84	28
38. <i>Melilotus alba</i> Desv.	4	2,080	560
39. <i>Falcaria vulgaris</i> Bernh.	4	456	123
40. <i>Centaurea pannonica</i> Heuf.	4	32	17

Moreover, there were found in *three* instances : *Polygonum lapathifolium* L. (6), *Nigella arvensis* L. (14), *Lotus corniculatus* L. (32), *Vicia tetrasperma* (L.) Mönch. (15), *Euphorbia exigua* L. (4), *Convolvulus arvensis* L. (8), *Lactuca scariola* L. (12), *Centaurea micranthus* Gmel. (24).

Twice : *Phleum pratense* L. (20), *Festuca pratensis* L. (14), *Ranunculus repens* L. (6), *Rubus caesius* L. (20), *Galega officinalis* L. (30), *Geranium dissectum* L. (8), *Barbarea vulgaris* Rbr. (6), *Hibiscus trionum* L. (16), *Passerina annua* Wekstr. (11), *Petroselinum segetum* Koch. (50), *Echinopspermum lappula* Lehm. (16), *Salvia verticillata* L. (16), *Galeopsis ladanum* L. (10), *Lampsana communis* L. (18), *Carduus acanthoides* L. (86).

Once : *Panicum miliaceum* L. (4), *Setaria italica* (L.) P.B. (4), *Rumex crispus* L. (40), *Polygonum hydropiper* L. (8), *Polygonum Convolvulus* L. (4), *Amarantus retroflexus* L. (16), *Papaver somniferum* L. (56), *Stellaria media* Cyr. (4), *Spergula arvensis* L. (24), *Scleranthus annuus* L. (28), *Brassica nigra* (L.) Koch. (8), *Lepidium campestre* R. Br. (4), *Lepidium Draba* L. (196), *Berteroa incana* Dc. (1020), *Reseda lutea* L. (4), *Vicia hirsuta* (L.) S. F. Gray (4), *Lathyrus hirsutus* L. (4), *Viola arvensis* Murr. (8), *Torilis nodosa* (L.) Gärtner (8), *Conium maculatum* L. (4), *Myosotis arvensis* (L.) Hill. (4), *Chaiturus Marrubiastrum* (L.), Reichb. (8), *Ballota nigra* L. (4), *Lycopersicum esculentum* Mill. (4), *Cerinth minor* L. (4), *Galium mollugo* L. (40), *Cirsium canum* (L.) M. B. (36), *Cirsium lanceolatum* (L.) Scop. (4), *Arctium Lappa* L. (4), *Centaurea jacea* L. (4)

APPENDIX IV.

Roumanian Lucerne.

Examinations by Dir. Jon Enescu.

	Frequency (con- stancy.)	Number of seeds found (dominancy).	
		Greatest number in 1,000 gr.	Average number in 1,000 gr.
<i>Very frequent species</i>			
1. <i>Chenopodium album</i> L. -	8	8,800	1,739
2. <i>Trifolium pratense</i> L. - -	8	35,200	5,329
3. <i>Setaria viridis</i> (L.) P.B. - -	7	6,800	1,413
<i>Frequent species</i>			
4. <i>Setaria glauca</i> (L.) P.B.	6	4,400	772
5. <i>Polygonum aviculare</i> L. - -	6	1,000	225
6. <i>Daucus carota</i> L.	6	2,120	362
7. <i>Plantago lanceolata</i> L. -	6	1,320	551
8. <i>Cichorium Intybus</i> L.	6	3,840	728
9. <i>Medicago lupulina</i> L. -	5	100	45
<i>Less frequent species</i>			
10. <i>Atriplex patulum</i> L.	4	24	18
11. <i>Sinapis arvensis</i> L. -	4	12	8
12. <i>Panicum Crus galli</i> L. - -	3	369	129
13. <i>Melandrium album</i> Garcke	3	2,560	857
14. <i>Falcaria vulgaris</i> Bernh. -	3	96	57
15. <i>Stachys annuus</i> L.	3	128	47
16. <i>Cirsium arvense</i> (L.) Scop. -	3	8	7

Unimportant species : Twice : *Setaria italica* (L.) P.B. (74), *Panicum sanguinale* L. (26), *Festuca pratensis* Huds. (16), *Delphinium Consolida* L. (4), *Lepidium Draba* L. (774), *Lotus corniculatus* L. (163), *Torilis nodosa* (L.) Gärtn. (14), *Anagallis arvensis* L. (16), *Cuscuta suaveolens* Sér. (74), *Brunella vulgaris* L. (98), *Galeopsis angustifolia* Ehrh. (8), *Galium Mollugo* L. (4), *Galium infestum* W.K. (6), *Carduus acanthoides* L. (20).

Once : *Panicum miliaceum* L. (400), *Lolium perenne* L. (393), *Dactylis glomerata* L. (8), *Bromus arvensis* L. (12), *Sorghum halepense* P.B. (4), *Rumex biformis* Menyh. (4), *Rumex crispus* L. (4), *Polygonum persicaria* L. (4), *Polygonum lapathifolium* L. (20), *Amarantus retroflexus* L. (72), *Ranunculus acer* L. (4), *Nigella arvensis* L. (12), *Glaucium corniculatum* Curt. (4), *Brassica nigra* (L.) Koch. (16), *Brassica campestris* L. (128), *Coronilla varia* L. (8), *Geranium dissectum* L. (4), *Euphorbia platyphyllos* L. (12), *Passerina annua* Wikstr. (8), *Cuscuta Trifolii* Babgt. (Capsules) (6,000), *Echium vulgare* L. (4), *Veronica polita* Fr. (4), *Valerianella dentata* Poll. (12), *Centaurea Cyanus* L. (8), *Centaurea micranthos* Gmel. (4), *Centaurea pannonica* Heuf. (16), *Carduus nutans* L. (4), *Lamprana communis* L. (16).

APPENDIX V.

Swedish Red Clover from Stockholms Län.

Examination by Dir. Gustaf Wiksell.

	Frequency (con- stancy).	Number of seeds found (dominancy).	
		Greatest number in 1,000 gr.	Average number in 1,000 gr.
<i>Very frequent species .</i>			
1. Phleum pratense - -	5	34,800	8,149
2. Rumex crispus - -	5	164	77
3. Chenopodium album . -	5	148	58
4. Sinapis arvensis -	5	616	202
5. Trifolium hybridum	5	8,440	1,785
<i>Frequent species</i>			
6. Thlaspi arvense -	3	20	17
7. Anthriscus silvestris	3	8	5
8. Lampsana communis	3	1,192	408
<i>Less frequent species :</i>			
9. Triticum repens - - -	2	64	42
10. Rumex Acetosella - -	2	72	46
11. Stellaria graminea	2	152	77
12. Stellaria media	2	12	8
13. Medicago lupulina	2	48	46
14. Galium Vaillantii - - -	2	16	19
15. Matricaria inodora -	2	124	64

Unimportant species.—(One found): Bromus secalinus (44), Rumex domesticus (12), Polygonum aviculare (36), Polygonum lapathifolium (4), Spargula arvensis (68), Ranunculus repens (264), Trif. repens (8), Pimpinella saxifrage (32), Myosotis arvensis (52), Brunella vulgaris (12), Stachys palustris (344), Plantago lanceolata (68), Achillea millefolium (4), Chrysanthemum leucanthemum (192), Anthemis tinctoria (28), Anthemis arvensis (152), Cirsium arvense (2,000), Leontodon autumnale (88).

(b) *Other impurities.*—In all samples brown earth (clay) and particles of quartz were found, and in some cases also felspar.

(c) *Colour.*—The separation of grains according to colour resulted on the average of the 5 samples :—

violet - - - - -	11
predominating violet - - - - -	153
mixed - - - - -	336
predominating yellow - - - - -	242
yellow - - - - -	258

(d) 1,000 *grain weights*.—The 1,000 grain-weights of 20 samples each of red-clover from Stockholms Län harvested in 1921 and 1922 showed :—

Year.	Weight, fresh.	Weight, dried.
1921 - - -	1.87	1.66
1922 - - -	1.78	1.56
Average	1.83	1.61
Maxima - -	2.27	1.99
Minima	1.57	1.36

The 5 samples examined as to accessory species gave a fresh-weight of 1.71–2.07, average 1.87, and a dried-weight of 1.52–1.79, average 1.61.

Sir Lawrence Weaver said he felt sure the meeting would be impressed by the skill with which *Dr. Volkart* had prepared his report and that they would be distressed to learn that he felt unable to undertake the development of his enquiry. It would be necessary at to-morrow's meeting of the Seed Testing Congress to make arrangements for carrying on this work.

Dr. Volkart then brought to the notice of the meeting the following paper by *Mr. Tryti* (Norway) :—

New Methods for the Determination of the Origin of Seed.

BY

G. TRYTI,

State Seed Control Institution, Christiania (Oslo).

Introduction.

About 30 years ago Professor Bastian Larsen, the founder of the Norwegian experimental stations for plant cultivation and official seed control, showed by his experiments that Norwegian and northern-grown seed of clover, timothy and other species produces a considerably more abundant crop than seed from southern countries. The same thing had previously been demonstrated in Denmark by *Mr. P. Nielsen*, the founder of the Danish Government's experiments in plant culture. It is, consequently, of the greatest importance to determine the origin of seed, and it is regrettable that so little has been done in Norway in this matter. I will endeavour to explain briefly some new methods which, according to my view, we ought to follow if we are to make any progress in solving the problems that arise.

1. *Characteristic Seed.*

To specialists this method is so familiar that I shall only touch on the subject lightly. The so-called characteristic seed (leading species) is seed peculiar to certain countries. One gets, for instance, seed with characteristics of its Russian or American origin, &c. The characteristic seed spreads, however, through the channels of commerce and communication, and will, in this way, soon become an uncertain and unreliable criterion in the determination of origin. If, moreover, a sample is devoid of characteristic seed, testing by this means can tell nothing as to its origin. I should like, however, to suggest that by identifying parts of the stalks or leaves of characteristic plants, an expedient might be used to reinforce the old method. For instance, in samples

of seed from the United States of North America I have noticed that splinters of bark, leaves, and parts of stalk, all with a hairy surface, are characteristic. These plant particles, according to Konservator Dahl, of the Botanical Museum, University of Christiania, come from a species of *Solanum*, probably *Solanum carolinense* L. (the horse nettle). From statements made by the Public Mycologist, Mr. Jörstad, it appears that it may be possible to determine the origin of the seed fairly accurately if only one can identify the hairy plant particles contained in the sample. Some splinters have stellated hairs and thorns, others have single hairs. The splinters with stellated hairs are found particularly in poa and agrostis seed, and splinters with single hairs especially in phleum and festuca seed. The portions of the plants in question are an unusually sure sign of identification of seed from the United States of America, but it is in the first place necessary to be able to recognise the splinters.

2. *The Weed Flora.*

In co-operation with Mr. P. A. Øyen, the Glacial Geologist, I have found that, even if a sample does not contain characteristic seed, in the old sense of the word, the weed flora as a whole will give a good idea as to the origin of the seed. In short, Norwegian seeds give one "floral picture," seeds of the southern part of Sweden (Scania) give another, German seeds give yet another, and so on. I am sure that this method will be of the greatest importance. The weed flora is like the species of animals, biologically localised. By this method it is not only possible to say if the seed is Norwegian, but also from which part of Norway it comes.

3. *The Mineral Impurities in a Sample.*

In the autumn of 1922, Mr. P. A. Øyen, the Glacial Geologist of the University of Christiania, delivered a course of lectures on the deposits of the Glacial period in Northern Europe, and in these lectures he maintained that Norwegian arenaceous quartz is different from that of Central Europe. Later on Mr. Heggenhougen, the Public Chemist, said that Central European quartzose has eolian marks and that the sand in Central Europe was eolian-drift sand. I have since carried out work in the same direction. The quartzose sand-grains in the German Loess soil, in the sand from the Luneburger heath, in the Danish sand, and even in the sand from the Sahara, are rounded with a wind-worn surface, dotted, scarred, carved, and with a dull lustre. Norwegian sand, the sand of North Sweden and of Finland, and Canadian sand has a sharp-edged grain, and is a deposit of rivers and seas. About 30 years ago Professor Bastian Larsen pointed out that seed containing silurian sand must be regarded as seed grown in the district about Lake Mjøsen. Norwegian and Scandinavian Seed Control Stations, however, had no idea that quartz sand might be of importance in deciding as to the origin of seed until Mr. Øyen, in his lectures, brought this truth home to us. By ascertaining the type of sand, its appearance, colour and surface, and by examining the particles of earth in the sample, one gets the "mineral picture" of the sample; and, just as the flora varies in different arable lands, so also the soil is variable. I am of the same opinion on this matter as Mr. P. A. Øyen, and I am most grateful to him for all he has done to help Norwegian seed control and Norwegian agriculture. Finally, I should like to add that in seed of American origin, as, for instance, timothy, a quantity of excrements is sometimes found which, among others mentioned above, especially characterise American seed. I am unable to suggest by what animals these black bodies are excreted.

Mr. Dorph-Petersen referred to the fact that his station at Copenhagen had taken part in these provenance investigations, and stated that he also had found plant and mineralogical

particles in seed samples which afforded useful information as to the origin of the seed. Great difficulty was experienced in connection with these investigations when, as was often the case, seed bulks contained mixtures of seeds of different origin. During the past year he had, on several occasions, found that bulks which were stated to be of Polish, Bohemian or Hungarian origin, contained seed characteristic of the southern part of Europe.

(Time would not permit of any further discussion on this subject, and the Chairman called on Mr. Edgar Brown.)

Mr. Brown then read the following paper (a French translation being communicated to the meeting by one of the official reporters).

The Evaluation of Hard Seeds.

BY

EDGAR BROWN, Washington.

Hard Seeds are those, particularly of Leguminosae, which do not take up water readily under normal conditions for germination. The most striking examples among our commonly cultivated crops are *Melilotus*, *Vicia*, *Medicago* and *Trifolium*.

The crop-producing value of hard seeds depends on the conditions under which seeding is done. Crocker seeded hard seed of *Melilotus* in December and in April. In the following June the December seedings showed 72 per cent. germination and the April seeding 2 per cent. The Iowa Agricultural Experiment Station reports similar results when *Melilotus* seeds are exposed to alternate freezing and thawing.

Harrington reported only a small proportion of hard *Trifolium* and *Melilotus* seeds as germinating promptly when sown in warm weather, and a relatively high germination when seeded in freezing weather.

There is a rather definite line between the hard seeds and those not hard in the case of *Trifolium pratense* and *Melilotus*, while there is not such a definite line in the case of *Medicago sativa* and *Vicia villosa*.

Our knowledge of the proper evaluation of hard seeds is incomplete, and there is need for further investigation.

I am very glad to say that, no doubt inspired by the example of the British seed trade in making possible the establishment of your splendid Institute of Agricultural Botany, the American Seed Trade, through the medium of our National Research Council, has established a fellowship for the investigation of the agricultural value of hard seeds and we expect that most valuable practical information will result.

In America what is the present practice as to the evaluation of hard seeds?

This question does not arise in the administration of the Seed Importation Act, as the requirements of that Act are not specified in terms of germination but of live seed.

With few exceptions the laws in the several States regulating the sale of agricultural seeds require labelling with certain information including the percentage of germination. In some States this percentage of germination has been construed to include all hard seeds, in some States a portion only of the hard seeds and in other States none of the hard seeds.

In order that there might be a uniform basis for labelling in all States, the Association of Official Seed Analysts of North America adopted the following rule: "In reporting the germination of samples of leguminous seeds, a portion of which usually remain hard at the end of the test, the actual percentage of germination should be reported and also the percentage of seed remaining hard."

In view of the state of our knowledge relative to the crop-producing value of hard seed, it is believed that this form of statement is more useful to the ultimate consumer, the farmer, than is the assigning of any arbitrary value.

With certain kinds of seeds it is, no doubt, important to scarify them so that they will germinate promptly under normal field conditions. Harrington has shown that this can be done most effectively and with least injury to the seeds themselves at the time of threshing through the use of proper machinery carefully adjusted.

Little attention has been given in America to the determination of broken seedlings except in the case of *Trifolium incarnatum*. We are, in this case, governed by the rule of the Association of Official Seed Analysts of North America, which is: "Seeds of leguminosae should not be considered germinated when both cotyledons break off."

In closing, I want to stress the importance of research. To you seed merchants of all countries: your business is dependent on agriculture, and on agriculture alone. Your business serves agriculture, and to agriculture you owe everything. Do not give grudgingly, but follow the lead of your associates of the British seed trade in promoting research in agriculture. To you directors of seed control stations and seed analysts: too great a proportion of our energy has been spent on the routine of our work and too little has been given to the investigation of those fundamental biological principles on which seed testing and agriculture in general is based. At the same time that we are applying our present empirical knowledge of how to do, let us earnestly devote ourselves to that research which alone will tell us why.

Mr. David Bell (of the Scottish Seed Trade Association) intimated that he was both a seed merchant and a farmer, and that while, as a merchant, he was obliged to scarify hard seed for the sake of his business, he had never sown scarified seed on his farm. He was very glad that Mr. Brown was investigating the question of hard seed. Mr. Bell stated that he had sown wild white clover which contained over 30 per cent. of hard seed and that a beautiful crop resulted.

Mr. Lafferty referred to experiments conducted by Dr. G. H. Pethybridge (late Director of the Seed Testing Station, Dublin), on the germination of the hard seeds of some clovers. These trials which extended over a period of 10 years showed that, under the conditions obtaining in the laboratory germinators, approximately 50 per cent. of the hard seeds of red clover germinated within a period of three years. After this time germination became very much slower with the result that not all the hard seeds had germinated when the trials were concluded after 10 years. When, however, the remaining ungerminated seeds were scarified and immediately replaced in the germinators, normal germination took place in the majority of cases within a few days. When parallel trials on the germination of the hard seeds of clovers were conducted in the laboratory germinators and in pots of soil in an unheated greenhouse it was found that during the period of the test, which continued for approximately 18 months, a higher percentage of germination was obtained where the seeds were planted in the soil than was the case of the seed in the germinators. Mr. Lafferty expressed the view that

certificates should merely state the percentage of hard seeds contained in a sample, and that it should be left to the farmer to place his own valuation on the seeds.

Mr. Brown intimated that experiments in the U.S.A. had shown that seeds which had been buried in the soil for 20 years germinated immediately on being scarified.

Mr. Devoto stated that in the Argentine they were of the opinion that 50 per cent. of hard seeds were capable of germination.

Professor Bussard and *Dr. von Degen* intimated that their stations considered that all hard seeds were capable of germination sooner or later.

Mr. Dorph-Petersen distributed to the meeting copies of a mimeographed paper containing remarks on *Mr. Brown's* paper, and also a printed pamphlet entitled "How long do the various seed species retain their germination power?" The paper detailed the results of tests made on samples stored under varying conditions of moisture and temperature. These results showed that in some cases the percentage of hard seeds in samples of red clover, yellow trefoil, and of bird's foot trefoil stored in a warm, dry place (central heated, about 18° C.), was considerably greater than when the samples were stored under cool, moist conditions such as in ordinary storerooms. It was presumed, however, that these results were exceptional; but as such exceptions must be taken into consideration, the Copenhagen Station proposed to make a considerable number of experiments in the future in connection with leguminous seeds with the view of ascertaining definitely how the content of hard seeds is influenced by the conditions of storage. *Mr. Dorph-Petersen* further intimated in his paper that, in view of the fact that the scarification of seeds often causes wounds which result in broken seedlings, hard seeds ought, in his opinion, to be regarded as capable of germination when the percentage of such seeds in a sample is not greater than is normal for the species concerned. In his view agriculturists who purchased field seeds which give one crop a year ought to require that the seed must not contain more hard seeds than is normal for the species. In referring to the printed pamphlet mentioned above, *Mr. Dorph-Petersen's* paper stated that examinations showed that lucerne seed retains its germinating power for the longest period, and that when scarified the hard seeds were almost always capable of germination.

Mr. Brown expressed the view that all present were agreed that hard seeds were "live" seeds and capable of germination at some time. The investigations carried out in his country were always directed to the determination of the agricultural value of hard seeds.

When the meeting resumed, after a short interval for tea, a paper on the subject of hard seeds of clover and broken seedlings, which had been prepared by Messrs. G. Pammer and J. Schindler, of Vienna, was considered. The paper, which is appended, was

not read because of lack of time, but copies had previously been distributed to the meeting.

On the questions of Hard Husk in Clover Seed and of Broken Seeds.

BY

G. PAMMER AND J. SCHINDLER, VIENNA.

The estimation of hard husked seeds of clovers is arrived at according to the technical standards for seed testing laid down by the Union of Agricultural Experimental Stations in Germany (in force since 13th September, 1912). It is provided that the percentage of hard-husked seeds shall be indicated as such in the investigational report, and it is added that "a small undetermined proportion would presumably germinate in due course."

The text-book of the Austrian Union of Agricultural Experimental Stations (in use as from 1st January, 1913) prescribes that, "in the case of lucerne, one half of the quantity of hard-husked seeds be added to figures indicating seed which has actually germinated, and one third in the case of other clover seeds. The corresponding results are, however, to be specified as well."

In connection with these two divergent sets of instructions, we would draw attention to the fact that, for the last 40 years, there has been an extraordinarily heavy increase in Austria in the use of clover seed for fields to be laid down for forage supply. This is chiefly due to the enlightened labours of F. G. Stebler in Switzerland and T. von Weinzierl in Austria. The cultivation of clover (red clover in particular), either pure, or mixed solely with one variety of grass, no longer accounts entirely for the demand for clover seed. Large quantities are used for fields to be laid down for from three to six years' ley, and thus it is made clear that the necessity arises to take up the question of the value of hard-husked clover seed.

The area of pastures and meadows laid down to an even longer ley (10 to 12 years), either freshly or artificially sown with clover and grass seed, increases year by year, and annually absorbs large quantities of seed. In view of these circumstances, it is important to settle the question whether the hard-husked clover seed which does not grow in the year of sowing is really to be regarded as useless.

When clover is planted alone for a one to two years' ley it springs up quickly and develops regularly—which means avoiding, as much as possible, seed showing a high percentage of hard husk. The state of affairs is different in the case of fields laid down for several years. Storage of the clover seed at a moist, low temperature during the first and second winters, or some other determining factor, is capable of mitigating hard husk. As the clover seed, germinating by degrees, would gradually add its quota to the whole stock sown, the existence of hard-husked seed should not, therefore, be regarded as a drawback in the case of clovers principally sown when laying down fields for several years—such as white clover, alsike, bird's foot trefoil, marsh bird's foot trefoil, and hop clover.

It is a well-known fact that clover growths in a meadow undergo continual renewal by later germination. But, so far as we are aware, no experiments which might have solved this question have been carried out. Steglich* made and supervised his experiments for a period of not more than 17 months—i.e., from 15.4.08 to 15.9.09. It was not ascertained, therefore, whether any appreciable percentage of the remaining hard seed

* B. Steglich: "Investigations *re* Hard Husk and Broken Seeds during Germination of Clover Seed." Vols. 79 and 80 of "Agricultural Experimental Stations"; pp. 611 to 620 (Berlin, 1913).

germinated in the two succeeding spring seasons, after wintering. By experiments which have been made with fruit kernels and kernels of the Weymouth pine,* or *Pinus cembra*, we know that fairly prolonged storage (from one month to several months) at a moist, low temperature, either facilitates the germination of seed normally germinating with difficulty, or is the only factor rendering germination possible.

Even Hojesky's experiments† only extended over one germination period, although he lays stress on the necessity for extending these experiments over a fairly considerable length of time.

From Hojesky's articles quoted above we learn that hard-husked clover seed in the soil is subject to most varied influences which mitigate the hard husk. Hojesky has more particularly established that the hard husk of lucerne seed in dry soil during the warm summer months decreases to a very considerable extent. In a small wooden box filled with earth, the dry earth reached a temperature of between 40° and 50° Celsius on five consecutive days during the month of June, between 11 a.m. and 1 p.m. In as short a period as two days, samples of hard-husked lucerne removed from this earth and planted out germinated to the extent of 87 per cent., and to the extent of 100 per cent. if not removed for five days. During this period the hard husk in kidney vetch decreased by 50 per cent., whilst red clover showed 15 per cent. of germination after five days. The other varieties showed hardly any traces of germination.

We therefore see that it is only in the case of lucerne that hard husk is entirely eliminated by warming in the soil, kidney vetch improving by 50 per cent. This does not mean to say that, by means of some other determining factor, hard husk would not be eliminated in those varieties of seed uninfluenced or only slightly affected by mere warming in the soil. Such a factor could be, for instance, keeping the seed at a moist, low temperature in the soil during the winter season. This problem remains unsolved, and the nature of hard husk in lucerne seed and the factors influencing it must first be determined.

Before proceeding to judge hard husk of other clover varieties, we must know what factors tend to eliminate hard husk in each variety and to what extent they do so. Only then will it be possible to assume that the vexed question can be definitely answered. The question of time is also extremely important in the matter of hard-husked clover seed.

A mere indication of the presence of hard-husked seed after conclusion of the germination test, with no inclusion of a fixed proportion in the figure for germinative power, is quite an insufficient method of procedure. Even in the case of vegetable seed and seed for trade purposes the quantity of sound seed remaining after conclusion of the germination test is indicated. There is, however, a great difference between clover seed remaining sound in a field laid down for many years, and similar seed of a plant whose seeds, germinating later, may only come to maturity after the clover crop generally has been taken from the field. Furthermore, it should not be forgotten that in some years a very high percentage of hard husk regularly makes its appearance, especially in lucerne seed, attaining from 40 per cent. to 50 per cent. In such cases it would be quite absurd to compare this seed—which only from 40 per cent. to 50 per cent. could germinate within the prescribed period owing to the existence of a large proportion of hard husk—with seed which is several years old and only germinates to the extent of from 40 per cent. to 50 per cent. on account of its age.

* A. Grisch and G. Lakon; "Experiments regarding Germination of Kernels of the Weymouth pine." Swiss Agricultural Year-Book, 1923.

† "How Seeds adapt Themselves to Climatic Conditions (even as far as entire Reversion of Germination Period)." By W. Kinzel; No. I. of 1924 of the practical text-books published by the Bavarian Agricultural Institute for the Cultivation and Protection of Plants.

† "Hard Husk Clover Seeds." By J. Hojesky. Journal of Austrian Experimental Stations: Nos. 7-12 of 1921.

It is, therefore, justifiable to require that a certain well defined proportion of hard husked seeds be included in the germination total. Revision is required of the principles governing this calculation in regard to each particular variety. The statement can, however, already be considered proved that, according to experiments made to date, the figure of 50 per cent. is approximately correct for hard husk in the case of lucerne, and that of one third in the case of red clover. Experimental proof is still required as to the percentages of hard husk existing in the case of white clover, alsike, kidney vetch, bird's foot trefoil, and marsh bird's foot trefoil.

BROKEN SEEDS.

The Union of Agricultural Experimental Stations in Germany lays down, in its technical regulations, that "perceptibly broken and/or entirely spoilt seeds, in so far as they are clearly incapable of germinating, must be excluded when determining purity and germinative power."

According to the text-book of the Austrian Union of Agricultural Stations, "injured and/or greatly shrivelled seeds of the variety to be tested, in so far as they are clearly incapable of germinating," must be taken out.

It frequently happens, especially with regard to red clover and kidney vetch (but less often in lucerne and hop clover), that the seed examined contains a very high percentage of grains showing very slight threshing damage. If these—i.e., grains of which, say, part of the husk or the tip of one cotyledon is missing—are taken out and grown on, it will be seen that they give healthy shoots. If the latter are planted out in clay dishes containing earth (according to gardeners' methods), they mostly develop into normal plants. One can even go further, and handle in the same way seeds showing considerably greater threshing damage, i.e., those with the entire upper half of both cotyledons missing. A considerable percentage of these shoots can also be brought to production.

In addition to broken seed, the existence of which is perceptible beforehand, there exist injuries which can only develop in the germination bed (so-called "internal break,") and by which the germ is affected. In this respect the technical instructions lay down the following standard:—

"All broken shoots should be held not to have germinated if both cotyledons fall off in germination bed. The loss of one cotyledon shall not be considered important. Shoots with broken rootlets shall be held to have germinated if one or more adventitious roots develop by the final day."

These instructions may be considered applicable in regard to seed in which injury through breaking only becomes perceptible in the germination bed. But, in respect of seeds with perceptible *outer* injury, it must be stated that their exclusion from sowing would be wrong; for they could also give a germ capable of healthy development, with seedlings of which only a small proportion would have one or both cotyledons missing.

It is, however, extremely difficult to draw a definite line between those broken seeds whose injuries do not affect the germ, and those which only give weak plants which develop tardily and finally fail. For this reason, it appears that it should be unequivocally laid down as standard *that all clover seed which shows any outwardly perceptible injury should be excluded both in the purity and the germination tests, although we know that a portion thereof can give a germ capable of development.*

We may, therefore, accept what is laid down in the text-book, i.e., that "shoots with broken rootlets are held to have germinated, if one or more adventitious roots develop by the final day." But what is laid down regarding the exclusion of clover seed with an outwardly perceptible injury should be more clearly defined. Instead of the wording which

reads :—"Perceptibly broken and/or entirely spoilt seed," etc., the phrase might read as follows :—

- "Perceptibly broken seeds should be taken out *without exception*, and entirely spoilt seeds only so far as they are clearly incapable of germinating."

Judging from investigational work to date, we can, therefore, only say that, so far as B. Steglich's experiments are concerned, an indefinite amount of hard husked red clover seed germinates within a measurable space of time (in Steglich's experiments, 17 months at the most), and a still smaller amount thereof can yield useful plants. Analogous results were obtained from Hojesky's similar field experiments.

The most important positive result of general scientific and practical importance in this question is Hojesky's ascertainment that, by a five days' warming of hard husked lucerne seed in dry soil during the summer, at 40° to 50° Celsius, hard husk entirely disappeared, and 50 per cent. disappeared among kidney vetch.

Investigation still remains to be carried out as to how various factors affect the other varieties of clover, more especially prolonged storage at a moist, low temperature, and the bad influence of varying temperature and moisture on the seed, as also of organisms found in the soil.

What Hojesky writes as to the influence of the warmth of the soil on hard husked lucerne and kidney vetch seed, goes to prove that other factors persisting over a lengthy period would also influence the seed. No experiments on these lines have as yet been made.

As, according to Hojesky's experiments, one quarter to one third of hard husked red clover seed will eventually germinate, as also will 50 per cent. of lucerne, there is justification for the Vienna station's decision to consider these proportions of hard husked seed as capable of germination. Special experiments must establish how far this should be the case with other clovers, but, in any event, the question of this hard husked seed must not be neglected or so treated that dealers in seeds should be allowed to settle it in their own way.

As regards broken seeds, it appears necessary to take out all particularly noticeable broken seed. Though this does not quite meet the case, the phrase is not liable to misconstruction. Broken germs in the germination bed should only be considered as having germinated if not more than one cotyledon is missing, or if the broken rootlet is replaced by adventitious roots by the final day.

Professor Voigt (who was to have read the paper) gave a summary, and made interesting comments upon it in English, French and German.

Mr. Lafferty took exception to the statement made in the last paragraph of the paper to the effect that, if both cotyledons are broken, the seed from which such a seedling arose should not be considered as having germinated. At his station it had been proved that even if both cotyledons were missing, provided the bud was not broken, the seedling could produce a plant in a few cases. *Dr. Voigt* drew diagrams on a blackboard to illustrate his point of view that germination in such cases depended on the point of breakage. Both the last-named gentleman and *Mr. Dorph-Petersen* were of the opinion that, where both cotyledons

were missing, seedlings were of no use to the agriculturist. In Denmark such broken seedlings were always counted as "dead."

Mr. Anderson stated that at his station 195 portions of seedlings, of red clover consisting of root and plumule only were planted and only 3 portions produced leaves. *Mr. Lafferty* agreed that the percentage of such seedlings which were capable of producing plants would be very small. *Mr. Anderson* was of the opinion that the percentage was negligible and concurred in the views expressed by *Mr. Dorph-Petersen* and *Professor Voigt*.

Mr. Fleischner (Czecho-Slovakian delegate to 1st International Seed Trade Conference) and *Dr. Chmelař* intimated that the seed trade would not be satisfied unless more than 50 per cent. of hard seeds were regarded as capable of germination. It was very desirable, from the point of view of the trade, that seed testing stations should state precisely what percentage of hard seeds is capable of germination and what percentage represents really "hard" seeds, and that there should be uniformity in this matter.

Reference was also made to the cause of breakage in the case of broken seedlings. *Mr. Devoto* was of the opinion that breakage is caused by excess of moisture in the embryo, and *Mr. Lafferty* described the cause as internal strain (super-pressure) during the actual process of germination.

In summing up the discussions on the papers by *Mr. Brown* and *Messrs. Pammer* and *Schindler*, *Dr. Voigt* referred to the wide differences of opinion existing in regard to the question of hard seeds, and said that the more the matter was studied the more difficult it became. It was very desirable, therefore, that efforts should be made to devise an international standard of value. Broken seedlings (or "cripples") would be of little use in Europe. He agreed with *Mr. Devoto* that excess of moisture caused breakage.

It will be observed from the report of the Thursday afternoon session that a committee was appointed to deal with the questions of hard seeds and broken seedlings.

The business of the session having concluded, *Dr. Woodman*, of the University School of Agriculture, gave the meeting a short but interesting sketch of the manifold activities of the school, and thereafter conducted the Delegates and visitors on a tour of inspection.

In the evening the committee of nine, which was appointed on Tuesday to consider *Dr. Volkart's* draft Constitution of the International Seed Testing Association and to settle other important matters, met and continued in session until a late hour. A number of the other delegates were conducted round *Christ's College* and grounds by the Master, *Sir A. E. Shipley*.

Thursday, 10th July.

Morning Session.

The Congress assembled at 9.30 a.m.

Dr. Chmelař read a paper of which the following is an English summary :—

**Determination of the Botanic Identity of Varieties in Laboratories
and in Experimental Fields.**

BY

DR. F. CHMELAŘ, BRÜNN.

The more the intensity of plant cultivation develops and the utility of selected strains realized, the greater the necessity for guarantees of the genuineness and purity of seed becomes, as well as that of determining all the signs of identity in the laboratory and in the field. The testing of seeds and the determination of identity of common varieties in a number of European States requires the establishment of the authenticity and purity of varieties in field growths and also in the samples of seeds and bulbs, &c., sent to different institutes.

In addition, this determination is required when the identity or origin of selected varieties intended for exportation has to be established.

The methods which are used to establish the botanical identity of varieties are not yet fully studied, inasmuch as it is mainly the most striking signs giving a guarantee of a good crop and quality which attract the attention of selectors, while it is often important to observe also practically insignificant factors.

A good method for the determination of varieties of the sugar beet and the mangold is observation of the colour of the shoots which develop in a temperature of 15° C. under diffused light in the course of two weeks (Pieper). Determination of the colour of the shoots, particularly of the intermediate forms, is facilitated by the use of chromatic filters (Vitek). To establish the saccharine richness of the root it is necessary to analyse, at least three times in succession, 40 beets developed in a normal culture and to make use of a quantity of mash four times larger than normally if the saccharine richness is to be established to a 0.1 per cent. exactness. (Method of the Sugar Research Station at Prague.) In Denmark an analogous method (Hallquist's method) is followed to determine the colour of the root according to the colour of shoots of cruciferous plants.

An excellent means for determining the different varieties of potatoes is the observation of the colouring of the cymes of shoots sprouted in diffused light (Snell) or indeed observation of the colour of shoots developed in obscurity (Vilmorin). Recently it has been ascertained that the size of starch grains (Parow), established by the Lindner method, is the sign of such and such a variety. If the variety must be established on the fields, it is necessary to ascertain not only the qualities of the tubers but also of the plant in its entirety. As regards the tubers, it is most important to observe: the shape, the colour of the skin and that of the flesh and the eyes; as to the plant, the height, thickness and colour of the stem; as regards the leaves, the shape, the colour of the folioles, the position of the terminal foliole, the shape of the point, the colour of the petiole, the coalescence of the leaflet; as to the inflorescence, the quantity of flowers, the bractea, the shape and length of points of the sepals of the calyx, the size and colour of the corolla, as well as flowers with double corolla, and, finally the position of stamens and pistil.

The determination of varieties of corn is the most difficult as they are very numerous; and it is necessary, very often, to distinguish varieties of which the difference is but slight, or rather where it is only biological. The determination of the varieties of wheat is carried out by the observation of different degrees of colouring of grains (pericarp) produced after six hours by the preparation oxybenzine-mercury-chloride (mercurial chlorophenol) No. 778 in a 1 per cent. solution after having previously been steeped for 24 hours (Pieper method). I have followed this method in establishing the difference of 61 varieties, mainly of Czecho-Slovak origin, and I have been able to ascertain that the differences were considerable. Steeping in distilled water showed itself to be the best. I have also ascertained that the colouring of coleoptiles of shoots of wheat is a very valuable method in laboratory work.

Of these 61 varieties that I have observed, the coleoptile was as follows:—

Coloured brown-red	-	-	-	-	11
Without colour	-	-	-	-	33
Some grains only coloured					17

As regards wheat grain it is as well to know also the length of the hairs of the grains and the number of rows of thick membrane cellulose similar to the epidermic cellulose of the central layer of the pericarp (Kondo).

If it is desired to discern the "a" and "c" types of leaning barley (*H. dist. nutans*) it is necessary to ascertain microscopically if the hairs are of one (type "a") or rather of two or even several cellulose (type "c"). If barley is concerned it is also wise to ascertain the contours of the grain in the lateral position, and when 6-row varieties of barley are concerned it is desirable to establish the greatest width of grain (Holmgaard). The best determination of oats is made on the exterior of the grain and what aids us here is also the colouring of the first leaves of the shoots (Holmgaard).

I have only enumerated some of the more remarkable and more frequently used signs. If varieties have to be determined on the field, all characteristics must be ascertained and a detailed description of them compiled.

To facilitate determination still more, it is not only necessary to have collections of seed, ears, tubercles, roots and collections of leaves and inflorescences, but also to establish trial gardens of varieties. The material to be observed must be taken, it is true, directly from the plant breeders, and it is necessary to cultivate the plants normally with a view to their having a normal appearance. To know thoroughly the biological qualities of plants, trials should be made several years in succession.

It is desirable that the European Seed Testing Association should extend the unification and studies of methods and usual standards to the determination of identity and purity and, eventually, to the quality of varieties.

It would consequently be necessary that exchange of matters observed in the variety trial gardens should be reciprocal among the various institutes, and that there should exist among them a sort of mutual communication of descriptions of different varieties, as is already the case among the administrations of botanical gardens.

(The full paper in German will be found on pp. 204–215.)

A discussion followed on the various methods of identification of different species and varieties, viz., biological, biometrical, morphological, pathological, physico-chemical, and what the Polish delegate aptly said might be described as the Bertillon method.

Professor Showky Bakir referred to the usefulness of the pathological method for purposes of identification.

Professor Kuleschoff then demonstrated how the staff at his station distinguish between winter wheat and spring wheat. He stated that, after a number of experiments, they established the fact that spring wheat in their district is characterised by a hairy growth appearing on the first leaf sprouted, whereas in the case of winter wheat the growth is absent or very much less developed.

Mr. Dorph-Petersen gave detailed information with regard to the comprehensive work of the Danish State Seed Testing Station in the above connection, and distributed for the information of the delegates two pamphlets entitled "Danish experiments in Plant Culture and Details about the Trade in Controlled Danish Seed," and "Some Prominent Danish Varieties and Strains of Agricultural Plants."

He especially emphasised the necessity of having a sufficiently large number of plants grown in at least two control fields on which to form a judgment. The plants must be examined very carefully several times during their growth (the cereals 5-6 times during the summer) in order to determine whether or not they are true to variety and free from disease.

Mr. Dorph-Petersen did not consider the praecipitin method reliable enough, whereas the Hallquist method, by which the yellow and white-fleshed crucifers can be separated, seemed reliable.

In summing up the discussion, *Mr. Dorph-Petersen* proposed the appointment of a committee to consider the matters raised in *Dr. Chmelar's* paper. The names of the persons whom *Mr. Dorph-Petersen* suggested should constitute the committee are set out in the report of the Thursday afternoon session.

The Congress unanimously concurred in *Mr. Dorph-Petersen's* proposal.

Professor Kuleschoff then exhibited and explained tables and a graph bearing on the question of seed standards, and asked that international regulations might be framed for dealing with this matter.

(Two papers submitted by *Professor Kuleschoff*, viz., "Programme and Organisation of, and Results obtained by, the Kharkow Seed Testing and Control Station," and "A brief sketch of the Development and present conditions of Seed Control in the Ukraine" and one by *Professor Issatchenko*, "Seed Testing in Russia," have been published in the *International Review of the Science and Practice of Agriculture*, Rome.)

Mr. Brown hoped that the present Congress would formulate international rules as to uniformity of tests on which could be devised a form of contract which would involve a standard method of arbitration. The proper person to act as arbitrator should be the head of the Official Seed Testing Station of the country of

importation. If this could be done it would be of the greatest possible use to the international seed trade.

Professor Munn then read the following paper :—

**The Work of the Association of Official Seed Analysts of
North America, 1921-1924.**

By

M. T. MUNN, Geneva, New York.

President of Association of Official Seed Analysts of North America.

It is a great pleasure and an honour which I have of attending the sessions of this Congress, and while I cannot appear before you as a delegate from the United States of America, I do have, with your kind permission, the honour, as their President, of representing the Association of Official Seed Analysts of North America and to bring to you their greetings and best wishes in this work of seed testing. I wish to take this opportunity to express on behalf of our Association a most sincere appreciation of the very hearty welcome and generous reception which you have accorded me here as their representative, and also I wish to emphasize the fact that the seed analysts of my country are vitally and keenly interested in the things for which this Congress stands and is trying to do. The analysts of North America are to-day watching with the utmost interest the deliberations of this Congress and what it may mean in international collaboration.

In response to your kind invitation to tell of the work of our Association in America I can only begin this brief story at the point where it was discontinued four years ago at the Third International Congress, when members of the North American Association, among other things, told you of the organization of our Association in 1908 and of its work since that time. Since the time of the last Congress in Copenhagen the seed work in America in its various phases in the thirty-eight or more States and in the several provinces of Canada has progressed most rapidly. To speak briefly, perhaps one of the most important advances made has been the certification of those seed laboratories which have attained a certain degree of excellence or qualification, according to rather definite yet flexible standards adopted by the Association. The certification work is based upon at least four points, namely :—training and experience of the analyst, equipment of the laboratory sufficient to carry out satisfactorily the suggested rules for seed testing, the quality of the work done as shown by the results of tests made upon referee seed samples, and the application of the entire time of the analyst to seed testing in its various phases. It has stimulated greater activity, precision of work, and a keener interest upon the part of both analysts and officials connected therewith. This work of certification of the laboratories, though still preliminary, being based upon but three years of work, has provided a list of some twenty or more laboratories where dependable results can be expected. We plan to continue and add to this work from year to year, possibly making more exacting standards of excellence to be attained.

Since the certification of the seed laboratories has such a close connection with and is partly dependent upon the results of comparative tests upon replication seed samples or the referee work, I should speak of our work along this line which has now been pushed continuously for some nine or more years. This referee testing work, while it has its limitations, has yielded at least two very definite results of value. It has put the analysts in touch with the best-known methods of seed testing

by their actually using them in practice, thus tending toward uniformity; also, it has shown us rather definitely the limitations or variations which may be expected with some kinds of seeds and the mixtures of seeds. Out of this work there has also come two increasingly distinct conclusions or deductions, namely, that with a variable, truly biological product such as seeds, apparatus and laboratory equipment or facilities are not the prime essentials, and, on the other hand, great knowledge or skill are not necessarily the things of greatest importance. It is very plain that there must be a happy medium of these two essentials or prime requisites. We are trying to bring all the analysts to realize most fully that there is no piece of work which requires more skill and thorough knowledge of conditions than viability testing of seeds, and certainly no work which requires greater good judgment or mental acumen than seed purity analysis. In other words, carelessness, poor judgment, lack of skill or training on the part of the analyst at any point in the process of securing the sample or its analysis, inadequate equipment, working conditions or facilities, most unmistakably show in the final results. On the other hand, our years of referee testing work have shown most conclusively, we believe, that laboratories adequately equipped and properly manned do produce consistent, characteristic, and wholly dependable results.

As to the methods of testing, we urge that all the analysts in the Association use the suggested "Rules for Seed Testing" as recommended by the Association. These rules are revised from time to time under the guidance of a special research committee as new and better knowledge is gained through research and experience. Our rules for testing have always provided for the use of the so-called "continental" method of purity analysis of grasses. We feel that, in connection with purity analysis, a result is not complete unless it shows the percentage of the four component parts of commercial seed:—namely, pure seed, weed seed, inert matter, and other crop seed, if any, or all of such as are present. The grouping of weed seeds and other crop seeds or incidental seeds into one component does not supply the information which both the vendor and the ultimate user should have. There may be some instances where it is economically impossible to classify a plant as a weed or as a crop plant, but such are the exception rather than the rule. In reporting upon the viability of a given lot of seed, we feel that the best interests of all are met when the percentage of germination in terms of normal sprouts is given, and, in addition, the percentage of hard seeds or impermeable seeds when testing Leguminosae. The matter of seed-borne plant diseases is most important and many of our analysts are now making reports upon this matter in all cases where indicated.

It is rather difficult to state definitely just what is being done in the seed testing laboratories in America in the way of pure research upon seed problems, since the line between research and routine testing is not very marked: in fact, some of our most valuable facts have come out of routine testing work, and we feel that it is a sad mistake to discard, or leave untabulated, any data which may, at any point, yield information as to weed dispersal or population increase, provenance or origin, seed longevity, hard seededness, spread of plant diseases through seed-borne parasites, or any of a number of such indications which the mass of seed material may present. Our Association has an active committee on research and methods of testing through which the research work is being pressed forward, attacking the hard-seed problem, vegetable and flower seed germination, longevity, seed-borne diseases, effects of frost or freezing, seed disinfection, and, among other things, the fundamental germination studies upon which we can base present testing practice. Analysts are encouraged to attack their tasks with the research spirit, and, to this end, the most successful supervising analysts or officers have arranged the work of the laboratory, so that competent and qualified workers may take advantage of every opportunity afforded to add something to the sum total of knowledge.

The matters of commerce in seeds and seed testing are inseparable. Seed laws designed to control the sale of seeds must be enforced, and upon a practical basis. An unenforced seed law is often worse than no law at all, since it often handicaps good intentions and puts a premium upon falsity. In this connection it seems to be quite generally conceded that the best interests of all are met when the technical, analytical work of seed analysis is quite apart or separated from the control or law-enforcement phase. We strive to insist that seeds be sold in a manner satisfactory to both buyer and seller. Purity, viability and weed-seed content must be given in intelligible terms. Provenance, or origin, are all-important in the case of clover and alfalfa, and some other kinds of seed—and this information must be insisted upon. The person who, either through negligence, carelessness or intent, loses or disguises the facts regarding origin or provenance in the essential cases is a great menace to agricultural welfare and should be most promptly exposed. To speak of the sale of seeds of known variety, high purity and viability, and of known origin, one at once thinks of the trade in seed or the seedsmen. The seed trade has unlimited opportunities to render a great service to agricultural welfare, and if, therefore, there are unethical practices or abuses in the sale of seeds which have sprung up under the pressure of competition or habit, and which have brought about the need of drastic seed laws, they can be corrected if the trade itself will but apply the Golden Rule in its own conduct and correct the wrong within itself. Character in the commerce in seeds cannot be built by laws. It will come as the sum total of the moral fibre of the individuals engaged therein.

Seed-testing work in America apparently has its handicaps, as has proved to be the case elsewhere. In altogether too many cases, the salary offered is not sufficient to attract and hold competent trained workers and, as a result, there is a lack of analysts of the type which seed analysis and testing required. There is also in some cases a lack of appreciation or realization of the great importance of this work. These and other circumstances are to be regretted, since the seed-testing staff should be a well-trained one, sufficiently remunerated to ensure its permanency, and it should be unhampered in the working out and pushing vigorously forward of a policy based upon the agricultural needs of the country which it serves. We believe that seed testing as a profession and as a great public service project is rapidly becoming established upon a more or less uniform basis and is taking the large place it is destined to fill.

While I may have the opportunity later during our pleasant visits to tell you personally of some of the things which the North American analysts are doing, I wish to tell you collectively that it was another desire which caused me to travel all the way to fair England. I wanted to exchange greetings with you who have so kindly co-operated with us in the past in so many ways and bespeak a new and fresh mutual understanding and co-operation for the future, for it is only upon international friendship and good-will that our efforts will be enhanced and co-operation permanently built.

Dr. Gentner submitted the following paper on Plant Diseases and followed this with a lecture in German on the same subject, illustrated by lantern slides. In introducing his subject *Dr. Gentner* mentioned that in 1841 Professor Henslow lectured in Cambridge on the various diseases by which seeds are attacked, and that he regarded it as an honour to be able to speak in the same town and on the same theme.

The Determination of Plant Diseases Transmitted by Seed.

BY

G. GENTNER, MUNICH.

Besides the testing for purity and germinating capacity, it is a very important task of the seed testing stations to investigate the state of health of the seed. In many cases the pests and the causal organisms can be detected in the purity and germination test or by means of special methods.

In the purity test it is possible to find *Aplanobacter Rathayi* on *Dactylis*, *Ustilago laevis* in *Avena*, *Ustilago Jensenii* in *Hordeum*, *Tilletia tritici* in *Triticum*, *Ustilago perennans* in *Arrhenatherum*, *Ustilago bromivora* in *Bromus*, *Tilletia Holci* in *Holcus*, sclerotia of *Claviceps* in *Secale*, *Phleum*, *Holcus*, *Poa*, *Agrostis*, *Typhula trifolii* in *Trifolium* and *Lotus* species, sclerotia of *Sclerotinia trifoliorum*, and of *Botrytis cinerea* and indeterminate species in *Trifolium*, *Anthyllis* and *Medicago*.

The examination of the state of health of the seed in the germination bed is made as follows :—The seeds are placed in the bed some distance from each other, and are not removed when the germination has finished. The fungi mycelium are then able to continue their development, and conidia, pyknidia or perithecia can be formed, by which it is possible to identify the fungi. The most simple way is to place the seeds in Petri dishes on moist filter paper or in cardboard dishes. The development of the fungi is favoured when the seeds are kept as moist, warm and dark as possible. It is necessary to keep under observation the decayed seeds in the germination bed, as these often show the causal organisms particularly well developed. Inspections on from 5 to 10 days suffice in most cases.

When the attacks by fungi, especially by *Fusarium*, are to be determined in figures, Director Hiltner's "brick dust" method in which the seeds are placed in large grained sterile brick dust (size of grain 2 mm.) should be used. In this way the mycelium partly develops on the surface around the seedlings, and partly on the sheaths, giving them a brown colour. As *Helminthosporium* and *Cephalosporium Acremonium* may cause a similar colouring, it is recommended, in cases of doubt, to place the seedlings taken from the brick dust on to moist filter paper in glass dishes for several days. *Botrytis* diseases in the seed are easy to determine in percentage by this method.

Phoma oleracea in *Brassica* species and *Phoma lini* in *Linum* are easy to recognise by means of the attacked cotyledons when the seeds are placed to germinate in soil.

By these means I have been able to determine the following causal organisms on the seed :—

Bacteria.—*Bacillus cerealium* on *Hordeum*, *Triticum*, *Secale*, *Zea*, *Pisum*, other bacteria species on *Avena*, *Cucumis*, *Vicia Faba*, *Brassica*, *Solanum Lycopersicum*.

Helminthosporium on *Hordeum*, *Avena*, *Lolium*, *Agrostis*.

Macrosporium and *Pleospora* on *Avena*, *Hordeum*, *Medicago sativa*, *Trifolium pratense*, *Lotus*, *Onobrychis*, *Ornithopus*, *Glycyrrhiza*, *Galega*, *Pisum*, *Brassica*, *Spinacia*, *Cannabis*, *Daucus*, *Apium*, *Petroselinum*, *Lactuca*, *Cichorium*.

Alternaria on *Triticum vulgare*, *Phleum*, *Spinacia*, *Brassica*, *Sinapis alba*, *Onobrychis*, *Vicia Faba*, *Daucus*, *Petroselinum*, *Cucumis*, *Lactuca*, *Scorzonera*, *Cichorium*.

Fusarium on *Secale*, *Hordeum*, *Triticum*, *Avena*, *Zea Mais*, *Medicago*, *Trifolium*, *Lotus*, *Ornithopus*, *Lupinus*, *Pisum*, *Phaseolus*, *Atriplex hortense*, *Brassica*, *Linum*, *Daucus*, *Nicotiana*, *Borrage*, *Cucumis*, *Lactuca*, *Scorzonera*, *Cichorium*.

Botrytis cinerea on Secale, Avena, Trifolium pratense, Lotus corniculatus, Ornithopus, Lupinus, Vicia sativa, Pisum, Spinacia, Cannabis, Brassica, Daucus, Nicotiana, Cucumis, Lactuca, Scorzonera, Cichorium.

Diplodia Maydis on Zea Mais.

Mycosphaerella hordei on Hordeum.

Phoma on Brassica, Linum, Trifolium pratense, Medicago sativa, Lupinus, Apium.

Gleosporium Lindemuthianum on Phaseolus.

Gleosporium lini on Linum.

Ascochyta Pisi on Pisum sativum.

Ascochyta graminicola on Secale.

Septoria graminum on Hordeum.

Cephalosporium Acremonium with Melanospora damnosa on Triticum, Hordeum, Avena.

Professor Mohammed Showky Bakir then gave a short but interesting account of the pink boll worm (a pest of South Asiatic origin), which attacks the most important Egyptian crop—cotton—with disastrous effects. He stated that this pest had been introduced into his country since 1890 through the importation of Indian cotton, and that it spread rapidly because conditions were favourable. The delegate stated that both chemical and mechanical means had been tried in order to combat this pest, and that finally the hot-air method had been adopted. Three hot-air machines were tried and ultimately one, known as the "Auto-regulator," was found to be effective. The Professor displayed to the meeting various pictures and exhibits illustrating his remarks and also diagrams of the various machines which he mentioned. In conclusion he asked that the other countries represented at the Congress—especially the United States of America—would assist Egypt in her difficult work of fighting this pest.

At the conclusion of the morning session the foreign Delegates were entertained at lunch at Magdalene College by the Master, Dr. Arthur C. Benson, C.V.O., LL.D., and the Fellows of the College.*

Afternoon Session.

The Congress resumed at 2.30 p.m.

Sir Lawrence Weaver announced the attendance of Mr. Elmar Kirotar, Secretary to the Esthonian Legation in London, who had been empowered by the Esthonian Government to represent them.

Dr. Volkart's Draft Constitution, as amended by the Provisional Committee appointed on Tuesday, was then considered, copies having been distributed to the Delegates. *Sir Lawrence Weaver* read the clauses one by one, making explanatory comments; the clauses and comments being subsequently given in French and German respectively. Each clause was submitted in turn to the Congress and unanimously approved, subject to one or two minor verbal amendments.

* The speech delivered by Dr. Benson on this occasion is given on pp. 143-144.

Dr. Andronescu stated that, while he personally was prepared to approve the Constitution, he could not bind his Government to accept it. *Mr. Kirotar* (Esthonian Legation) and *Mr. Devoto* expressed similar views. *Sir Lawrence Weaver* stated that it was well recognised that all those present were subject to the Governments who sent them and that the various Governments could not be bound by the decisions that had been reached. It would be the duty of the Delegates to make strong representations to their Governments with the view of securing the adoption of the Constitution.

The Constitution which is appended was then unanimously approved by the Congress.

THE INTERNATIONAL SEED TESTING ASSOCIATION.

Constitution.

1. *Name and Object*.—Under the name of the International Seed Testing Association, a union of Official Seed Testing Stations with legal domicile at the residence of its President exists for the purpose of advancing all questions connected with the testing and judgment of seeds. The Association seeks to attain this object through :—

(a) Comparative tests and other researches directed to achieving more accurate and uniform results than hitherto obtained.

(b) The formulation of uniform methods and uniform terms in the analysis of seeds in international trade.

(c) The organisation of international congresses attended by representatives of Official Seed Testing Stations for the purpose of mutual deliberation and information, the publication of treatises and reports on seed testing and mutual assistance in the training of technical officers.

2. *Membership*.—The following may be members of the Association :—

(a) Official Stations which deal entirely, or to a considerable extent, with seed investigations and are directly controlled by Governments.

(b) Similar Official Stations managed by Institutes or Corporations and effectively controlled by Governments.

(c) Associations of Official Seed Analysts.

Each member engages to take active part in the work of the Association and each subscribing member receives a free copy of the Association's publications.

3. *Finance*.—The income of the Association is derived from :—

(a) Ordinary annual contributions from its members.

(b) Extraordinary revenues.

The amounts of the annual contributions will be approved at each general assembly of the Association for at least the ensuing three years. They will be paid either by :—

(c) A Government on behalf of all the official Stations in that country, the sum not to exceed fifty pounds sterling per annum.

(d) An Official Station or an Institute.

(e) An Association of Official Seed Analysts.

When the contribution is in accordance with clause 3 (c) all Official Stations in the contributing country have the right of membership and voting subject to provisions of clause 8. The amounts of the contributions

will be so fixed that they are sufficient to cover the cost (a) of the publications of the Association, (b) of comparative tests and other researches, (c) of stationery and clerical assistance.

4. *Meetings, Committees and Administration.*—A Congress will be summoned by the Association approximately every third year and at the same time the general assembly of the Association will meet. At this assembly the following Executive Committee and officers will be elected :—

- (a) The President.
- (b) The Vice-President.
- (c) Not less than 3 nor more than 5 ordinary members of the Executive Committee.
- (d) Two substitute members of that Committee.
- (e) Two honorary auditors and one substitute who shall not be members of that Committee.

All the foregoing must be technical officers in direct charge of Official Seed Testing Stations.

The General Assembly shall also elect such further Committees as may be necessary for the better ordering of finance, research, publications, &c. All such Committees and officers shall hold office until the next General Assembly of the Association.

The General Assembly will decide as to place and date of future Congresses, will approve the amount of the contributions and will nominate as honorary members men who have, by reason of their seed testing work or their labours on behalf of the Association, especially deserved this distinction.

By resolution of the Executive Committee a General Assembly may be summoned at other times than that of the triennial Congress.

The General Assembly forms a quorum when 20 members with the right of voting are present.

5. *Despatch of Business.*—The Executive Committee will consist of the President, the Vice-President and its ordinary members. When, by reason of death or prolonged inability to serve, an ordinary member is unable to assist in the despatch of business, the President may call upon the services of either or both of the substitute members. The accounts of the Association shall be audited in each year by the two auditors and the audited accounts shall be circulated annually to all members with the Executive Committee's report on the year's work.

The Executive Committee will make decisions as to expenditure, will elect sub-committees and approve the business of the Congress. When the General Assembly is not a quorum the Committee has power to make final decisions on finance and the next place of meeting for the Congress. In case of equal voting on the Committee the President shall have a casting vote.

6. *The President.*—The President will preside over the General Assembly and the Executive Committee and at those sessions of the Congress at which important technical resolutions are passed.

He will, as Chairman of the Executive Committee and with the Committee's knowledge and approval, take the initiative in conducting the business of the Association, in intercourse with Governments and other Associations whether of Official Stations and seed analysts or of members of the seed trade. He will arrange, in consultation with representatives of the country where a Congress is to be held, (a) the programme of the Congress, (b) the proposal for the chairmanship of the Congress, (c) the admission to the Congress of observers and guests. He will summon the meetings of the Executive Committee, will be an ex-officio member of all other committees and sub-committees of the Association and will supervise the publication of the Association's reports.

The President shall have power to appoint a Secretary-Treasurer to assist him, at such remuneration as may be approved by the Executive

Committee, and will be responsible for (a) the safe custody of the property of the Association, (b) the proper disbursement of its funds, (c) submitting to the auditors proper accounts.

7. *The Vice-President.*—In the absence of the President from meetings of the General Assembly or the Executive Committee the Vice-President shall take his place.

8. *Assemblies and Congresses : Delegates and Voting.*—Every member of the Association will be entitled to attend the General Assemblies and Congresses. The Executive Committee will, before each Congress, take into account (a) the contributions of the various countries and members and (b) the importance of the work of the Official Stations which they represent, and will determine the number of votes, not exceeding five, to be exercised by the delegates from each country, in voting on the reports and proposals of the Committees of the Association or on the proposals of the delegates. Voting will be by secret ballot, if so demanded, otherwise by show of hands. Resolutions will be carried by a majority of those present and voting. In case of equal voting the President shall have a casting vote.

9. *Voting by Correspondence.*—In the event of any important question arising between meetings of the General Assembly, the Executive Committee may refer it on a voting letter to the members of the Association having the right to vote, and may act on the decision of the majority of the members who signify their wishes by such written vote.

10. *Withdrawal, Dissolution, etc.*—Withdrawal of countries and members can only take place at the end of the calendar year and the President must be advised at least three months beforehand of the intention to withdraw.

Dissolution of the Association can only take place when a General Assembly, summoned for this purpose, shall have voted for it by a three-fourths majority of those present and voting.

Any proposed alterations in this Constitution are to be prepared by the Executive Committee and communicated in writing to the members at least two months before a General Assembly at which they are to be moved. Resolutions effecting such alterations must be carried by a two-thirds majority of those present and voting.

11. *Relations with International Institute of Agriculture.*—The Association will, in respect of publications and in such other ways as the Executive Committee may find convenient, work in co-operation with the International Institute of Agriculture at Rome. In the event of the dissolution of the Association, any assets held by the Association shall be handed over to the International Institute.

12. *Interpretation.*—In cases where the interpretation of Clauses of the Constitution is in doubt, the English text shall govern.

The following Resolutions were also unanimously passed :—

(1) That the Executive Committee are at liberty, before printing the Constitution as adopted by the Congress, to make such minor verbal amendments as will make their intention more clear.

(2) That, as the Congress has not available time to consider fully in plenary session the amounts of the annual contributions to be made in accordance with Clause 3 of the Constitution, this question is hereby remitted to the Executive Committee for decision with the instruction that the Committee shall communicate a note of the amounts required to the appropriate Governments, Stations and Associations.

Mr. Kirotar (Esthonian Legation) stated, with reference to Clause 3, that in his opinion the contributions to be made by Governments should be fixed in accordance with the financial position of the various countries. *Sir Lawrence Weaver* replied that it was well-recognised by the Executive Committee that the basis for fixing the amount of the contributions would be the capacity of a country to pay.

Sir Lawrence Weaver also referred to the title of the Association which he said should appear at the head of the Constitution in French and German as well as in English. It was desirable that the translation should be as literal as possible. He suggested, and the Congress agreed, that this matter should be left to the Executive Committee to settle.

Sir Lawrence Weaver then proposed "that the following Executive Committee and officers be, and they are hereby elected" :—

President	Mr. K. Dorph-Petersen.
Vice President - -	Dr. W. J. Franck.
Three Ordinary Members of Executive Committee	{ Mr. A. Eastham. Prof. M. T. Munn. Mr. W. v. Petery (Argentina).
Two Substitute Members of Committee -	{ Prof. Mohammed Showky Bakir Effendi. Mr. Edgar Brown.
Not members of Executive Committee :—	
Honorary Auditors - - -	{ Professor Bussard. Professor Voigt.
Substitute Honorary Auditor -	Mr. E. Kitunen.
The above were unanimously elected en bloc.	

Mr. Dorph-Petersen thanked the Congress for electing him President, and asked that all those present would help him to carry out the work. He expressed deep regret that Dr. Volkart, who had assisted him so much during the past three years, was unable, because of his official duties, to continue the work. He therefore hesitated to assume the task as he had neither the necessary ability nor sufficient time. He hoped to obtain support especially from the Executive Committee and more particularly from the Vice-President.

Mr. Dorph-Petersen then proposed that Dr. Volkart and *Sir Lawrence Weaver*, whose organising ability was mainly responsible for the presentation of a Constitution which had been so readily accepted by the Congress, should be elected as the first two Honorary Members of the Association in accordance with Clause 4 of the Constitution.

This proposal having been approved with acclamation, Dr. Volkart and *Sir Lawrence Weaver* thanked the Congress.

Mr. Dorph-Petersen then submitted a list of the special Committees proposed to be appointed, and their personnel, for the approval of the Congress.

After one or two alterations in personnel had been made, the Congress approved the appointment of the Committees and the personnel shown in the following list :—

<i>Research Committee for Countries with Temperate Climate.</i>	<i>Dr. Franck</i> , Professor Voigt, Professor Munn, Mr. Clark, Professor Bussard, Mr. Anderson, Dr. von Degen, Dr. Chmelař.
<i>Research Committee for Countries with Warm Climate.</i>	<i>Mr. Devoto</i> , Professor Mohammed Showky Bakir Effendi, Director A. Garcia Romero (Spain), Professor Todaro (Italy), Mr. Francisco de Assis Iglesias (Brazil).
<i>Provenance Determinations</i> -	<i>Dr. von Degen</i> , Dr. Franck, Dr. Volkart, Dr. Gentner, Professor Bussard, Dr. Chmelař, Mr. Eastham, Mr. Devoto, Mr. Brown.
<i>Hard seeds and broken seedlings</i> -	<i>Professor Voigt</i> , Dr. Chmelař, Dr. Pammer (Austria), Mr. Brown, Dr. Grisch (Switzerland), Dr. Andronescu, Mr. Anderson.
<i>Moisture Content and Drying</i> -	<i>Dr. Buchholz</i> , Professor Zaleski, Mr. Brown, Mr. Hammer (Sweden), Professor Issatchenko.
<i>Investigations of Genuineness of Variety and of Plant Diseases.</i>	<i>Dr. Chmelař</i> , Dr. Gentner, Dr. Franck, Professor Nilsen-Ehle (Sweden), Professor Kuleschoff, Mr. Holmgaard (Denmark), Professor Munn.
<i>Dodder Committee</i> - - -	<i>Dr. von Degen</i> , Professor Bussard, Professor Voigt, Director Vitek (Czechoslovakia), Director Enescu, (Roumania), Mr. Brown, Mr. Devoto, Professor Kuleschoff.
<i>Publications and Registration</i> -	<i>Dr. Franck</i> , Dr. Chmelař, Professor Munn, Professor Voigt, Professor Bussard, Mr. Anderson, Miss Yeo (Secretary,—representative of the International Agricultural Institute, Rome).

Beet Sub-Committee - - *Professor Müller* (Germany),
 Dr. von Degen, Professor
 Bussard, Professor Zaleski,
 Professor Kuleschoff, Dr.
 Chmelař, Mr. Wieringa.

Those whose names are in italics were requested to take charge of the constitution of the respective committees and to start the work, so far as this was possible, before the close of the Congress.

Professor Showky Bakir asked that copies of the above list might be circulated to all the Delegates at an early date; *Mr. Dorph-Petersen* promised that this should be done. He then raised the question of the method of expressing the results of comparative tests carried out at the request of the Association, and the Congress agreed that the method used during the last three years should continue to be employed.

The question of the *venue of the next Congress* having been reached, *Miss Yeo* proposed, in view of the collaboration between the Association and the International Agricultural Institute, Rome, that the next Congress should be held in Rome. *Mr. Dorph-Petersen* intimated that, during his recent visit to Rome, the Secretary-General of the I.A.I., Dr. Dragoni, had suggested that the next Congress should be held in Rome, and that Sir Daniel Hall, who attended the Congress on the first day as a representative of the I.A.I., had promised that an official letter would be sent in due course inviting the Congress to meet in that city.

The Delegates unanimously agreed that the invitation of the I.A.I. should be accepted with thanks; and after some discussion it was agreed that *the next Congress should be held in Rome during the first half of May, 1927*, the precise date to be fixed later by the Executive Committee.

On behalf of himself, Professor Munn and Mr. Brown, *Mr. Clark* thanked the Association for permitting North America to take part in the deliberations of the Congress.

The Congress agreed that a letter of thanks should be sent to the Council of the National Institute of Agricultural Botany for permitting the Congress to meet in such pleasant surroundings, and in recognition of the services rendered by Mr. W. H. Parker (Director), Mr. F. C. Hawkes (Assistant Director), and Mr. A. Eastham (Officer in Charge, Official Seed Testing Station).

A hearty vote of thanks was accorded to the following for their services :—

Mr. H. Chambers (Organising Secretary)
 and his Assistants—

Dr. Gray,
 Miss Grierson,
 Mr. L. E. Cook,
 Mr. A. W. Knee,
 Mr. A. R. Whyte.

On the proposition of *Professor Johannsen*, who characterised him as an ideal chairman, the delegates agreed that a hearty vote of thanks should be accorded to Sir Lawrence Weaver for his services in organising and presiding over the deliberations of the Congress.

The business meetings of the Congress then concluded.

SUPPLEMENTARY PAPERS PRESENTED TO THE CONGRESS, BUT NOT READ.

Investigations of Agricultural Seeds with special reference to Conditions in Japan.

BY

DR. M. KONDO,

Director of the Ohara Institute for Agricultural Research, Kurashiki,
Japan.

It is hardly necessary to state that seed testing is very important in reference to the problem of crop improvement. Properly executed, seed testing affords the means of avoiding much expense and annoyance if this work be done before seeds are purchased in large quantities. During the past fifty years seed testing has become an established practice in most countries of Europe and in America. I regret to state, however, that seed testing on a large scale has not become a generally established practice in Japan, for the following reasons :—

In Japan, animal industry has remained undeveloped, and farm animals are relatively few in number; they are, moreover, largely fed on rice straw and on grass from the fields and slopes. Forage crops, as such, are grown only on a very small scale, or in some regions not at all, and, not being in demand, seeds of forage crops are rarely offered for sale. In Europe and in America the testing of forage crop seeds forms the larger part of the seed testing industry. However, in Japan the growing of vegetables forms a large part of the agricultural industry, and, consequently, the demand for vegetable seeds is great. The testing of vegetable seeds should, therefore, be an important matter, but each individual farmer's need for vegetable seeds is always small, and it is impracticable to test an indefinite number of small lots of seeds. Thus, it has so happened that seed testing has not as yet been developed in Japan. It is evident, however, that in the future, through associations of farmers and gardeners, seeds will be purchased on a co-operative basis. This system of purchasing, which is already carried on to some extent, will enable the co-operative societies to have their seeds properly tested.

An International Seed Testing Conference was held in Copenhagen, Denmark, in July, 1921, which was attended by specialists from many countries of Europe and America. Although invited to attend this Conference, I was unable to accept the invitation. A second conference is to be held in London in 1924. While I am personally much interested in the seed testing conferences, I am as yet scarcely in a position to contribute materially to the meetings, for, as explained above, seed testing is yet in its infancy in Japan.

In view of the facts that agricultural and garden seeds offered for sale in Japan are frequently not true to name, are often impure, and frequently present a very low percentage of germination, it is evident that seed testing will, in the near future, occupy an important place in Japanese

agriculture. Under present conditions, farmers and gardeners are frequently disappointed in finding that their crops, as they approach maturity, are not what they expected from the seeds purchased, and frequently suffer much inconvenience and even severe losses. I suppose in Europe and in America similar results are not infrequent occurrences when seeds other than those of standard brands are purchased.

In Northern Japan and in Korea sugar-beet cultivation has been established, and the areas devoted to this crop are constantly being increased. To supply the demands of the sugar-beet planters, large quantities of seeds must be imported from foreign countries. It frequently happens that farmers receive seeds of the field beet rather than seeds of the sugar beet. The seeds of both varieties are very similar in appearance, and, naturally, the average farmer is unable to distinguish between them.

Many tests made by me show that frequently the percentage of germination of the seeds is very low. The chief difficulty is, however, that the seeds on sale are often not true to name. Mixed strains are often sold as pure strains. The loss to the farmer may be very great, if, for example, he finds that, as his crop approaches maturity, his beets are of the field variety rather than of the sugar variety. It thus becomes as important to determine the correctness of the varietal name as it does to determine the percentage of germination, purity, etc.

In agriculture, horticulture and general gardening, the correct identification of the seeds to the genus and the species must be supplemented by further accurate identifications as to the variety, form, or sort, because, even though seeds may be correctly identified as to the genus and species, they may have no value as seeds for agricultural purposes when the identification as to the particular variety or form is incorrect.

It is, of course, a very difficult and exacting matter to determine purity of sort and correctness of varietal identification from seeds alone—at least, in very numerous cases. As a pre-requisite we must have a most thorough knowledge of the seed characters of all standard varieties and forms of every species of agricultural or horticultural importance. For instance, in Japan among the cultivated brassicas, variously classified as *Brassica campestris*, *B. japonica*, *B. nigra*, *B. juncea* and *B. oleracea*, about fifty varieties or forms are commonly cultivated. The seeds of all these varieties closely resemble each other, and it is, therefore, a very difficult matter to distinguish them properly. We also find, in cultivation in Japan, about thirty garden varieties of the common radish, *Raphanus sativus*. As with the cultivated brassicas, while the growing plants of the different varieties are readily distinguishable, it is exceedingly difficult to distinguish these radish varieties from the seeds alone, or, I might say, for the ordinary farmer or untrained observer it is practically impossible to distinguish them. Farmers and gardeners are therefore often puzzled by incorrectly-named seeds and by mixed seeds which are not infrequently offered for sale by unscrupulous merchants. The matter of the correct identification and certification of garden varieties of seeds thus assumes an important position, and we are forced to an intensive macroscopic and microscopic examination of the numerous varieties of seeds in order to determine just what the varietal differences, as presented by the seeds, may be.

In general practice in Europe and in America seed testing is carried on chiefly with a view to determining the percentage of germination and the relative number of weed seeds present, and determination as to the correctness of identification of the variety or form is not usually attempted. I believe, however, that the latter should form an important part of seed testing.

Since 1908, I have carried on an intensive investigation of the Japanese agricultural seeds which are more commonly offered for sale with a view to correlating the seed characters of the numerous species, varieties, and forms, with the distinctive specific, varietal, and form characters of the plants themselves. The results of my investigations are in part recorded in the "Berichte des Ohara-Instituts für landwirtschaftliche Forschungen."

So long as seeds are offered for sale, I am firmly of the opinion that similar investigations to those reported in the above publication must be carried on, and that it is also important that similar investigations be made in every country where agricultural seeds are produced.

Some kinds of seeds, of course, present distinctive differences, even among the numerous horticultural forms and varieties of the same species, while, in other cases, the resemblances are so great that it is exceedingly difficult properly to distinguish the various strains. Up to the present time I have investigated intensively the seeds of the following species, and have published my results :—

Brassica campestris var. *chinensis* Ito.
Brassica campestris var. *rapifera* Metzg.
Brassica japonica Thunb.
Brassica nigra Koch.
Brassica juncea Coss.
Brassica oleracea capitata Linn.
Brassica oleracea botrytis Linn.
Brassica oleracea caulocarpa Linn.
Raphanus sativus Linn.
Solanum melongena Linn.
Cucurbita moschata Duch. var. *Toonas* Makino.
Lagenaria vulgaris Ser.
Benincasa cerifera Savi.
Citrullus vulgaris Schrad.
Luffa cylindrica Roem.
Momordica charantia Linn.
Cucumis melo Linn.
Cucumis melo Linn. var. *Conomon* Makino.
Cucumis sativus Linn.
Allium fistulosum Linn.
Allium odorum Linn.
Allium cepa Linn.
Allium porrum Linn.
Daucus carota Linn.
Cryptotaenia canadensis DC. var. *japonica* Makino.
Apium graveolens Linn.
Petroselinum sativum Hoff.
Arctium lappa Linn.
Lactuca sativa Linn.
Chrysanthemum coronarium Linn.
Chrysanthemum cinerarifolium Bocc.
Chrysanthemum roseum Web.
Spinacia spinosa Moench.
Spinacia glabra Miller.
Beta vulgaris Linn.
Capsicum annuum Linn.
Nicotiana tabacum Linn.
Cannabis sativa Linn.

In initiating the work, I first secured as many samples as I could by purchase, by exchange, and by gathering the seeds from plants cultivated in the garden of the Institute. The characters of each individual seed studied were recorded under the following general heads :—

(a) External characters, such as shape, colour, markings, the presence or absence of spots, foveolae, wrinkles, hairs, ribs, projections, etc.

(b) Size, weight per thousand, and the specific gravity of seeds or fruits.

(c) Anatomical characters of the testa (seed coat) or pericarp, embryo, endosperm, etc.

(d) Characteristics of the seedlings as to colour, presence or absence of hairs or other types of indumentum, shape and size of the cotyledons, hypocotyl, and the first leaves of the seedlings.

Under the above items some kinds of seeds and fruits can be very easily distinguished. Thus, in *Brassica*, *Raphanus*, *Daucus*, *Allium*, *Capsicum*, *Lactuca*, *Spinacia*, *Beta*, etc., varietal and form characters can be distinguished fairly well from the seeds or fruits alone. It is scarcely necessary to mention here that the various cereal and leguminous crops present a great wealth of varieties, but with these, as with representatives of those genera mentioned above, varieties can be easily distinguished from the seed characters alone. A prime essential, however, for the accurate identification of garden varieties of seeds is an intimate knowledge of the different forms, a knowledge that can only be gained through intensive study and long experience.

In Japan, as elsewhere, agricultural seeds have been but slightly investigated. This is all the more curious when we reflect that agriculture is the absolute basis of our civilisation, and anything that will forward agriculture will, of course, have its effect, direct or indirect, on modern civilisation. My experience leads me to believe that scientific investigations, such as those that I have carried on for a number of years on the identification and standardization of agricultural and garden seeds, are not only of very great interest and usefulness, but are definitely practicable. One by one the various economic species are being taken up and their many varieties and forms are being intensively studied. Since Harz's book, published in 1885, very little has appeared on this subject in the scientific and agricultural literature of Europe and America.

Summarizing, I would state that in seed testing, the question of the percentage of germination and the question of contamination by weed seeds are by no means the most important considerations, for strains must be tested as to nomenclature; that is, that the seeds are true to the type of the variety or form under which they are sold. Until very recently, no investigations on this important subject have been made; it is, however, clearly a most important part of seed testing. Such investigations should be greatly extended and adequately supported as a vitally important branch of agricultural science. Research should not be confined to the seeds themselves, but should be extended to the seedlings both from the botanic and agronomic viewpoint. The major subjects for observation and comparison should be :—

- (a) External characters.
- (b) Size, weight, specific gravity.
- (c) Anatomical structure.
- (d) Seedling characters.

Examinations of the occurrence and vitality of various weed seed species under different conditions, made at the Danish State Seed Testing Station during the years 1896–1923.*

BY

K. DORPH-PETERSEN,

Director of the Danish State Seed Testing Station.

The Danish journal "*Tidsskrift for Landbrugets Planteavl*" (Journal of Agricultural Plant Culture, vol. 17, 1910) contains a report, "*Nogle Undersøgelser over Ukrudsføes Forekomst og Levedygtighed, udførte ved Statsanstalten Dansk Frøkontrol 1896–1910*" (Investigations of the

Copies of this paper were circulated to the delegates in connection with Professor Bussard's lecture on weed seeds (*see pp. 52–54*).

occurrence of weed seeds and their vitality, made at the Danish State Seed Testing Station during the years 1896-1910).

That report contains partly a summary of the results of experiments published in earlier volumes of the journal and partly a supplement to these—viz., results of later examinations and, finally, results of investigations not previously published.

This article is in all essentials a summary of the above report, the division of which is, therefore, kept here. Those sections likely to be of interest to foreign readers are mentioned somewhat in detail, whereas those of particularly local interest are only reported briefly. In some cases information is given which is not contained in the report, but is to be found in an earlier volume of "*Tidsskrift for Landbrugets Planteavl*." The reference to some of the series of experiments is further supplemented with results obtained since 1910, several of the investigations not being finished at that time.

I.—How many weed seeds do clover and grass seed contain ?

In this section attention is drawn to the fact that the apparently small quantities by weight (most frequently 0.1-1.0 per cent.) of weed seeds which the samples of grass and clover seed in general contain, represent a considerable number of seeds per kilogramme of the bulk, so that even in the case of a good bulk, when using 25 kg. per ha., 13-25 weed seeds are often sown per square metre. "Uncontrolled seed"—i.e., seed tested without the seller's knowledge or consent and sold by firms, the deliveries of which have not been under a regular control of the Danish State Seed Testing Station—frequently contains very large quantities of weed seeds.

In three of the annual reports of the Danish State Seed Testing Station ("*Tidsskrift for Landbrugets Planteavl*," vol. 7, pp. 23-42; vol. 8, pp. 23-25 and vol. 10, pp. 22-23), Mag. sc. O. Rostrup has given an account of seeds of uncultivated species which were found in the samples of clover, grass, root and other seed tested at the State Seed Testing Station up to 1902. A corresponding account of the occurrence of weed seed species in the samples tested of late years at this station will, presumably, be published in the near future, possibly in the Review of the International Agricultural Institute.

II.—The progress of germination and the germinating capacity of seeds of some indigenous plants.

The examinations of the ability of seeds of indigenous plants to germinate were, to a great extent, made by O. Rostrup during the years 1896-1902, and thereafter by the writer. The results of these tests are to be found in "*Tidsskrift for Landbrugets Planteavl*," vol. 6, pp. 158-169; vol. 8, pp. 27-30; vol. 9, pp. 26-29; vol. 10, pp. 24-28; vol. 11, pp. 172-175; vol. 12, pp. 43-49; and vol. 13, pp. 38-41.

Fully matured seed was used in the tests and placed to germinate shortly after it had been harvested. It has thereafter been on the germination apparatus until all the seeds were either germinated or decayed. For most species the Jacobsen tank was used*; only the seeds of aquatic plants were tested for germination in water. The germination apparatus stood on an unheated glass verandah. The seed was in this way exposed to a temperature that did not differ much from that in the open air.

The progress of germination was very different for the various species. O. Rostrup has set up the groups in the lists on pp. 130-133, in which all the species tested, with a few exceptions, can be placed.

The figure stated after the name of the species is the entire germinating capacity, which is high for most of the samples. This is, without doubt, due to the fact that the tests were made at temperatures similar to those to which the seed is exposed in nature. A comparison of the results for germination of some species placed on heated apparatus similar to that used

* See pp. 32-33 in "*Statsfrøkontrollen 1871-1896-1921*." (The Danish State Seed Testing Station, 1871-1896-1921) by K. Dorph-Petersen.

by the State Seed-Testing Station for crop seed, and germination results obtained upon an unheated apparatus placed in an open verandah, shows that all the species tested, with a single exception, germinate most rapidly and best under the circumstances last mentioned. O. Rostrup suggests that when Nobbe and Haenlein, in examinations similar to those mentioned, found very low germination results, it is probably due to the fact that they used too high a temperature (see "Die landwirtschaftlichen Versuchs-Stationen," vol. xx., p. 74, and vol. xxv., p. 465, Berlin).

In the case of a small number of the species in question several samples were tested. The progress of germination of the various samples of the same species was not in all cases alike. Probably the germination is influenced by the crop, degree of maturity, provenance, and, perhaps, the strain or racial characteristics. In future examinations of this kind it would be desirable to use samples harvested from single plants. Even with this precaution as to the material used for the test, it is impossible always to be sure that the seed germinates equally. Professor Correns has thus pointed out that, among other things, the germination is, in some cases, influenced by the position of the seed in the fruit or in the inflorescence; the seeds from the ray florets of many of the compositæ have proved thus to germinate otherwise than seeds from the disc florets (see "Jahresbericht der Vereinigung für angewandte Botanik," 8th annual publication, 1910, p. 258).

III.—*The influence of the degree of maturity on the germinating capacity of weed seeds and the permanence of the germinating capacity.*

In order to throw light upon this matter, the writer has carried out the investigations mentioned below. In 1904 "ripe" as well as "unripe" seeds of the species stated in Table 1 (see p. 133) were collected. The unripe seeds were still greenish, had a tough albumen, and were so firmly attached to the mother-plant that they had to be picked off. The ripe seeds were by a slight touch easily removed from the plant, and the seed-shell or seed-vessel had the appearance typical of maturity. Ripe and unripe seeds were harvested from the same piece of ground, but not absolutely from the same plant. The seeds were stored in paper bags in drawers situated in rooms which were heated during the winter, so that the moisture content, being greatest in the unripe seeds at the time of harvest, became comparatively rapidly almost alike in ripe and unripe seeds. Shortly after the harvesting and each following autumn, 100 ripe and unripe seeds respectively of each species were placed to germinate upon a Jacobsen tank in an open verandah, as described on p. 125. Table 1 shows the main results of these examinations.

Under the conditions given, the ripe seeds retained their germinating capacity for the longer time; the unripe seeds of most of the species germinated more rapidly than did the mature, especially in the first years after the harvesting of the seed.

In Table 2 (see p. 134) an account is given of how several other species have retained their germinating power during a series of years. The conditions of storing and the method of germination have been the same as indicated above (dry storing and germination on unheated apparatus).

IV.—*How many weed seeds are found in the soil?*

(Some information as to the number of seeds which various weed plants are able to give is stated hereunder.)

The seeds of some plants of various indigenous species were occasionally counted ("Tidsskrift for Landbrugets Planteavl," vol. 13, pp. 35-37). Of the results, mention should be made of the following:—

Daucus carota.—A plant standing isolated gave 110,000 seeds, while seven plants in a grass field gave on an average about 4,000 seeds per plant.

Plantago lanceolata.—A vigorous plant in a grass field gave about 15,000 seeds; six smaller specimens in the same field gave on an average about 2,500 seeds.

Chrysanthemum leucanthemum.—A vigorous plant in a grass field gave about 26,000 seeds; six smaller plants at the same place gave from 1,300 to 4,000 seeds per plant.

Sonchus arvensis.—Six plants in an oat-field were found to average 3,000 seeds per plant. On about four square metres 70 similar plants were found.

Matricaria inodora.—A specially vigorous, isolated specimen gave about 310,000 ripe seeds, which in six days germinated 97 per cent. *The plant gave thus about 300,000 germinable seeds.* Another isolated plant gave about 130,000 seeds. In later examinations the present writer has twice found specimens giving each about 300,000 germinable seeds.

Cirsium arvense.—In a plant colony of this species, 25 powerful stems were found per 0.4 of a square metre; some of these (the male plants) gave no seeds, whereas the female plants on an average gave about 4,500 seeds per stem.

In order to throw light upon *how many weed seeds can be found in arable soil*, samples of soil were drawn in 1907 from four fields in Jutland. This was done by means of a four-sided iron frame 15 cm. high, so that the samples comprised a layer of earth 15 cm. thick which corresponds to the layer which in the selected district was subject to direct treatment with plough and harrow.

As the fields in question were supposed to contain many weed seeds, one dare not take the results as an expression of how many weed seeds Danish fields generally contain.

The samples were washed out in sieves with meshes so small that all weed seeds were retained. By an examination of carefully drawn average samples of the content of the sieves, the species and the amount of weed seeds in the samples of soil were determined. Seed of the following genera and species occurred in greatest amount:—*Chenopodium* sp., *Scleranthus* sp., *Spergula* sp., *Polygonum lapathifolium* and *Rumex acetosella*. From the results of the investigations, it was calculated that the fields contained in the 15 cm. top layer of the soil 193,600, 116,600, 88,200 and 141,900 weed seeds respectively per square metre. The seed of *Chenopodium* found in one of the samples germinated 70 per cent., but the main part of those species which were tested for germinating capacity germinated between 20 and 30 per cent. Supposing the average germinating capacity to be 25 per cent., and that the seed was evenly dispersed in the entire layer of soil, the 2.5 cm. top layer in the four fields contained, according to the calculation of the figures stated, the following numbers of germinable weed seeds per square metre: Number 1—8,066; No. 2—4,855; No. 3—3,674 and No. 4—5,913.

V.—How do the weed seeds retain their germinating capacity in the soil?

The procedure in these experiments has, in all cases, been that small flower-pots, in the middle of which 100 seeds mixed with soil were placed, were buried at the beginning of the experiment. Each spring, a number of these pots were dug up and the seeds from them tested for germinating capacity. The contents of the flower-pots were spread in earthen bowls which were, beforehand, almost filled with garden mould from a place where the weed species under test had not grown in the memory of man. For comparison 100 seeds of the same original sample—which was, in the interval, stored dry in the rooms of the State Seed Testing Station—were sown each year in a similar way as the above-mentioned. The main results of the first series of experiments of this kind are to be found in Table 3 (see page 135).

In the experiments mentioned in this table, seeds were buried at 30 cm. only. As it is of considerable interest to see how the seed retains its germinating capacity at those depths of the soil which are generally cultivated,

and if the vitality of the seed is different at different depths, experiments were commenced in 1903, similar in principle to those mentioned above, except that portions of 100 seeds of every species were buried at depths of 8, 20 and 30 cm. A portion from each depth was examined every spring together with a sample stored under dry conditions at the seed testing station. The main results are recorded in Table 4 (*see* p. 136).

The rather considerable variations in the germinating capacity of the same sample year by year are probably due to the comparatively small number of seeds (100) annually tested. In some cases earthworms and other animals had bored through the soil in the flower-pots; the results obtained are therefore not quite reliable. The conditions of germination were, further, not quite equal in the various years on account of the different atmospheric conditions.

As might be expected, all the species examined retained their germinating capacity most poorly at a depth of 8 cm., where the supply of oxygen is largest and where the conditions of temperature and moisture are most variable. Seed of *Daucus carota* and *Cirsium arvense* was only buried 20 cm. deep. Besides the species mentioned in the table, seeds of *Secale cereale*, *Avena sativa*, *Avena elatior*, *Lolium perenne* and *Agrostemma githago* were investigated in the same way. Except a few seeds of *Avena elatior* and *Lolium perenne*, all the seeds buried of these species died in the first winter.

The crop seeds, as a rule, retained their germinating capacity less in the soil than the weed seeds. Even the oil-charged seed of *Brassica campestris rapifera*, when lying in the soil, retained its germinating power much less than the nearly related *Sinapis arvensis*.

VI.—*How many weed seeds are contained in forage grain before and after grinding, imported forage grain, chaffs, cleanings, etc.?*

During 1907, 37 samples of cereal seed for forage purposes were tested for content of weed seeds, before as well as after grinding. It became apparent that the common supposition that the weed seeds are crushed and made harmless by the grinding of the cereal seed, is by no means correct. The samples tested contained on an average 16,400 weed seeds per kg. before grinding, and after this 9,300 uninjured weed seeds per kg. Only a little more than one-third of the weed seeds were thus crushed in the mill. The samples contained 54 species of weed seeds altogether. As might be expected, mainly the species with small and hard seeds were found in the cereal seed after its treatment in the mill (*see* Table 5 on p. 137).

Other investigations with barley, which is imported into Denmark from the countries along the Black Sea, are also mentioned, which show that large quantities of weed seeds are frequently contained in this imported forage grain; in one case a cleaning of barley sold for forage purposes at almost the same price as that of pure barley contained 55.8 per cent. weed seeds, in another, 41 per cent.

It is also mentioned in the Report that the amount of weed seed in cleanings and chaff is so great that it is necessary, when using such residual products, to take measures in order to prevent the spreading of weed seeds contained in the said products on the field.

VII.—*How does weed seed that has passed through the digestive system of the domestic animals germinate?*

On this subject information is given in "Tidsskrift for Landbrugets Planteavl," vol. 8, pp. 33-35, and vol. 12, pp. 51-53 (the reports of the Danish State Seed Testing Station for 1899/1900 and 1903/04).

In the first-mentioned report, O. Rostrup has given particulars of the result of the examination of the manure of a cow which had been fed with seed-bearing plants of ten different species. Of eight of these, stated

below, seeds were found in the manure with the following capacity for germination :—

<i>Solanum nigrum</i>	-	-	52	per cent.
<i>Stellaria media</i>			49	"
<i>Sonchus asper</i>	-	-	27	"
<i>Senecio vulgaris</i>			5	"
<i>Capsella Bursa pastoris</i>	-	-	24	"
<i>Urtica urens</i>	-	-	11	"
<i>Atriplex patula</i>	-	-	8	"
<i>Polygonum aviculare</i>	-	-	35	"

The cow had besides been fed with plants of *Sinapis arvensis* and *Silene inflata*, but seeds of these were, strange to tell, not found in the manure; the seed in question in the fodder was in all probability not fully matured. Besides the above species, 26 others were found in the manure; these were probably in the hay with which the cow was fed.

In a later experiment carried out by the writer ("Tidsskrift for Landbrugets Planteavl," vol. 17, pp. 618-626), a cow was fed with definite quantities of *Plantago lanceolata* and *Matricaria inodora* as well as with forage which did not contain weed seeds. The manure was collected during the following five days, and each day's sample was washed out and tested. The main results of these experiments are recorded in Table 6 (see page 137).

The feeding with weed seeds took place at 7 o'clock in the morning, and the principal part of the weed seeds were found in the manure the next day. Seeds which were two days in passing through the cow had about 20 per cent. lower germinating capacity than had the seed which remained only one day in the intestinal canal.

An experiment with a pig (weighing about 70 kg.) was carried out so that the animal was fed daily with 2.8 kg. of a fodder which contained a great amount of weed seeds. After this feeding had been carried on for some time, the manure for four days in succession was tested. The feeding with the weed-charged fodder was also continued during these days. The manure from each day was investigated separately and the tests gave corresponding results. The average figures for the four days mentioned are stated in Table 7 (see page 138).

Results of a similar experiment in feeding of poultry are stated in Table 8 (see page 138).

The investigations reported in this article show—

(1) That seed for seeding purposes—especially clover and grass seed—contains often rather large quantities of weed seeds.

(2) That cereal seed for forage purposes, and especially chaff and cleanings, often contain considerable amounts of weed seeds.

(3) That the weed seed has, as a rule, a good germinating power; that it frequently germinates slowly during several years, and that many species retain their power of germination for many years, when stored dry as well as when lying in the soil.

(4) That weed seeds are far from destroyed after passing either through the mill or the digestive system of domestic animals.

In recent years, experiments have been carried out at the Danish State Seed Testing Station in order to throw some light upon how the weed seed retains its germinating capacity in the manure heap. These investigations are still unfinished. Mention should, nevertheless, be made of the fact that the weed seeds in the manure heap are able partly to retain their germinating capacity when lying in the loose top layer, whereas the species tested seem to be destroyed in a short time when lying in those layers of a well-tended manure heap where the manure is firmly pressed together, so that it retains its moisture and becomes heated.

Duration of Vitality and Germinating Capacity of Seeds of Indigenous Plants.

Lebens- und Keimfähigkeit von Samen wildwachsender Pflanzen.

List. I.—All or mostly all of the seeds germinated at once or soon after they had been harvested.

Liste I.—Alle oder die meisten Samen keimten gerade oder kurz nach der Ernte.

Seed species.	Germinating capacity.	Seed species.	Germinating capacity.
Samenart.	Keimfähig-keit.	Samenart.	Keimfähig-keit.
	%		%
<i>Lolium Linicola</i> Sonder	94	<i>Trifolium pratense</i> L.	97
<i>Phleum pratense</i> L.	66	<i>Epilobium montanum</i> L.	97
<i>Phleum Boehmeri</i> Wib.	84	<i>Hedera Helix</i> L.	100
<i>Avena pubescens</i> L.	90	<i>Pastinaca sativa</i> L.	64
<i>Poa nemoralis</i> L.	65	<i>Cuscuta Epilinum</i> Weihe	68
<i>Poa trivialis</i> L.	66	<i>Veronica agrestis</i> L.	100
<i>Poa pratensis</i> L.	72	<i>Veronica Anagallis</i> L.	96
<i>Festuca littorea</i> Wahlenb.	80	<i>Melampyrum cristatum</i> L.	94
<i>Luzula campestris</i> (L.) D. C.	95	<i>Plantago lanceolata</i> L.	99
<i>Luzula multiflora</i> (Ehrh.) Hoffm.	99	<i>Plantago Coronopus</i> L.	27
<i>Rumex nemorosus</i> Schrad.	51	<i>Myosotis arvensis</i> (L.) Hill.	100
<i>Rumex Acetosa</i> L.	99	<i>Scabiosa suaveolens</i> Desf.	85
<i>Cerastium glomeratum</i> Thuill.	93	<i>Lactuca muralis</i> (L.) Lessing	96
<i>Gypsophila Vaccaria</i> L.	48	<i>Taraxacum Dens leonis</i> Desf.	100
<i>Silene dichotoma</i> Ehrh.	99	<i>Crepis biennis</i> L.	98
<i>Lychnis Viscaria</i> L.	100	<i>Pieris hieracioides</i> L.	93
<i>Agrostemma Githago</i> L.	98	<i>Centaurea jacea</i> L.	82
<i>Arabis hirsuta</i> (L.) Scop.	65	<i>Carduus acanthoides</i> L.	82
<i>Cochlearia danica</i> L.	97	<i>Carduus nutans</i> L.	67
<i>Hypericum quadrangulum</i> L.	100	<i>Tussilago Farfara</i> L.	75
<i>Geranium pratense</i> L.	100	<i>Erigeron canadensis</i> L.	100
<i>Saxifraga granulata</i> L.	98	<i>Bellis perennis</i> L.	97
		<i>Arnica montana</i> L.	94
		<i>Senecio silvaticus</i> L.	99

List II.—The seeds began to germinate at once or soon after they had been harvested and continued without considerable intermissions, some during a few, others during several months.

Liste II.—Die Samen fingen gerade oder kurz nach der Ernte an zu keimen und keimten ohne merkbare Unterbrechungen in wenigen oder mehreren Monaten.

Seed species.	Germinating capacity.	Seed species.	Germinating capacity.
Samenart.	Keimfähig-keit.	Samenart.	Keimfähig-keit.
	%		%
<i>Briza media</i> L.	35	<i>Papaver somniferum</i> L.	92
<i>Festuca gigantea</i> (L.) Vill.	94	<i>Turritis glabra</i> L.	99
<i>Lemna gibba</i> L.	76	<i>Sisymbrium Loeselii</i> L.	100
<i>Lepigonum rubrum</i> (L.)	92	<i>Brachyolobus paluster</i> Leyss.	98
<i>Lepigonum salinum</i> (Presl.)	99	<i>Lepidium rudemale</i> L.	100
<i>Lepigonum marinum</i> Wohlb.	100	<i>Malva silvestris</i> L.	95
<i>Stellaria Holostea</i> L.	90	<i>Trifolium repens</i> L.	94
<i>Stellaria uliginosa</i> Murr.	100	<i>Lathyrus sphaericus</i> Retz.	93
<i>Dianthus superbus</i> L.	100	<i>Lycium barbarum</i> L.	87
<i>Silene maritima</i> With.	98	<i>Antirrhinum Orontium</i> L.	100
<i>Thalictrum minus</i> L.	96	<i>Linaria minor</i> (L.) Desf.	96
<i>Myosotis minimus</i> L.	97	<i>Valerianella Auricula</i> Poll.	96
<i>Ranunculus sceleratus</i> L.	100	<i>Jasione montana</i> L.	93

Seed species.	Germinating capacity.
Samenart.	Keimfähigkeit.
	%
<i>Lactuca Scariola</i> L. -	100
<i>Sonchus arvensis</i> L. -	99
<i>Hypochaeris glabra</i> L.	85
<i>Centaurea Cyanus</i> L.	83
<i>Cirsium oleraceum</i> L.	
(Scoop.) -	93

Seed species.	Germinating capacity.
Samenart.	Keimfähigkeit.
	%
<i>Achillea Millefolium</i> L. -	98
<i>Anthemis Cotula</i> L. -	99
<i>Chrysanthemum Leucanthemum</i> L. -	89
<i>Senecio aquaticus</i> Huds. -	56

List III.—Some seeds germinated at once after they had been harvested, the remainder in the following spring.

Liste III.—Ein Teil der Samen keimten gleich nach der Ernte, der Rest in dem folgenden Frühjahr.

Seed species.	Germinating capacity.
Samenart.	Keimfähigkeit.
	%
<i>Nardus strictus</i> L. -	72
<i>Agropyrum caninum</i> (L.) R. et S. -	90
<i>Digraphis arundinacea</i> (L.) Trin. -	95
<i>Milium effusum</i> L. -	100
<i>Airopsis præcox</i> Fr. -	98
<i>Airopsis caryophyllæa</i> Fr. -	100
<i>Glyceria fluitans</i> (L.) R. Br. -	80
<i>Festuca pratensis</i> Huds. -	97
<i>Dactylis glomerata</i> L. -	100
<i>Ruppia rostellata</i> Koch. -	44
<i>Triglochin palustre</i> L. -	89
<i>Rumex domesticus</i> Hartm. -	100
<i>Lepigonum marinum</i> (L.) -	100
<i>Sagina apetala</i> L. -	82
<i>Cerastium strigosum</i> Fr. -	86
<i>Silene conoidea</i> L. -	84
<i>Lychnis Flos cuculi</i> L. -	100
<i>Ranunculus fluitans</i> Lam. -	88
<i>Barbarea vulgaris</i> R. Br. -	98
<i>Potentilla argentea</i> L. -	93
<i>Spiraea filipendula</i> L. -	67
<i>Medicago falcata</i> L. -	96
<i>Epilobium pubescens</i> Roth. -	97

Seed species.	Germinating capacity.
Samenart.	Keimfähigkeit.
	%
<i>Epilobium palustre</i> L. -	99
<i>Daucus carota</i> L. -	100
<i>Samolus Valerandi</i> L. -	100
<i>Solanum Dulcamara</i> L. -	99
<i>Veronica arvensis</i> L. -	97
<i>Veronica officinalis</i> L. -	100
<i>Plantago media</i> L. -	85
<i>Clinopodium vulgare</i> L. -	85
<i>Brunella vulgaris</i> L. -	31
<i>Valeriana officinalis</i> L. -	97
<i>Valerianella olitoria</i> (L.) Poll. -	79
<i>Scabiosa arvensis</i> Poll. -	83
<i>Campanula rotundifolia</i> L. -	96
<i>Hieracium vulgatum</i> Fr. -	94
<i>Hieracium umbellatum</i> L. -	93
<i>Centaurea Scabiosa</i> L. -	94
<i>Carduus crispus</i> L. -	94
<i>Solidago Virga aurea</i> L. -	93
<i>Achillea Millefolium</i> L. -	100
<i>Matricaria inodora</i> L. -	93
<i>Chrysanthemum segetum</i> L. -	73
<i>Chrysanthemum segetum</i> L. -	25

List IV.—All or mostly all of the seeds germinated in the first spring.

Liste IV.—Alle oder fast alle Samen keimten in dem ersten Frühjahr.

Seed species.	Germinating capacity.
Samenart.	Keimfähigkeit.
	%
<i>Elymus arenarius</i> L. -	98
<i>Scirpus maritimus</i> L. -	98
<i>Scirpus silvaticus</i> L. -	100
<i>Carex incurva</i> Lightf. -	76
<i>Carex leporina</i> L. -	95
<i>Carex leporina</i> L. -	98
<i>Carex paniculata</i> L. -	39
<i>Carex vulpina</i> L. -	98

Seed species.	Germinating capacity.
Samenart.	Keimfähigkeit.
	%
<i>Carex muricata</i> L. -	88
<i>Carex canescens</i> L. -	96
<i>Carex remota</i> L. -	95
<i>Carex remota</i> L. -	57
<i>Carex pallescens</i> L. -	93
<i>Carex flava</i> L. -	98
<i>Carex Hornschuchiana</i> Hoppe -	77

Seed species.	Germinating capacity.	Seed species.	Germinating capacity.
Samenart.	Keimfähigkeit.	Samenart.	Keimfähigkeit.
	%		%
<i>Carex Pseudocyperus</i> L. -	50	<i>Heracleum Sphondylium</i> L. -	90
<i>Typha latifolia</i> L. -	24	<i>Glaux maritima</i> L. -	95
<i>Calla palustris</i> L. -	78	<i>Anagallis arvensis</i> L. -	95
<i>Triglochin maritimum</i> L. -	98	<i>Lysimachia thyrsiflora</i> L. -	96
<i>Juncus glaucus</i> Ehrh. -	100	<i>Primula officinalis</i> (L.) Hill. -	98
<i>Juncus compressus</i> Jacq. -	99	<i>Hottonia palustris</i> L. -	96
<i>Luzula albida</i> D.C. -	99	<i>Solanum Dulcamara</i> L. -	98
<i>Alnus glutinosa</i> Gärt. -	31	<i>Solanum Dulcamara</i> L. -	58
<i>Urtica dioica</i> L. -	81	<i>Solanum nigrum</i> L. -	99
<i>Rumex Hydrolapathum</i> -		<i>Physalis Alkekengi</i> L. -	92
Huds. -	86	<i>Verbascum thapsiforme</i> -	
<i>Rumex maritimus</i> L. -	99	Schrad. -	99
<i>Polygonum lapathifolium</i> L. -	99	<i>Veronica Beccabunga</i> L. -	96
<i>Polygonum Hydropiper</i> L. -	99	<i>Serophularia nodosa</i> L. -	95
<i>Corrigiola littoralis</i> L. -	92	<i>Linaria vulgaris</i> Mill. -	91
<i>Ohenopodia maritima</i> Moq. Tand. -	87	<i>Plantago major</i> L. -	100
<i>Chenopodium album</i> L. -	86	<i>Verbena officinalis</i> L. -	18
<i>Chenopodium rubrum</i> L. -	100	<i>Lycopus europaeus</i> L. -	37
<i>Atriplex hastata</i> L. -	76	<i>Lycopus europaeus</i> L. -	91
<i>Ranunculus acer</i> L. -	96	<i>Mentha aquatica</i> L. -	95
<i>Erysimum cheiranthoides</i> L. -	99	<i>Thymus Chamaedrys</i> Fr. -	19
<i>Viola canina</i> L. -	62	<i>Thymus Chamaedrys</i> Fr. -	88
<i>Oxalis stricta</i> L. -	94	<i>Ajuga reptans</i> L. -	93
<i>Linum catharticum</i> L. -	99	<i>Ligustrum vulgare</i> L. -	92
<i>Impatiens Noli tangere</i> L. -	84	<i>Scabiosa succisa</i> L. -	78
<i>Impatiens parviflora</i> D.C. -	98	<i>Campanula Trachelium</i> L. -	51
<i>Acer Pseudoplatanus</i> L. -	95	<i>Campanula latifolia</i> L. -	78
<i>Acer platanoides</i> L. -	74	<i>Crepis tectorum</i> L. -	89
<i>Aesculus Hippocastanum</i> L. -	72	<i>Aracium paludosum</i> Monnier -	17
<i>Sedum Telephium</i> L. -	95	<i>Hieracium</i> sp. -	89
<i>Parnassia palustris</i> L. -	86	<i>Leontodon autumnalis</i> L. -	99
<i>Sorbus fennica</i> (Kahn.) Fr. -	16	<i>Tragopogon pratensis</i> L. -	100
<i>Rubus caesius</i> L. -	79	<i>Centaurea jacea</i> L. -	80
<i>Potentilla anserina</i> L. -	90	<i>Serratula tinctoria</i> L. -	88
<i>Geum urbanum</i> L. -	99	<i>Lappa minor</i> (Schk.) -	88
<i>Spiraea Ulmaria</i> L. -	95	<i>Cirsium oleraceum</i> (L.) Scop. -	84
<i>Lythrum Salicaria</i> L. -	94	<i>Cirsium arvense</i> (L.) Scop. -	88
<i>Sanicula europaea</i> L. -	95	<i>Cirsium heterophyllum</i> (L.) All. -	70
<i>Pimpinella Saxifraga</i> L. -	91	<i>Bidens tripartitus</i> L. -	98
<i>Sium latifolium</i> L. -	90	<i>Bidens cernuus</i> L. -	65
<i>Selinum palustre</i> L. -	93	<i>Artemisia vulgaris</i> L. -	95
<i>Selinum lineare</i> Schum. -	100	<i>Matricaria discoidea</i> D.C. -	98

List V.—The seeds germinated in the first and second springs.

Liste V.—Die Samen keimten in dem ersten und zweiten Frühjahr.

Seed species.	Germinating capacity.	Seed species.	Germinating capacity.
Samenart.	Keimfähigkeit.	Samenart.	Keimfähigkeit.
	%		%
<i>Elymus arenarius</i> L. -	97	<i>Chenopodium polyspermum</i> L. -	100
<i>Carex silvatica</i> Huds. -	98	<i>Nasturtium Amphibium</i> L. -	98
<i>Corylus Avellana</i> L. -	35	<i>Reseda luteola</i> L. -	93
<i>Carpinus Betulus</i> L. -	71	<i>Empetrum nigrum</i> L. -	29
<i>Helianthus peplodes</i> L. -	93	<i>Euonymus europaea</i> L. -	16
<i>Arenaria triervia</i> L. -	92	<i>Alchemilla vulgaris</i> L. -	52
<i>Stellaria graminea</i> L. -	76	<i>Bryonia alba</i> L. -	93
<i>Amarantus retroflexus</i> L. -	100		

Seed species. Samenart.	Germinating capacity. Keimfähig- keit.	Seed species. Samenart.	Germinating capacity. Keimfähig- keit.
	%		%
<i>Circaea lutetiana</i> L. -	100	<i>Linaria vulgaris</i> Mill. -	94
<i>Cornus sanguinea</i> L. -	98	<i>Rhinanthus Crista galli</i> L. -	87
<i>Cicuta virosa</i> L. -	95	<i>Odontites rubra</i> Gil. -	99
<i>Cicuta virosa</i> L. -	97	<i>Utricularia vulgaris</i> L. -	57
<i>Aegopodium Podagraria</i> L. -	72	<i>Scutellaria galericulata</i> L. -	75
<i>Sium angustifolium</i> L. -	96	<i>Stachys silvaticus</i> L. -	97
<i>Angelica silvestris</i> L. -	98	<i>Leonurus Cardiacus</i> L. -	68
<i>Torilis Anthriscus</i> (L.) Gmel. -	99	<i>Lampsana communis</i> L. -	98
<i>Lysimachia vulgaris</i> L. -	71	<i>Eupatorium cannabinum</i> L. -	94

List VI.—The seeds germinated during several autumns in succession.

Liste VI.—Die Samen keimten in mehreren nach einander folgenden Herbsten.

Seed species. Samenart.	Germinating capacity. Keimfähig- keit.	Seed species. Samenart.	Germinating capacity. Keimfähig- keit.
	%		%
<i>Airopis praecox</i> Fr. -	87	<i>Alchemilla arvensis</i> L. -	89
<i>Arenaria serpyllifolia</i> L. -	76	<i>Scandix Pecten Veneris</i> L. -	59
<i>Papaver dubium</i> L. -	69	<i>Veronica hederifolia</i> L. -	90
<i>Papaver Rhoeas</i> L. -	89	<i>Melampyrum arvense</i> L. -	97
<i>Teesdalia nudicaulis</i> (L.) -		<i>Lithospermum arvense</i> L. -	95
R. Br. -	65		

TABLE 1.

Germination tests of ripe and unripe weed seeds harvested in the autumn 1904.
Keimprüfungen von reifen und unreifen Unkrautssamen, geerntet im Herbst 1904.

Seed species. Samenart.	Degree of Ripeness. Grad der Reife.	Number of years after the harvest. Anzahl Jahre nach der Ernte.													
		0. %	1. %	2. %	3. %	4. %	5. %	6. %	7. %	8. %	9. %	10. %	11. %	12. %	13. %
Bromus secalinus L. -	Unripe†	100	89	94	87	51	30	7	0	—	—	—	—	—	—
	Ripe†	100	97	97	92	93	81	54	12	1	—	—	—	—	—
Polygonum lapathi- folium L.	Unripe	62	49	24	0	—	—	—	—	—	—	—	—	—	—
	Ripe	85	77	55	28	23	18	4	0	—	—	—	—	—	—
Chenopodium album L.	Unripe	61	52	13	11	0	2	—	—	—	—	—	—	—	—
	Ripe	64	57	47	6	0	0	—	—	—	—	—	—	—	—
Silene inflata Sm. -	Unripe	71	75	39	25	21	8	1	—	—	—	—	—	—	—
	Ripe	89	80	62	53	28	12	14	0	—	—	—	—	—	—
Sinapis arvensis L. -	Unripe	76	72	47	11*	34	24	20	9	7	2	—	—	—	—
	Ripe	79	82	75	76	78	77	68	75	51	66	36	40	42	12
Capsella Bursa pastoris L.	Unripe	34	33	6	3*	—	—	—	—	—	—	—	—	—	—
	Ripe	74	65	79	20*	48	31	22	10	2	—	—	—	—	—
Thlaspi arvense L. -	Unripe	70	83	34	0	—	—	—	—	—	—	—	—	—	—
	Ripe	98	97	74	11	6	0	0	—	—	—	—	—	—	—
Plantago major L. -	Unripe	98	96	87	36	1	—	—	—	—	—	—	—	—	—
	Ripe	99	97	100	81	27	0	0	—	—	—	—	—	—	—
Sonchus oleraceus L. -	Unripe	62	50	47	43	61	33	48	35	21	25	1	—	—	—
	Ripe	87	64	53	49	59	56	33	30	19	8	1	—	—	—
Crepis tectorum L. -	Unripe	44	31	19	13	5	2	—	—	—	—	—	—	—	—
	Ripe	94	93	85	77	40	9	0	—	—	—	—	—	—	—
Matricaria inodora L. -	Unripe	67	42	47	44	42	34	33	44	29	3	1	—	—	—
	Ripe	80	56	59	53	58	44	53	49	43	12	7	3	3	0
Lampsana communis L.	Unripe	27	26	8	2	—	—	—	—	—	—	—	—	—	—
	Ripe	31	20	10	1	—	—	—	—	—	—	—	—	—	—

* Destroyed by fungi and worms.

* Zerstört von Pilzen und Würmern.

† Unreif.

† Reif.

TABLE 2.

Results of examinations as to the ability of weed seeds to retain their germinating capacity.

Resultate von Untersuchungen über, wie Unkrautsamen ihre Keimfähigkeit bewahren.

Seed Species. Samenart.	Year Jahr.													
	1. %	2. %	3. %	4. %	5. %	6. %	7. %	8. %	9. %	10. %	11. %	12. %	13. %	14. %
<i>Bromus secalinus</i> L. -	100	99	100	90	96	81	49	5	0	-	-	-	-	-
" -	100	100	99	97	99	82	44	9	7	0	-	-	-	-
<i>Carex rostrata</i> Willh. -	47	10	0	-	-	-	-	-	-	-	-	-	-	-
<i>Rumex crispus</i> L. -	100	98	99	99	97	100	100	98	95	91	74	69	46	18
" -	99	100	98	99	98	96	98	91	81	70	37	0	-	-
" <i>obtusifolius</i> L. -	95	91	96	95	90	95	90	78	65	6	12	0	-	-
<i>Polygonum lapathifolium</i> L. -	86	96	79	48	23	7	0	0	-	-	-	-	-	-
" <i>Persicaria</i> L. -	78	63	50	13	7	2	0	-	-	-	-	-	-	-
" <i>Convolvulus</i> L. -	86	82	63	54	31	61	32	30	15	-	-	-	-	-
<i>Silene inflata</i> Sm. -	98	98	97	94	90	80	78	60	48	31	10	7	2	0
<i>Viscaria viscosa</i> (Gil.) -	100	96	96	75	57	27	5	0	-	-	-	-	-	-
<i>Agrostemma Githago</i> L. -	98	99	99	98	88	35	0	-	-	-	-	-	-	-
<i>Chenopodium album</i> L. -	53	-	49	17	2	4	4	2	0	-	-	-	-	-
<i>Sinapis arvensis</i> L. -	82	83	90	92	86	69	74	59	70	83	35	34	44	10
<i>Capsella Bursa pastoris</i> L. -	65	52	69	24	19	3	0	-	-	-	-	-	-	-
<i>Thlaspi arvense</i> L. -	94	96	38	1	0	0	-	-	-	-	-	-	-	-
<i>Alyssum calycinum</i> L. -	99	45	6	2	0	-	-	-	-	-	-	-	-	-
<i>Chelidonium majus</i> L. -	99	95	36	0	-	-	-	-	-	-	-	-	-	-
<i>Pastinaca sativa</i> L. -	87	24	0	-	-	-	-	-	-	-	-	-	-	-
<i>Solanum nigrum</i> L. -	99	100	96	98	91	73	27	2	0	-	-	-	-	-
<i>Echium vulgare</i> L. -	83	83	59	5	0	0	0	-	-	-	-	-	-	-
<i>Plantago lanceolata</i> L. -	99	98	86	90	81	73	65	50	38	11	8	4	0	-
" -	99	100	100	100	99	83	36	9	6	1	-	-	-	-
<i>Lampsana communis</i> L. -	94	99	99	85	30	0	-	-	-	-	-	-	-	-
<i>Taraxacum vulgare</i> Lam. -	100	17	0	-	-	-	-	-	-	-	-	-	-	-
<i>Centaurea Cyanus</i> L. -	84	90	71	78	61	53	25	29	12	2	-	-	-	-
<i>Tussilago Farfara</i> L. -	75	0	-	-	-	-	-	-	-	-	-	-	-	-
<i>Matricaria inodora</i> L. -	88	88	98	88	84	81	72	49	38	25	4	2	0	-

TABLE 3.

Results of germination tests of seed samples stored dry and of corresponding seed samples buried 30 cm. under the surface of the earth. Harvested and buried in 1899.

Resultate von Keimversuchen mit trocken aufbewahrten Samenproben und entsprechenden Samenproben 30 cm. unter der Erdoberfläche eingegraben. Geerntet und eingegraben im Jahre 1899.

The seeds dug up and placed to germinate. Die Samen aufgegraben und zum Keimen gelegt.	Plantago lanceolata L.		Sinapis arvensis L.	
	Seeds stored dry. Samen trocken aufbewahrt. Germinating capacity. Keimfähigkeit.	Seeds which have been buried in the soil. Samen, die in der Erde eingegraben gewesen sind. Germinating capacity. Keimfähigkeit.	Seeds stored dry. Samen trocken aufbewahrt. Germinating capacity. Keimfähigkeit.	Seeds which have been buried in the soil. Samen, die in der Erde eingegraben gewesen sind. Germinating capacity. Keimfähigkeit.
Year. Jahr.	%	%	%	%
1900	98	35	82	77
1901	94	(13)*	91	81
1902	97	40	89	86
1903	94	40	66	64
1904	87	31	50	81
1905	73	23	58	66
1906	42	21	61	94
1907	33	32	54	85
1908	22	30	33	80
1909	0	8	24	87
1910	0	2	21	87
1911	—	—	11	78
1912	—	—	8	70
1913	—	—	5	72
1914	—	—	—	75
1915	—	—	—	37
1916	—	—	—	30
1917	—	—	—	17

* See the last footnote on page 136. Siehe die Fussnote unterst auf Seite 136.

TABLE 4.

Results of germination tests of seed samples stored at the Danish State Seed Testing Station (= S. in the Table) and corresponding seed samples buried in 1904 (8, 20 and 30 cm. respectively under the surface of the earth.) Dug up and placed to germinate in April or May.

Resultate von Keimprüfungen von Samenproben, an der Dänischen Staatsamenkontrolle aufbewahrt (= S. in der Tabelle), und entsprechenden Samenproben im Jahre 1904 eingegraben, beziehungsweise 8, 20 und 30 cm. unter der Erdoberfläche. Aufgegraben und zum Keimen im April oder Mai gelegt.

Seed species. Samenart.	Buried cm. Cm. eingegraben.	Germinating capacity.						Seed species. Samenart.	Buried cm. Cm. eingegraben.	Germinating capacity.					
		Keimfähigkeit.								Keimfähigkeit.					
		1905.	1906.	1907.	1908.	1909.	1910.			1905.	1906.	1907.	1908.	1909.	1910.
		Number of growths per 100 clusters. Anzahl Keime von 100 Knäulen.								% %					
Beta vulgaris	S.	87	120	(43)	90	75	—	Centaurea Cyanus	S.	69	*	*	—	—	—
	8	17	1	2	0	1	—		8	20	10	14	—	—	—
	20	37	7	3	4	2	—		20	14	12	12	—	—	—
	30	45	36	18	8	2	—		30	11	13	10	—	—	—
Brassica campestris rapifera	S.	90	85	71	65	65	31	Matricaria inodora	S.	42	(13)	39	(3)	28	28
	8	13	2	4	2	2	—		8	40	(11)	71	52	20	—
	20	20	3	9	5	3	2		20	60	(20)	48	40	—	8
	30	15	20	10	14	11	—		30	55	50	41	14	28	—
Trifolium pratense	S.	88	59	41	32	14	16	Silene inflata	S.	100	81	83	20	6	1
	8	63	2	1	1	1	—		8	52	26	*	21	16	—
	20	47	5	16	11	9	9		20	91	52	38	37	49	14
	30	63	48	18	37	37	—		30	88	65	61	36	12	—
Trifolium repens	S.	77	64	35	13	18	—	Rumex crispus	S.	—	—	92	50	33	34
	8	23	2	0	4	0	—		8	—	—	64	42	14	—
	20	19	5	3	6	1	—		20	—	86	74	89	59	3
	30	15	9	3	2	1	—		30	—	91	70	79	63	—
Lotus corniculatus	S.	59	52	15	18	13	19	Plantago lanceolata	S.	73	75	68	62	31	—
	8	42	0	0	2	0	—		8	73	8	8	6	5	—
	20	32	13	16	10	3	10		20	59	43	43	(1)	—	—
	30	47	30	21	20	13	—		30	75	56	(1)	63	60	—
Medicago sativa	S.	74	—	—	—	—	—	Sinapis arvensis	S.	94	82	75	57	50	68
	8	8	—	—	—	—	—		8	52	37	(1)	15	30	—
	20	5	—	—	—	—	—		20	69	38	57	55	51	66
	30	7	—	—	—	—	—		30	74	(40)	75	(1)	59	—
Dactylis glomerata	S.	58	20	—	—	—	—	Daucus Carota	Not buried before in 1907†						
	8	54	1	—	—	—	—		S.	Not buried before in 1907†					
	20	56	5	—	—	—	—		20	Not buried before in 1907†					
	30	50	10	—	—	—	—		S.	Not buried before in 1907†					
Cirsium arvense															

* A mischance happened to the sample.

* Ein Unfall mit der Probe geschehen.

† Nicht bevor 1907 eingegraben.

The results in parentheses are such which differ much from those obtained in the former and the following year (see page 128).

Die eingeklammerten Resultate sind solche, die von denen in dem vorigen und dem nachfolgenden Jahr erzielten sehr abweichen (siehe Seite 128).

TABLE 5.

Account of the occurrence of the various seed species in 36 samples of cereal seed before and after grinding.

Übersicht über das Vorkommen verschiedener Unkrautsamen in 36 Getreideproben vor und nach dem Mahlen.

Seed species. Samenart.	Occurred in number of samples. In Anzahl Proben vorgekommen.	
	Before the grinding. Vor dem Mahlen.	After the grinding. Nach dem Mahlen
Chenopodium sp. - -	27	24
Polygonum lapathifolium L. -	26	23
Cerastium sp. - -	19	13
Stellaria media (L.) - -	15	10
Bromus secalinus L. -	23	11
Agrostis Spica venti L. -	18	11
Myosotis sp. - -	18	10
Rumex Acetosella L. -	16	8
Polygonum Convolvulus L. -	16	0
Veronica sp. - -	15	9
Agrostemma Githago L. -	13	1
Scleranthus sp. - -	11	4
Claviceps purpurea - -	11	1
Capsella Bursa pastoris (L.) -	10	6
Polygonum aviculare L. - -	10	4

TABLE 6.

How many seeds are able to pass uninjured through the digestive system of a cow?
Wie viele Samen können unbeschädigt durch den Darmkanal einer Kuh passieren?

Seed species. Samenart.	The Forage contained. Das Futter enthielt.			The Manure contained. Der Dünger enthielt.			Per 100 seeds in the forage, the manure contained. Pro 100 Samen in dem Futter enthielt der Dünger	Per 100 germinable seeds in the forage, the manure contained. Pro 100 keimfähiger Samen in dem Futter enthielt der Dünger
	Number of seeds. Anzahl von Samen.	Germinating capacity. Keimfähigkeit. %	Number of germinable seeds. Anzahl keimfähiger Samen.	Number of seeds. Anzahl von Samen.	Germinating capacity. Keimfähigkeit. %	Number of germinable seeds. Anzahl keimfähiger Samen.		
Plantago lanceolata L.	100,000	89	89,000	85,500	61	52,040	86	58
Matricaria inodora L.	600,000	94	564,000	198,000	76	149,840	33	27

TABLE 7.

How many seeds are able to pass uninjured through the digestive system of a pig ?
Wie viele Samen können unbeschädigt durch den Darmkanal eines Schweins passieren ?

Seed species. Samenart.	The Forage contained. Das Futter enthielt.			The Manure contained. Der Dünger enthielt.			Per 100 seeds in the forage, the manure contained. Pro 100 Samen in dem Futter enthielt der Dünger.	Per 100 germinable seeds in the forage, the manure contained. Pro 100 keimfähiger Samen in dem Futter enthielt der Dünger.
	Number of weed seeds per day. Anzahl von Unkraut-samen pro Tag.	Germinating capacity. Keimfähigkeit %	Number of germinable seeds per day. Anzahl keimfähiger Samen pro Tag.	Number of weed seeds per day. Anzahl von Unkraut-samen pro Tag.	Germinating capacity. Keimfähigkeit %	Number of germinable seeds per day. Anzahl keimfähiger Samen pro Tag.		
Cerastium sp.	787,000	77	606,000	433,000	18	78,000	55	13
Spergula sp.	267,000	27	72,000	252,000	2	6,000	94	8
Airopsis sp.	56,000	73	41,000	41,000	9	4,000	73	10
Myosotis sp.	29,000	66	19,000	17,000	0	0	59	0
Rumex Acetosella L.	29,000	47	14,000	24,000	23	5,000	83	40
Chenopodium sp.	27,000	41	11,000	27,000	27	7,000	100	64
Veronica sp.	26,000	86	22,000	15,000	0	0	58	0
6 other species (andere arten)	19,000	—	—	10,000	—	—	53	—

TABLE 8.

How many seeds are able to pass uninjured through the digestive system of a hen ?
Wie viele Samen können unbeschädigt durch den Darmkanal eines Huhns passieren ?

Seed species. [Samenart.	The Forage contained. Das Futter enthielt.			The Manure contained. Der Dünger enthielt.			Per 100 seeds in the forage, the manure contained. Pro 100 Samen in dem Futter enthielt der Dünger.	Per 100 germinable seeds in the forage, the manure contained. Pro 100 keimfähiger Samen in dem Futter enthielt der Dünger.
	Number of weed seeds per day. Anzahl von Unkraut-samen pro Tag.	Germinating capacity. Keimfähigkeit %	Number of germinable seeds per day. Anzahl keimfähiger Samen pro Tag.	Number of weed seeds per day. Anzahl von Unkraut-samen pro Tag.	Germinating capacity. Keimfähigkeit %	Number of germinable seeds per day. Anzahl keimfähiger Samen pro Tag.		
Cerastium sp.	45,100	77	34,800	1,241	55	684	3	2
Spergula sp.	15,400	27	4,160	513	9	46	3	1
Airopsis sp.	3,200	73	2,340	118	The germinating capacity not tested.*		4	—
Myosotis sp.	1,665	66	1,100	194			12	—
Rumex Acetosella L.	1,665	47	782	309			19	15
Chenopodium sp.	1,535	41	636	273			18	15
Veronica sp.	1,475	86	1,265	453	12	54	31	4
6 other species (andere arten)	972	—	—	21	—	—	2	—

* Die Keimfähigkeit nicht untersucht.

The Longevity of Seeds.

By

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One of the most absorbing chapters in the science of seeds is that which relates to the study of the life within the individual grain of seed.

Strange indeed is the phenomenon manifested in this grain of seed, in this tiny structure almost entirely isolated from the outside world and endowed with all the characteristics of a living being reduced to the smallest volume, frequently indeed to a few cells, and capable of persisting in this condition, apparently devoid of life, until, under favourable circumstances, the cells once more revive and produce the parent-plant again, strong and rejuvenated, with all its constituent organs intact.

It is marvellous, in our eyes, to observe how, for instance, the life of the orchid-plant in all its glory, the life of the tree of mighty growth, becomes for a while concentrated in a minute seed—a seed, in the case of the orchid, so small as to be scarcely more than a grain of dust—and how this life can endure in this state for many years.

Such a grain of seed confines within itself the greatest mysteries of Biology, the mystery of life and death, the mysteries of fertilisation and of hereditary transmission. For the study of all these problems the grain of seed constitutes a most favourable object, ever present in endless quantities, patient under treatment and easy of manipulation; and it is strange that, in spite of the wealth of literature on the subject, the numerous questions connected with the cause of life and death, and some kindred questions, such as that of suspended life, the so-called “*vie latente*,” and that of the decay of life force, remain still almost entirely unsolved.

Truly, a world for thought lies concealed in the fact, most simple in itself, that I, with a slight exertion of force, simply by crushing or by otherwise injuring the grain of seed, can destroy all its life-functions, can in a moment annihilate, by a relatively insignificant effort, immense possibilities of life, and can, in short, transform a living being into an inert substance.

Within the scope of a short lecture it is impossible even to enumerate all the problems involved in the life confined in the grain of seed. I beg you, therefore, to permit me to discuss but one of these problems, and that also only in brief outline, namely, the question of the suspended life of the seed. How does this state arise, and how long can it endure? How does life subsist in this state, and in what manner, by what cause, does the latent life or apparent death lapse into actual death?

Old seeds are the objects presented to us for this kind of study, and especially those seeds of which the age is accurately known.

In this connection, it appears most remarkable how relatively insignificant is the stock of reliable old material at our disposal. The historic and prehistoric material derived from excavations, especially of tombs, the museums and old herbaria still furnish us with our main supply, but, unfortunately, in the case of such seeds, it is not always possible to determine their age with precision, nor yet, in many cases, even their origin.

Errors are of frequent occurrence. I will not here repeat the oft-told tales of mummy-wheat, and of the grain discovered by Desmoulins,* alleged to have germinated after the lapse of thirteen or sixteen centuries: these data have, for the most part, been critically discussed in *Paul Becquerel's* admirable work, “*Recherches sur la vie latente des graines*.”†

* Actes de la Soc. Linn. Bordeaux, 1835 : 65.

† Annales des Sciences Nat., Sér V., 1907 : 249-311.

I will mention here only one case in the experience of our own Hungarian station, which sometimes has the task of determining seeds presumed to be of ancient date.

In the year 1911, some old seeds were discovered in jars, in the so-called "tumuli" at Donnerskirchen in West Hungary. In some of these seeds, which were supposed by the finders to be millet, every organic ingredient had perished, and there remained only the inorganic skeleton, from which we succeeded in determining the material to be the relics of barley-seed. Along with these seeds we received the seeds of a *Convolvulus*—likewise supposed to be antique—which resembled in form the seeds of the *Convolvulus arvensis*, but were smaller and of a brighter colour. We were somewhat in doubt as to whether we should not assign them as belonging to the *Ipomaea*, when, in preparing cross-sections, we were struck with the soft consistency of the interior substance. Curious to see the result, we laid the seed in the germinating apparatus where, after some time had elapsed, they yielded germs from which we succeeded in rearing the typical *Convolvulus arvensis*. Subsequently there came to our hands the article of *Larionow**, in which it is mentioned that, in middle Asia, the *Convolvulus arvensis* produces small, pear-shaped seeds of a yellowish-grey colour and smoother surface. Our seeds, therefore, were obviously *Convolvulus* seeds of recent date, mixed by chance with the antique seed, and belonging most probably to the Eastern race of this species.

With the establishment of seed-control stations in all civilized states, it becomes the task of such institutions to procure and preserve the material required for future investigations.

Here I should intercalate the proposal that no station should omit to provide such objects in its collection, with precise details relating to the place and especially to the date of the discovery of the seed, and to record, as far as possible, the method employed for its conservation. The stations should also make it their task to add to their collection all authentic antique material obtainable and preserve it systematically.

I request the Congress to clothe this proposal in the form of a Resolution and duly to communicate it to all existing stations. In this manner much valuable material may be gathered and saved for the benefit of future research.

I remark, in passing, that old material would also furnish us with much information relating to the distribution of weeds.

The practical seed-controller is only interested to a small extent in the above questions, and notably in the question as to how long the full germinating capacity of the seeds of cultivated plants and of weeds will last, and as to the degree to which this capacity becomes impaired with the lapse of time.

Numerous data are accessible, but many of them are contradictory. Would it not be desirable to collect these data, to complete what is lacking, to examine the discrepancies critically, and to place the results as a synoptical whole at the disposal of the control-stations? Would it not also be desirable to include in the synopsis the results of the different methods of conservation?

It is proved beyond doubt that natural desiccation, and artificial desiccation still more, is one of the most important factors in the conservation of germinating power. This, however, does not hold good for all seeds. There are seeds which, after desiccation, lose their germinating power (*Salix*, *Melampyrum*, &c.), or only germinate again after a considerable time has elapsed.

These, however, are exceptions, with all of which it would be of great interest to get acquainted. In general, desiccation still remains the best method of conservation, and it is truly marvellous—and still inexplicable—what such a desiccated seed is capable of enduring.

* *Annalen der Russischen Samenprüf.* Stat. 1913.

Freezing to 220°, heat up to 122°,* vacuum, exposure through long years to fluids, to alcohol, even to alcohol-sublimate, that is, to what for living cells, is deadly poison—all this a desiccated seed could actually endure without injury, and, according to the theory of *Arrhenius*, *Helmholtz*, or that of *Lord Kelvin*, could survive uninjured the flight from one planet to another.†

But how far can this desiccation proceed without destroying the germinating power? At all events, an upper limit is fixed by the point at which the seed is burnt or charred. At the degree of dryness which the chemists regard as absolute, that is, after desiccation during six days at a temperature of 80°, a sample of wheat still germinated fully 100 per cent. but, on the other hand, it failed to endure a two days' heating at 100° (*Van Tieghem* and *G. Bonnier*:—"Sur la vie latente des graines").‡ Similar results appear under exposure to extreme cold, with the difference that, hitherto, no degree of cold could be applied intense enough to kill the dry seed.

This resistance of the dry seeds to extremes of temperature arises from the behaviour, the reaction, of the protoplasm.

Whereas protoplasm containing water coagulates at a certain degree of heat, and whereas such protoplasm is frozen to death at a certain degree of cold (the degrees in question depending on the chemical composition of the protoplasm), this critical limit of temperature, as a result of continuous slow desiccation, is very considerably raised in the former case and lowered in the latter, as the classical and hitherto unrefuted experiments of *Chevreul* have proved. ("Deshydratation," 1819). De-hydrated albuminoid substances begin to coagulate at a much higher temperature than that at which hydrous albuminoids coagulate.

Chevreul dried albumen slowly at 45°, and when it had lost 90 per cent. of its water, it changed into a yellowish, hard mass; but, on water being added, it again swelled and recovered its original properties.

In this dry state, the albumen has a high power of resistance to the influences of temperature, only the desiccation may not be continued to a degree at which the power of absorbing water is lost and the albumen can no more be restored to the colloid state.

This is the reason why forms of living vegetables are less resistant than such durable forms as seeds, spores and Sclerotia. The same applies also to resistance against chemical influences. Here an important part is played by the permeability of the seed coats. This quality of the seeds involuntarily calls to mind the methods employed by the Indian Joga, Jogin or Fakirs,§ for the purpose of reducing the functions of the body to a minimum, among which methods the most important seems to be the diminution of the water-contents of the tissues. The desiccation of the protoplasm also, after a certain time, reduces the change of matter to the zero-point, so that in the case of seeds a change of gaseous elements at least (metabolism) is no longer discernible (*Becquerel*, l. c. V. 271). For the rest, however, the change of matter or gas is, in itself, no sign of life, but it is a property of the organic substance under consideration—a property possessed also by seeds which may be dead or even pulverized, for instance, barley-seeds (*Kolkwitz*||) or pieces of a potato. In *Becquerel*, p. 272, we find the phrase, "Pour se conserver la graine n'aurait pas besoin de respirer." Seeds were kept by *Giglioli*¶ in the course of his

* *Just ap. Cohn* Beitr. z. Biol. der Pflanzen 1877, and *Thiselton Dyer* and *Dewar*, Ann. Sc. Bot., 1901 : 599.

† *Wittmack*—Landwirtschaftliche Samenkund, 1922 : 101.

‡ *Bullet. de la Soc. bot. de France*, 1882 : 150.

§ *N. C. Paul*. Treatise on the Joga Philosophy. Benares, 1851. cit-after *W. Preyer*, Ueber die Erforschung des Lebens, Jena, 1872.

|| *Berichte der deutsch botan. Ges.*, 1919 : 286.

¶ *Nature*, 1895, Oct. 3.

well-known experiments, for a period of 16 years in Oxygen, Nitrogen Hydrogen, Carbon-dioxide, &c., without losing their power of germination.

However, in the case of seed containing a certain (or a normal) quantity of water there ensues, on the occasion of a rise of out-door temperature, for instance in the spring-time, a livelier respiratory movement, manifested by what is known to the millers as the "working" of the warehoused grain. At the same time, there ensues a rise in the temperature of the seed. *Becquerel's* experiments have proved that, in the case of dry seeds, there is also no intermolecular respiration, for, when the seed is kept in Nitrogen and in Carbonic acid, there occurs no perceptible exchange of gas.

Romanes, with the assistance of *Crookes* (1893), kept various seeds in a vacuum for a period of 15 months and all the seeds germinated. Similarly *Kochs* (1890) and *Laurent* (1902) maintained seeds in a vacuum for seven years without loss to their germinating power. It is, however, certain that the power of germination diminishes with age and finally becomes extinct. With respect to this, it would be of importance to know what is the limit for the different varieties of seed. We find much matter relating to this question collected in manuals, and much scattered in the pages of periodicals.

With regard to the seeds of vegetable-garden plants, we find a good compilation in *Vilmorin* "*Les plantes potagères*," 1891: 648. With regard to the upper limit of the duration of germinating power, surely the best material is to be found in the above-mentioned treatise of *Paul Becquerel*. According to this work, out of 501 different old seeds subjected to experiment, the seeds which germinated after the longest periods were those of *Nelumbo*, then those which belong to the family of *Leguminosae*, *Malvaceae* and *Labiatae*; notably seeds of *Cassia bicapsularis* have germinated after 87 years, those of *Cytisus biflorus* after 84 years, &c. In the experiment were included seeds as old as 192 years. *The duration of the capacity of germination is, therefore, obviously far shorter than is generally assumed on the ground of many unreliable data*, most of these data collapse under criticism, and we must, with *Ewart*,* accept a period of from 150 to 250 years as the probable maximum for the duration of germinating power.

For much valuable material, which also affords an insight into the course of germinating power, we are indebted to the *Copenhagen Seed Control Station*, whose tables supply us with an indispensable auxiliary to our studies. The well-known works of *Stebler* and *Schröter*, and of *Stebler* and *Volkart* on the best fodder-plants, contain the most important data relating to the duration of germinating capacity.

In the Budapest station extensive experiments have been made for the purpose of ascertaining the conservation of germinating power of the most important weed seeds buried in arable land.† In spite of the difference in the methods employed, these experiments are parallel with the studies which have been carried out by *Beal* in North America.

How useful it would be if we had all these data at hand, collected in such a manner as to enable us to detect the nature of the germinating power of those species which are most important from the point of view of seed-control, to enable us also, in the case of seeds of known age and of known method of conservation, to make approximate deductions as to their germinating capacity; and, vice versa, to enable us, when we have determined a certain grade of germinating power and know also the method of conservation, to draw conclusions as to the age of the seed. In the law courts such problems are frequently presented to us for solution.

I am well aware of the difficulties involved in this question, and among these difficulties I will mention here only the influence of the complete

* On the Longevity of Seeds. Proc. Roy. Soc., Victoria, &c., 21, Pt. 1, 2-210.

† *Dr. D. Kozma*, Ueber das Verhalten der Unkrautsamen im Ackerboden. Kiserl Közlem. XXV., 1922.

ripening of the seeds. This is connected with the desiccation and its attendant preservative effect above-mentioned.

As an instance, I will mention that the beet and grass seeds—and some others also—harvested in Hungary, where the climate is of a marked continental character, possess a much greater germinating power than seeds of the same species harvested in more Northern districts.

The next question, which belongs really to the scope of physiology, is: "What causes the natural death of the seed?"

In the literature on the subject we find several causes given, one positive, the others negative.

The positive cause, apart from catastrophic influences, is a degree of desiccation at which the embryo becomes separated from the nourishing-tissue and is, therefore, a cause of a physical nature. These seeds are for the most part carbonized by slow oxydation, and the connection of the inner parts broken. This is the case with such mummy wheat and Peruvian maize as have hitherto been examined with scientific accuracy. These were found in ancient tombs, but the reports of their germination belong to the realm of fable. Nevertheless, such rumours continually recur and, indeed, quite recently, a "Tutankhamen" wheat has appeared on the market.

As a physiological cause of death, the expiration or slow consumption of the nourishing matters contained in the seed must be rejected—thanks to the efficient labours of physiologists in recent times, especially those of *Paul Becquerel*. That the disintegration of certain more labile substances, for instance, the oils and fats, diminishes the duration of the germinating capacity, is also an assertion which cannot be maintained. It is notable that certain seeds which are rich in fat, such as the Cucurbitaceae, Charlock and Hedge mustard, preserve their germinating power for an exceptionally long period.

Then, again, the decay of the diastasic effect of the enzymes has been designated as a cause of natural death; this, also, in the case of man. This is another alleged cause which cannot be accepted. I will only refer here briefly to the latest experiments of *Hugo Mieke*,* who has established that, in the case of rye-seed, at least 120, and possibly 280, years old, in which the embryo was already separated from the nourishing tissue, the diastase obtained from the still intact nourishing tissue was yet capable of decomposing starch, and that, therefore, the efficiency of the enzymes survives the life of the germ. Thus, this mystery also, like so many others connected with the life of the grain of seed, remains still unsolved: in this respect we are still to-day in the same position as *Becquerel* (230) who, after solving so many detailed physiological problems, nevertheless, with regard to the main questions, came only to the conclusion, "La vérité c'est, qu'on n'en sait rien."

Speech delivered by Dr. Arthur C. Benson, C.V.O., LL.D., at the Magdalene College Lunch, on the 10th July:—

"It is a great pleasure to us to welcome here the members of so distinguished a congress. It is true that all congresses are in a sense distinguished, inasmuch as they are representative. But this congress is what many congresses are not—not only ornamental, but positively useful and beneficial.

"To-day, it has been truthfully said, the world is ruled by experts. The old Gospel promise was, *Blessed are the meek—for they shall inherit the earth*. Well, gentlemen, I have known many experts. They have been modest, gracious, courteous,

* *Berichte der deutschen botan Ges.*, 41, 1923: 263.

but none of them have been exactly meek. It is not the expert's business to be meek. In fact, he is paid *not* to be meek, but to know the value of his own opinion.

"We have many experts in many branches of literature and science at Cambridge, but we all live together in very tolerable amity. We respect each other, we even like each other, though often strangely ignorant of each other's stock-in-trade. You will remember what a shock it was to the great Prime Minister Canning when he was told that the tadpoles which he saw swarming in a pool on Hampstead Heath were frogs, only in an earlier stage. He refused to believe it. He said it contradicted the evidence of his senses. The great Greek Professor Kennedy, who rose at a very early hour of the morning to pursue his studies, was told by his doctor that he must take an early cup of tea; and his daughters installed a gas-ring in his dressing-room. The following morning they were aroused at some untimely hour by the cries of the Professor. 'This arrangement of yours is an entire failure. It does not heat my tea. I have turned the tap twenty times, and all that results is a strange hissing sound and an intolerable smell.'

"We students of literature do not, however, enjoy half the credit and respect enjoyed by the men of science. We end our days as a book or two on a dusty shelf. Meanwhile we see science girdling the earth with unseen voices, propelling humanity along the roads far more rapidly than it is safe to travel, and enriching the breakfast-table of the humblest human being with food that is increasingly cheap and wholesome.

"Even in literature itself we feel the influence of the hand of science. I was reading the other day the works of Tennyson and came upon the well-known lines :—

‘And all can raise the flower now,
For all have got the seed.’

"I read, and a dark suspicion came over me. ‘Yes, no doubt,’ I said, ‘but was it properly tested seed?’ I fear not. I fear that we must continue to think that the men of whom Tennyson speaks had to be content with an inferior article. How different it would be now, when the seed would have been properly tested and certified, owing to the wise forethought and beneficial labours of those whom we welcome here to-day!

"Gentlemen, I offer to you a hearty welcome here to-day in the name of the College. I wish that more of our staff had been able to be present, but even literary experts must take a holiday sometimes, however easily earned. We will, however, give ourselves the pleasure of drinking the health of our guests, and invoking a blessing on their labours; and I will join with this the name of my friend and colleague, Sir Lawrence Weaver, whom, with Lady Weaver, we are proud to entertain here to-day."

EXCURSIONS.

Friday, 11th July.

On Friday morning the delegates proceeded by motor coach to Harpenden, where they were shown over the world-famed laboratories and trial ground of the Rothamsted Experimental Station by the Director, Sir John Russell, who also entertained them to lunch and tea.

In the evening, the delegates were entertained at dinner by the British Government in the Hall of Trinity College, Cambridge, by the kind permission of the Masters and Fellows of the College: the Right Hon. Noel Buxton, Minister of Agriculture, presided. In extending a hearty welcome to the delegates and other guests on behalf of the Government, Mr. Buxton said the Government fully recognised the importance of seed testing, and it was felt to be a privilege to be able to hold a congress at Cambridge. In agriculture, rather more than a well-prepared, fertile soil was needed. Seed testing was essential to the improvement of seed and to the solution of present day problems.

Professor Dr. W. L. Johannsen and Dr. Volkart replied on behalf of the delegates. The toast of the Chairman was proposed by Mr. E. Insulander, and seconded by Sir Lawrence Weaver. The singing of grace at the close of the dinner and the rendering of glees by the choir of Trinity College, greatly added to the interest of the delegates and other guests.

Saturday, 12th July.

On Saturday the delegates and friends proceeded by rail to Wembley to visit the British Empire Exhibition, where arrangements were made for conducting the party to the most interesting points in the Exhibition. In the afternoon the delegates were entertained at tea by Sir Lawrence Weaver.

Monday, 14th July.

The delegates visited Ipswich to inspect the up-to-date warehouse and seed-cleaning plant of the Eastern Counties Farmers' Co-operative Association, Ltd. Much interest was exhibited in the Bedell magnetic dodder-separating plant, which is installed on the premises of the Association. The Committee of the Association entertained the delegates at lunch.

Tuesday, 15th July.

On Tuesday the delegates and friends visited the well-known seed establishment of Messrs. Sutton & Sons, Ltd., Reading. After inspecting the offices, cleaning and packing plant, and the seed-testing laboratory, the party proceeded to visit the Reading trial ground. After lunch the party left by motor-car for the Langley

trial ground of the firm, passing through Ascot, Windsor Great Park, Windsor, and Eton. After inspecting the trial ground, tea was served, and the party left by motor-car for Slough Station.

Wednesday, 16th July.

The delegates visited the Royal Botanic Gardens at Kew, where admirable arrangements had been made by the Director, Dr. A. W. Hill, for conducting them to the various special points of interest in the Gardens.

QUATRIÈME CONGRÈS INTERNATIONAL D'ESSAIS DE SEMENCES.

Lundi, 7 juillet, 11.30 h.

Les congressistes se réunissent dans la salle des conférences de l'Institut national de botanique agricole (N.I.A.B.), à Cambridge.

Sir Lawrence Weaver ouvre la séance et souhaite la bienvenue aux délégués. Il évoque le souvenir de leur vénéré collègue, M. le directeur Bruijning, et rappelle ses remarquables travaux.

Il signale ensuite à l'assemblée le vœu, émis par un certain nombre de délégués, de rendre internationale l'association européenne d'essais de semences.

Sur la proposition de M. le directeur *Dorph-Petersen*, *Sir Lawrence Weaver* est élu président du congrès; il invite M. le *Dr. Johanssen* à le seconder dans sa tâche. Ce dernier accepte, et donne la parole à M. *Eastham*, chef de la station d'essais de semences de l'Institut national de botanique agricole, pour la lecture de son rapport sur les travaux de la station.

ŒUVRE DE LA STATION OFFICIELLE D'ESSAIS DE SEMENCES DE L'ANGLETERRE ET DU PAYS DE GALLES.

PAR

A. EASTHAM,

chef de la station officielle d'essais.

La station officielle d'essais comprend quatre divisions ou sections principales :

- (I) Essais pour le commerce des semences;
- (II) Essais d'échantillons soumis par les stations particulières autorisées;
- (III) Essais d'échantillons de vérification prélevés par les inspecteurs (règlement de 1920);
- (IV) Recherches.

I.

Sous cette rubrique se groupent les essais faits pour les marchands de semences, les fermiers, etc.—soit pour leur propre gouverne, soit pour les déclarations demandées par le règlement. Les laboratoires s'occupent séparément de quatre groupes principaux de semences : trèfles; fourrages; céréales et plantes légumineuses; racines et légumes. C'est sur ce groupement que se base toute la statistique de la station officielle d'essais, laquelle sera exposée à MM. les délégués pendant leur visite de l'établissement.

Chaque analyste fait un stage dans les quatre sections. Elle est donc apte à entreprendre le travail de n'importe quelle section, si le ministère désire la transférer de l'une à l'autre.

Son emploi *permanent* dépend du résultat satisfaisant de l'examen annuel de la station officielle d'essais.

Exception faite de quelques détails peu importants, nous suivons, à Cambridge, une méthode analogue aux méthodes continentales, MM. les délégués en trouveront la description dans les différentes laboratoires.

En 1922-23 le nombre des échantillons essayés pour le commerce s'est élevé à 19,829, et en 1921-22 à 23,865. Nous n'avons pas encore en mains les chiffres de la saison qui vient de se clore, lesquels seront probablement un peu moins élevés.

II.

Il existe, en Angleterre, bon nombre d'établissements particuliers autorisés par le ministère de l'Agriculture, à faire dans leurs propres laboratoires l'essai d'une ou de plusieurs catégories de semences. Cette autorisation est donnée par patente, à condition (a) que les essais se fassent d'une manière et sous la direction d'un analyste approuvés par le ministère; (b) que le laboratoire dispose de l'installation nécessaire; et (c) que l'analyste fasse uniquement emploi des méthodes officielles d'essai.

Les stations autorisées doivent dresser la statistique complète de tous leurs essais, en en gardant au moins trois mois les échantillons. Les inspecteurs du ministère tirent de ces derniers des échantillons dénommés "licensed station reserve portion" (partie de réserve des stations autorisées), qu'ils envoient ensuite à la station officielle d'essais.

Afin de développer encore l'uniformité souhaitable entre les stations autorisées et la station officielle d'essais, cette dernière a remis cette année aux stations autorisées des échantillons—dénommés "referee samples" ou échantillons de référence—dont les essais ont été très intéressants.

Les analystes désirant trouver un emploi commercial se soumettent à un entraînement d'un mois à la station officielle d'essais, et reçoivent, après un examen satisfaisant, le certificat d'aptitude à l'essai des semences.

Une conférence aura désormais lieu, une fois par an, après cet entraînement. Y seront invités, non seulement les analystes dirigeant les stations officielles d'essais de la Grande Bretagne et de l'Irlande, mais aussi ceux des stations autorisées.

Une première conférence a déjà eu lieu l'année dernière, avec un résultat très heureux.

En outre, les stations autorisées recevront désormais une feuille officielle, donnant le résultat des recherches faites à la station officielle d'essais, ainsi que d'autres renseignements utiles aux analystes.

III.

La station officielle d'essais reçoit les échantillons de vérification de ses inspecteurs, et le résultat des essais est soumis au ministère. Ce dernier en fait part aux intéressés. De cette manière, la vente des semences est contrôlée; tandis que toute infraction au règlement de 1920 devient impossible.

Il incombe uniquement à la station officielle d'essais de dresser le rapport sur la pureté et la germination des échantillons soumis. Toute poursuite judiciaire ultérieure—quoique souvent basée sur un tel rapport—est intentée par le ministère.

IV.

La station officielle d'essais s'est déjà chargée d'un grand nombre de recherches; et elle espère augmenter considérablement son œuvre dans cette voie. Les questions qu'elle s'efforce maintenant de résoudre sont les suivantes:

- (a) Perte de vitalité des semences emmagasinées dans diverses conditions;
- (b) Germination retardée, (notamment celle des céréales);
- (c) Graines dures: détermination de leur valeur réelle dans les semences de légumineuses;

(d) Rapport entre la germination des pois au laboratoire et celle en plein champ;

(e) Germination du sainfoin—notamment en ce qui regarde sa croissance irrégulière;

(f) Étude de l'état plumeux, ou croissance irrégulière, des Graminées.

Après lecture de ce rapport, MM. les délégués visitent la station et l'institut.

Séance de l'après-midi.

La séance s'ouvre à 15 h.

M. le directeur Dorph-Petersen donne lecture de son mémoire sur les travaux de l'Association Européenne d'Essais de Semences, de 1921 à 1924.

(Voir pp. 15-37 ce rapport en langue anglaise. Le rapport en allemand se trouve à pp. 178-184.)

M. le Dr. Johannsen signale le fait que des stations usant de méthodes identiques accusent assez souvent des écarts notables dans leurs résultats d'analyses, alors que celles qui appliquent des méthodes différentes arrivent parfois aux mêmes résultats. Il ajoute que l'analyse n'est pas seulement une question mécanique.

M. le professeur Zaleski est d'avis que les résultats ne dépendent pas uniquement de l'outillage d'une station, mais plutôt de son personnel—ce dont témoignent les chiffres tout à fait remarquables obtenus par la station de Paris. Il propose aux stations exécutant des analyses comparatives de n'étudier que les espèces de semences qui les intéressent tout spécialement.

M. le professeur Bussard dit que le personnel de la station de Paris possède une longue expérience et que la formation technique et les traditions sont à considérer en matière d'essais.

M. le Dr. von Degen est du même avis. Sa station se passe autant que possible de machines et d'appareils.

M. le professeur Showky Bakir prie l'association de s'occuper de la question des semences de coton.

M. le Dr. Andronescu dit que les différences dans les résultats d'analyse ne le surprennent pas. Il trouve tout naturel qu'un organisme vivant, tel que la semence, se sente de l'influence du climat, de l'humidité atmosphérique, des différentes méthodes d'essai, etc.

M. le Dr. Buchholz est d'avis que personnel et matériel ont une égale importance.

M. le Dr. Chmelář dit que les différences dans les résultats dépendent de circonstances diverses, telles que la constitution et le poids des échantillons, la valeur attribuée aux graines déformées, brisées, dures, etc. Il propose que les stations se mettent d'accord au sujet de l'interprétation à donner aux termes "mauvaises herbes" et "graines pures."

M. Devoto attache une certaine importance à la dimension des graines d'un lot déterminé, et à la température pendant l'analyse.

M. le directeur Dorph-Petersen dit qu'il importe de se souvenir que la semence est un organisme vivant. Comme suite aux observations de *M. le délégué tchécoslovaque*, l'orateur invite ceux des congressistes qui s'intéressent aux analyses comparatives à assister à sa démonstration de la manière dont la station de contrôle danoise constitue les échantillons de semences pour l'analyse.

En terminant, il prie les chefs des diverses stations de contrôle de signaler au nouveau comité exécutif qui sera prochainement élu les espèces de semences qui ont un intérêt spécial pour elles.

Lundi, 8 juillet ; 9.30 h.

M. le Dr. Volkart soumet à l'assistance son projet de statuts de l'Association Européenne d'Essais de Semences. (Le projet définitivement adopté se trouve à la pp. 171-174.) Il propose l'élection d'un comité spécial chargé d'étudier et de modifier ces statuts.

La discussion est ouverte.

M. le Dr. Chmelař demande la nomination d'un vice-président de l'Association. Il désire savoir si les fonds de l'association internationale peuvent passer à l'Institut International d'Agriculture de Rome, en cas de dissolution.

M. Clark demande si l'association sera internationale. Dans l'affirmative, est-il possible d'indiquer dès à présent le mode d'admission de membres de l'Amérique septentrionale ?

Sir Lawrence Weaver dit que l'association acceptera volontiers non seulement des membres provenant des États-Unis et du Canada, mais aussi d'autres parties du monde.

M. le directeur Dorph-Petersen partage l'avis de *Sir Lawrence Weaver*.

M. Devoto annonce que la République Argentine désire faire partie de l'Association et payer sa cotisation à cet effet.

M. Insulander attire l'attention de l'assemblée sur l'article du projet de statuts, stipulant que seules les stations officielles d'essais de semences et celles appartenant à des corporations relevant de l'État sont admises. Les statuts interdisent donc à tout savant—même s'il a fait des découvertes importantes dans le domaine des essais de semences—de devenir membre de l'association, s'il n'appartient pas à une station de contrôle.

Un État payant sa cotisation en qualité de membre ne peut-il choisir un représentant spécial pour contrôler l'emploi des revenus de l'association, ou soumettre à cette dernière des propositions concernant la conduite de ses travaux ?

M. le directeur Dorph-Petersen répond que si le gouvernement d'un pays paie la cotisation, il en découle naturellement que ce gouvernement possède le droit de se faire représenter aux congrès. Il propose que ce point soit très explicitement indiqué dans les statuts.

M. le professeur Voigt demande que cette question de représentation des États soit discutée, attendu que son gouvernement réclamera sans aucun doute le droit de figurer aux congrès.

M. Devoto exprime le vœu de voir se réaliser une coopération étroite avec l'Institut International d'Agriculture de Rome, ce dernier s'occupant de la publication régulière des rapports, etc.

M. Munn demande si la nouvelle association doit faire partie intégrante de l'Institut International d'Agriculture de Rome. Plusieurs gouvernements payent déjà leurs cotisations à ce dernier et cela pourrait causer des complications. Il propose la création d'un comité chargé de fixer le chiffre des cotisations et tous autres détails indispensables, afin que MM. les représentants puissent souscrire les cotisations de leurs gouvernements respectifs, et activer de cette manière la création de l'association internationale.

Sir Lawrence Weaver est d'avis que la nouvelle association doit coopérer avec l'Institut International d'Agriculture de Rome, mais ne doit pas y être englobée. De cette manière on évitera toute confusion à l'égard des cotisations. La création d'un comité tel qu'il a déjà été envisagé lui semble utile.

Une fois les statuts définitivement établis, les congressistes pourront demander l'adhésion de leurs gouvernements respectifs à l'association. La cotisation sera probablement assez minime pour qu'aucun gouvernement ne refuse son adhésion.

Comme membres du comité chargé d'étudier le projet de *M. le Dr. Volkart*, *M. le Dr. Johannsen* propose à l'assemblée les noms des délégués suivants :—

Comité provisoire.

M. le Professeur Showky Bakir Effendi; *M. le professeur Bussard*; *M. Clark*; *M. Devoto*; *M. le directeur Dorph-Petersen*; *M. le professeur Munn*; *M. le Dr. Voigt*; *M. le Dr. Volkart*; *Sir Lawrence Weaver*.

Cette proposition est adoptée à l'unanimité.

Mlle. Yeo prend la parole, au nom de l'Institut International d'Agriculture de Rome. En raison de la coopération proposée entre la nouvelle association et l'Institut—lequel réservera aux questions d'essais de semences cent pages du "International Review of the Science and Practice of Agriculture"—l'Institut de Rome l'a chargée de remettre aux congressistes des exemplaires spécialement tirés de ses rapports et mémoires spéciaux. Désormais, on espère pouvoir centraliser la publication des articles, notes et rapports se référant aux sujets agricoles, et faire emploi de la Revue comme organe mutuel.

M. Anderson donne lecture de son mémoire, "Sur l'uniformité dans les bulletins d'essais de semences."

UNIFORMITÉ DES RAPPORTS SUR LES ESSAIS DE SEMENCES.

PROPOSITION DE

T. ANDERSON,

Services Agricoles de l'Ecosse.

La nécessité d'une méthode uniforme d'exprimer les résultats des analyses s'impose, afin de satisfaire aux besoins du producteur de graines de semence, du cultivateur et des intermédiaires commerciaux.

Bien des objections s'opposent à l'application de formules arbitraires pour déterminer la valeur intrinsèque, parce que :

1. le caractère nuisible d'une impureté spécifique n'est pas le même dans tous les pays ou régions ;
2. il est assez difficile d'estimer jusqu'à quel point les mauvaises herbes sont propagées par les semences ;
3. la réussite des récoltes fourragères dépend presque entièrement d'une culture habile et soignée, de l'utilisation d'engrais et de la combinaison d'influences saisonnières appropriées ;
4. l'influence de la disposition naturelle, ou du pays d'origine, réduit à son minimum l'importance des impuretés contenues dans un sac de semences.

Pour répondre aux besoins de toutes les parties intéressées, l'indication la plus utile est celle qui a rapport aux semences pures capables de germer.

La proposition que je sou mets maintenant à la Conférence est la suivante :—Les délégués devraient s'entendre pour admettre et poser en principe que, dans le libellé des bulletins, on supprime le résultat de l'essai de germination, pour y substituer le pourcentage calculé de semences pures capables de germer.

Les avantages réalisés en procédant ainsi sont les suivants :—

1. Le chiffre concernant les semences pures capables de germer donne aussi approximativement que possible le pourcentage, en poids, de semences vivantes de l'espèce fournie, au lieu du pourcentage de germination qui, si on le considère comme s'appliquant à l'échantillon entier, comme c'est souvent le cas, entraîne à des résultats erronés.

2. Il y aurait évidemment plus d'uniformité dans les rapports, car les écarts entre les stations dans l'évaluation des "semences pures capables de germer" sont généralement moindres que dans la détermination du pourcentage de germination.

3. Le rapport donnerait une indication plus juste du caractère réel des impuretés.

Forme de Rapport suggérée :—

Semences pures capables de germer.

Graines dures.

Graines brisées.

Graines mortes.

Glumes vides.

Impuretés (corps étrangers).

Comprenant { Menue paille, matières inertes.
Graines de mauvaises herbes.
Graines utiles.

Rapport s'appliquant seulement à une séparation de pureté.

Semences pures.

Non compris { Graines brisées.
Graines ratatinées.
Glumes vides.

Impuretés (corps étrangers).

Comprenant { Menue paille, matières inertes.
Graines de mauvaises herbes.
Graines utiles.

(Voir pp. 41-47 la traduction complète en langue anglaise.)

Mr. Anderson ajoute qu'il présente le point de vue du consommateur. A son avis, les intérêts de ce dernier ne sont pas suffisamment consultés par les stations de contrôle. Il se peut que les propositions énoncées dans son mémoire s'accordent assez difficilement avec les lois et les coutumes établies depuis longtemps, et notamment avec les us et coutumes existant dans le Royaume Uni. L'orateur ose cependant croire que ses propositions auraient une certaine utilité, si elles provoquaient la création d'un comité chargé d'établir des normes et des règles d'analyse internationales.

Si cette idée est acceptée, *M. Anderson* offre de fournir au nouveau comité des explications complémentaires.

M. le directeur Dorph-Petersen propose à l'assemblée de désigner, jeudi après-midi, un comité chargé de discuter à fond la proposition de *M. Anderson*.

Cette proposition est adoptée à l'unanimité.

Mr. le Dr. Buchholz donne lecture de son rapport sur la détermination du taux d'humidité des semences.

(Voir pp. 47-51 la traduction anglaise de ce rapport, et pp. 189-191 la version allemande).

M. Devoto déclare que ce rapport a un intérêt tout spécial pour les agriculteurs de la République Argentine, qui perdent annuellement de fortes sommes à cause de l'humidité contenue dans le maïs. Il ajoute qu'on fait depuis cinq ans emploi, en Argentine, de l'appareil Brown-Duval pour la détermination de l'humidité du maïs. Cet appareil épargne du temps, mais ne donne pas toujours des résultats exacts.

M. Brown, inventeur de ce procédé, répond qu'à l'origine il était destiné plutôt au commerce grainier. L'appareil est simple, et l'essai ne dure qu'un quart d'heure. Pourvu que l'on ait soin de varier la température et la durée de la dessiccation suivant l'espèce de semences soumises à l'examen, les résultats sont satisfaisants. L'emploi de l'appareil fait disparaître les erreurs causées par le broyage et la pesée de la graine.

M. le professeur Voigt dit que l'on applique en Allemagne une température de 98° C. ou de 103° C., selon les cas. On place les semences dans un four froid, que l'on chauffe ensuite jusqu'à la température voulue. Le délai nécessaire pour le séchage est compté à partir du moment où cette température est atteinte.

M. le Dr. Volkart déclare que la station d'essais de Zürich refuse de faire le dosage de l'humidité quand la graine ne lui est pas remise en récipient étanche.

M. le directeur Dorph-Petersen dit que l'on procède de même au Danemark, où le séchage se fait pendant cinq heures à une température de 98° C.

Suit une discussion sur les différentes températures employées pour le séchage, ainsi que sur le danger d'oxydation.

M. Devoto souligne qu'il ne faut pas oublier le point de vue du marchand grainier et du cultivateur.

Séance de l'après-midi.

M. le professeur Bussard lit la communication suivante :

Dans l'énoncé de la pureté des semences, ne convient-il pas d'indiquer expressément le pourcentage en poids des graines de mauvaises herbes et le nom de celles qui dominent dans l'échantillon d'analyse ? Quelles sont les espèces à signaler comme mauvaises herbes ?

LÉON BUSSARD,

Directeur Adjoint de la Station d'Essais de Semences de Paris.

Lors du Congrès de Copenhague, il y a trois ans, notre très distingué et très regretté collègue, M. Bruijning, Directeur de la station de Wageningen, après avoir demandé qu'on substituât le terme de *grade* à celui de "valeur culturale" ou "valeur utile," proposa de calculer ainsi cette valeur :

$$\text{Grade} = \frac{\text{Pureté} \times \text{Faculté germinative}}{100} - \frac{\text{Pourcentage des mauvaises herbes}}{3} \times 3.$$

Il s'appuyait, pour justifier cette méthode de calcul, sur ce fait incontestable que la présence de graines de mauvaises herbes dans un lot de semences est beaucoup plus nuisible pour la culture que celle de matières inertes, car elle a pour conséquence, non seulement de réduire la quantité des bonnes semences, mais d'introduire dans les terres des germes de plantes salissantes ou parasites.

Or, le grade ou valeur culturale, tel qu'il est déterminé par la formule courante :

$$\text{Grade} = \frac{\text{Pureté} \times \text{Faculté germinative}}{100}$$

ne fait état que du total des impuretés, sans tenir compte de leur degré de nocivité. Il ne donne donc qu'une mesure imparfaite, une image grossière en quelque sorte, de la valeur réelle pour la culture du lot de semences analysé.

La proposition de M. Bruijning suscita une longue et intéressante discussion. Les congressistes qui y participèrent furent d'accord pour reconnaître le bien fondé de l'observation faite par le rapporteur, mais ils se montrèrent généralement opposés à l'adoption de la formule qu'il préconisait. Cette méthode de calcul soulève, en effet, plusieurs objections :

(1) Le coefficient 3, attribué aux mauvaises herbes, est arbitraire ; pourquoi le choisir plutôt que le coefficient 2 ou le coefficient 4 ?

(2) En retranchant le pourcentage des mauvaises herbes, coefficienté ou non, de la valeur

$$\frac{\text{Pureté} \times \text{Faculté germinative}}{100}$$

on fait entrer deux fois ce pourcentage dans le calcul du grade, puisqu'il intervient déjà dans l'établissement de la pureté :

(3) On ne peut donner aux mauvaises herbes banales la même importance chiffrée qu'aux espèces franchement nuisibles;

(4) L'écart, souvent considérable, entre les chiffres obtenus avec l'ancienne et avec la nouvelle méthode de calcul du grade, apparaît excessif quand il résulte de la présence de graines de mauvaises herbes banales. Par exemple, avec 5 % d'impuretés dont 2 % de *Bromus mollis*, une semence de *Lolium italicum* germant à 86 % donnerait, par la méthode courante, 81.70 % de valeur culturale ou grade, et, par la méthode hollandaise, 75.70 % seulement.

L'inconvénient le plus grave de ce dernier mode de calcul réside dans ce fait qu'il serait difficilement compris des intéressés, cultivateurs ou marchands grainiers, et que les résultats en donneraient lieu, de la part de ceux-ci, à des interprétations erronées.

Si les stations veulent éviter des confusions, des contestations possibles, il leur faut s'en tenir à la formule simple, claire, aisément compréhensible :

$$\text{Grade} = \frac{\text{Pureté} \times \text{Faculté germinative}}{100}$$

Cependant, pour répondre à la préoccupation, des plus justifiées, de M. Bruijning, il est indispensable de compléter ce qu'a d'insuffisant l'indication chiffrée résultant de cette formule, en faisant connaître au cultivateur ou au négociant la nature et la proportion des graines de mauvaises herbes contenues dans l'échantillon d'analyse.

Ce principe admis, dans quelles limites et suivant quelles règles l'appliquera-t-on ?

Si très peu d'espèces de mauvaises herbes existent dans l'échantillon, il sera facile autant qu'utile de les énumérer toutes.

Lorsqu'au contraire ces espèces sont nombreuses, la nomenclature complète n'en offrirait pas d'intérêt, et l'on négligera celles dont une ou deux graines seulement auront été rencontrées à l'analyse.

Quant au pourcentage en poids des graines adventices, on le déterminera (a) pour l'ensemble des différentes espèces, quand la proportion de chacune d'elles est trop faible pour donner lieu à un dosage séparé; disons, par exemple, quand elle se trouve inférieure à 0.30 % dans le cas des petites graines, à 0.50 % dans le cas des grosses; (b) pour chaque espèce séparément, quand ces proportions se trouveront dépassées.

De ces données, qu'au besoin la station d'essais commentera, l'intéressé tirera toutes conclusions utiles.

Pour l'application des règles qui précèdent, une question préjudicielle se pose :

Que faut-il entendre par " mauvaises herbes " ?

A notre avis, en principe, toute plante qui n'est pas à sa place dans une culture est une mauvaise herbe : mauvaise herbe que l'orge dans une avoine, la minette dans l'anthyllide, le trèfle dans la luzerne ou réciproquement.

Toutefois on peut donner au terme " mauvaises herbes " un sens plus restrictif, en désignant sous ce nom les seules espèces qui n'ont aucune utilisation culturale. On distingue alors, parmi les graines étrangères à l'espèce indiquée, celles qui appartiennent à des plantes cultivées (useful seeds) de celles qui représentent des plantes salissantes ou nuisibles (weed seeds or noxious seeds). C'est là l'interprétation la plus généralement admise, celle que nous adopterons désormais, en considérant comme mauvaises herbes seulement les espèces spontanées ou espèces sauvages. Nous ferons toutefois observer que la limite entre les espèces cultivées et les espèces sauvages est parfois imprécise. C'est ainsi que le règlement interprétatif de la loi américaine sur l'importation des semences (Seed Importation Act of August 24, 1912) comprend parmi les mauvaises herbes des plantes fourragères telles que la minette (*Medicago lupulina*) et l'anthyllide (*Anthyllis vulneraria*).

Quelles sont les espèces de graines qu'il faut ne pas omettre de signaler comme mauvaises herbes dans les bulletins d'analyse délivrés par les stations d'essais ?

Pour nous permettre de répondre à cette question en toute connaissance de cause, M. Dorph-Petersen a pris l'initiative d'une enquête consistant dans l'envoi, aux différentes stations d'Europe et d'Amérique, d'un questionnaire comprenant 206 espèces ou genres de plantes communes, appartenant à 40 familles botaniques distinctes.

La mention suivante figurait en tête de ce questionnaire : " Prière de rayer les espèces que votre station ne rencontre pas, d'ajouter celles non citées que vous considérez comme mauvaises herbes et de souligner les noms des plantes nuisibles. Veuillez indiquer la fréquence des espèces citées, en les notant de 1 à 5, le chiffre 1 correspondant aux plus communes et le chiffre 5 aux plus rares."

Trente stations nous ont retourné le questionnaire dûment annoté. En voici la nomenclature, avec la désignation des pays auxquels elles appartiennent :

EUROPE.

<i>Norvège</i>	Christiania, Trondhjem.
<i>Suède</i>	- Örebro, Malmö, Skara, Linköping, Hernösand; Stockholm.
<i>Danemark</i>	- Copenhague.
<i>Finlande</i>	- Helsinki.
<i>Estonie</i>	Tallinn.
<i>Lettonie</i>	- Riga.
<i>Russie</i>	Moscou.
<i>Pologne</i>	Léopol.
<i>Allemagne</i>	Hambourg, Breslau.
<i>Pays-Bas</i>	- Wageningen.
<i>Écosse</i>	- Edimbourg.
<i>Irlande</i>	- Belfast, Dublin.
<i>France</i>	- Paris.
<i>Autriche</i>	- Vienne.
<i>Italie</i>	- Bologne, Modène.
<i>Roumanie</i>	Bucharest.

AMÉRIQUE.

<i>Canada</i>	Quebec.
<i>États-Unis</i>	Wisconsin, Colorado, Virginie.

Océanie.

<i>Nouvelle-Zélande</i>	Weraroa.
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Aux espèces figurant au questionnaire, les stations qui viennent d'être citées en ont ajouté d'autres, spéciales à leurs régions respectives, de telle sorte que, de cette enquête sur l'existence et la fréquence locales des graines de mauvaises herbes, on peut tirer—nous l'avons fait nous-même incidemment—d'intéressantes indications pour la détermination de l'origine des semences. Nous signalons, en passant, ce fait à M. le Dr. Volkart, qui s'est spécialisé dans les questions de provenance, et nous mettons volontiers les documents que nous possédons à sa disposition.

D'autres réponses de stations importantes nous ont fait défaut. Celles que nous avons reçues suffisent pour baser nos conclusions. De leur dépouillement, et du rapprochement des notes attribuées à une même espèce par les différentes stations, se dégage cette constatation, d'ailleurs à prévoir, que très peu d'espèces de mauvaises herbes se rencontrent avec une fréquence à peu près égale sur les différents points de la zone tempérée du globe, que nous avons plus particulièrement à envisager.

Citons d'abord, comme les plus également et les plus abondamment répandues dans toute l'Europe septentrionale et moyenne, sud de la France et nord de l'Italie compris, et jusqu'en Amérique même :

Sinapis arvensis,
Plantago lanceolata,

Chenopodium album,
Rumex acetosella.

Puis, surtout européennes, avec une notation moins uniforme :

Daucus carota,
Centaurea cyanus,
Sherardia arvensis,
Stellaria media,
Brunella vulgaris,

et des espèces, variant de l'une à l'autre contrée, des genres

Ranunculus,
Vicia,
Galium.

Il semblerait donc que ce sont là les mauvaises herbes essentielles dont la présence, et éventuellement le quantum, doivent être constamment signalés dans les bulletins d'analyse.

Pour les autres espèces, même en envisageant des régions géographiques moins étendues,—par exemple, Europe septentrionale, Europe moyenne, Europe méridionale—les notes de fréquence sont trop discordantes pour qu'on puisse songer à prescrire uniformément l'indication de ces espèces à l'ensemble des stations de ces régions et, à plus forte raison, à toutes les stations européennes ou extra européennes. Cela ne signifie pas qu'elles aient, pour une région déterminée, moins d'importance que celles précédemment désignées. Telle plante spontanée n'occupant qu'une aire géographique restreinte peut être, dans les limites de celle-ci, particulièrement redoutable pour les cultivateurs, auxquels il importe alors que les stations indiquent avec soin la présence des graines de cette plante dans les semences d'espèces cultivées. N'est-ce pas le cas des cuscutes, notamment des cuscutes à grosses graines, si dangereuses pour les cultures de Légumineuses fourragères dans le centre et le midi de l'Europe, si peu inquiétantes au contraire pour les contrées septentrionales ?

Est-il possible, en réalité, de préciser les catégories de graines de mauvaises herbes que les stations d'essais doivent signaler ?

Chaque pays, chaque territoire à climat distinct, en dehors des plantes à large expansion qu'il héberge, a ses espèces nuisibles propres ; le cultivateur ne sera en mesure d'en éviter la propagation que si l'existence de leurs germes dans les semences qu'il se propose d'employer lui est révélée par l'analyse. En France, *Bromus mollis* dans les semences de Graminées, *Melilotus officinalis* dans celles de Légumineuses, doivent toujours être mentionnés.

La nomenclature des mauvaises herbes à proscrire spécialement figure dans certains textes législatifs. Aux Etats-Unis, le règlement complémentaire de la "Seed Importation Act of August 24, 1912," énumère 105 espèces ou genres de plantes à classer parmi les mauvaises herbes,

Le règlement interprétatif de la "loi des semences, 1923," du Canada, groupe les graines de plantes adventices en quatre catégories :

(1) mauvaises herbes dangereuses au 1 ^{er} degré -	8 espèces.
(2) mauvaises herbes dangereuses au 2 ^{ème} degré	22 „
(3) mauvaises herbes inutiles -	8 „
(4) mauvaises herbes nuisibles, toutes les espèces non énoncées précédemment.	

Les espèces énumérées sont évidemment celles qui intéressent particulièrement ces pays, celles dont les stations nationales, et éventuellement les stations étrangères, doivent tenir le plus grand compte. Il en est dans le nombre d'absolument négligeables chez nous.

En définitive, toutes les fois qu'une graine de mauvaise herbe, quelle qu'en soit l'espèce, figure dans un lot de semences en quantité appréciable,

elle doit faire l'objet, dans le bulletin d'analyse, d'une mention en nom et en poids. Et, comme la proportion des graines étrangères de plantes cultivées n'est pas non plus sans intérêt, il est recommandable de présenter comme suit les résultats de l'analyse de pureté (nous choisissons à dessein un exemple compliqué; le plus souvent l'analyse donnera des résultats beaucoup plus simples):

Semences pures	-	-	-	-	-	-	95.54 %
Graines étrangères—							
Espèces cultivées (useful seeds).							
a	-	-	-	-	-	-	0.60 %
b	-	-	-	-	-	-	0.36 %
							<hr/> 0.96 %
Mauvaises herbes (weed seeds).							
c	-	-	-	-	-	-	1.10 %
d	-	-	-	-	-	-	0.40 %
e	-	-	-	-	-	-	0.32 %
diverses	-	-	-	-	-	-	0.18 %
							<hr/> 2.00 %
Matières inertes.							
Terre et pierres	-	-	-	-	-	-	0.80 %
Débris végétaux (feuilles, tiges, balles, graines brisées)	-	-	-	-	-	-	0.70 %
							<hr/> 1.50 %
							<hr/> <hr/> 100.00 %

On pourra, le cas échéant, réunir a et b, ou c, d et e, pour une seule pesée. Quant aux semences de plantes parasites, telles que la cuscute, doivent être mentionnées en nombre et non en poids.

Etablir ainsi le bulletin d'analyse ne constituera pas une innovation pour certaines stations, qui ont depuis longtemps l'habitude de donner un tableau complet, ou presque, des impuretés contenues dans les échantillons examinés.

M. le directeur Dorph-Petersen attire l'attention de MM. les délégués sur un rapport de la station danoise de contrôle sur des recherches, faites entre les années 1896 et 1923, concernant la dissémination et la vitalité des graines de mauvaises herbes. (Voir pp. 221–226 la traduction allemande de ce rapport, et pp. 124–138 la version anglaise.)

La dissémination des graines des mauvaises herbes et leur faculté de se reproduire rapidement (vitalité) ont été si bien établies par les recherches, qu'il est possible d'inscrire exactement sur les bulletins d'analyse les espèces et la proportion des mauvaises herbes dangereuses.

M. le Professor Showky Bakir, MM. Bussard, Devoto, von Degen et Kouleshoff prennent part à la discussion qui suit. Il est proposé de faire établir la liste des mauvaises herbes les plus redoutées, dans chaque pays membre de l'association. Ces questions, et d'autres du même genre, sont renvoyées à l'examen du comité à élire le jeudi suivant.

M. le Dr. von Degen donne lecture du compte-rendu du comité de la cuscute, élu lors du congrès de Copenhague.

Rapport du Comité de la Cuscute.

PAR

M. le directeur A. VON DEGEN,

chef de la Station royale de contrôle des semences de Budapest.

Pour étudier la question de la cuscute, notre congrès à Copenhague a élu un comité composé de MM. Vitek, Bussard, Voigt, Enesco et moi-même—tous représentants de pays européens où la culture du trèfle et de la luzerne est très importante. Le congrès ayant décidé que ce comité pourrait choisir son président, je fus élu par mes collègues et j'ai fait depuis le nécessaire pour aborder la solution du problème principal soumis à nos études.

Ce problème est celui de fixer—au moins d'une façon approximative et, en premier lieu, pour l'Europe seulement—les limites de l'existence de la cuscute, et de distinguer, autant que possible, entre les lieux de croissance préférés de *Cuscuta racemosa* ou *suaveolens* et de *Cuscuta trifolii*.

Certains territoires européens—tels que les régions septentrionales et les territoires situés à une certaine hauteur au-dessus du niveau de la mer—sont exempts, ou presque exempts, de ce fléau. La cuscute introduite artificiellement ne peut s'y acclimater et disparaît rapidement.

D'autre part, nous savons également qu'il existe des régions européennes où la cuscute peut s'acclimater, quoique d'une façon incertaine et peu constante—variable selon l'absence ou la présence de la chaleur et de la pluie pendant la végétation de cette mauvaise herbe—régions cependant où la présence de la cuscute peut se manifester, ou qui peuvent être exposées à la contagion par l'emploi de semences cuscutées provenant de l'étranger.

Nous nous trouvons donc en présence du fait que le climat joue ici un rôle très important.

La culture du trèfle violet et de la luzerne uniquement comme fourrages, et leur culture pour la récolte des graines, peuvent ou bien nuire au développement de la cuscute, ou bien la favoriser à un certain degré. Le fauchage répété, rendu nécessaire dans le premier cas, en empêche la croissance, et souvent même la germination; tandis que, dans les régions où la récolte des graines se fait également, on laisse pousser plus longtemps le trèfle sans y toucher, et la cuscute a le temps de se développer plus à l'aise. Mais le but de la culture—l'emploi comme fourrage ou pour la récolte des graines—dépend beaucoup du climat, car la récolte des semences de trèfle se fait invariablement dans les régions sèches et chaudes, tandis que dans celles où la pluie est plus abondante et la température moins élevée, le trèfle se cultive uniquement comme fourrage. La question du climat est donc également prépondérante dans ce cas.

Tandis que les pays cultivant les fourrages seulement doivent semer de la graine étrangère, ceux qui cultivent la semence envoient annuellement à l'étranger une partie de leur récolte, et il n'est pas douteux qu'une certaine quantité en est cuscutée.

Les conditions de culture existant dans les différents pays exercent également une influence sur la propagation de la cuscute—et notamment l'abstinence plus ou moins stricte aux règlements officiels établis pour combattre ce fléau. Cependant, comme les méthodes d'extirpation sont fort coûteuses, les pays européens se contentent souvent d'empêcher l'importation de la cuscute, en insistant sur des degrés obligatoires de pureté pour les graines de provenance étrangère. C'est pour cette raison même qu'il serait très intéressant de connaître les limites régionales de la cuscute.

Il est donc également important pour les cultivateurs de fourrages, les marchands grainiers et les stations officielles de contrôle des semences d'être renseignés à l'égard de ces limites. Je crois ne pas me tromper en

disant que la question intéresse aussi l'Amérique et devra bientôt intéresser l'Asie.

Vu son importance, je constate avec regret le peu d'intérêt qu'éveillent les travaux du comité de la cuscute. Cette apathie est probablement causée par la confusion politique et financière existant actuellement dans l'Europe centrale et orientale.

Il ne nous a pas été possible d'obtenir des renseignements à ce sujet de la Russie—renseignements qui auraient été d'autant plus intéressants que la cuscute y a, dit-on, des limites régionales très nettes, s'étendant de l'est à l'ouest.

L'Allemagne ne nous a pas envoyé d'indications précises, et cela sans doute à cause de troubles politiques prolongés. Tous les efforts de M. le professeur Voigt ont échoué.

En ce qui concerne la France, M. le professeur Bussard déclare que *Cuscuta trifolii* n'a pas de limites régionales, mais que cette mauvaise herbe est répandue dans tout le pays. *Cuscuta racemosa* ou *suaveolens*, au contraire, n'existe que dans certains territoires dont le nombre et l'étendue varient chaque année selon les conditions climatiques. Il est très difficile de fixer les limites de ces territoires dont la distribution n'est pas régulière. M. le professeur Bussard ajoute qu'il est impossible d'établir les limites de la cuscute en France sans faire d'autres enquêtes plus approfondies.

La Roumanie ne m'a pas envoyé de détails. J'ai exposé à M. le professeur Enesco notre système de questions pour fixer les limites de croissance de la cuscute, mais sa réponse me manque encore.

Il n'en est de même pour la Tchécoslovaquie. J'ai le regret de vous dire que je n'ai pas pu prendre contact avec M. le directeur Vitek.

C'est M. le Dr. A. Volkart (Suisse) qui m'a fait parvenir les renseignements les plus importants à cet égard, renseignements admirablement présentés. Il paraît qu'en Suisse, de ce côté des Alpes, ce n'est que *C. trifolii* qui joue un rôle plus ou moins important, et cela dans la courbe pluviale de 1000 mm. Dans les régions où il tombe plus de pluie, son influence n'est pas néfaste. Pendant les saisons sèches et chaudes, la cuscute fait plus de dégâts et produit une grande quantité de graines mûres, lesquelles souillent de leurs germes les terres qui les reçoivent, et cela pendant plusieurs années. Le mal décroît pendant les saisons humides.

La cuscute pousse cependant toujours à certains endroits, même dans les régions, où par suite du système d'assolement, l'on a l'habitude de ne récolter que chaque 4 ou 5 ans les fourrages mixtes de trèfle et de graminées. Ses dégâts ne sont nulle part importants. Le trèfle pousse très abondamment en Suisse, ce qui empêche le développement de la cuscute.

Dans les cantons de Vaud et de Genève, ainsi que dans le Valais, la cuscute est plus nuisible qu'ailleurs. Dans le Tessin, la pluie, plus abondante, facilite la croissance du trèfle et empêche celle de la cuscute. Le Tessin ne possède aucune zone où il ne tombe pas 1000 mm. de pluie. *C. racemosa* ne croît que d'une façon isolée en Suisse, tandis que *C. arvensis* Beyr. semble y être inconnue.

La ligne isohyète de 1000 mm. est donc une ligne très importante, car elle représente probablement la ligne de limite de croissance de la cuscute.

Une autre ligne délimitatrice est la ligne isohypse de 800 m. M. le Dr. J. V. Szyzylowicz, de Lemberg, l'a signalée en premier lieu à l'occasion de la conférence d'essais de semences de Hambourg (*Jahresb. der Ver. f. angew. Bot.*, W. 1907; 298). Il n'est pas douteux que les conditions climatiques existant à cette hauteur jouent ici un rôle important. Ceci est confirmé par nos observations d'avant-guerre, faites au nord-est de la Grande Hongrie, dans les forêts des Carpathes. En raison des pluies abondantes, les graines de trèfle récoltées dans cette région furent relativement pures, bien qu'une grande quantité de cuscute eût poussé.

Vers la fin de la guerre, d'importantes quantités de semences de trèfle très cuscutées (*C. racemosa*) furent expédiées de Hongrie en Bavière. Autant que je le sache, cette cuscute ne s'est pas acclimatée en Bavière.

et cela sans doute parce que les régions ensemencées avec le trèfle en question sont au-dessus du niveau de la limite de la cuscute. Les conditions existant dans l'Autriche actuelle sont probablement les mêmes qu'en Suisse et en Bavière.

En ce qui regarde les effets de la cuscute dans les limites rétrécies de la Hongrie actuelle, il faut croire que tout le pays en est infecté. Comme il est entièrement situé dans les lignes limites de la cuscute, cette mauvaise herbe peut se développer sur son territoire entier, et si elle ne le fait pas partout, c'est grâce à des mesures de préservation et de destruction énergiques.

Ce territoire contient—je ne l'ignore pas—des régions avoisinant, en Hongrie occidentale, les frontières de la Styrie et de l'Autriche, où il tombe annuellement 800 mm. de pluie, et où le trèfle pousse peu mélangé de cuscute. A l'est de ce territoire et jusqu'au Danube, la moyenne annuelle des pluies est de 700 mm.; encore plus à l'est, elle va diminuant, n'atteignant plus qu'une moyenne de 600 et 500 mm. Toutes ces régions sont situées entre les lignes limites des cuscutes.

En un mot, il me semble qu'en Hongrie les lignes limites de la cuscute sont tracées un peu au-dessous de la ligne pluviale de 1000 mm.

En ce qui regarde les limites de la cuscute en Angleterre, le journal officiel (*Journal of the Ministry of Agriculture*, Vol. 30, 1923; 38-41), contient le renseignement important que *Cuscuta trifolii* n'existe pas en Ecosse, que sa présence est rare au nord de la rivière Trent et jusqu'aux frontières de l'Ecosse, mais qu'elle devient plus fréquente dans les comtés qui se rapprochent du sud et de l'est de l'Angleterre.

Impossible d'ignorer le rapport existant entre l'éteridue de la ligne de croissance de la cuscute et le volume annuel des pluies. Le chiffre s'en élève à 700 ou 800 mm. au sud et à l'est de l'Angleterre, à 800, 900, et 1000 mm. à l'ouest, et à une moyenne encore plus élevée au nord de la rivière Trent. *Cuscuta racemosa* ne s'est acclimatée nulle part en Grande Bretagne.

Je regrette de ne pas pouvoir vous fournir des renseignements plus copieux et plus précis, comme résultat des enquêtes de mon comité. Je suis cependant d'avis que la solution du problème est intimement liée à la possibilité de fixer les limites climatiques, et que même les données peu précises que nous possédons actuellement peuvent, faute de mieux, nous être utiles dans l'appréciation du danger qu'offre la présence de la cuscute.

Je termine en vous soumettant les propositions suivantes :

1°. Que la période d'existence du comité de la cuscute soit prolongée par le Congrès;

2°. Que le comité poursuive ses recherches au sujet des limites climatiques mentionnées ci-dessus, ainsi que sur les lignes isohyètes et isohypses, et—dans la mesure du possible—les lignes isothermes;

3°. Qu'il serait utile d'aborder la question des limites de la cuscute par voie d'expériences.

L'expérience la plus intéressante serait de cultiver la cuscute, en premier lieu dans les régions considérées comme en étant exemptes, et secondement, dans celles où elle n'existe presque pas.

Les trois vœux émis par ce comité sont adoptés.

M. le Professeur Johannsen propose l'élection de MM. Brown, Devoto et Kouleshoff comme membres correspondants du comité de la cuscute. Ces messieurs acceptent et sont élus.

Mercredi, 9 juillet; 10 h.

M. le professeur Voigt lit son rapport "Sur des méthodes d'essais de germination."

(Voir pp. 192-194 le rapport in extenso en langue allemande.)

Résumé français.

Depuis notre congrès à Copenhague, l'intérêt pour les questions de physiologie de la germination des semences a bien augmenté. Spécialement les travaux de Mm. Merckenschlager ("Keimungsphysiologische Probleme") et Boas et de différents auteurs donnent des idées très modernes sur la résistance des différentes semences contre les forces déterminant et retardant la germination, et pas seulement les forces mécaniques, mais aussi les forces chimiques et physico chimiques. Les résultats de M. Popoff augmentant de rendement des blés et l'effet des fungicides Uspulun et Germisan procèdent des mêmes idées. Hélas ! à mon avis, le moment n'est pas encore venu d'introduire ces méthodes dans les essais pratiques de germination.

D'autre part, il y a des études faites en collaboration par les stations de Zürich et de Hohenheim (*Pinus Strobus*) et d'autres à Copenhague (*Pinus Strobus*) et à Hambourg (*Anthoxanthum Puelii*, *Festuca ovina*, *Aira flexuosa*, *Cynosurus cristatus*), qui sont directement utilisables pour la pratique.

Néanmoins les deux enquêtes faites pendant les dernières années par Copenhague ont donné des résultats assez congruents et par conséquent il ne paraît pas nécessaire d'introduire des règles nouvelles.

M. le professeur Voigt fait circuler parmi les congressistes des exemplaires de sa communication au congrès de Copenhague intitulée "Directives pour les essais de germination."

(Voir pages 86 et 88 des Comptes rendus du Congrès de Copenhague en 1921.)

Une longue discussion s'engage au sujet de ces directives. Les questions s'y rapportant sont renvoyées à l'étude du comité à élire.

M. le Dr. Franck donne communication de ses "Recherches sur les germinations à basse température" (la traduction en langue anglaise de ce rapport se trouve pp. 59-75 du présent compte rendu).

Résumé français.

1°. En la comparant avec la méthode alternante ordinaire (de 20° à 30°) et avec d'autres méthodes, on constate que la méthode alternante avec emploi de l'appareil Jacobsen (placé dans un local exposé au nord) à une température de 11° à 26°, conduit à l'obtention d'une germination plus élevée et plus constante dans le cas de diverses espèces de semences.

2°. Une température de 10° Centigrades est excellente. Elle permet presque toujours d'obtenir la germination maxima pour les céréales hollandaises incomplètement mûres (à l'exception de l'orge), et pour quelques autres espèces de semences.

Il arrive rarement que la germination soit retardée par cette température basse. Quand cela se produit, il suffit d'un séchage intensif pendant 5 à 7 jours, à une température de 35°, pour amener les semences—à l'exception de l'orge—à une germination normale.

3°. La meilleure température pour faire germer les semences d'agrément, agricoles ou potagères, est une température basse et constante de 10°, ou bien une température alternante de 10° à 20°. Grâce à l'emploi d'une machine frigorifique A.S., les thermostats bien isolés peuvent atteindre et conserver, avec une constance suffisante, une température de 10° Centigrades.

M. le Dr. von Degen fait observer que la méthode de *M. le Dr. Franck* ne peut être employée que dans les pays dont les conditions de climat rappellent celles de la Hollande. Avec un climat comme celui de la Hongrie, il ne peut être question pour les semences indigènes que de graines complètement mûres; l'emploi de températures alternantes est nécessaire, au contraire, pour les graines de betterave de provenance allemande.

M. le professeur Bussard dit qu'il y a lieu de tenir compte de la teneur en eau, en ce qui concerne les semences de céréales récoltées par temps humide, sous les climats froids. De telles semences germent généralement mieux après dessiccation artificielle.

M. Anderson pense que l'expression "maturation retardée" n'exprime pas l'état véritable des céréales. L'orge est toujours décortiquée, à sa station, pour donner satisfaction au commerce grainier; l'expérience démontre que cette opération en active, en effet, la germination.

M. Clark dit qu'au Canada, il arrive souvent que la semence est atteinte par la gelée. On la sèche alors dix jours sous verre. Afin de savoir si la graine est encore capable de germer, on la sème ensuite dans de la terre soigneusement stérilisée et préparée à cet effet.

M. le directeur Dorph-Petersen se réfère à son rapport intitulé "Recherches sur les céréales incomplètement mûres," dont le texte anglais figure pp. 76-82.

Séance de l'après-midi.

Visite de l'Ecole d'agriculture de l'Université de Cambridge.

Les représentants des marchands grainiers et des cultivateurs assistent à la séance. *Sir Lawrence Weaver* et *M. le directeur Dorph-Petersen* leur souhaitent la bienvenue, au nom du Congrès et de l'Association européenne des stations d'essais de semences. *M. E. G. Bell* les remercie au nom du Congrès international des marchands grainiers et de l'Association des marchands grainiers britanniques.

Sir Lawrence Weaver prie *M. le Dr. Volkart* de lire son rapport sur "La détermination des provenances établie par l'Association."

(Le texte anglais de ce rapport est inséré pp. 83-97.)

Conclusions.

1. Les résultats de l'examen de diverses séries d'échantillons de trèfle violet de provenances différentes d'après le procédé proposé au nom du congrès international d'essais de semences à Copenhague, démontrent qu'il est possible d'arriver par cette voie à des descriptions exactes et authentiques des provenances. Ces recherches seront donc à continuer.

2. Il est absolument nécessaire d'exécuter ces recherches et de publier leurs résultats d'après un seul plan afin que ceux-ci soient comparables entre eux et puissent être utilisés facilement.

3. Comme par le passé, l'examen d'une provenance donnée doit être la tâche de l'établissement du pays originaire. Cet établissement recueillera les échantillons et les examinera d'après le plan uniforme. La publication détaillée est réservée à cet établissement.

4. Le quatrième congrès international d'essais de semences à Cambridge désignera un bureau central, par lequel ces recherches seront encouragées et aidées. La tâche de ce bureau sera

- (a) de développer et d'unifier les méthodes de recherche;
- (b) d'instruire et d'aider les établissements y participant;
- (c) de publier de courts résumés des résultats de ces recherches, de les interpréter et de les distribuer aux membres de l'association;
- (d) de poursuivre ces recherches pour les pays dans lesquels les établissements de contrôle des semences sont hors d'état de les exécuter eux-mêmes;
- (e) d'examiner les groupes d'espèces qui ont une importance particulière pour la détermination de la provenance, de publier les caractères distinctifs et de distribuer des spécimens authentiques de graines de ces espèces aux établissements prenant part aux recherches;
- (f) d'organiser et d'administrer une collection centrale (propriété de l'association) de tous les résultats individuels de l'examen des différents échantillons d'une même provenance.

5. L'association fixera une somme annuelle pour les travaux de ce bureau et le comité de l'association accordera en outre des subventions suffisantes pour les recherches spéciales qui deviendraient nécessaires.

Sir Lawrence Weaver complimente M. le Dr. Volkart pour son remarquable exposé et exprime ses regrets qu'il ne puisse continuer, au profit de l'association, ses travaux sur la détermination des provenances.

M. le Dr. Volkart attire l'attention de l'assemblée sur un rapport concernant la provenance dressé par M. Tryti, de Christiania.

(Voir pp. 97-98 de la section anglaise.)

M. le directeur *Dorph-Petersen* fait observer qu'à Copenhague, comme à Christiania, on s'est rendu compte du fait que la présence, dans un lot de semences, de débris végétaux et de débris minéraux offre des renseignements précieux sur la provenance. La détermination exacte est difficile, lorsqu'il s'agit de mélanges de graines de diverses provenances.

M. *Edgar Brown* présente, en anglais, un rapport sur la évaluation de semences dures.

Évaluation des Graines Dures.

PAR

M. EDGAR BROWN, de Washington.

Les graines dures se trouvent notamment chez les semences des légumineuses n'absorbant pas facilement l'eau dans les conditions normales de germination—telles que *Melilotus*, *Vicia*, *Medicago* et *Trifolium*.

La valeur de récolte des graines dures dépend des conditions d'ensemencement. Par exemple, quand Crocker sema de la graine dure de *Melilotus* aux mois de décembre et d'avril, 72 % de la première partie germa au mois de juin, ainsi que 2 % de la seconde partie.

L'institut d'essais agricoles d'Iowa arriva au même résultat avec de la semence de *Melilotus* exposée alternativement au gel et au dégel.

Harrington signale qu'une faible proportion de graines dures de *Trifolium* et de *Melilotus* a germé rapidement pendant la saison chaude, mais une quantité relativement importante pendant l'hiver.

En ce qui regarde *Trifolium pratense* et *Melilotus*, il y a une différence assez grande entre les graines dures et non dures; cette différence n'est pas aussi grande pour *Medicago sativa* et *Vicia villosa*.

Nos connaissances en cette matière ne sont pas complètes, et la question de la meilleure méthode d'évaluer les graines dures doit être étudiée à fond.

Je suis heureux de pouvoir vous dire que, s'inspirant sans doute du bel exemple donné par le magnifique Institut de botanique agricole britannique, les marchands grainiers américains ont distribué—par l'intermédiaire du Conseil national de recherches des États-Unis—les fonds nécessaires pour des recherches au sujet de la valeur agricole des graines dures. Nous nous attendons à de bons résultats pratiques.

Évaluation des graines dures en Amérique.—Cette question n'entre pas dans l'application du règlement actuel sur l'importation des semences étrangères, attendu que la loi des États-Unis exige uniquement l'indication des graines viables.

Le règlement de presque tous les états des États-Unis exige l'indication du pourcentage de germination. Quelques états indiquent donc les graines dures, d'autres une proportion seulement, d'autres encore n'en font pas mention.

Notre association nationale a adopté la norme suivante pour le plombage des sacs :—

“ En mentionnant le chiffre de germination des graines dures des légumineuses (dont une partie reste dure après l'essai), il faut indiquer le pourcentage véritable de germination, ainsi que celui des graines restées dures.”

Vu l'état actuel de nos connaissances au sujet de la valeur des graines dures pour la culture, les autorités américaines sont d'avis que cette indication est plus utile au fermier que n'importe quelle évaluation arbitraire.

Il est important, en ce qui regarde quelques espèces de semences, d'entamer le tégument des graines, afin de les faire germer plus rapidement en terre.

Harrington a signalé une bonne méthode, qui consiste à passer la semence—après le battage—dans un appareil spécial.

En ce qui regarde les semences brisées, nous n'en faisons pas beaucoup de cas aux États-Unis, à l'exception de *Trifolium incarnatum*. Nous observons cependant la règle suivante de notre association nationale :—

“ Les graines des légumineuses ne germent pas, si les deux cotylédons sont brisés net.”

Avant de terminer, je veux souligner l'importance extrême des recherches agricoles, en raison de la valeur universelle de l'agriculture.

Le commerce grainier dépend uniquement de l'agriculture. Vous la servez, MM. les marchands grainiers, et c'est à elle que vous devez tout ! Payez donc de bonne grâce votre contribution, pour venir en aide aux recherches agricoles.

Et j'ose vous dire—à vous, MM. les chefs des stations d'essais et analystes—que vous dépensez trop de votre énergie sur la routine, et pas assez sur les questions biologiques de première importance, bases des

essais de semences et de l'agriculture même. Ne vous contentez pas de savoir *comment* vous poursuivez vos travaux; consacrez vous ardemment aux recherches, qui seules vous en expliqueront la raison !

M. David Bell déclare que, comme cultivateur, il n'entame jamais le tégument des graines dures, mais que, comme marchand grainier, il doit le faire pour le commerce.

Il a fait l'expérience de semer de la graine de trèfle blanc sauvage contenant plus de 30 pour cent de graines dures, et il a obtenu d'excellents résultats.

M. Lafferty donne des détails sur quelques expériences faites par la station de Dublin, pour établir le degré de faculté germinative des graines dures. Les essais, qui ont duré dix ans, ont démontré qu'environ 50 pour cent des graines dures contenues dans de la semence de trèfle rouge germaient après trois ans. La germination devient plus lente ensuite; après dix années d'essai, toutes les graines dures n'avaient pas encore germé. En coupant la pointe des graines restées dures, et en les remettant immédiatement au germoïr, il a obtenu la germination de la plupart en peu de jours. En faisant des essais parallèles avec des graines dures de trèfle, la moitié étant mises en germination au laboratoire et l'autre moitié semée dans des pots à fleurs placés dans une serre froide, *M. Lafferty* a pu constater qu'une proportion plus grande de ces graines avait germé dans le sol qu'au germoïr. Il est d'avis que les bulletins d'analyse ne doivent énoncer que la proportion des graines dures contenues dans l'échantillon d'analyse. C'est au cultivateur d'en déterminer la valeur.

M. Brown dit que des essais faits aux États-Unis ont démontré que, dès qu'on en coupe la pointe, la graine dure peut germer, même après un séjour de vingt ans dans le sol.

M. Devoto fait observer qu'en Argentine, on considère que 50 pour cent des graines dures sont capables de germer.

M. le professeur Bussard et *M. le Dr. von Degen* admettent que toutes les graines dures sont en état de germer.

M. le directeur Dorph-Petersen présente des exemplaires dactylographiés de ses observations sur le rapport de *M. Brown*, ainsi que d'une brochure intitulée "Combien de temps les semences de diverses espèces peuvent-elles garder leur faculté germinative?" Cette dernière donne les résultats d'essais faits avec des lots de semences emmagasinés dans des conditions variées de température et d'humidité. Ces essais ont prouvé que le contenu en graines dures de semences de trèfle violet, de trèfle jaune et de lotier corniculé a été souvent beaucoup plus élevé dans les lots conservés dans des pièces chaudes et sèches (chauffage central à 18° C.), que dans ceux gardés dans des pièces fraîches, humides.

Étant donné qu'on brise souvent la graine en la coupant, *M. Dorph-Petersen* est d'avis que la graine dure doit être

considérée comme apte à germer si la proportion contenue dans le lot considéré n'est pas sensiblement plus élevée que la proportion admise comme normale pour l'espèce. Les expériences faites ont démontré que c'est la semence de luzerne qui garde le plus longtemps sa faculté germinative, et que les graines dures sont presque toujours capable de germer, pourvu qu'on les coupe.

M. Brown constate que toute l'assistance lui semble d'avis que les graines dures sont capables de germer.

Après le thé, le rapport de *MM. Pammer et Schindler* (Vienne) sur les semences dures et les graines brisées est présenté à l'assistance par *M. le Dr. Voigt*.

(Voir pp. 102-105 la traduction anglaise de ce rapport. La version allemande se trouve pp. 200-203).

M. Lafferty critique le dernier paragraphe de ce rapport—où il est dit que la plante n'est pas sensée être viable si ses deux cotylédons sont brisés. Les expériences faites par sa station ont prouvé qu'une graine peut germer malgré la mutilation des cotylédons pourvu que le germe soit intact.

M. le professeur Voigt donne au tableau noir une démonstration de sa thèse, que la possibilité de germination dépend du point où la semence est mutilée.

M. le directeur Dorph-Petersen et *M. Anderson* sont tous deux d'avis que les semences brisées doivent être considérées comme "mortes," et *M. Lafferty* leur donne raison au sujet de la vitalité très minime de ces semences.

M. Fleischner (délégué tchécoslovaque au congrès des marchands grainiers) et *M. le Dr. Chmelar* traitent la question au point de vue commercial. Ils sont d'avis que les bulletins d'analyse doivent non seulement indiquer le pourcent des graines dures en état de germer contenues dans un échantillon, mais énoncer également celui de toutes les graines dures.

M. Devoto pense que la graine se brise souvent à cause d'une sécheresse trop grande, et *M. Lafferty* que la cause en est une tension interne anormale de l'embryon au germe.

M. le Dr. Voigt prévoit la nécessité—en raison des opinions divergentes qui se manifestent à ce sujet—de créer une norme internationale pour l'évaluation des graines dures. En Europe, les semences brisées ont peu d'importance. Il partage l'opinion de *M. Devoto* au sujet de leur cause.

Le comité de neuf membres élu le mardi précédent se réunit dans la soirée pour une longue séance. Il dresse le projet de statuts de l'Association internationale de contrôle, et s'occupe d'autres questions importantes se rattachant à ce sujet.

Jeudi, 10 juillet ; 10 h.

M. le Dr. Chmelař donne lecture de son mémoire sur la détermination de l'identité botanique des variétés dans les laboratoires et les champs d'expériences.

DÉTERMINATION DE L'IDENTITÉ BOTANIQUE DES VARIÉTÉS DANS LES LABORATOIRES ET LES CHAMPS D'EXPÉRIENCES,

PAR

DR. F. CHMELAŘ, BRÜNN.

L'importance de la garantie de l'identité botanique et de la pureté des variétés, ainsi que la nécessité de déterminer tous les caractères qui les distinguent l'une de l'autre, dans les laboratoires et dans les champs, s'accroissent avec le développement de l'intensité de la culture des plantes et avec l'emploi de plus en plus fréquent des variétés sélectionnées.

La révision des semences et la détermination de l'identité d'origine des variétés usuelles dans un grand nombre des états européens exige l'établissement de l'authenticité et de la pureté des variétés dans les cultures et aussi dans les échantillons de graines, de bulbes, de tubercules, etc., envoyés aux différents instituts.

En outre, cette détermination est exigée lorsqu'on a à établir l'identité d'origine des variétés sélectionnées destinées à l'exportation (Tchécoslovaquie, Danemark).

Les méthodes dont on se sert pour établir l'identité botanique des variétés ne sont pas encore étudiées à fond, vu que les signes les plus frappants donnant la garantie d'une bonne récolte et d'une qualité satisfaisante attirent surtout l'attention des sélectionneurs, tandis qu'il importe souvent aussi d'observer les caractères pratiquement insignifiants.

Un bon moyen de détermination des variétés de betteraves sucrières et fourragères est l'observation de la couleur des germes développés à la température de 15° C., à la lumière diffuse, au bout de deux semaines (Pieper). La détermination de la couleur des germes et notamment des formes intermédiaires est facilitée par l'emploi des filtres chromatiques (Vitek). Pour établir la richesse saccharine des racines, il faut analyser au moins trois fois de suite 40 betteraves développées en culture normale et se servir d'une quantité de jus quatre fois plus grande que normalement, si l'on doit établir la richesse saccharine exactement à 0.1 % (Méthode de la Station de recherches sucrières de Prague). En Danemark (Hallquist), on suit une méthode analogue pour déterminer la couleur des racines d'après la couleur des germes des crucifères.

Un excellent moyen pour déterminer les différentes variétés de pomme de terre, c'est l'observation de la coloration de l'extrémité des germes ayant poussé à la lumière diffuse (Snell), ou bien l'observation de la couleur des germes développés à l'obscurité (Vilmorin). Récemment, on a constaté que la grosseur des grains d'amidon (Parow), établie par la méthode Linder, est un caractère de variété. Si l'on doit déterminer la variété dans les champs, il faut constater non seulement les qualités des tubercules, mais encore de la plante toute entière. En ce qui concerne les tubercules, il importe surtout d'observer la forme, la couleur de la peau et celle de la chair et des yeux. Quant au plant : la hauteur, l'épaisseur et la couleur de la tige. Pour ce qui est des feuilles : la forme, la couleur des folioles, la position de la foliole terminale, la forme de la pointe, la couleur du pétiole, la coalescence des folioles et des foliolules. Pour l'inflorescence : la quantité de fleurs, les bractées, la forme et la longueur des pointes des sépales du calice, la grandeur et la couleur de la corolle, ainsi que des fleurs à corolle double et enfin la position des étamines et du pistil.

La détermination des variétés de blé est la plus difficile, parce qu'elles sont très nombreuses et qu'il faut très souvent discerner des variétés peu différentes ou ne présentant que des différences biologiques. La détermination des variétés de froment s'obtient par l'observation des différents degrés de coloration des grains (péricarpe) produite après 6 heures par la préparation oxybenzine-mercure-chlorure (chlorophénol mercurieux) n° 778 dans la solution de 1 %, après trempage préalable de 27 heures (Méthode Pieper). J'ai suivi cette méthode en établissant les différences de 61 variétés d'origine tchécoslovaque et j'ai pu constater que ces différences étaient considérables. Le trempage dans l'eau distillée s'est manifesté comme le meilleur. J'ai aussi constaté que la coloration des coléoptiles des germes de froment est un moyen très précieux dans les travaux de laboratoire.

De ces 61 variétés que j'ai observées, ont eu la coléoptile

colorée en rouge-brun	-	-	-	-	-	11
incolore	-	-	-	-	-	33
colorée seulement sur quelques-uns de grains	-	-	-	-	-	17

En ce qui concerne le grain de froment, il est très bon de connaître aussi la longueur des poils des grains et le nombre de rangées des cellules à membrane épaisse, semblables aux cellules épidermiques de la couche centrale du péricarpe (Kondo).

Si l'on veut discerner les types *a* et *c* de l'orge penchée (*H. dist. nutans*), il faut constater, microscopiquement, si les poils sont à une (type *a*) ou bien à deux et même à plusieurs cellules (type *c*). S'il s'agit de l'orge, il est aussi bon de constater les formes des grains dans la position latérale et s'il s'agit des variétés d'orge à 6 rangs, il convient d'établir la plus grande largeur des grains (Holmgaard). La meilleure détermination de l'avoine se fait sur le grain externe et ce qui nous aide ici, c'est aussi la coloration des premières feuilles des germes (Holmgaard).

Je n'ai énuméré que quelques signes plus marquants et plus souvent utilisés. Si l'on est obligé de déterminer les variétés dans les champs, on doit constater tous les caractères et en donner une description détaillée.

Pour faciliter davantage la détermination, il importe non seulement d'avoir des collections de semences, d'épis, de tubercules, de racines et des herbiers de feuilles, d'inflorescences, mais aussi de fonder des jardins d'essais de variétés. La matière à observer doit être prise, il est vrai, directement chez les sélectionneurs, et il faut cultiver les plantes en culture normale, dans le but d'en avoir l'aspect normal. Pour bien connaître les qualités biologiques des plantes, il faut faire des essais plusieurs années de suite.

Il sera nécessaire que l'Union européenne des stations d'essais de semences étende l'unification et l'étude des méthodes et des normes usuelles à la détermination de l'identité, de la pureté, éventuellement de la qualité des variétés.

Il faudra ensuite qu'il existe un échange réciproque entre les diverses stations, des matières observées provenant des jardins d'essais de variétés et qu'il existe entre elles une sorte de communication mutuelle des descriptions des diverses variétés, comme c'est déjà le cas entre les directions des jardins botaniques.

(Voir pp. 204-215 le texte en langue allemande).

Une discussion s'engage sur les diverses façons de déterminer l'identité des variétés de plantes: méthodes biologiques, biométriques, morphologiques, pathologiques, physico-chimiques, et enfin ce que M. le délégué polonais nomme la méthode de *Bertillon*.

M. le professeur *Showky Bakir* fait l'éloge de la méthode pathologique, et M. le professeur *Kuleschhoff* donne une démon-

stration de la manière dont sa station établit la différence entre le froment d'hiver et le froment d'été, ce dernier ayant des plantules velues.

M. le directeur Dorph-Petersen expose les travaux de la station de contrôle danois relatifs à ce sujet, et se réfère à deux brochures rédigées en langue anglaise — l'une intitulée "Danish Experiments in Plant Culture and Details concerning the Trade in Controlled Danish Seed," et l'autre "Some prominent Danish Varieties and Strains of Agricultural Plants" — dont il distribue des exemplaires aux congressistes. Il propose la création d'un comité spécial s'occupant des questions soulevées par le rapport de M. le Dr. Chmelar.

M. le professeur Kuleschoff présente un rapport contenant des tableaux de normes de germination de diverses plantes, et demande un règlement international à ce sujet.

Nota.—Deux rapports rédigés par M. le professeur Kuleschoff, et traduits en anglais sous les titres "Programme and Organisation of and Results obtained by the Harkoff Seed-Testing and Control Station," et "A Brief Sketch of the Development and present Conditions of Seed Control in the Ukraine," seront publiés à Rome dans le journal "The International Review of the Science and Practice of Agriculture," ainsi qu'un compte-rendu de M. le professeur Issatchenko sur "Les Essais de Semences en Russie."

M. Brown exprime le vœu de voir établir un règlement international concernant l'uniformité des essais. On pourrait, en le prenant pour base, rédiger une formule de contrat dont la clause d'arbitrage indiquerait la station officielle d'essais du pays d'importation comme arbitre, en cas de désaccord.

M. le professeur Munn donne lecture d'un rapport sur les travaux de l'Association des analystes officiels de l'Amérique du Nord, dont voici le résumé en français :—

Résumé de quelques questions importantes contenues dans le rapport de M. Munn.

Les autorités compétentes ont maintenant l'habitude, aux États-Unis, de donner aux meilleurs laboratoires s'occupant de l'analyse des semences, un certificat officiel d'une grande importance. Il est basé sur (a) l'entraînement de l'analyste; (b) l'outillage du laboratoire; (c) la valeur de son travail démontrée par les essais; et (d) la nécessité, pour l'analyste, de consacrer tout son temps aux essais et analyses de semences.

Les essais comparés des différentes stations ont donné deux résultats très importants—ils ont mis les analystes en contact avec les meilleures méthodes d'essai, et ils ont établi la limite des écarts ou variations des semences.

Les essais ont démontré également qu'avec un produit aussi biologique que la semence, ce sont, au point de vue de l'analyse, le talent et la science qui l'emportent sur l'excellence de l'outillage. Il faut cependant combiner l'un et l'autre.

Les analystes américains appliquent les règles établies par l'association officielle, lesquelles subissent de temps à autre un changement. Ce

changement y est toujours apporté par un comité spécial de recherches. On emploie, d'après ce règlement, les méthodes continentales.

Une analyse complète pour la pureté doit indiquer, pour chaque lot examiné :—

- 1° Semences pures ;
- 2° Matières inertes ;
- 3° Graines de mauvaises herbes ;
- 4° Graines d'autres plantes cultivées.

Les membres de l'association américaine poursuivent des recherches indépendantes, mais ils en exécutent également avec l'aide de l'Association des recherches. Nous étudions les problèmes suivants :—

- 1° Graines dures ;
- 2° Maladies propagées par la semence ;
- 3° Influence de la gelée sur les plantes ;
- 4° Désinfection des semences ;
- 5° Longévité ;
- 6° Etudes biologiques et physiologiques servant de bases aux méthodes d'essai actuelles.

(Voir pp. 110–112 le rapport en langue anglaise.)

M. le Dr. Gentner fait une communication très intéressante sur la détermination des maladies des plantes transmettre par les semences, avec de nombreuses et remarquables projections.

(Voir pp. 216–217 le rapport en allemand, et pp. 113–114 la traduction en langue anglaise.)

M. le professeur Showky Bakir fait part au congrès des grands dégâts causés dans les cultures de coton en Egypte par la *Gleichia gossypella*. Il explique les différentes méthodes dont on a fait usage pour combattre ce fléau, méthodes presque entièrement abandonnées pour celle du régulateur automatique.

L'orateur fait circuler des spécimens d'insectes et de photographies, en demandant la coopération de l'Association internationale pour la destruction du parasite.

Séance de l'après-midi, 14.30 h.

Sir Lawrence Weaver présente au congrès le projet de statuts de l'Association internationale. Ce projet est accepté article par article, sauf quelques changements de forme.

Statuts de "l'Association Internationale d'Essais de Semences."

1. *Designation et But.*—Sous le nom d'Association internationale d'Essais de Semences ("Internationale Vereinigung für Samenkontrolle"—"International Seed Testing Association I.S.T.A.")—il est créé une union des stations officielles de contrôle des semences, dont le siège légal se trouve au lieu de résidence du président. Cette association a pour but de faire progresser l'étude de toutes les questions concernant l'analyse et l'appréciation des semences. Elle s'efforce d'atteindre ce but—

(a) par des essais comparatifs et des recherches propres à déterminer l'obtention de résultats d'analyse plus exacts et plus uniformes ;

(b) par l'établissement de méthodes et de termes uniformes applicables aux analyses de semences à l'usage du commerce international ;

(c) par l'organisation de congrès internationaux des délégués des stations officielles de contrôle des semences, occasion de discussion en commun et d'information mutuelle, de publication de traités et de rapports sur l'analyse des semences, d'aide réciproque dans l'instruction des fonctionnaires techniques.

2. *Membres.*—Peuvent devenir membres de l'Union :—

(a) les stations officielles qui s'occupent exclusivement ou principalement de recherches relatives au contrôle des semences ;

(b) les établissements de même nature appartenant à des instituts ou à des corporations effectivement soumis au contrôle des gouvernements ;

(c) les Unions de fonctionnaires techniques des stations officielles pour le contrôle des semences.

Les membres s'engagent à participer activement aux travaux de l'Association. Chaque souscripteur reçoit gratuitement les publications de l'Association.

3. *Ressources.*—Les ressources de l'Association consistent dans :—

(a) les cotisations annuelles de ses membres ;

(b) les recettes extraordinaires.

Le montant des cotisations annuelles doit être approuvé par l'assemblée générale pour au moins 3 années consécutives. Ces cotisations peuvent être payées—

(c) par un gouvernement pour l'ensemble de ses stations officielles ; la somme totale à verser dans ce cas n'excédera pas 50 livres sterling par an ;

(d) par une station officielle ou par un institut ;

(e) par une association de techniciens des stations d'essais de semences.

Au cas où la cotisation est payée comme il est spécifié au paragraphe (c), toutes les stations officielles du pays intéressé deviennent automatiquement membres de l'Union et ont droit de vote avec les restrictions du § 8. Le montant des cotisations sera fixé de façon à couvrir les frais :

(a) des publications de l'Association ;

(b) des essais comparatifs et autres recherches ;

(c) de bureau et de secrétariat.

4. *Assemblées, Direction et Administration.*—Un congrès sera tenu par l'Association autant que possible tous les trois ans. L'assemblée générale de l'Association aura lieu simultanément. A cette assemblée, il sera procédé à l'élection du Comité directeur, ainsi composé :—

(a) le président,

(b) le vice-président,

(c) les membres ordinaires, au nombre de trois au moins et de cinq au plus,

(d) deux membres suppléants,

(e) deux contrôleurs des comptes et un suppléant pris en dehors du Comité.

Tous les membres du Comité doivent être des fonctionnaires techniques des stations d'essais de semences.

L'Assemblée générale élira également les Comités nécessaires pour assurer la bonne marche des finances, des recherches, des publications, etc. Ces comités et le Bureau resteront en fonction jusqu'à l'Assemblée générale suivante.

L'Assemblée générale décide du lieu et de la date du futur congrès ; elle approuve le chiffre de la cotisation et nomme membres honoraires les personnes qui, en raison de leurs travaux concernant l'analyse des semences ou de l'aide apportée à l'Association, ont mérité cette distinction.

Par décision du Comité directeur, une Assemblée générale peut être convoquée à d'autres dates que celle du congrès triennal.

L'Assemblée générale atteint le quorum quand vingt membres ayant le droit de vote se trouvent présents.

5. *Organisation du travail.*—Le Comité exécutif se compose du Président, du Vice-Président et des membres ordinaires. Lorsque, par suite de décès ou d'incapacité prolongée, l'un des membres ordinaires se trouve empêché de participer aux travaux du Comité, le Président peut faire appel au concours de l'un des membres suppléants.

Les comptes de l'Association seront examinés chaque année par les deux contrôleurs et ces comptes, vérifiés, seront communiqués à tous les membres de l'Association, en même temps que le rapport du Comité sur les travaux de l'année.

Le Comité prendra toutes dispositions relatives aux dépenses, élira les sous-comités et approuvera les travaux du Congrès.

Si l'Assemblée générale ne réunit pas le quorum, le Comité a tous pouvoirs pour prendre les décisions concernant le budget et le lieu de réunion du prochain congrès. En cas d'égal partage des voix au Comité, la voix du Président est prépondérante.

6. *Président.*—Le Président préside les Assemblées générales, les séances du Comité exécutif et toutes celles du Congrès où des questions techniques importantes doivent être discutées.

Comme président du Comité exécutif, et avec l'approbation de celui-ci, il prend la direction des travaux de l'Association, et se tient en relations avec les Gouvernements et les autres associations soit de stations officielles soit d'analystes des semences, soit de marchands grainiers. Il établit avec les représentants du Gouvernement du pays où se tiendra le Congrès :

- (a) le programme du congrès ;
- (b) les propositions pour la présidence du congrès ;
- (c) l'admission au congrès des auditeurs et des invités.

Il décide des réunions du Comité. Il fait partie d'office de tous les autres comités et sous-comités de l'Association. Il surveille la publication des rapports de ceux-ci.

Le Président peut se faire assister d'un Secrétaire-Trésorier appointé, dont la rétribution sera soumise à l'approbation du Comité. Il est responsable :

- (a) de la garde des biens de l'Association ;
- (b) de la gestion des fonds ;
- (c) de la communication des comptes aux contrôleurs.

7. *Vice-Président.*—En l'absence du Président, à l'Assemblée générale ou aux réunions du Comité, le Vice-Président le remplace.

8. *Assemblées et Congrès—Délégués et Votes.*—Tout membre de l'Association sera convoqué à l'Assemblée générale et au Congrès. Avant chaque congrès, le Comité devra établir le bilan : (a) des cotisations des pays et des membres de l'Association ; (b) des travaux des stations officielles qu'ils représentent, et déterminer le nombre de voix, au maximum cinq, auquel auront droit les délégués de chaque pays pour les votes concernant les rapports des Comités de l'Association et les propositions présentées. Le vote aura lieu à bulletin secret si ce mode de vote est réclamé, sinon, à main levée. Les résolutions seront prises à la majorité des membres présents et votants. En cas d'égal partage des voix, la voix du Président sera prépondérante.

9. *Vote par Correspondance.*—Au cas où une question importante doit être tranchée entre deux réunions de l'Assemblée générale, le Comité peut en référer par lettre aux membres de l'Association ayant le droit de vote et prendre une décision conforme à la majorité des votes émis par correspondance.

10. *Démissions, Dissolution, etc.*—La démission des pays et des membres de l'Association est valable seulement pour la fin de l'année civile et le Président doit en avoir été avisé trois mois auparavant.

La dissolution de l'Association ne pourra avoir lieu qu'après qu'une Assemblée générale, réunie à cet effet, aura émis un vote dans ce sens à la majorité des trois-quarts des membres présents et votants.

Toute modification aux statuts doit être proposée par le Comité exécutif, et communiquée aux membres de l'Association au moins deux mois avant l'Assemblée générale où elle sera discutée.

Les décisions relatives à ces modifications doivent être prises à la majorité des deux tiers des membres présents et votants

11. *Relations avec l'Institut international d'Agriculture.*—L'Association travaillera en collaboration avec l'Institut international d'agriculture pour ce qui concerne les publications et toutes autres questions que le Comité exécutif jugera convenables. En cas de dissolution de l'Association, l'avoir de celle-ci sera transmis à l'Institut international.

12. En cas de doute sur l'interprétation des présents statuts, le texte anglais sera considéré comme texte authentique.

Le comité exécutif devra :—

1°. Apporter les modifications adoptées à ce projet de statuts et en compléter les termes avant qu'il ne soit imprimé;

2°. Comme le temps manque au congrès, fixer le montant des cotisations annuelles à verser à la nouvelle association (conformément au texte du paragraphe 3); en faire part aux différents gouvernements, établissements et associations intéressés.

M. Kirotar estime qu'en fixant le montant des cotisations, il faudra tenir compte du taux du change dans les différents pays.

Sir Lawrence Weaver répond que le comité en tiendra naturellement compte. Il ajoute que la dénomination de l'association doit être fixée dans les trois langues principales du congrès, et qu'il serait utile de charger le comité de la traduction.

Sur la proposition de *Sir Lawrence Weaver*, le comité exécutif est élu. Les noms des membres en sont indiqués à la page 118 du rapport anglais.

M. le directeur Dorph-Petersen propose l'élection, comme membres honoraires de l'Association internationale d'essais de semences, de *Sir Lawrence Weaver* et de *M. le Dr. Volkart*.

Les autres comités spéciaux sont alors élus, sur la proposition de *M. le directeur Dorph-Petersen*. Leur composition se trouve indiquée à pp. 119-120 du rapport anglais.

La question de la date et du lieu du prochain congrès étant alors soulevée, *Mlle. Yeo* annonce qu'elle a été autorisée, au nom de l'Institut International d'Agriculture de Rome, à inviter le congrès à se réunir à Rome.

L'assemblée remercie et accepte cette invitation. Après discussion concernant la date, il est décidé de tenir le prochain congrès à Rome en 1927, dans la première quinzaine du mois de mai.

Les congressistes remercient vivement *M. Chambers* et le personnel auxiliaire de leurs excellents offices. Sur la proposition

de *M. le Dr. Johannsen*, ils expriment à Sir Lawrence Weaver leurs remerciements les plus chaleureux pour la façon parfaite dont il a présidé le congrès.

Clôture du Congrès.

RAPPORTS SUPPLÉMENTAIRES.

Dr. M. Kondo, Kurashiki : "Examinations de semences d'agriculture, surtout quant au Japon." (voir la section anglaise, pp. 121-124).

M. K. Dorph-Petersen, Copenhague : "Quelques examinations quant à l'occurrence et la vitalité de plusieurs espèces de mauvaises herbes sous de différentes conditions, faites à la Station d'Essais de Semences de l'Etat Danois pendant les années 1896-1923." (voir la section anglaise, pp. 124-138, et la section allemande, pp. 221-226).

Dr. A. v. Degen, Budapest : "La vitalité des semences." (voir la section anglaise, pp. 139-143).

IV.—INTERNATIONALER KONGRESS FÜR SAMENPRÜFUNG.

Montag den 7. Juli 1924.

Vormittags-Sitzung.

Die erste Sitzung des Kongresses fand in der Aula des Nationalen Institutes für Landwirtschaftliche Botanik (N.I.A.B.) in Cambridge statt.

Sir Lawrence Weaver eröffnete den Kongress, hiess die Anwesenden herzlich willkommen und brachte den verstorbenen Direktor Bruijning und seine ausgezeichneten Arbeiten auf dem Gebiete der Samenkontrolle in ehrende Erinnerung.

Sir Lawrence Weaver legte den Wunsch einiger Delegierten vor, die "Europäische Vereinigung für Samenkontrolle" zu einer internationalen zu gestalten. Er wurde auf Antrag des Herrn Direktor Dorph-Petersen als Vorsitzender der Konferenz gewählt, worauf er Herrn Professor Johannsen bat, sich ihm als Mitvorsitzender anzuschliessen. Dieser gab das Wort an den Herrn A. Eastham, den Vorstand der Staatssamenprüfungsanstalt in N.I.A.B., der einen Bericht über die Tätigkeit seiner Station vorlas.

Die Arbeit der Amtlichen Samenuntersuchungsanstalt (S.U.A.) für England und Wales.

VON

A. EASTHAM, Leiter der Anstalt.

Die Arbeit der amtlichen Samenuntersuchungsanstalt für England und Wales zerfällt in 4 Hauptabteilungen, und zwar:—

- (1) Untersuchungen für Handelszwecke;
- (2) Untersuchungen der von den amtlich bewilligten Privatanstalten herstammenden Proben;
- (3) Untersuchungen der durch amtlichen Inspektoren erhobenen und eingesandten Kontrollproben (Gesetz von 1920);
- (4) Versuchsarbeiten.

I.

In die erste Kategorie fallen alle für Samenhändler, Landwirte u.s.w., gemachten Prüfungen, sowohl für die amtlich erforderlichen Anzeigen als für Privatzwecke. Vier Hauptgruppen—Klee; Gräser; Getreide und Hülsenfrüchte; Wurzelgewächs—und Gemüsesamen—erhalten in je seinem Laboratorium Behandlung. Die gesammte Registratur der Anstalt (deren Arbeitsweise den Herren Delegierten bei der Besichtigung erklärt wird) beruht auf diese Gruppierung.

Die Analytikerinnen bilden sich in allen 4 Sektionen aus, können also in dem Laboratorium, wo es zur betreffenden Zeit am zweckmässigsten ist, dienen. Nur solche Damen werden jedoch fest angestellt, welche einer der jährlichen Examina der Samenuntersuchungsanstalt in befriedigender Weise durchgemacht haben.

Mit Ausnahme einzelner unwichtigen Abweichungen, benützen wir in Cambridge die kontinentale Methode. Erläuterungen darüber können sich die Herren Delegierten in den Laboratorien holen.

Im Jahre 1922-23 wurden 19,829, und im Jahre 1921-22 etwa 23,865 Handelsproben geprüft. Die Zahl für dieses Jahr wird wohl etwas niedriger sein.

II.

Eine nicht geringe Anzahl englischer Samenhändler haben vom Landwirtschaftsministerium die Erlaubnis erhalten, in ihren Privatanstalten eine oder mehrere Samenarten selbst zu prüfen. Die Genehmigung wird nur dann erteilt, wenn Sicherheit besteht, (a) dass die Untersuchungen in zufriedenstellender Weise durchgeführt werden; (b) dass eine vom Ministerium anerkannte Analytikerin die Aufsicht übernimmt; (c) dass die nötigen Einrichtungen zu Diensten stehen; und (d) dass die Untersuchungen nach den Vorschriften des Ministeriums vorgenommen werden.

Jede Privatanstalt muss eine genügende Register für alle Prüfungen führen und die geprüften Proben mindestens 3 Monate behalten. Aus ihnen entnehmen die amtlichen Inspektoren die sogenannten "Privatanstalts-Reserveproben" ("licensed station reserve portion"), welche dann der Samenuntersuchungsanstalt zur Prüfung zugeschickt werden.

Um eine wünschenswerte Uniformität zwischen der amtlichen Anstalt und den Privatanstalten noch mehr zu entwickeln, sind dieses Jahr einige neue Proben—die sogenannten "referee samples"—den Privatanstalten gesandt worden. Die Resultate sind recht interessant ausgefallen.

Es wird Handelsanalytikern gestattet, sich einem Monatskurse bei der Samenuntersuchungsanstalt anzuschliessen, wonach sie ein Examen in Samenprüfung durchmachen müssen. Eine jährliche Konferenz wird jetzt am Ende des Examens stattfinden, an welche nicht nur die Analytikerinnen der amtlichen Samenuntersuchungsanstalten für Grossbritannien und Irland, sondern auch diejenigen der Privatanstalten teilnehmen können.

Eine derartige Konferenz hat schon letztes Jahr mit recht befriedigendem Resultate stattgefunden.

Den Privatanstalten wird in der Zukunft ein amtliches Blatt regelmässig zugehen, woraus sie die Resultate der Untersuchungen der amtlichen Anstalt und andere nützlichen Nachrichten entnehmen werden können.

Kontrollproben werden der Anstalt durch ihre Inspektoren zugeschickt. Dem Ministerium für Landwirtschaft gehen alsdann die Resultate der Prüfungen zu, welche von diesem an die Interessenten weitergeschickt werden. Der Samenverkauf wird auf diese Weise kontrolliert, und jede Übertretung des Samengesetzes von 1920 unmöglich gemacht.

Die Samenuntersuchungsanstalt hat ferner die Aufgabe über Keimfähigkeit und Reinheit der ihr zugesandten Proben zu berichten. Ein gerichtliches Verfahren, das sich in den meisten Fällen auf den Bericht der Anstalt begründet, wird, wenn nötig, vom Ministerium für Landwirtschaft unternommen.

Die Samenuntersuchungsanstalt, die schon eine Reihe Versuchsarbeiten zu Stande gebracht hat, hofft in der Zukunft noch andere Probleme lösen zu können, darunter:—

- (a) Rückgang der Keimfähigkeit von unter verschiedenen Verhältnissen gelagerten Samen;
- (b) Keimverzögerung (besonders beim Getreide);
- (c) Hartschaligkeit: Bewertung der in Leguminosensamen gefundenen hartschaligen Samen;
- (d) Unterschied zwischen der Keimung der Erbsen im Laboratorium und im Felde;
- (e) Keimung der Esparsette (spez. in Bezug auf zerbrochene Keime);
- (f) Unregelmässige Gewächse (Gräser).

Nach der Vorlesung dieses Berichtes besichtigten die Delegierten die Samenprüfungsanstalt in N.I.A.B.

Nachmittags-Sitzung.

Direktor Dorph-Petersen las seinen Bericht über "Die Arbeit der Europäischen Vereinigung für Samenkontrolle in den Jahren 1921 bis 1924" vor.

Die Arbeit der Europäischen Vereinigung für Samenkontrolle in den Jahren 1921 bis 24.

VON

K. DORPH-PETERSEN,

Direktor der Dänischen Staatssamenkontrolle.

Nachdem die Vereinigung der europäischen Samenkontrollanstalten an dem internationalen Samenkontrollkongress in Kopenhagen in 1921 gebildet war, wurde ein Komitee aus Direktor F. F. Bruijning, Wageningen, Direktor, Dr. A. Volkart, Zürich, und mir selbst bestehend, gewählt, um die Arbeit der Vereinigung zu leiten; unglücklicherweise starb Dr. Bruijning kurz danach und die Vereinigung verlor dadurch eine ausgezeichnete Kraft. Dr. Bruijning führte eine behebende und selbstständige Organisationsarbeit an der Samenkontrollanstalt in Wageningen aus, eine Arbeit, die ich mehrmals die Gelegenheit hatte kennen zu lernen. Wir wollen uns seiner und seiner Arbeit bei dieser Gelegenheit erinnern. An einer Sitzung in Prag im September 1921 konstituierten sich die zurückgebliebenen Mitglieder des Komitees als Komitee mit Dr. Volkart als Sekretär; infolge eindringlicher Bitte von Dr. Volkart übernahm ich den Vorsitz. Wir einigten uns darüber, die Arbeit bis zu dem Kongress in England weiterzuführen zu versuchen, und es dem Kongress zu überlassen, ein neues Komitee zu wählen.

Der Plan der Arbeit.

An der Sitzung in Prag einigte sich das Komitee über das Ziel der Arbeit und dessen Richtlinien und Verteilung. In dem Vorschlag, der auf dem Kongresse in 1921 von Sir Lawrence Weaver gestellt wurde, ist angeführt, dass das Ziel der Arbeit einheitliche Analysenmethoden in Europa samt Gleichartigkeit in der Weise, in welcher die Analysenergebnisse und die Qualität des untersuchten Samens ausgedrückt werden, sein solle. Dr. Volkart und ich waren darüber einig, nicht zu weit in der ersterwähnten Richtung zu gehen, weil bindende Instruktionen kaum eingehalten würden, und weil es ferner notwendig sei, auf die Lokalbedingungen, das Vermögen und die disponiblen Mittel der Anstalten Rücksicht zu nehmen. Es würde genügen die Richtlinien der zukünftigen Arbeit zu geben, vorausgesetzt, dass diese gefolgt würden; die Hauptsache sei, dass man gleichartige Analysenergebnisse erzielte. Die Methoden, nach welchen dies erreicht werden sollte, musste man den verschiedenen Vorstehern zu wählen überlassen. Das Komitee sollte sich damit begnügen, Ratschläge zu geben, wenn solche gewünscht würden. Um die Arbeit zu beschränken, wurde bestimmt, dass diese vorläufig nur offizielle Samenkontrollanstalten umfassen sollte.

Es wurde bestimmt die Arbeit so zu verteilen, dass Dr. Volkart die Bewerksstellung vergleichender Herkunftsbestimmungen übernehmen sollte, während ich diejenigen betreffend Reinheit und Keimfähigkeit übernahm, sowie ich auch den Briefwechsel mit den Anstalten, die sich der Vereinigung angeschlossen hatten oder anzuschliessen wünschten, übernehmen sollte.

Herkunftsbestimmungen.

Diese Richtlinien der Arbeit sind im wesentlichen seit der Sitzung in Prag gefolgt worden. Dr. Volkart, der die grösste Erfahrung hatte, was die Provenienzfrage betrifft, und dessen Anstalt seit einer Reihe von Jahren eine grosse Rolle in der Bestimmung der Herkunft der Samen spielt, hat vergleichende Untersuchungen in dieser Hinsicht bewerkstelligt. Diese Frage ist—wie bekannt—eine der schwierigsten auf dem Gebiete der Samenkontrolle und verlangt bedeutende Studien und genaues Zusammenarbeiten, falls man positive Resultate zu erzielen wünscht. Dr. Volkart wird diesbetreffend einen Vortrag am Mittwoch d. 9. halten.

Vergleichende Untersuchungen.

Kurz vor dem Kongresse in Kopenhagen wurden Serien gleichartiger Samenproben (25) zur vergleichenden Untersuchung versandt. In dem Bericht des erwähnten Kongresses* ist eine Übersicht über den von 19 Anstalten in Europa, 4 in Amerika und 1 in Japan eingegangenen Ergebnissen angeführt.

In der nächsten Zeit nach dem Kongresse korrespondierte ich mit diesen Anstalten und machte sie auf diejenigen ihrer erzielten Ergebnisse aufmerksam, die nicht innerhalb passender Latituden mit dem Durchschnitt der Resultate der grösseren Anstalten übereinstimmen. Die Analysenergebnisse der erwähnten grösseren Anstalten stimmen im Allgemeinen innerhalb der Latituden, die in den Regeln der dänischen Staatssamenkontrolle festgesetzt sind, überein.

Nach dem Kongresse wurden neue Serien aus 24 gleichartigen Samenproben bestehend versandt, und ein Briefwechsel dem obenerwähnten entsprechend wurde mit 43 Anstalten (37 europäischen, 4 amerikanischen, 1 neuseeländischen und 1 japanischen), von denen Ergebnisse eingegangen waren, geführt. Von der Tabelle 1 (Seite 21–26) ist ersichtlich, dass diese Ergebnisse, was eine Reihe von Anstalten betrifft, in der Regel innerhalb passender Latituden übereinstimmen. Viele dieser Anstalten, die gleichartige Ergebnisse erzielt haben, benutzen Analysenmethoden, die in manchem verschieden sind; einige davon haben ganz kurzgefasste Analysenregeln, während andere gar keine offiziellen haben. Im Gegensatz ist es unvermeidlich zu bemerken, dass Resultate von Anstalten erzielt, die sehr detaillierte, einheitliche Regeln für Samenkontrolle haben, in vielen Fällen ziemlich verschieden sind.

Es ist die Hauptsache, dass die Richtlinien für Samenkontrolle gleichartig sind, und dass das Personal eine gute Ausbildung und die genügende Übung hat. Es ist darum nicht zweckmässig, wenn die Samenkontrollarbeit in einem Lande—wie z. B. Deutschland oder Schweden—zwischen verschiedenen kleinen Anstalten verteilt ist, wo die Samenkontrollanstalten häufig Unterabteilungen von chemischen Institutionen sind. Eine Konzentration der Arbeit an einer oder wenigen gut ausgerüsteten Anstalten würde zweifelsohne das beste Mittel sein, besser übereinstimmende Ergebnisse zu erzielen.

Es hat ein umfassender Briefwechsel mit den an der Vereinigung beteiligten Anstalten samt auch anderen stattgefunden. Ich habe versucht, die Hauptquellen zu den grössten Abweichungen zu finden und habe nachgewiesen, dass z. B. von Larven angegriffene und schlecht entwickelte Samenkörner, eingeschrumpfte und beschädigte Samen der Leguminosen, "harte Samenkörner" und im Besonderen "zerbrochene Keimlinge" Gegenstand sehr verschiedener Beurteilung gewesen sind. Die Abzählung der reinen Samen für die Keimprüfung, Unterschiede in der Temperatur und Feuchtigkeit und vielleicht in einem einzelnen Fall die Lichtbedingungen, u. s. w., sind alle Faktoren, die Unterschiede in den Resultaten verursacht haben. Es muss indessen angeführt werden, dass die versandten Proben durchgehend von solcher Beschaffenheit gewesen

* "Verhandlungen der Internationalen Konferenz für Samenprüfung in Kopenhagen vom 6.—10. VI. 1921" von K. Dorph-Petersen (Seite 76–83).

sind, dass sie schwierig zu analysieren waren, d. h. Proben, die verhältnismässig viele solche "zweifelhafte" Samenkörner enthalten, die Anlass zu verschiedener Bewertung geben. Von einer einzelnen Seite ist dies betreffend Unzufriedenheit mit den Proben geäussert worden; mir scheint es indessen, dass es am richtigsten ist, Proben wie die erwähnten zur vergleichenden Analysierung zu versenden. Dass man durch Prüfung von Proben, die leicht zu analysieren sind, übereinstimmende Ergebnisse erzielen kann, ist meiner Meinung nach keine Prüfung der Analysenfähigkeit.

Die meisten von diesen und auch andere Fragen werden in den Vorträgen, die an diesem Kongresse gehalten werden sollen, besprochen, und es wird uns Gelegenheit gegeben, die verschiedenen Fragen zu diskutieren. Alle Stationen haben die sogenannte "Kontinentale Methode" angenommen, nur mit Ausnahme der Anstalt in Dublin, die bei den Grassamen stets die "Irische Methode" benutzt. Die erwähnte Anstalt hat jedoch die gemeinsamen Untersuchungen mit Bezug auf beide Methoden durchgeführt.

Im November 1923 wurden neue gleichartige Samenproben (21 Proben von 19 verschiedenen Arten) an 54 Anstalten gesandt. Die von 45 Samenkontrollanstalten (38 europäischen, 6 amerikanischen und 1 japanischen) eingegangenen Ergebnisse sind in der Tabelle 2 (Seite 27-32) angeführt.

Es ist erfreulich, dass die Ergebnisse der Analysierung dieser Proben durchgehend besser als es mit den zwei früher versandten Serien der Fall war, übereinstimmen, obwohl die zuletzt versandten Proben schwieriger zu analysieren waren als die früher versandten. Von der Tabelle ist indessen jedoch ersichtlich, dass stets, was ein Teil der Anstalten betrifft, grosse Abweichungen vorhanden sind.

Samen fremder Kulturpflanzen und Unkrautsamen.

Bei früheren vergleichenden Untersuchungen wurde der Gehalt an Samen fremder Kulturpflanzen und Unkrautsamen nicht im Gewichtsprozent angegeben. Viele Stationen haben überhaupt nicht die verschiedenen bei der Analyse gefundenen Arten spezifiziert. In der Tabelle 4 (Seite 34-37) ist eine summarische Übersicht über die Gewichtsprozente von Samen fremder Kulturpflanzen und Unkrautsamen, die an den verschiedenen Anstalten gefunden sind, samt eine Angabe der Mengen, die in dieser Hinsicht untersucht sind, angeführt. Einige der Ergebnisse stimmen gut überein, während grosse Unterschiede, was mehrere Anstalten betrifft, vorhanden sind. Der Grund dazu ist unter anderem, dass Arten, wie z. B. *Bromus mollis*, *Setaria* sp. und *Melilotus* sp., an einigen Anstalten als Kultursamen beurteilt sind, an anderen als Unkraut. Weil aber morgen eine Gelegenheit gegeben wird, die Frage "Unkrautsamen" zu besprechen, werde ich mich nicht weiter darüber aufhalten.

Eine andere Ursache zu den verschiedenen Ergebnissen ist, dass die Gewichtsmengen, die auf fremde Kultursamen und Unkrautsamen untersucht sind, in manchen Fällen zu klein waren. An der Kopenhagener Anstalt werden Durchschnittsproben, die 10 mal so gross sind wie diejenigen, die im allgemeinen auf Reinheit untersucht werden, in dieser Hinsicht analysiert, wenn Maximum für Gehalt an fremde Kultursamen und Unkrautsamen garantiert ist.

In einigen Fällen liegt den Unterschieden dies zu Grund, dass die Stationen gar nicht, oder nur teilweise, gewisse Samenarten von den reinen Samen gesondert haben. Dies ist z. B. der Fall mit dem Gehalt an *Lolium* sp. in der Probe *Festuca pratensis* No. 73A, (siehe Seite 36).

Ausser den Proben von Samen der Landwirtschaft haben einige Samenkontrollanstalten vergleichende Untersuchungen mit Forstsamenarten vorgenommen. Die Resultate (siehe die Tabelle 3, Seite 33) stimmen mit Bezug auf einige Arten ganz gut überein, während sie, was andere betrifft, sehr verschieden sind. Weil es von Bedeutung ist, die Untersuchungen in der erwähnten Hinsicht fortzusetzen, schlage ich vor, dass die Vorsteher von Anstalten, welche an dieser Sache interessiert sind, ihre Teilnahme an neuen Untersuchungen anmelden.

Was Gartensamen betrifft, so sind einzelne vergleichende Untersuchungen an den Samenkontrollanstalten in Wageningen, Zürich und Kopenhagen unternommen. Ich habe Dr. Franck in Wageningen aufgefordert, neue vergleichende Untersuchungen an den Stationen, die in dieser Hinsicht interessiert sind, zu bewerkstelligen.

Mit Bezug auf die Samen der Landwirtschaft scheint es mir bei zukünftigen vergleichenden Untersuchungen zweckmässig zu sein, einige der Arten, die in den früher versandten Serien vorhanden waren, mit anderen umzutauschen. Ich bitte Sie, meine Herren, unter der Diskussion Vorschläge diesbetreffend zu stellen.

Obwohl auch Grund dazu wäre, mehr über diese leitende Arbeit innerhalb der Vereinigung während der verfloßenen drei Jahre zu sprechen, getraue ich nicht, meine Kollegen damit zu ermüden und werde darum die Sache zur nachfolgenden Diskussion verweisen, oder, falls man dieses vorzieht, zur freundschaftlichen Diskussion in den folgenden Tagen. Ich bin sehr für die Einquartierung in den Kollegien gestimmt gewesen, weil ich meine, dass es ein Vorteil für uns sein wird, in dieser ruhigen Universitätsstadt zu wohnen, lieber als zerstreut, wie es in London der Fall sein würde.

An dem Kongress in Kopenhagen war man darüber einig, dass die Europäische Vereinigung für Samenkontrolle ein Zusammenschliessen mit den nordamerikanischen Anstalten in Aussicht halten solle. Die Verbindung mit den Führenden auf dem Gebiete der Samenkontrolle in Nordamerika, wo eine entsprechende gemeinsame Arbeit bewerkstelligt ist, ist infolgedessen sehr aktiv gewesen. Die Vorsteher der amerikanischen Samenkontrollanstalten, mit welchen wir korrespondierten, haben grosses Interesse für die Sache gezeigt. Um einen Vortrag über die gemeinsame Arbeit zu halten, wurde ich eingeladen die jährliche Sitzung der Nordamerikanischen Vereinigung von offiziellen Samenkontrollanstalten, welche am 27. Dezember 1923 in Cincinnati abgehalten wurde, beizuwohnen. Es war mir indessen nicht möglich zu reisen, weshalb ich einen Bericht über die Arbeit innerhalb der Europäischen Vereinigung sandte, sodass dieser an der Sitzung vorgelesen werden könnte.

In Verbindung mit der Erwähnung der vergleichenden Untersuchungen bitte ich Sie Ihre Aufmerksamkeit auf den Vorschlag, der von Professor *Schribaux* und Dr. v. *Degen* an den zwei früheren Samenkontrollkongressen (siehe Seite 120–21 in dem Bericht über den Kopenhagener Kongress in 1921) gestellt ist, zu wenden. Die in den Punkten 1–5 des erwähnten Antrages vorgeschlagenen vergleichenden Untersuchungen sind, wie erwähnt, schon bewerkstelligt. Vor der Aufstellung der Analysenübersicht habe ich die verschiedenen Stationen gefragt, ob sie etwas dagegen hätten, dass ihre Namen in Verbindung mit den Resultaten, die von ihnen erzielt waren, veröffentlicht würden. Keine der Anstalten hat etwas gegen die Veröffentlichung gehabt.

Es ist mir dagegen unmöglich gewesen, auf Basis der erzielten Analysenergebnisse etwas betreffend *internationaler Latituden*, die alle Stationen, die an der Arbeit teilgenommen haben, umfassen, aufzustellen. Dazu sind die erzielten Ergebnisse zu abweichend gewesen. Wenn es möglich wäre, die Resultate einiger bestimmten Stationen auszuwählen, würde wahrscheinlich nichts den Vorschlag, passende Latituden festzusetzen, hindern.

Ausserdem wurde gewünscht, dass ein Vorschlag für *einheitliche Regeln für Samenkontrolle*, der auf die verschiedenen existierenden Regeln basiert war, diesem Kongress vorgelegt werden solle. Unter den augenblicklichen Verhältnissen ist es mir jedoch unmöglich gewesen, diesen auszuarbeiten. Ich würde es als zweckmässig betrachten, wenn ein Komitee aus einigen wenigen Vorstehern der meist bedeutenden Samenkontrollanstalten bestehend gebildet werden könnte. Dieses Komitee sollte die internationalen Latituden in Vorschlag bringen und eventuell auch die einheitlichen Analysenregeln. Diese Vorschläge sollten an die Mitglieder der Vereinigung verteilt werden, damit diese ihre Bemerkungen dazu geben könnten. Der endliche Antrag sollte dem nächsten internationalen

Samenkontrollkongress vorgelegt werden, sodass dieser Bestimmung in der erwähnten Hinsicht treffen kann.

Das Seidekomitee.

An dem Kongress in Kopenhagen wurde hervorgehoben, dass es mit Bezug auf die Festsetzung von Seide-Latituden von entschiedener Bedeutung sein würde, bestimmte Grenzen, innerhalb welchen die Seide reift und im Stande ist, Schaden zu verursachen, festzusetzen. Die Sache wurde an einen Ausschuss verwiesen, der von 5 Mitgliedern aus Ländern, wo die Seide in bedeutendem Grade auftritt, zusammengesetzt wurde. Aus verschiedenen Gründen, über welche Dr. v. Degen morgen Auskunft geben wird, ist die Arbeit dieses Komitees noch nicht so weit geführt.

Briefwechsel mit und Besuche an ausländischen Samenkontrollstationen.

Durch den Briefwechsel ist es nach und nach gelungen in Verbindung mit einer Reihe von Kollegen zu kommen, einige davon ausserhalb Europas, und viele Gegenstände sind von den Kollegen zur Besprechung auf dem Kongress und innerhalb der Vereinigung vorgeschlagen. Mehrere dieser Gegenstände werden in den folgenden Tagen diskutiert; weil unsere Zeit sehr begrenzt ist, ist es aber notwendig gewesen, einige der vorgeschlagenen Gegenstände wegfallen zu lassen.

Ich habe ein Paar Reisen vorgenommen, um die Arbeit innerhalb der Vereinigung mit verschiedenen Kollegen zu besprechen. Dies ist ein nicht unwesentlicher Punkt in der Arbeit, weil es zum Verstehen der Bedeutung der gemeinsamen Arbeit beiträgt. Es wurde in 1921 in Kopenhagen der Vorschlag gestellt, dass Vorsteher und Assistenten der verschiedenen Anstalten die Gelegenheit haben sollten, in kurzen Perioden die Arbeit an den grossen, gut ausgerüsteten Anstalten zu sehen und auch an dieser teilzunehmen. Die ersten Schritte in dieser Hinsicht sind getan. Die dänische Staatssamenkontrolle ist von zwei Assistenten und später von dem Vorsteher des "Official Seed Testing Station," Cambridge, besucht worden. Auch von Norwegen, Schweden und Finnland sind Besucher mehrere Tage an der Kopenhagener Anstalt gewesen, um mit den unsrigen Methoden bekannt zu werden. Ausserdem sind viele von Samenkontrollanstalten der ganzen Welt auf kürzeren Besuchen gewesen. Zwei unserer Assistentinnen, die während beziehungsweise 18 und 13 Jahre eine tüchtige Arbeit an der dänischen Staatssamenkontrolle ausgeführt haben, wurden vor ca. 2 Jahren gewählt, die leitende Arbeit respektive in dem Reinheits- und Keimlaboratorium, wenn die jetzigen älteren Assistentinnen ihre Arbeit aufgeben, zu übernehmen. Nachdem sie systematische Botanik, Pflanzen-Physiologie, Vererbungslehre und Mikrobiologie studiert hatten, haben sie in den erwähnten Fächern ein Examen an der Königlichen Dänischen Landwirtschaftlichen Hochschule durchgemacht. Ferner haben sie gezeigt, dass sie im Stande sind, respektive die deutsche und englische Sprache auf dem Gebiete der Samenkontrolle zu benutzen. Gleichfalls müssen sie die wichtigste Litteratur des Gebietes der Samenkontrolle auf diesen Sprachen durchgelesen haben.

Die zwei Assistentinnen — Fräulein Lassen und Suell — haben jetzt eine Reise an einige der führenden europäischen Samenkontrollanstalten angetreten und arbeiten zur Zeit hier in Cambridge; ich hoffe, dass sie Gelegenheit bekommen werden, mit der Arbeit in den Reinheits- und Keimlaboratorien bekannt zu werden. Meiner Meinung nach ist die beste Weise, übereinstimmende Ergebnisse zu erzielen, persönlich das Verfahren auf dem Gebiete der Samenkontrolle zu kennen, welches wertvoller ist, als nur Unterricht durch gedruckte Regeln zu bekommen, in welchen anscheinende Kleinigkeiten, die aber nichtsdestoweniger von entschiedener Bedeutung für die Arbeit sein können, oft nicht beschrieben sind. Falls es gewünscht wird, können die zwei Assistentinnen Auskunft über die Arbeit an der dänischen Staatssamenkontrolle geben, und ich hoffe, dass sowohl die zwei Damen als auch die Anstalten von dem Besuch Vorteil haben werden.

Gemeinsames Organ.

Seit 1921 ist es unsere Absicht gewesen, ein gemeinsames Organ für die Mitglieder der Vereinigung herauszugeben, weil Artikel die Samenkontrolle oder damit verwandte Gegenstände betreffend bis jetzt in vielen Zeitschriften über die ganze Welt verbreitet sind. Dieses gemeinsame Organ sollte teils originale Artikel enthalten, teils Resümees von Artikeln, die anderswo veröffentlicht werden. Der Hauptgrund, warum dieses Organ seit langem nicht realisiert ist, liegt darin, dass die Mittel fehlen, weil noch keine Anstalt ökonomischen Zuschuss zu der Arbeit innerhalb der Vereinigung geleistet hat. Im Herbst 1923 unternahm ich — hauptsächlich diesbetreffend — eine Reise nach Rom, um mit dem Internationalen Landwirtschaftsinstitut zu verhandeln, inwiefern wir von dieser Seite Hilfe zur Herausgabe des erwähnten Organs bekommen könnten. Der General-Sekretär *Dr. Dragoni* und der Vorsteher des Auskunftsbureaus für die Landwirtschaft, *Dr. Saulnier*, waren darüber einig, dem permanenten Komitee des Institutes vorzuschlagen, dass das Bulletin des Institutes Artikel der Samenkontrolle etc. betreffend bis 100 Seiten jährlich aufnehmen solle. Das Bulletin wird in vier verschiedenen Sprachen gedruckt: Englisch, Französisch, Italienisch und Spanisch. Früher wurde es auch auf Deutsch gedruckt, weil aber die Länder, in welchen die deutsche Sprache benutzt wird, zur Zeit keinen Zuschuss zu dem Bulletin leisten, wird dieses jetzt nicht auf Deutsch gedruckt. Es ist sehr zu hoffen, dass dies bald der Fall sein wird, weil die deutsche Sprache von so vielen an Samenkontrolle Interessierten benutzt wird. Abdrucke dieser Artikel sollten in den respektiven gewünschten Sprachen an die Mitglieder der Vereinigung, die nur die mit dem Versand verbundenen Unkosten zu bezahlen hat, versandt werden. Dieser Vorschlag wurde vorläufig für ein Jahr von dem permanenten Komitee angenommen. Die Vereinigung hat in dieser Weise auf — scheint es mir — günstige Bedingungen ein gemeinsames Organ erzielt. Der Artikel: "Wie lange bewahren die verschiedenen Samenarten ihre Keimfähigkeit," der an die Anwesenden verteilt ist, wird in der Nummer des Organs, die im Juli in Rom herauskommt, veröffentlicht.

An dem Kopenhagener Kongress wurde zuletzt von Sir Lawrence Weaver bemerkt, dass eine Maschine unter Konstruktion sei, und dass diese jetzt ihre Arbeit anfangen solle. Es muss gesagt werden, dass der Anfang gemacht ist, dass das Endresultat aber noch weit entfernt liegt. Wir müssen hoffen, dass ein Stoss vorwärts hier in Cambridge gemacht wird.

Mittel für die Arbeit.

Inwiefern es uns gelingen wird, die Arbeit weiterzuführen, beruht u. a. auf den ökonomischen Verhältnissen. Seit 1921 hat Dänemark die meisten der nicht unwesentlichen Unkosten (mehr als £400), die mit der Arbeit verbunden waren, gedeckt. Die dänische Staatssamenkontrolle hatte von dem Landwirtschaftsministerium Erlaubnis bekommen, die Unkosten, die mit der erwähnten Arbeit verbunden waren, zu decken. Dies wird aber in der Zukunft nicht stattfinden können. Ich hoffe darum, dass manche der Delegierten Erlaubnis haben, ihre Regierungen für einen Zuschuss für die zukünftige Arbeit zu binden.

Statuten.

An einer Sitzung mit Dr. Volkart in Zürich im September 1923 wurde ein Vorschlag betreffend die Statuten der Vereinigung, von Dr. Volkart ausgearbeitet, behandelt. Der Vorschlag, welcher Fragen betreffend Mitglieder, Mittel, Kongresse, Geschäftsführung, Wahlen von Komiteemitgliedern, Abstimmungen u. s. w. umfasst, wird dem Kongress morgen von Dr. Volkart vorgelegt, sodass Bestimmungen in dieser Hinsicht genommen werden können.

Der Samenhändlerkongress.

Von verschiedenen Seiten ist der Wunsch, einen Samenhändlerkongress gleichzeitig mit dem Samenkontrollkongress abzuhalten, geäußert worden. Infolge diesem ist eine gemeinsame Sitzung am Mittwoch angeordnet, sodass Fragen, die für beide Parteien Interesse haben, besprochen werden können.

Man hofft, dass die jetzigen Verhältnisse nicht das Zusammenarbeiten hindern werden, welches zwischen Fachleuten von allen Ländern, wo offizielle Samenkontrollanstalten vorhanden sind oder geplant werden, stattfinden muss, falls die Arbeit international werden soll und dadurch wirkliche Bedeutung bekommen kann.

Ich bitte Sie jetzt dringend, meine sehr verehrten Kollegen, Ihre Bemerkungen zu meinem Vortrag zu machen und zu kritisieren, wo Sie Grund dazu finden. Dr. Volkart und ich haben die Arbeit in den 3 Jahren allein durchgeführt, und wir sind darüber im Klaren, dass viel mehr gemacht werden sein sollte; die Verhältnisse sind aber nicht leicht gewesen, und unsere Zeit ist sehr von offiziellen Pflichten in Anspruch genommen gewesen, sodass es uns nicht möglich war, die wünschenswerte Zeit der gemeinsamen Arbeit zu opfern, und wir haben keine Mittel gehabt, die notwendigen Gehilfen zu halten.

Ich erlaube mir hiermit sowohl der englischen Regierung, weil diese uns zu diesem Kongresse eingeladen hat, als auch den Herren — besonders Sir Lawrence Weaver und Herrn Chambers — die die Schwierigkeiten der Vorbereitungen gehabt haben, unseren besten Dank auszusprechen. Auch denjenigen die eingewilligt haben, Vorträge zu halten, und allen Kollegen, die an der gemeinsamen Arbeit während der verflossenen drei Jahre teilgenommen haben, danke ich bestens.

Als Vorsitzender der Vereinigung erlaube ich mir die Anwesenden herzlich willkommen zu dem Kongress zu heissen. Ich erlaube mir ein besonderes Willkommen an die Kollegen zu wenden, die nicht an dem Kongress in Kopenhagen teilgenommen haben. Als mir Professor Munn und Herr Brown vor drei Wochen schrieben, dass die Vereinigten Staaten sich nicht auf dem Kongress offiziell vertreten lassen würden, habe ich das tief bedauert, weil ich bisher so viel Freude und Nutzen aus dem Zusammenarbeiten mit meinen amerikanischen Kollegen gehabt hatte, und ich mir deshalb viel von unserem Zusammensein versprach. Ich telegraphierte augenblicklich Professor Munn und Herr Brown ein Willkommen zu dem Kongress. Zu meiner grossen Freude ist es Professor Munn gelungen hierher zu kommen. Wir wünschen ihm als Vorsitzender der nordamerikanischen Samenkontroll-Vereinigung ein besonderes Willkommen, indem wir ihm danken, weil er innerhalb so kurzer Frist gekommen ist. Wir danken gleichfalls Herrn Clark aus Canada, weil er die lange Reise gemacht hat, um sich an dem Kongress zu beteiligen. Wir nehmen es als ein Zeichen, dass unsere Kollegen jenseits des Atlantischen Oceans mit uns zusammenzuarbeiten wünschen. Ich reiche den Kollegen im Namen der Europäischen Samenkontroll-Vereinigung meine Hand zu diesem Zusammenarbeiten.

Ich hoffe, dass wir jetzt einige erfolgreiche Tage zusammen haben werden.

Professor Johannsen hob hervor, dass Anstalten, trotzdem sie einheitliche Methoden gebrauchen, öfters ziemlich verschiedene Ergebnisse erzielen, während Anstalten, die verschiedene Methoden benützen, in mehreren Fällen zu gut übereinstimmenden Resultaten erlangten. Die Analyse sei keine mechanische, sondern eine physiologische Sache.

Professor Zaleski bemerkte, dass die Resultate seiner Meinung nach nicht so sehr von der Einrichtung einer Anstalt abhängig seien, als vielmehr von dem Personal. Dies zeigte z.B. die Anstalt in Paris. Er schlug vor, dass die Stationen bei der

vergleichenden Analysierung nur Samenarten, an welchen sie besonders interessiert seien, untersuchen sollten.

Professor Bussard erwähnte, dass das Personal der Pariser Station vieljährige Übung hätte, und dass die Tradition in dieser Hinsicht nicht ohne Bedeutung sei. Dr. v. Degen schloss sich dieser Meinung an. An seiner Anstalt würden Apparate so wenig wie möglich gebraucht.

Professor Showky Bakir ersuchte die Vereinigung, die Bearbeitung der Frage betreffend die Samen von Baumwolle aufzunehmen.

Dr. Andronescu fand die Differenzen der Analysenresultate nicht überraschend, weil ein lebender Organismus wie der Same selbstverständlich durch den Druck und die Feuchtigkeit der Atmosphäre, die verschiedenen Untersuchungsmethoden usw. beeinflusst würde.

Dr. Buchholz war der Meinung, dass Übung und Apparate von gleicher Wichtigkeit seien.

Dr. Chmelář bemerkte, dass die Differenzen auf verschiedene Ursachen zurückzuführen seien, z.B. auf die Art der Probeziehung, die Grösse der Proben, die verschiedene Bewertung der Samen, z.B. der zerbrochenen Samen usw. Er schlug vor, dass die Stationen sich bezüglich der Begriffe "Unkrautsamen" und "reine Samen" einigen sollten.

Herr Devoto hielt die Grösse der Samenkörner, die Anzahl derselben in einer Probe und die Temperatur, welcher die Samen während der Untersuchung ausgesetzt sind, für wichtig.

Herr Dorph-Petersen unterstrich, dass die Samen lebende Organismen seien, weshalb Differenzen zu erwarten wären. Er lud unter Bezugnahme auf Dr. Chmelars Bemerkung die an den vergleichenden Untersuchungen Interessierten ein, einer Demonstration beizuwohnen, wie die versandten Proben an der Dänischen Staatssamenkontrolle seinerzeit gezogen worden sind. Schliesslich bat er die Vorsteher der Samenkontrollanstalten dem neuen am Donnerstag zu wählenden Exekutiv-Komitee anzugeben, welche Arten für vergleichende Untersuchung von speziellem Interesse für sie sein würden.

Dienstag den 8. Juli.

Vormittags-Sitzung.

Dr. Volkart legte dem Kongress seinen Antrag der Statuten der Vereinigung der europäischen Samenkontrollanstalten vor. (Der endlich angenommene Vorschlag ist auf Seite 217-220 angeführt.) Er schlug vor, ein Komitee zu wählen, das die Frage der Statuten behandeln solle.

Dr. Chmelář schlug vor, einen Vizepräsidenten der Vereinigung zu erwählen und im Falle der Auflösung derselben ihr Vermögen an das Internationale Landwirtschafts-Institut in Rom zu übergeben.

Herr Clark fragte, ob es geplant sei, die Vereinigung international zu machen, und im Bejahungsfalle, ob die Grundlage für die Aufnahme von Mitgliedern aus Nordamerika festgesetzt sei. *Sir Lawrence Weaver* bemerkte, dass nicht allein Mitglieder aus den Vereinigten Staaten und Canada, sondern auch solche aus anderen Weltteilen willkommen seien, wenn sie sich an der Vereinigung zu beteiligen wünschten. *Herr Dorph-Petersen* schloss sich der Meinung von *Sir Lawrence Weaver* unter Hinweis auf die Tatsache an, dass der Handel international sei.

Herr Devoto teilte mit, dass der argentinische Staat Mitglied der Vereinigung zu werden und seinen Beitrag zu der Vereinigung zu bezahlen wünsche.

Herr Insulander machte darauf aufmerksam, dass zufolge des Antrags der Statuten nur offizielle Samenkontrollanstalten oder Korporationen, die solche Anstalten unter Kontrolle des Staates leiteten, Mitglieder werden könnten. Kein Gelehrter, selbst wenn er auf dem Gebiete der Samenprüfung Untersuchungen von besonderem Wert unternommen hätte, könnte infolge dieser Statuten als Mitglied aufgenommen werden, wenn er nicht einer Samenkontrollstation angegliedert sei. Ein Staat, der einen jährlichen Beitrag leiste, könne auch nicht einen besonderen Vertreter wählen, die Verwendung der Mittel der Vereinigung zu kontrollieren oder Anträge betreffend Verbesserungen der Arbeit innerhalb dieser zu stellen.

Herr Dorph-Petersen antwortete, dass die Regierung eines Landes, welches einen Jahresbeitrag bezahle, selbstverständlich das Recht habe, sich bei den Kongressen repräsentieren zu lassen. Er schlug vor, dies in den Statuten festzusetzen.

Professor Voigt schlug vor, die Frage staatliche Vertreter gegenüber Vertretern der offiziellen Samenkontrollanstalten zu überlegen, weil seine Regierung das Recht, sich bei den Kongressen repräsentieren zu lassen, fordern würde.

Herr Devoto hielt eine enge Verbindung zwischen der Vereinigung und dem Landwirtschafts-Institut in Rom für wünschenswert; ferner dass die Publikationen der Vereinigung durch dieses Institut veröffentlicht würden.

Herr Main fragte, ob die neue Vereinigung einen absoluten Teil des Institutes ausmachen solle. Dies würde Schwierigkeiten verursachen, weil verschiedene Regierungen bereits Jahresbeiträge zu dem Institute bezahlten. Er schlug vor, einen Ausschuss einzusetzen, um die Grundlage der Beiträge und andere notwendige Einzelheiten festzustellen, damit die Vertreter das Gutachten ihrer respektiven Regierungen einholen könnten, sodass "Die Internationale Vereinigung für Samenkontrolle" möglichst bald eine Tatsache würde.

Sir Lawrence Weaver war der Meinung, dass die Vereinigung mit dem Internationalen Landwirtschafts-Institut zusammenarbeiten, aber keinen Teil davon ausmachen solle. Dadurch würde keine Verwirrung wegen der Beiträge entstehen. Er hielt

auch die Ernennung eines Ausschusses wie der vorgeschlagene für nötig. Wenn Einigkeit über die verschiedenen Anträge erreicht sei, könnten die Delegierten bei ihren Regierungen anfragen, ob sie sich der Vereinigung anzuschliessen wünschten. Die Beiträge würden wahrscheinlich so klein werden, dass sie kaum den Anschluss irgend eines Landes hindern würden.

Professor Johannsen schlug vor, dass die folgenden Delegierten den Antrag von Dr. Volkart bezüglich der Statuten bearbeiten sollten :

Provisorisches Komitee.—Professor Mohammed Showky Bakir Effendi, Professor Bussard, Herr Clark, Herr Devoto, Herr Dorph-Petersen, Professor Munn, Professor Voigt, Dr. Volkart, Sir Lawrence Weaver.

Der Vorschlag wurde einstimmig angenommen.

Miss Yeo wandte sich im Namen des Internationalen Landwirtschafts-Instituts in Rom an den Kongress. Unter Bezugnahme auf das jetzige Zusammenarbeiten zwischen der Vereinigung und dem Institut, welches jährlich 100 Seiten in dem "International Review of the Science and Practice of Agriculture" für Fragen, die Samenprüfung betreffend, reservieren wollte, hätte das Institut Sonderabdrucke seiner zuletzt veröffentlichten Abhandlungen und Berichte an den Kongress geschickt. Man hoffe, die Auskünfte über landwirtschaftliche Gegenstände mehr und mehr zentralisieren und die erwähnte Zeitschrift des Instituts als ein gemeinsames Organ der Vereinigung benutzen zu können.

Herr Andersen trug hierauf seinen Bericht: "Übereinstimmung in der Angabe der Analysenergebnisse" vor.

ÜBEREINSTIMMUNG IN DER ANGABE DER ANALYSENERGEBNISSE.

EIN VORSCHLAG

VON

T. ANDERSON,

Schottisches Ministerium für Landwirtschaft.

Es ist notwendig, dass die verschiedenen Samenkontrollanstalten gleiche Methoden für Angabe der Analysenergebnisse gebrauchen, um die Anforderungen der Samenveredler, Landwirte und Samenhändler zu befriedigen.

Gegen die Anwendung von willkürlichen Formeln, um den wirklichen Wert anzugeben, ist folgendes auszusetzen:—

1. Der nachteilige Charakter der Unkrautsamen ist nicht derselbe in allen Ländern oder Gegenden.

2. Die Verbreitung solcher schädlichen Pflanzen durch Samen kann nicht gehörig beurteilt werden.

3. Der Ertrag von Grasfeldern hängt beinahe völlig von effektivem Anbau, Düngung und Behandlung in Verbindung mit dem Einfluss der Jahreszeiten ab.

4. Der Stamm und die Herkunft einer Ware sind oft von grösserer Bedeutung als die darin vorkommenden Unkrautsamen.

Um die Anforderungen aller Beteiligten entgegenzukommen, ist es am Besten nur Analysenscheine mit Bezug auf reine keimfähige Samen auszustellen.

Die Vertreter sollten sich darüber einigen, nicht das Keimresultat für sich, sondern den Prozentsatz der reinen keimfähigen Samen anzugeben. Die Vorteile, die dadurch erzielt werden, sind:—

1. Die Angabe der reinen keimfähigen Samen giebt so genau, wie man es berechnen kann, den Prozentsatz von lebenden Samen der betreffenden Art an, statt des Prozentsatzes der gekeimten Samen, welcher, indem man es auf die ganze Probe bezieht, oft missweisend ist.

2. Grössere Übereinstimmung in den Angaben der Analysenergebnisse; die Unterschiede in der Schätzung von "reinen keimfähigen Samen" an den verschiedenen Samenkontrollanstalten werden in dieser Weise geringer, als wenn der Prozentsatz der gekeimten Samen angegeben wird.

3. Die Analysenscheine werden ein besseres Bild von dem wahren Charakter der Unreinigkeiten geben.

Reine keimfähige Samen:—

Harte Samen.

Zerbrochene Samen, zerbrochene Keimlinge.

Gefaulte Samen.

Leere Spelzen.

Unreinigkeiten (fremde Bestandteile):—

einschliessend { Spreu.
Unkrautsamen.
Kultursamen.

Bei einer Reinheitsuntersuchung allein:—

Reine Samen—

ausschliessend { Zerbrochene Samen.
Eingeschrumpfte Samen.
Leere Spelzen.

Unreinigkeiten (Fremde Bestandteile)—

einschliessend { Spreu.
Unkrautsamen.
Kultursamen.

Nach seinem Vortrag bemerkte Herr Anderson, dass sein Standpunkt denjenigen der Verbraucher repräsentiere. Dieser würde seiner Meinung nach von den Samenkontrollanstalten nicht genügend berücksichtigt. Sein Vorschlag stehe vielleicht in Widerspruch mit festgestellten Gesetzen, z.B. mit den in Grossbritannien festgesetzten. Vielleicht sei der Antrag dennoch von Nutzen, falls ein Komitee eingesetzt würde, um eine Skala für internationale Latituden und gemeinsame Analysenregeln festzusetzen. Falls der Vorschlag angenommen würde, wäre er bereit, völlige Klarheit darüber zu geben, wie der Vorschlag für alle Arten benutzt werden könne, und ihn dem eventuellen Komitee vorzulegen.

Herr Dorph-Petersen schlug vor, am Donnerstag Nachmittag einen Ausschuss für Erwägung des Antrages von Herrn Anderson einzusetzen.

Dieser Vorschlag wurde von dem Kongress angenommen.

Dr. Buchholz trug hierauf seinen Bericht "Über Feuchtigkeitsbestimmung bei Saatwaren" vor.

Über Feuchtigkeitsbestimmung bei Saatwaren.

VON

DIREKTOR DR. YNGVE BUCHHOLZ, KRISTIANIA.

Die Feuchtigkeitsbestimmung bei Saatwaren ist oft von grosser Wichtigkeit, sowohl um von dem Wasserinhalt der Probe Kenntnis zu nehmen, als auch das 1000 (Korn) Gewicht des trockenen Samens zu erfahren.

Die Feuchtigkeitsbestimmung erfolgt, wie bekannt, dadurch dass man eine gewisse abgewogene Menge Stoff innerhalb einer bestimmten Zeit bis zu einer bestimmten Temperatur erhitzt und dann den Gewichtsverlust bestimmt. Rein technisch ist diese Analyse so einfach, dass es oft eine der ersten Arbeiten ist, die man einem Anfänger in den chemischen Laboratorien anvertraut.

Es ist indessen absolut nicht einfach den wirklichen Feuchtigkeitsinhalt organischer Stoffe zu bestimmen, wie z. B. bei Saatwaren, weil das Resultat in hohem Grade von den Bedingungen, unter welchen die Bestimmungen vorgenommen werden, abhängig ist. Dies hängt damit zusammen, dass es nicht leicht ist bei der Erhitzung alles Wasser zu entfernen, ohne dass gleichzeitig andere Prozesse vorgehen, sowohl solche die einen Gewichtsverlust verursachen, als auch solche welche eine Gewichtsvermehrung hervorbringen (wie z. B. bei gewissen Oxydationsprozessen). Die ersten würden eine zu grosse, die letzten eine zu niedrige Analysenzahl für Feuchtigkeit aufzeigen.

Rein theoretisch kann man sagen, dass es absolut unmöglich ist, durch Gewichtsverlust-Analyse den Feuchtigkeitsinhalt ganz genau zu bestimmen; aber Methoden zu schaffen, die in höherem Grade den rein theoretischen Forderungen Rechnung tragen, ist eine so komplizierte Sache, dass es für die praktische Samen-Kontrolle ganz ausgeschlossen ist, sich darauf einzulassen.

Das einzig richtige wäre, so zu arbeiten, dass die Wirkungen der Nebenprozesse so klein wie möglich werden, und dass man gleichzeitig dafür sorgt, dass alles Wasser so *quantitativ* wie möglich ausgetrieben wird. Die *Bedingungen*, die hier in besonderem Grade Einfluss ausüben, sind:—

- (1) Die Zubereitung der Probe (Grad der Zermahlung).
- (2) Die Temperatur, unter welcher die Bestimmung stattfindet.
- (3) Die Zeit, d.h. Dauer, der Bestimmung.

Diese Bedingungen müssen so gewählt werden, dass man soweit möglich bei der Parallelanalyse übereinstimmende Resultate bekommt, wie sie auch gleichzeitig leicht ausführbar sein müssen.

Bei der Samenkontrolle in Skandinavien, wie wohl auch in den meisten anderen Ländern, wird eine sehr einfache Art der Vorbereitung verwendet: man mahlt die grosskörnigen Sorten (Cerealien, Leguminosen) grob und nimmt von allen feinkörnigen Sorten die Körner ganz. Hiervon wird 2½ gr. bzw. 1 gr. 5 Stunden bei ca. 98° C. getrocknet (Dampftrockenschrank). Zu diesem Verfahren ist zu bemerken, dass das grobe Mahlen oder das Nicht-Mahlen das Entweichen des gebildeten Wasserdampfes verhindert, dies gilt auch von der Temperatur 98° C., welche ja unter dem Siedepunkt liegt.

Aus diesem letzten Grunde ist man in den *chemischen* Laboratorien allmählich dazu übergegangen, eine höhere Temperatur zu verwenden, nämlich 103°–105° C. (Electrischer Trockenschrank) bei Bestimmung der Feuchtigkeit bei organischen Stoffen.

Schon früher hat man in diesen Laboratorien eine viel gründlichere Zubereitung der Probe verwendet, indem man gemahlen hat, bis die ganze Probe ein Sieb mit 1 mm. Maschenweite passieren konnte. Eine Schwierigkeit bei dieser gründlichen Zubereitung ist, dass sie längere Zeit in Anspruch nimmt, wodurch der Feuchtigkeitsinhalt der Probe sich während der Arbeit ändern kann.

Um eine Zahlen-Grundlage bei der Diskussion dieser Fragen zu erhalten, habe ich eine Reihe von Untersuchungen gemacht über den Einfluss, welche die verschiedenen Kombinationen, Temperatur und Zeit auf die Analysenresultate haben. Wegen Mangel an Zeit musste ich das Analysenmaterial beschränken, und habe einige von den wichtigsten Saatwarensorten ausgewählt, nämlich 2 von Hafer (*avena sativa*), 2 von Gerste (*hordeum vulgare*), 2 von Roggen (*secale cereale*), 2 von Timotheegrass (*phleum pratense*), 1 von Rotklee (*trifolium pratense*), 1 von Alsike-Klee (*trifolium hybridum*), 2 von Wiesenfuchsschwanz (*alopecurus pratensis*), 2 von Turnips (*brassica camp. rap.*).

Alle diese 14 Proben werden jetzt auf 2 verschiedene Arten zubereitet, entweder auf die bei der Samenkontrolle gewöhnliche Art—grosse Samenkörner werden grob gemahlen, kleine werden ganz gelassen; oder soweit möglich wie bei der chemischen Analyse, d.h. Vermahlen und Sieben der grossen Samenkörner und Zerquetschen der kleinen Körner in einer Reibschale.

Diese 28 Proben wurden jetzt sowohl bei 98° C. als bei 103° C. getrocknet, zuerst 4 Stunden und hiernach noch 1 Stunde. Soweit möglich wurde die Parallelbestimmung gemacht, und überall wurde 5 gr. Stoff verwendet. Die Resultate sind in der Tab. I. zusammengestellt. Weiter ist in der Tab. I. auf Seite 50 der Unterschied zwischen den Parallelbestimmungen angeführt. In der Tab. II. auf Seite 51 ist der Unterschied der Resultate der verschiedenen Behandlungsarten zusammengestellt.

Aus der Tab. I. geht hervor, dass die Übereinstimmung zwischen 2 Parallelanalysen im grossen und ganzen bei allen Methoden gut ist, sie ist aber bei 103° C. entschieden besser als bei 98° C., die gründliche Zubereitung macht auch die Übereinstimmung etwas besser; dagegen macht es nicht viel aus, ob man 1 Stunde über 4 Stunden trocknet.

Aus der Tab. II. geht hervor, dass die gründlichere Zubereitung ca. $\frac{1}{2}$ Prozent mehr Feuchtigkeit gibt als die gewöhnliche. Eine Ausnahme bildet hier *alopecurus*, der bei der gründlicheren Zubereitung ein niedrigeres Resultat zeigte, welches wahrscheinlich eine Verschiebung des Feuchtigkeitsinhaltes bei der Zubereitung zur Ursache hat. Weiter ergibt die Trocknung bei 103° C. ca. $\frac{1}{4}$ Prozent höheres Resultat als die Trocknung bei 98° C. Die Trocknung der einen Stunde nach den 4 Stunden ändert das Resultat nur mit einigen hundertsteil Prozent.

Die Hauptsache ist, eine Methode zu benutzen die es möglich macht, dass verschiedene Stationen gleiche Resultate bekommen. In Bezug auf die obigen Versuchsergebnisse und meiner Erfahrung als Chemiker, und mit Rücksicht darauf, dass die Methode so praktisch und einfach wie möglich und gleich für verschiedene Sorten von Saatwaren gemacht werden muss, erlaube ich mir vorzuschlagen, dass folgende Methode als international angenommen wird, sodass sie jedenfalls bei dem Umsatz von Saatwaren verwendet wird.

Die *Feuchtigkeitsbestimmung bei Saatwaren* wird wie folgt vorgenommen:—

(a) *Von Cerealien und anderen grossen Samensorten* (Trockengewicht von 1,000 Körnern, über 10 gr.): 5 gr. grobgemahlener Stoff wird 4–5 Stunden im Trockenschrank bis 103° C. erhitzt. Die Parallelbestimmung muss ausgeführt werden, wo Garantie erfordert.

(b) *Von kleinen Samensorten* (Trockengewicht von 1,000 Körnern, unter 10 gr.). $2\frac{1}{2}$ gr. ganze Körner werden 4–5 Stunden bis 103° C. erhitzt. Parallelbestimmung wie unter (a).

Anmerkung.—Es ist selbstverständlich, dass wenn die Feuchtigkeitsbestimmung für Garantiezwecke ausgeführt werden soll, (und am liebsten auch sonst), die Probe in einem luftdichten Glasbehälter oder zur Not in einer dichtverschlossenen Blechbüchse eingeschickt werden muss. Die Probe muss als eine gute Durchschnittsprobe ausgesucht werden und mindestens 100 gr. für grosse Samensorten und 50 gr. für kleine Samensorten wiegen. Die Probe wird vor dem Mahlen und vor dem Wiegen für die Analyse gut gemischt. Indem man zur Benutzung von 103° C., gegen früher 98° C. übergeht, muss man darauf aufmerksam sein, dass frühere Angaben gegenüber dem neuen Verfahren $\frac{1}{2}$ bis 1 Prozent weniger Feuchtigkeitsinhalt aufzeigen würden.

Herr Devoto erklärte, dass dieser Bericht von speziellem Interesse für die Landwirte in Argentinien sei, die wegen des Wassergehaltes im Mais jährlich viel Geld verlieren. Der Brown-Duval Apparat zur Bestimmung der Feuchtigkeit sei seit fünf Jahren in Argentinien eingeführt. Der Apparat spare Zeit, die erzielten Ergebnisse seien aber nicht genau. Als Erfinder des erwähnten Apparates erwiderte *Herr Brown*, dass dieser von Anfang an für den Getreidehandel konstruiert sei. Der Apparat sei einfach und die Prüfung dauere nur 15 Minuten. Vorausgesetzt, dass die Zeit und die Temperatur bei den verschiedenen Samenarten variiert würden, erziele man befriedigende Resultate. Beim Gebrauch dieses Apparates würden die Fehler, die durch das Vermahlen und die Wägung entstehen, eliminiert.

Professor Voigt sagte, dass man in Deutschland für gewisse Arten eine Temperatur von 98° C., für andere von 103° C. gebrauche. Die Samen würden in einen kalten Ofen gestellt, welcher bis zu der gewünschten Temperatur erwärmt würde. Von dem Augenblick an, wo die gewünschte Temperatur erreicht sei, würde die Trocknungszeit berechnet.

Dr. Volkart teilte mit, dass die Züricher Station Wassergehaltsbestimmungen vorzunehmen ablehne, falls die zu untersuchenden Proben nicht in luftdicht geschlossenen Behältern eingingen. *Herr Dorph-Petersen* erklärte, dass dasselbe der Fall in Dänemark sei. Das Trocknen würde bei einer Temperatur von 98° C. während 5 Stunden vorgenommen.

Eine Diskussion über die verschiedenen bei dem Trocknen angewandten Temperaturen und die Oxydationsgefahr folgte. *Herr Devoto* betonte, dass man bei der Untersuchung die Ansichten der Samenhändler nicht vergessen dürfe.

Nachmittags-Sitzung.

Professor Bussard hielt einen Vortrag über: "Sollen bei jeder Reinheitsbestimmung die Gewichtsprozente und Namen der am häufigsten vorkommenden Unkrautsamenarten nicht angegeben werden, und welche Arten sind stets als Unkraut zu betrachten?" Siehe Seite 52–54 für Vortrag auf Englisch und Seite 154–158 auf Französisch).

Herr Dorph-Petersen lenkte die Aufmerksamkeit auf einen Bericht: "Einige Untersuchungen über das Vorkommen und die Lebensfähigkeit mehrerer Unkrautsamenarten unter verschiedenen Verhältnissen, unternommen an der Dänischen Staatsamenkontrolle in den Jahren 1896–1923" (siehe Seite 221–226). Die Widerstandsfähigkeit der Unkrautsamen und ihre Fähigkeit, sich zu vermehren sind infolge dieser Untersuchungen so gross, dass man die vorhandenen Arten und die Anzahl derselben in dem Untersuchungsbericht absolut anführen muss.

Auch die Herren Showky Bakir, Devoto, v. Degen und Kuleschoff beteiligten sich an der Diskussion. Es wurde vorgeschlagen, dass jedes Land der Vereinigung für Samenkontrolle ein Verzeichnis über die Unkrautarten übergeben solle, die in dem betreffenden Land als besonders schädlich betrachtet würden. Diese und gleichartige Fragen wurden dem am Donnerstag zu wählenden Ausschuss überwiesen.

Dr. v. Degen legte seinen Bericht über: "Die Arbeit des Seidekomitees, welches bei dem Kongress in Kopenhagen gewählt wurde" (siehe den englischen Vortrag, Seite 55–57), vor.

Die Kongressmitglieder stimmten den drei von Dr. v. Degen gemachten Vorschlägen einstimmig zu.

Auf Vorschlag des Herrn Professor Johannsen wurden die Herren Brown, Devoto und Kuleschoff als weitere Mitglieder des Seidekomitees erwählt.

Mittwoch, den 9. Juli.

Vormittags-Sitzung.

Professor Voigt trug seinen Bericht: "Über Keimprüfungsmethoden," vor.

Über Keimprüfungsmethoden.

Prof. Dr. A. VON VOIGT, Hamburg.

Seit der letzten Zusammenkunft in Kopenhagen sind durch die Bemühungen des Kollegen Dorph-Petersen die vergleichenden Kontrollanalysen auf Reinheit und Keimkraft weiter durchgeführt worden und gleichzeitig haben vergleichende Analysen von seiten des *Association of Official Seed Analysts of North America* stattgefunden, an denen sich auch eine Reihe europäischer Anstalten beteiligt hat. Die Ergebnisse dieser Versuche haben uns gezeigt, dass im allgemeinen eine gute Übereinstimmung der Versuche in weitgehendstem Masse für die einzelnen Stationen besteht.

Wenn Abweichungen vorgekommen sind, so waren sie nach meiner Meinung nicht schwerwiegend. Die Differenzen lassen sich auf Grund unserer bisherigen Kenntnis der möglichen Fehlerquellen wohl verstehen und ausgleichen. Damit wäre für die praktische Samenkontrolle eine zur Zeit befriedigende Analysehandhabung festgestellt.

Ich erlaube mir dann in meinem Referat auf der letzten Versammlung darauf hinzuweisen, dass es wünschenswert wäre, den physiologischen Zusammenhängen des Keimungsprozesses auch von unserer Seite näherzutreten, vor allen Dingen die Beobachtung wesentlicher Abweichungen in dem Verhalten keimender Samen bei unseren praktischen Versuchen als Anregung zu vergleichenden Versuchen zu benutzen und die auftauchenden Fragen der reinen Wissenschaft zugänglich zu machen. Es kommt darauf an, die inneren Zusammenhänge des Keimprozesses immer klarer

zu erfassen. Ich habe in diesem Zusammenhang seinerzeit auf die Arbeiten von *Kinzel* und *Hollrung* näher hingewiesen. Wenn wir nun heute nach dem Stande dieser Fragen uns umsehen, so sind es zwei Probleme, die unsere besondere Beachtung verdienen. Das eine betrifft die Arbeiten *Popoffs** u.a., die uns zeigen, dass es möglich ist, durch chemische Beeinflussungen des Keimprozesses sowohl höhere Keimzahlen als auch quantitativ und qualitativ bessere Erträge zu erzielen. *Popoff* stützt seine Laboratoriumsversuche durch ausgedehnte, praktische Anbauversuche im freien Lande. Zu ganz ähnlichen Resultaten gelangt eine Reihe von Industrieunternehmungen, die sich mit der Herstellung von sogen. Impfmitteln für Getreide u. a. befassen. Es hat sich nämlich ergeben, dass diese Mittel nicht nur pilzwidrig wirken, sondern auch in dem Stande sind, das Auflaufen der geimpften Saat erheblich zu steigern.

Soweit ich bis heute die Sache übersehen kann, scheint es sich bei allen diesen Fällen um eine sehr zweckmässige Säuglingsfürsorge zu handeln, die dazu dient, die Kindersterblichkeit bei unseren Samen bzw. Keimpflanzen einzuschränken und evt. die Leistungsfähigkeit der entstandenen Pflanzen zu fördern. Es sind aber noch hin und wieder widersprechende Ergebnisse vorhanden, die eine weitere gründliche Durchführung dieser Fragen erfordern. In der vorliegenden Frage handelt es sich um Beobachtungen, die bei der experimentellen Behandlung des Saatgutes mit verschiedenen Mitteln aufgefallen sind.

Mehr vom theoretischen Standpunkt aus geht nun *Merkenschlager*,† der in seinen kürzlich erschienenen "Keimungsphysiologischen Problemen" eine ganze Reihe von zunächst theoretisch angestellten Versuchen benutzt, um den inneren Zusammenhängen bei der Keimung näher zu kommen. Die Bestrebungen *Kinzels*, einer gross angelegten Biologie der Samen die nötigen Unterlagen zu schaffen, werden jetzt ergänzt durch den Versuch *Merkenschlagers*, zunächst die verschiedengradige Resistenz verschiedener Samenarten gegen eine Reihe von Einflüssen zu prüfen. Es lässt sich seine Absicht wohl dahin zusammenfassen, dass es, wie schon vielfach angeregt worden ist, sehr wichtig ist, der Natur der Reservestoffe, den wirksamen Fermenten, den Entwicklungsstadien des Embryos in ihren Beziehungen zum Keimungsprozess näherzutreten und eine Anzahl Faktoren mechanischer, chemischer und physicochemischer Natur bei diesen Erscheinungen zu prüfen. An sich alles ein Problemkomplex der alle möglichen Ausblicke erwarten lässt und in der vorliegenden Mitteilung nach vielen Richtungen hin dankenswerte Anregungen bringt. Ob sie uns bereits heute Möglichkeiten eröffnen, unsere praktischen Keimmethoden nach irgendeiner Richtung hin zu beeinflussen, dünkt mir bei der Jugend der Beobachtungen nicht sehr wahrscheinlich. Es ist allerdings schon von manchen Seiten eine gewisse Schnellkeimung mit Hilfe von chemischen Agenzien empfohlen worden, so für Malzgerste und manche andere Getreide. Es will mir aber auch hier scheinen, dass für die praktische Samenkontrolle eine gewisse Versuchszeit vor der endgültigen Einführung notwendig ist. Wir sehen aber aus der Zusammenstellung *Merkenschlagers*, dass die Keimungsphysiologie seit unserem letzten Kongress nicht still gestanden ist und namentlich unter Zuhilfenahme der neuesten physicochemischen Fortschritte den komplizierten Vorgängen bei der Keimung immer näher auf den Grund zu kommen versucht.

Neu sind für uns, d.h. die praktische Samenkontrolle, die Einflüsse chemischer Stoffe auf den Keimungsprozess, die bisher ja für unsere Versuche ausgeschlossen waren. Als wertvolles Ergebnis möchte ich vor allen Dingen das Bestreben anerkennen zwischen den einzelnen Beobachtungen brauchbare Zusammenhänge festzustellen; so erstens das verschiedene Verhalten von Samen mit verschiedenen Reservestoffen, die akzessorische Wirkung vorhandener Alkaloide, Glykoside u.s.w., die

* *Popoff, M., & Gleisberg, W.*, "Zell-Stimulationsforschungen," Bd. 1, Heft 1. Berlin 1924.

† *Merkenschlager, F.*, "Keimungsphysiologische Probleme." I. Freising, München, 1924.

Bedeutung des Schleimes, der organischen Säuren u.v.a. Besonders wertvoll für den rein physiologischen Standpunkt erscheint mir die Annahme, dass die sogen. akzessorischen Stoffwechselprodukte doch eine ausgleichende Wirkung für den Lebensvorgang haben. Ferner ist die Feststellung des Verhaltens gegen die bei diesen Studien benutzten Stoffe in dem weiteren Lebensprozess der betreffenden Pflanze von grosser Bedeutung. Man kann wohl sagen, dass die alte Detmersche Physiologie des Keimungsprozesses, die auf ein Alter von 50 Jahren heute zurückblickt, zur Zeit die Unterlagen für eine neue Auffassung und Darstellung findet.

Auch die rein wissenschaftliche Physiologie fängt an, wenn auch vielfach aus anderen rein ernährungs-physiologischen Gründen, sich mit der Keimungsphysiologie zu beschäftigen. "Das ernährungs-physiologische Praktikum höherer Pflanzen" von *Grafe*, 1914, ist hierfür das beste Zeichen.

Von anderen Gesichtspunkten gehen Versuche aus, die zum Teil hier in Hamburg eingeleitet worden sind und durch einige Dissertationen belegt werden. Es handelt sich um Fragen des praktischen Keimversuches und um die Möglichkeit, die Keimreife eines Saatgutes zu erkennen. Namentlich kommen Grassaaten in Betracht, die zum Teil wild geerntet werden und nur in geringem Masse unter ganz einfachen Anbauverhältnissen ohne Berücksichtigung von Rassen und Formen gebaut werden. Es ist klar, dass auf diesem Wege meist Saaten von ganz verschiedener Reife und im Zusammenhang damit auch von verschiedener Keimfreudigkeit gewonnen werden können. So wurde für Schafschwingel, Geruchgras und Drahtschmiele ermittelt, dass die Keimenergie und Keimkraft ein deutliches Anwachsen zeigen bei Wiederholung der Versuche nach 6–12 Monaten. Junge Saat von *Anthoxanthum* steht unter starken Keimhemmungen, ebenso Schafschwingel und Drahtschmiele. Die Keimkraft ist aber relativ höher. Dunkelkeimung bringt viel niedrigere Werte als Lichtkeimung. Höhere Temperaturen sind bei *Anthoxanthum*, Aera—bei letzterem auch bei zunehmendem Alter—ungünstig, bei *Festuca* dagegen günstig. In ähnlicher Weise ist eine Reihe anderer Gräser geprüft worden. Es soll auf diese Art durch eine grössere Anzahl von Versuchen ermittelt werden, wie sich derartige Saaten im Laufe einer Reihe von Jahren je nach den beobachteten Ernteverhältnissen verhalten, um vor allem die Konstanz gewisser Bedingungen erkennen zu können. Recht wertvolle Beiträge liefern auch die vergleichenden Versuche über die Keimkraft der Weymouthskiefern, die gemeinsam von Zürich und Hohenheim angestellt worden sind.* Ähnliche Versuche liegen aus Kopenhagen vor.

Es ist dies der zweite Weg, der neben den rein wissenschaftlichen Versuchen aus der Praxis der Samenkontrolle heraus möglich ist und uns in gleicher Weise immer tiefer in die Zusammenhänge einführen wird.

Da es sich in meinem Referat in erster Linie darum handelt, zu einheitlichen Richtlinien für die Anstellung von Keimversuchen zu kommen, so möge diese allgemeine Übersicht über den heutigen Stand der wissenschaftlichen Erforschung der Keimungsvorgänge genügen.

Hiernach legte *Professor Voigt* seinen Antrag auf dem Kongress in Kopenhagen, "Richtlinien für Keimprüfungen"† dem Kongress vor.

Nach einer langen Diskussion wurden die mit diesen Richtlinien verbundenen Fragen dem am Donnerstag Nachmittag zu wählenden Komitee überwiesen.

* *Grisch, A., & Lakon, G.*, "Die Keimprüfung der Weymouthskiefernnsamen." Bern, 1923.

† Siehe Seite 86–88 in "Verhandlungen der Internationalen Konferenz für Samenprüfung in Kopenhagen, 1921."

Dr. Franck trug hierauf seinen Bericht über: "Keimversuche bei niedriger Temperatur" vor (siehe den Vortrag auf Englisch Seite 59–75).

Dr. v. Degen bemerkte, dass *Dr. Francks* Methode nur in Ländern mit klimatischen Verhältnissen, wie sie in Holland sind, verwendbar sei. In Ungarn kämen infolge der trockenen Witterung nur völlig reife Samen vor. Die Verwendung wechselnder Temperatur sei indessen notwendig für aus Deutschland eingeführte Beta-Samen.

Professor Bussard machte darauf aufmerksam, dass man bei Samen aus nördlichen Ländern die Feuchtigkeit in Betracht ziehen müsse. Getreide aus diesen Ländern keime oft besser nach dem Trocknen.

Herr Anderson meinte, dass der Begriff "Nach-Reife" nicht dem wirklichen Zustand des Getreides entspreche. An seiner Anstalt würde aus kommerziellen Gründen immer eine Abschälung der Haferkörner vorgenommen, weil diese seiner Erfahrung nach schnelle Keimung bewirke.

Herr Clark bemerkte, dass man in Canada oft mit Samen zu tun hätte, die dem Frost ausgesetzt gewesen waren. Man hätte es für zweckmässig gefunden, unter gewissen Verhältnissen solche Samen während 10 Tagen unter Glas zu trocknen. Um zu untersuchen, ob die Samen entwicklungsfähig seien oder nicht, würden diese in sorgfältig sterilisierter Erde ausgesät.

Herr Dorph-Petersen bezog sich auf seinen unten angeführten Bericht über: "Untersuchungen des nicht keimreifen Getreides und Feststellung der Keimkraft solcher Samen in Erde."

Deutsches Resümee.

Keimuntersuchungen im Laboratorium und in Erde von nicht keimreifem Getreide.

VON

K. DORPH-PETERSEN.

Direktor *J. Widén*, der zusammen mit mir den erwähnten Stoff behandelt haben sollte, ist leider vor Kurzem abgeschieden. Er war ein selten tüchtiger, feiner und sympatischer Mann, der stets in unserer Erinnerung sein wird.

Widén hätte uns gute Auskünfte dieser Frage betreffend geben können, weil das Getreide in Schweden sowie auch in Schottland, Norwegen, Finnland samt mehreren Ländern auf demselben Breitengrad häufig nicht keimreif wird.

Ausser den vielen Publikationen dieses Stoffs betreffend, auf welche *Dr. Franck* in seinem ausgezeichneten Vortrag: "Keimversuche bei niedriger Temperatur" die Aufmerksamkeit hingeleitet hat, erlaube ich mir besonders auf eine Publikation von Herrn *J. N. Walldén*, dem Vorsteher der Samenkontrollanstalt in Svalöf, über: "Eftermognad hos Spanmålsvaror"* (Nachreife von Getreidewaren) aufmerksam zu machen. *Walldén* nützte die alte Erfahrung aus, dass verletzte Körner

* "Sveriges Utsädesförenings Tidskrift," 1910, Heft 2, 3 und 6.

in einer nicht keimreifen Getreideware in der Regel schneller als die übrigen keimen, indem er, um festzustellen, inwiefern eine nicht keimreife Ware später keimen kann, eine gewisse Zahl von Körnern zum Keimen legt, an welchen die dem Keim entgegengesetzte Spitze abgeschnitten ist.

Die Staatssamenkontrolle in Kopenhagen hat gleichfalls diese Methode benutzt, indem man in den Jahren, wenn es sich zeigte, dass das Getreide, welches zur Untersuchung einging, nicht keimreif war, ausser der gewöhnlichen Anzahl von Samenkörnern, die man in dem Zustande, in welchem diese eingingen, in feuchtem Sand in Tonschalen zum Keimen legte, auch eine kleinere Anzahl wie vorher beschrieben angeschnittene Samenkörner zum Keimen legte. Falls es sich zeigte, dass diese letzteren besser als die anderen keimten, wurde auf dem Analysenschein folgendes angeführt: "Die niedrige Keimfähigkeit deutet darauf hin, dass die Probe nicht keimreif ist; wenn diese einige Zeit trocken aufbewahrt ist, wird sie wahrscheinlich ein höheres Keimresultat geben."

In der Saison 1922/23 ist eine Reihe von Untersuchungen von nicht keimreifem Getreide, geerntet in 1922, wo der Sommer verhältnismässig kühl und feucht war, an der dänischen Staatssamenkontrolle angestellt worden. Ein Teil dieser Untersuchungsergebnisse sind in dem Bericht der dänischen Staatssamenkontrolle für 1922/23* veröffentlicht.

Von den Zahlen in der Tabelle 1 (siehe Seite 81) ist ersichtlich, von welcher Bedeutung es ist, dass Saatgetreide eine gute Keimenergie hat (die Bezeichnung "Keimschnelligkeit" wird an der Kopenhagener Anstalt als Ausdruck für die Keimfähigkeit benutzt, welche eine Ware im Laboratorium in ungefähr einem Drittel der festgesetzten Keimzeit hat, während man dagegen die Bezeichnung "Keimenergie" in Verbindung mit Keimung in Erde, wo die Keime den Widerstand der bedeckenden Erdschicht zu überwinden haben, benutzt). An der Kopenhagener Anstalt untersucht man die Keimenergie entweder durch Aussaat im Versuchsfelde, oder, zu den Jahreszeiten, wo dies nicht möglich ist, in Blumentöpfen, wo die Samen mit einer Erdschicht von 2½ cm. (welche ungefähr derjenigen im Felde entspricht) bedeckt werden. Die Blumentöpfe werden während der Keimung in einem besonderen Gewächraum hingestellt. Nur die Samenproben, die sowohl eine gute Keimschnelligkeit als auch eine gute Keimfähigkeit haben, werden in dieser Weise einen guten, regelmässigen Bestand geben.

Aus der Tabelle 2 (siehe Seite 81) ist ersichtlich, dass nicht keimreifes Getreide schneller und besser bei einer Temperatur von 11–14° C. keimt als bei 17–20° C.

Die Tabelle 3 (siehe Seite 82) zeigt, dass die angeschnittenen Körner von nicht keimreifem Getreide sowohl besser als auch schneller als die nicht angeschnittenen keimen.

Durch Keimprüfungen von einer Reihe Getreideproben im Felde, die bei früheren Untersuchungen sich als nicht keimreif gezeigt haben, ist nachgewiesen, dass die in Erde erzielten Keimergebnisse im Ganzen ausserordentlich gut mit denjenigen, die durch Keimung von angeschnittenen Körnern der betreffenden Proben erzielt wurden, übereinstimmen. Die Ergebnisse eines solchen Versuches, der im Frühjahr 1924 angestellt wurde, sind in der Tabelle 4 (siehe Seite 82) zu finden.

Infolge den erzielten Resultaten der verschiedenen Versuchen kann festgestellt werden, dass man durch Keimprüfung angeschnittener Getreidekörner eine zuverlässige Anweisung bekommt, wie das nicht keimreife Getreide, wenn dies keimreif wird, im Felde keimen wird.

Im Herbst 1923 wurde an der dänischen Staatssamenkontrolle eine Untersuchung bewerkstelligt, um möglicherweise Erklärung über die Ursache der fehlenden Keimreife zu finden. Es wurden Proben von 2 Weizen-, 3 Gersten- und 2 Hafersorten in drei verschiedenen Reifestadien geerntet: (a) "grünreif" (grünliche Spelzen, das Samenweiss im Übergangszustande von milchlicher zu zäher Konsistenz, (b) "gelbreif" (fast gelbe Spelzen, das Samenweiss zäh) und (c) "völlig reif" (ganz gelbe

* "Tidsskrift for Planteavl," Band 30, Seite 329–37.

Spelzen, das Samenweiss von ungefähr fester Konsistenz). Die geernteten Getreideproben wurden bei drei verschiedenen Temperaturen 18–22°, 14–16° und 10–14° C., gleich nach der Ernte, 1 und 2 Monate später und einzelne noch ein oder zweimal mit einem Zwischenraum von 2–3 Wochen zum Keimen gelegt. Die Ergebnisse, die jedoch zu umfassend sind, hier zu erwähnen, zeigen, dass es an und für sich nicht fehlende Reife ist, welche die fehlende Keimreife verursacht. Die Untersuchungsergebnisse zeigen weiter, dass nicht keimreifes Getreide am besten bei der niedrigsten der drei erwähnten Temperaturen (10–14° C) keimt. Je näher das Getreide ist, "völlig reif" zu sein, desto höhere Temperatur kann bei der Keimprüfung verwendet werden, und wenn das Getreide "völlig reif" ist, keimt es in der Regel am schnellsten bei der höchsten der drei erwähnten Temperaturen. Es hat sich gezeigt, dass das bei der Keimprüfung der angeschnittenen Samenkörner erzielte Keimresultat, was alle Untersuchungen betrifft, nur mit Ausnahme der Prüfung, die unmittelbar nach der Ernte angestellt wurde, ungefähr demjenigen entspricht, welches man bei Keimversuchen, wenn das Getreide völlig keimreif ist, erzielt. Da man ja in der Praxis nie mit Keimprüfungen von Getreide unmittelbar nach der Ernte, bevor dies auf dem Felde getrocknet ist, zu tun hat, bestätigt diese Untersuchung, was früher erwähnt ist, dass man durch Keimprüfung der angeschnittenen Körner eine sichere Anweisung bekommt, welche Keimfähigkeit das betreffende Getreide durch passende Behandlung und Lagerung, wenn es keimreif wird, bekommen kann.

Die Untersuchungen zeigen :

(1) dass die fehlende Keimreife nicht dadurch verursacht ist, dass das Getreide, wenn es geerntet wird, nicht "völlig reif" gewesen ist.

(2) dass Keimresultate von nicht keimreifen Getreidekörnern, von welchen die dem Keim entgegengesetzte Spitze abgeschnitten ist, eine sichere Anweisung der Keimfähigkeit, die von der Partie, wenn diese keimreif wird, zu erwarten ist, gibt.

Weil das Anschneiden indessen nicht den Keim berührt, kann es nicht ein latenter Zustand des Keimes sein, der das Keimreifen hindert, sondern eine gewisse Eigenschaft der Samenschale, die wahrscheinlich hindert, dass Sauerstoff, Kohlensäure oder eventuell andere Stoffe durch die Samenschale dringen können.

Nachmittags-Sitzung.

Delegierte des Samenhändlerkongresses, welcher gleichzeitig mit der Vierten Internationalen Samenkontroll-Konferenz in London abgehalten wurde, nahmen an dieser Sitzung Teil und wurden von *Sir Lawrence Weaver* und *Herrn Dorph-Petersen* im Namen des Samenkontroll-Kongresses und der Europäischen Vereinigung für Samenkontrolle begrüsst. *Herr C. G. Bell* sprach im Namen des Samenhändler-Kongresses und der Vereinigung der britischen Samenhändler seinen Dank für den freundlichen Empfang aus.

Danach las *Dr. Volkart* seinen Bericht über: "Die an der Vereinigung bewerkstelligten 'Herkunftsbestimmungen'" vor (siehe den Vortrag auf Englisch Seite 83-97).

Schlussfolgerungen.

1. Die bisher vorliegenden Ergebnisse der Untersuchung von Rotkleie verschiedener Provenienz nach dem im Auftrage der Konferenz in Kopenhagen vorgeschlagenen einheitlichen Verfahren zeigen, dass auf diesem Wege genaue und zuverlässige Beschreibungen der einzelnen Provenienzen erhalten werden können. Die Untersuchungen sind daher fortzusetzen.

2. Es ist strenge daran festzuhalten, dass die Untersuchungen nach einheitlichem Plane fortgeführt und veröffentlicht werden, sodass die Untersuchungsergebnisse unter sich vergleichbar sind und leicht benutzt werden können.

3. Die Einzeluntersuchungen sind wie bisher in den Händen der Anstalten der verschiedenen Länder zu belassen. Diese Anstalten sammeln die Proben und untersuchen sie nach einheitlichen Vorschriften. Die ausführliche Veröffentlichung der Ergebnisse steht den einzelnen Anstalten zu.

4. Als Zentralstelle bezeichnet der 4. Kongress für Samenkontrolle eine Anstalt, von der aus diese Untersuchungen kräftig gefördert werden. Aufgabe dieser Zentralstelle ist:—

(a) der weitere Ausbau und die Vereinheitlichung der Untersuchungsmethode für die Erhebung;

(b) die Anleitung und Unterstützung der an der Untersuchung teilnehmenden Anstalten;

(c) die Zusammenfassung der Untersuchungsergebnisse in kurzen Uebersichten, ihre Erklärung (Interpretation) und Versendung an die Mitglieder der Vereinigung;

(d) die Durchführung der Erhebung für Länder, denen die Ausführung der Untersuchung selbst nicht möglich ist;

(e) Untersuchung einzelner für die Provenienzbestimmung besonders wichtiger Artgruppen und Veröffentlichung der unterscheidenden Merkmale ihrer Samen; Verteilung von authentischem Samenmaterial dieser Arten an die einzelnen Anstalten;

(f) Führung eines Archives in das die Ergebnisse aller Einzeluntersuchungen eingereiht werden.

5. Für die Arbeiten dieser Zentralstelle setzt die Vereinigung einen bestimmten alljährlich auszurichtenden Kredit aus und ihr Vorstand gewährt überdies weitere ausreichende Unterstützungen (Subventionen) für besondere Untersuchungen, die notwendig werden sollten.

Sir Lawrence Weaver dankte Dr. Volkart für seinen interessanten Bericht und bedauerte, dass Dr. Volkart keine Möglichkeit finde, die Arbeit über die Herkunftsbestimmungen innerhalb der Vereinigung fortzusetzen.

Dr. Volkart lenkte die Aufmerksamkeit auf einen Bericht über Herkunftsbestimmungen von Herrn Tryti, Kristiania, hin (siehe die englische Abteilung Seite 97–98).

Herr Dorph-Petersen bemerkte, dass auch die Kopenhagener Anstalt wie die Anstalt in Kristiania gefunden hätte, dass Bruchstücke von Pflanzen und Mineralien gute Auskünfte über die Herkunft einer Samenprobe geben könnten. Diese Bestimmungen seien besonders schwierig, wenn es sich um Mischungen von Waren verschiedener Herkünfte handle.

Herr Brown trug danach seine Mitteilungen über: “Die Bewertung der hartschaligen Samen” vor (siehe den englischen Vortrag Seite 99–100).

Herr D. Bell erklärte, obwohl er als Samenhändler gezwungen sei, hartschalige Körner zu ritzen, hätte er doch nie als Landwirt geritzte Samen ausgesät. Er habe wilden Weissklee mit mehr als 30 Prozent harten Körnern ausgesät und einen schönen Ertrag erzielt.

Herr Lafferty erwähnte einige in Dublin unternommene Versuche über die Keimfähigkeit hartschaliger Samen. Die Versuche, welche 10 Jahre dauerten, zeigten, dass nach drei Jahren ungefähr 50 Prozent der harten Körner von Rotklee keimten. Die Keimung wurde danach langsamer, sodass nach 10 Jahren beim Abschluss des Versuches noch nicht alle hartschaligen Samen gekeimt hatten. Nachdem der Rest der harten Körner geritzt und sofort auf den Keimapparat zurückgelegt wurde, keimten diese in den meisten Fällen normal innerhalb weniger Tage. Parallel-Versuche mit harten Körnern von Kleesamen, auf Keimapparaten im Laboratorium und in Blumentöpfen in einem ungeheizten Gewächshaus unternommen, zeigten, dass mehr Prozente in Erde als in den Apparaten keimten. *Herr Lafferty* meinte, dass die Untersuchungsberichte nur den Gehalt an harten Körnern angeben sollen, die Bewertung dieser Samen müsse man dem Landwirt überlassen.

Herr Brown teilte mit, dass Versuche in den Vereinigten Staaten gezeigt hätten, dass harte Körner die 20 Jahre hindurch in Erde lagen, nach dem Ritzen sofort keimten.

Herr Devoto sagte, dass man in Argentinien der Meinung sei, dass 50 Prozent der harten Körner keimfähig seien.

Professor Bussard und *Dr. v. Degen* betrachteten alle harten Körner als keimfähig.

Herr Dorph-Petersen verteilte zwischen den Anwesenden maschinengeschriebene Exemplare seiner Bemerkungen zu Herrn Browns Vortrag und eine Broschüre: "How long do the various seed species retain their germinating power?" Diese enthielt die Resultate von Versuchen mit Samenproben, die unter verschiedenen Feuchtigkeits- und Temperaturverhältnissen aufbewahrt waren. Die Versuche zeigten, dass Proben von Rotklee, Gelbklee und gemeinem Hornklee in einigen Fällen bedeutend mehr harte Körner enthielten, wenn die Proben unter warmen, trockenen Verhältnissen (in zentralgeheizten Räumen bei 18° C.) aufbewahrt, als wenn sie in kühlen, feuchten Räumen gelagert wurden. Weil das Ritzen oft Zerbrehen der Keimlinge verursache, dürften die harten Körner seiner Meinung nach als keimfähig betrachtet werden, wenn der Gehalt in einer Probe nicht wesentlich grösser als das Normale für die betreffende Art sei. Nach diesen Versuchen bewahren Luzernesamen ihre Keimfähigkeit am längsten und die harten Körner seien, wenn sie geritzt werden, fast immer keimfähig.

Herr Brown bemerkte, dass es scheine, dass alle Anwesenden die harten Körner als keimfähig betrachten.

Nach einer Teepause wurde in Kürze ein Bericht der Herren *Pammer* und *Schindler* (Wien) von *Professor Voigt* vorgetragen.

Zur Frage der Hartschaligkeit der Kleesamen und des Bruches.

REFERAT VON

G. PAMMER UND J. SCHINDLER, WIEN.

Die Bewertung der hartschaligen Körner bei den Kleearten erfolgt nach den in den technischen Normen für die Prüfung von Saatgut des Verbandes landwirtschaftlicher Versuchsstationen im Deutschen Reiche, gültig vom 13. September 1912 an enthaltenen Bestimmungen derart, dass "hartschalige (ungequollene) Samen im Untersuchungsbericht als solche zahlenmässig anzugeben sind, mit der Bemerkung, dass ein unbestimmter Bruchteil innerhalb nutzbarer Zeit voraussichtlich nachkeimen dürfte." Das Methodenbuch des Verbandes der landwirtschaftlichen Versuchsstationen in Österreich, ab 1. Januar 1913 geltend, schreibt vor, dass "bei Luzerne von den hartgebliebenen Körnern $\frac{1}{2}$, bei den übrigen Kleearten $\frac{1}{3}$, zu den tatsächlich gekeimten zuzuschlagen, die betreffenden Ergebnisse jedoch ausserdem noch anzugeben sind."

An diese beiden divergierenden Vorschriften anknüpfend möchten wir die Aufmerksamkeit auf die Tatsache lenken, dass die Verwendung von Kleesamen zur Anlage von mehrjährigen Futterflächen auf dem Ackerlande seit 4 Jahrzehnten, insbesondere durch die aufklärende Tätigkeit F. G. Steblers in der Schweiz und Th. v. Weinzierls in Österreich, ausserordentlich stark zugenommen hat. Der Anbau von Klee (insbesondere Rotklee) im Reinbau oder höchstens im Gemenge mit einer Gräserart nimmt nicht mehr ausschliesslich den ganzen Samenbedarf an Klee für sich in Anspruch, sondern es werden bereits grosse Mengen von Saatgut für die Anlage von Futterschlägen auf dem Ackerlande, welche 3 bis 6 Jahre genutzt werden sollen, verwendet, und *aus dieser Tatsache ergibt sich die Notwendigkeit, zu der Frage nach dem Werte der hartschaligen Kleesamen Stellung zu nehmen.*

Auch die Anlage von Dauerwiesen und Weiden mit noch längerer, 10–12 jähriger Nutzung durch Neuansaat oder künstliche Einsaat von Klee- und Grassamen nimmt von Jahr zu Jahr zu und erfordert alljährlich bedeutende Quantitäten von Saatgut. Unter solchen Umständen ist es wohl von Wichtigkeit, die Frage sicherzustellen, ob die im Ansaatzjahre nicht aufgehenden hartschaligen Kleesamen wirklich als nutzlos zu bezeichnen sind.

Bei Reinsaat und 1–2 jähriger Nutzungsdauer wird man darauf sehen, dass die Saat rasch aufläuft und sich gleichmässig entwickelt. Hier wird man also entschieden ein Saatgut, das einen hohen Prozentsatz harter Körner aufweist, möglichst vermeiden. Anders bei mehrjährigen Futteranlagen: ist die kühlfeuchte Lagerung der Kleesamen während des ersten und zweiten Winters, oder irgend ein anderer Faktor imstande, die Hartschaligkeit aufzuheben, so wäre gerade die Hartschaligkeit bei jenen Kleearten, welche bei der Anlage von länger dauernden Futterflächen, besonders aber von Dauerweiden und Dauerwiesen, hauptsächlich in Verwendung kommen (Weissklee, Bastardklee, Schotenklee, Sumpfschotenklee und Hopfenklee), durchaus nicht als eine nachteilige Eigenschaft zu werten, weil auch die nach und nach auskeimenden Kleepflanzen dem Bestande zugute kommen.

Dass sich der Kleebestand einer Wiese durch das Nachkeimen innerhalb längerer Zeiträume immer wieder ergänzt, ist eine bekannte Tatsache. Doch wurden bisher solche Versuche, welche diese Frage aufzuklären imstande wären, unseres Wissens nicht angestellt. Steglich* hat seine Versuche bis längstens 17 Monate, vom 15. IV. 1908 bis 15. IX. 1909 beobachtet. Es ist also nicht bekannt geworden, ob von den übrig

* B. Steglich: "Untersuchungen über Hartschaligkeit und Bruch bei der Keimung des Kleesamens." In *Landw. Versuchsstationen*, Bd. 79 und 80, Berlin, 1913, Seite 611 bis 622.

bleibenden harten Körnern im nächsten oder übernächsten Frühjahr durch Überliegen über den Winter ein beträchtlicher Teil noch zur Auskeimung gelangt ist. Dass eine längere (1 bis mehr monatliche) feuchte Lagerung bei niedriger Temperatur die Keimung von sonst unter normalen Bedingungen sehr schwer keimenden Samen sehr begünstigen oder überhaupt erst ermöglichen kann, wissen wir aus der Keimfähigkeitsprüfung von Obstkernen und von Weymouthskiefern (*Pinus Cembra*).*

Auch die Versuche von Hojesky† erstrecken sich nur auf eine Vegetationsperiode, obwohl dort die Notwendigkeit, solche Versuche auf eine längere Zeit auszudehnen, betont wird.

Dass die im Erdboden befindlichen hartschaligen Kleesamen den verschiedenartigsten Einflüssen ausgesetzt sind, und dadurch ein Rückgang ihrer Hartschaligkeit bewirkt wird, wissen wir aus der oben angeführten Arbeit von Hojesky. Hojesky hat im speziellen nachgewiesen, dass bei hartschaligen Luzernesamen im trockenen Erdboden die Hartschaligkeit durch starke Erwärmung während der heissen Sommermonate in sehr erheblichem Grade zurückgeht. In einem mit Erde beschickten Holzkistchen zeigte die trockene Erde an 5 aufeinander folgenden Tagen im Juni zwischen 11 Uhr und 1 Uhr mittags eine Temperatur von 40–50 Grad Celsius. Schon nach 2 Tagen zeigten hartschalige Luzernesamen, aus der Erde genommen und zur Keimung ausgelegt, 87 % Keimung, nach 5 Tagen entnommen 100 %. Der Wundklee ist in dieser Zeit auf die Hälfte der Hartschaligkeit zurückgegangen, Rotklee zeigte nach 5 Tagen 15 % Keimung, die übrigen Arten keimten fast gar nicht.

Wir sehen also, dass bei Luzerne durch Erwärmung im Boden allein die Hartschaligkeit zur Gänze aufgehoben wird, beim Wundklee zur Hälfte. Damit ist aber nicht gesagt, dass die anderen Kleearten, bei denen die Hartschaligkeit durch einfache Erwärmung im Erdboden nicht oder nur unerheblich abnimmt, nicht doch durch einen anderen auf dem Felde wirksamen Faktor die Hartschaligkeit verlieren können. Ein solcher Faktor wäre z.B. feuchtkühle Lagerung im Erdboden während des Winters. Diese Frage ist noch ungelöst und muss erst in derselben Eindeutigkeit gelöst sein, wie die Natur der Hartschaligkeit bei der Luzerne und deren Beeinflussung.

Bevor man daran geht, die Hartschaligkeit der übrigen Kleearten zu beurteilen, müssen wir wissen, durch welchen Faktor die Hartschaligkeit bei jeder einzelnen Kleeart aufgehoben werden kann, und in welchem Masse dies geschieht. Erst dann kann diese strittige Frage einer definitiven Beantwortung zugeführt werden. Auch die Frage, in welcher Zeit dies geschieht, ist für die Beurteilung der hartschaligen Kleesamen noch wichtig.

Dass die einfache Angabe der harten Körner beim Abschluss des Keimversuches, ohne Einrechnung eines bestimmten Teiles derselben in die Keimfähigkeit, eine ganz ungenügende Charakterisierung des Saatgutes enthält, geht schon daraus hervor, dass auch bei anderen Sämereien, z. B. Gemüsesamen, Industrie, und Handelsgewächsen, die Anzahl der gesundbleibenden Samen beim Abschluss des Keimversuches angegeben wird. Es ist aber ein grosser Unterschied zwischen den gesundbleibenden Samen einer Kleeart auf einer mehrjährigen Futteranlage, und den gesundbleibenden Samen irgend einer einjährigen Kulturpflanze, deren nachkeimende Samen vielleicht erst nutzbar werden, wenn die Kultur den Acker bereits verlassen hat. Ferner darf nicht vergessen werden, dass in manchen Jahren, besonders bei der Luzerne, die Hartschaligkeit ganz regelmässig in sehr hohem Grade auftritt und 40–50 % erreicht. In solchen Fällen wäre es ganz widersinnig, ein solches Saatgut, das infolge

* A. Grisch und G. Lakon: "Die Keimprüfung der Weymouthskiefern-samen" im *Landw. Jahrbuch der Schweiz*, 1923.

W. Kinzel: "Anpassung der Samen an klimatische Einflüsse (bis zur völligen Umkehr des Keimverlaufes)." In *Praktische Blätter der Bayrischen Landesanstalt für Pflanzenbau und Pflanzenschutz*, 1924, Heft 1.

† J. Hojesky: "Über hartschaliges Kleesaatgut." In *Zeitschrift für das Landw. Versuchswesen in Österreich*, Heft 7–12, 1921.

grosser Hartschaligkeit in der vorgeschriebenen Keimdauer: nur etwa 40–50 % tatsächlich gekeimter Samen liefern kann, gleich zuhalten einem Saatgut, das als mehrjähriges Saatgut infolge seines Alters auch nur 40–50 % Keimfähigkeit erreicht.

Es ist also die Forderung, einen ganz bestimmten Teil der harten Körner zur tatsächlichen Keimfähigkeit einzurechnen, berechtigt. Die Grundsätze, nach welchen bei dieser Anrechnung bei jeder einzelnen Art vorzugehen ist, bedürfen noch einer Revision. Dass die Einrechnung der Hälfte der harten Körner bei der Luzerne und eines Drittels beim Rotklee nach den bisherigen Untersuchungen annähernd den Tatsachen entspricht, kann bereits jetzt als erwiesen betrachtet werden. Wie die hartschaligen Körner bei Weissklee, Bastardklee, Wundklee, Schotenklee, Sumptschotenklee und Hopfenklee zu bewerten sind, bedarf noch des experimentellen Beweises.

BRUCHKÖRNER.

Nach den technischen Vorschriften des Verbandes landw. Versuchsstationen im Deutschen Reiche sind bei der Bestimmung der Reinheit (und damit auch bei der Bestimmung der Keimfähigkeit) “äusserlich verletzte oder vollständig verkümmerte echte Samen, sofern sie unzweifelhaft zur Keimung als unfähig erkannt werden können” auszuschalten. Nach dem Methodenbuch des Verbandes der landw. Versuchsstationen in Österreich sind “verletzte, sowie stark verschrumpfte Körner der zu untersuchenden Samenart, sofern diese unzweifelhaft als unkeimfähig erkannt werden können” auszuschalten.

Nun kommt es in manchen Jahren vor, dass besonders beim Rotklee und Wundklee, seltener bei der Luzerne, und beim Hopfen-Klee Warenposten zur Untersuchung kommen, welche einen sehr hohen Prozentsatz von Körnern enthalten, welche nur sehr geringe Druschverletzungen aufweisen. Wenn man nun aus solchen Warenposten Körner auswählt, die nur ganz wenig verletzt sind, denen also ein kleines Stück der Samenschale oder die Spitze eines Keimblattes fehlt, und zur Keimung auslegt, so kann man beobachten, dass diese Samen gesunde Keimlinge liefern und, wenn man dieselben auf Tonschalen mit Erde nach gärtnerischer Methode umpikiert, sich zum grössten Teile regelrecht zu normalen Pflanzen entwickeln. Man kann sogar noch weiter gehen und solche Samen, die eine wesentlich grössere Druschverletzung aufweisen, denen die ganze obere Hälfte beider Keimblätter fehlt, der gleichen Behandlung unterwerfen. Auch von diesen Keimlingen kann sich ein beträchtlicher Teil weiter entwickeln.

Neben diesen Samen, bei denen also schon bei der Auszählung die Bruchverletzung zu sehen ist, kommen noch Verletzungen vor, welche erst während der Quellung im Keimbette sichtbar werden (sogenannter “innerer Bruch”), bei denen also der Keimling zerfällt. Für diese Art von zerbrochenen Keimlingen haben die technischen Vorschriften folgende Norm vorgesehen: “Zerbrochene Keime gelten als ungekeimt, sofern beide Kotyledonen im Keimbett abfallen; der Verlust eines der Keimblätter wird als belanglos angesehen. Keime, deren Würzelchen abgebrochen sind, gelten als gekeimt, wenn sich bis zum Abschlusstage eine oder mehrere Adventivwurzeln ausbilden.”

Diese Richtlinien können für die Behandlung jener gebrochenen Keimlinge als richtig gelten, bei denen die Bruchverletzung erst im Keimbett sichtbar wird. Wenn wir aber jene Körner betrachten, bei denen eine Verletzung schon äusserlich sichtbar ist, müssen wir sagen, dass durch ihre Ausschaltung von den einzukeimenden Samen ein Fehler begangen wird; denn sie können sich ebenfalls zu gesunden Keimlingen entwickeln, denen nur ein geringer Teil eines oder beider Kotyledonen fehlt. Nun ist es aber äusserst schwer, eine feste Grenze zu ziehen, zwischen jenen gebrochenen Körnern, deren Verletzung den Keimling in seiner Entwicklung nicht schädigt, und jenen, die infolge ihrer Verletzung schwächliche Pflanzen liefern, die später in der Entwicklung zurückbleiben und schliesslich zugrunde gehen. Aus diesem Grunde erscheint es angezeigt, eine unzweideutige Norm aufzustellen, welche besagt, dass *all*

Kleesamen, die irgend eine äusserlich wahrnehmbare Verletzung zeigen, sowohl bei der Reinheitsbestimmung, als auch bei der Keimfähigkeitsprüfung auszuschalten sind, obwohl wir wissen, dass ein Teil derselben entwicklungsfähige Keimlinge zu liefern imstande ist.

Demnach können wir die Bestimmung der technischen Vorschriften, dass "Keime, deren Würzelchen abgebrochen sind, als gekeimt gelten, wenn sich bis zum Abschlusstage eine oder mehrere Adventivwurzeln ausbilden" als zutreffend bezeichnen. Nur die Bestimmung bezüglich der Ausschaltung der schon äusserlich sichtbar gebrochenen Kleesamen müsste etwas präziser gefasst werden, etwa so, dass statt: "äusserlich verletzte oder vollständig verkümmerte echte Samen, sofern sie, etc." gesagt wird, dass "äusserlich verletzte echte Samen *ohne Ausnahme*, vollständig verkümmerte nur, sofern sie unzweifelhaft als zur Keimung unfähig erkannt werden können," auszuschalten sind.

Wir können also nach den bisherigen Untersuchungen bloss sagen, dass, soweit die Versuche von B. Steglich in Frage kommen, von den hartschaligen Rotkleesamen ein unbestimmter Teil innerhalb absehbarer Zeit (d.i. bei den Versuchen Steglichs längstens 14 Monate) nachkeimt, und ein noch kleinerer Teil hievon nutzbare Pflanzen liefern kann. Ähnliche Resultate haben die methodisch ähnlich durchgeführten Freilandversuche von Hojesky ergeben.

Als wichtigstes positives Resultat von allgemein wissenschaftlicher und praktischer Bedeutung in dieser Frage ist die Feststellung Hojeskys, dass durch eine 5-tägige Erwärmung der hartschaligen Luzernesamen im trockenen Erdboden während des Sommers auf 40–50 Grad Celsius die Hartschaligkeit vollständig, beim hartschaligen Wundklee zur Hälfte aufgehoben werden kann.

Wie sich die übrigen hartschaligen Kleearten anderen Faktoren gegenüber verhalten, hauptsächlich gegenüber der feuchtkühlen Lagerung während einer längeren Zeit, ferner gegenüber der zerstörenden Einwirkung der Temperatur- und Feuchtigkeitsschwankungen und der Bodenorganismen auf die Samenschale, bleibt noch zu untersuchen.

Der Nachweis des Einflusses der Bodenwärme auf die Hartschaligkeit der Luzerne und des Wundklees durch Hojesky zeigt, dass ähnliche Einwirkungen auch von anderen Faktoren in längerer Zeitdauer zu erwarten sind. Diesbezügliche Versuche sind noch ausständig.

Da nach den Versuchen von Hojesky beim Rotklee die hartschaligen Körner zu $\frac{1}{4}$ bis $\frac{1}{2}$ nachkeimen, bei der Luzerne die *Halbte*, so erscheint der Vorgang der Wiener Anstalt, diese Anteile der hartschaligen Körner in die Keimfähigkeit einzurechnen, begründet. In welcher Weise die hartschaligen Körner bei den übrigen Kleearten zu bewerten sind, muss erst durch besondere Versuche erwiesen werden, keinesfalls können sie aber ganz vernachlässigt oder so behandelt werden, dass der Samenhändler die hartschaligen Körner bei diesen Arten selbst in Rechnung stellt, wie es ihm eben behagt.

Bezüglich der Bruchkörner erscheint es notwendig, äusserlich sichtbaren Bruch *vollständig auszuschalten*, obwohl dieser Vorgang nicht ganz zutreffend ist, aber eine eindeutige Vorschrift beinhaltet, und gebrochene Keimlinge im Keimbette nur dann als gekeimt gelten zu lassen, wenn nur ein Keimblatt fehlt, oder das abgebrochene Würzelchen bis zum Abschlusstag durch Adventivwurzeln ersetzt wurde.

Herr Lafferty bemerkte zu dem letzten Paragraphen, in welchem angeführt ist, dass, falls beide Keimblätter einer Pflanze gebrochen seien, der Same nicht als keimfähig gerechnet werden dürfe. Versuche an seiner Anstalt hätten gezeigt, dass auch, wenn beide Keimblätter fehlten und nur die Knospe

unbeschädigt sei, der Same in manchen Fällen keimen könne. Professor Voigt illustrierte an einer Tafel, dass das Keimen von der Stelle des Bruches abhängig sei.

Herr Dorph-Petersen und *Herr Anderson* waren darüber einig, dass zerbrochene Keimlinge als "tote" zu betrachten seien, und *Herr Lafferty* war der gleichen Meinung wie die genannten Herren, dass der keimfähige Prozentsatz solcher Keimlinge sehr klein sei.

Herr Fleischner (der Abgeordnete der Tschechoslowakischen Samenhändler) und *Dr. Chmelar* traten der Frage vom kaufmännischen Standpunkt aus näher. Sie waren der Meinung, dass der Prozentsatz der keimfähigen Körner und derjenige der harten je für sich in dem Untersuchungsbericht angegeben sein müsse.

Herr Devoto erklärte, dass zu grosse Feuchtigkeit des Keimes oft Ursache des Bruches sei, und *Herr Lafferty* beschrieb die Bruchursache als innere Spannung während des Keimprozesses.

Die Diskussion zusammenfassend betonte *Professor Voigt*, mit Rücksicht auf die grossen Meinungsunterschiede, die Notwendigkeit, eine internationale Norm für die Bewertung harter Körner aufzustellen. Zerbrochene Keimlinge seien von wenig Nutzen in Europa. Er sei mit Herrn Devoto über die Bruchursache einig.

Der Ausschuss der neun Herren, der am Dienstag gewählt wurde, hielt eine lange Abendsitzung, um einen Entwurf für die Statuten der Internationalen Vereinigung für Samenkontrolle auszuarbeiten und andere mit der Arbeit verbundene wichtige Fragen zu besprechen.

Donnerstag, den 10. Juli.

Vormittags-Sitzung.

Dr. Chmelar las seinen Bericht über: "Die Bestimmung der Sortenechtheit im Laboratorium und im Feldbestande" vor.

Die Bestimmung der Sortenechtheit im Laboratorium und im Feldbestande.

von

DR. FR. CHMELAR,

Vorstand der Sektion für die Samenprüfung der Mährischen landwirtschaftlichen Landes-Versuchsanstalt in Brünn, Čechoslovakei.

I.—Die Bedeutung der Sortenechtheitbestimmung für die Landwirtschaft und für die Ausfuhr.

Bei der Samenprüfung verlangte man bisher ausser Reinheits- und Keimfähigkeitsbestimmung am häufigsten noch die Bestimmung der Echtheit der Art und eventuell die Bestimmung der Provenienz. Die

Pflanzenzüchtung hat aber in den letzten Jahren bei allen Kulturpflanzen und zuletzt auch bei den Futterpflanzen so grosse Fortschritte gemacht, dass im Ackerbau, Gartenbau und auch auf den Dauerfutterflächen (Wiesen und Weiden) vorherrschend die gezüchteten Sorten oder bewährten Landsorten zum Anbau benützt werden.

Will der Landwirt nur gezüchtete Sorten, welche sich durch ihre biologischen Eigenschaften für seinen Standort und für von ihm beabsichtigte Zwecke am besten eignen, benützen, so ist er dazu gezwungen, bestimmte bewährte Sorten und eine Garantie der Sortenechtheit zu verlangen.

Damit man die Eigenschaften der Sorten feststellen könne, hat sich die "Sorten- und Saaten- Anerkennung" auf dem Felde bei dem Züchter entwickelt. Dieselbe ist in Deutschland seit dem Jahre 1897 (bei der Deutschen Landwirtschafts-Gesellschaft in Berlin, bei den Landwirtschaftskammern oder bei den Versuchsanstalten einzelner Staaten), weiter in Oesterreich (Oesterreichische Gesellschaft für Pflanzenzüchtung und Deutsche landwirtschaftliche Gesellschaft für Oesterreich) eingeführt. In Ungarn ist seit dem Jahre 1915 die Anerkennung von gezüchteten Sorten und deren Prüfung für die Aufnahme in das Hochzuchtregister eingeführt und wird dieselbe von der Versuchsanstalt in Magyarorvár durchgeführt. In der Schweiz sind mit der Anerkennung seit dem Jahre 1915 die Versuchsanstalten beauftragt. In den Vereinigten Staaten von Nordamerika ist die Saatenanerkennung bei Kartoffeln in dem Staate Wisconsin eingeführt. In den letzten Jahren (im J. 1922) hat auch Frankreich die Saatenanerkennung vorläufig nur für den Weizen eingeführt.

In der Čechoslovakiei besteht ein Gesetz über die Saatenanerkennung und Sortenprüfung vom 17. März 1921, Nr. 128. Durch dieses Gesetz wird die staatliche Anerkennung von gezüchteten Sorten und die Erteilung des Rechtes eine Sorte als "Original" zu bezeichnen geregelt. Die Durchführung der Saatenanerkennung und der Sortenprüfung durch Feldversuche wird durch dieses Gesetz genau festgesetzt. Bemerkt sei noch, dass die Saatenanerkennung in der Čechoslovakiei schon früher eingeführt wurde (in Mähren seit dem Jahre 1907, in Böhmen seit dem Jahre 1910).

Bei der Sorten und Saatenanerkennung ist es besonders wichtig, die Sortenechtheit festzustellen und zwar sowohl auf dem Felde bei der Feldbesichtigung, wie an den von der Ernte zwecks Analyse eingesandten Körner- oder Knollenproben.

In unserer Versuchsanstalt in Brünn gelangen zur Begutachtung zwecks Saatenanerkennung jährlich bis 1000 Proben. Für die Abnehmer von Originalsaatgut dient als Garantie der Sortenechtheit in der Čechoslovakiei noch der Umstand, dass jeder Sack von Originalsaatgut mit der Plombe des Züchters geschlossen sein muss, ausserdem hat bei jedem anerkannten Saatgut der Abnehmer das Recht eine Probe der zuständigen Versuchsanstalt zur Nachkontrolle einzusenden. Die Analyse dieser Kontrollproben geschieht unentgeltlich.

Eine noch grössere Bedeutung hat die Garantie der Sortenechtheit bei der Ausfuhr. In der Cechoslovakiei muss nach dem zitierten Gesetze das zur Ausfuhr bestimmte Originalsaatgut, wenn seine Menge 50 q übersteigt, amtlich durch eine staatliche oder Landesanstalt für Samenprüfung plombiert werden. Dadurch ist die Sortenechtheit genügend sichergestellt.

In Dänemark findet eine staatliche Inspektion des zur Ausfuhr bestimmten Saatgutes statt, wenn es vom Käufer verlangt wird, und ein besonderes Regulativ derselben wurde im Jahre 1920 herausgegeben. ("Regulativ for Statens Udsædsinspektions Kontrol med Saasæd, bestemt for Export i 1920.") Geprüft wird ausser anderen Eigenschaften auch die Sortenechtheit und Sortenreinheit. Für die Beimischung von fremden Sorten ist als die grösste zulässige Grenze 1 pro mil. festgestellt. Den Normen nicht entsprechendes Saatgut wird zur Ausfuhr nicht zugelassen.

Erwähnt sei noch die Saatgutbezeichnung, welche in Schweden von der Kontrollabteilung des Vereines für Pflanzenzüchtung in Svalöf bei dem durch die "Allgemeine schwedische Saatgut A.G." gelieferten Saatgut durchgeführt wird. Diese Bezeichnung ist seitens des Ministeriums für Landwirtschaft, welches die genannte Gesellschaft unterstützt, verordnet worden. Jeder Sack ist mit einem Spitzzettel mit Qualitäts- und Sortenangabe versehen und ein gleicher Zettel befindet sich auch in dem plombierten Sacke.

II.—*Einige zur Bestimmung der Sortenechtheit benützte Methoden.*

In diesem Referate kann ich wegen Zeitmangels die Methoden zur Bestimmung der Sortenreinheit nicht eingehend behandeln. Ich will deshalb in erster Linie an einige, in unserer Anstalt benützte Methoden aufmerksam machen. Diese Methoden wurden von mir nachgeprüft und ihre Brauchbarkeit bestimmt. Besonders werde ich diejenigen Kulturpflanzen berücksichtigen, die bei uns oft geprüft werden. Die Benützung der Precipitinmethode (biologisches Eiweissdifferenzierungsverfahren) befindet sich für die Zwecke der Sortenbestimmung in den Anfängen, deshalb lasse ich sie unberücksichtigt.

(1) *Zucker- und Futterrübe (Beta vulgaris).*—Am häufigsten kommt die Feststellung der Sortenechtheit oder Sortenreinheit bei der Futter- und Zuckerrübe vor. In unserer Anstalt wird zur raschen Unterscheidung der Futterrübensamen von dem Samen der Zuckerrübe die von Dr. H. Pieper angegebene Methode benützt (*Zeitschrift des Vereines der deutschen Zuckerindustrie* 1919).

Nach dieser Methode unterscheidet man die Samen der farbigen Futterrüben von den Samen der Zuckerrübe nach der *Farbe der Keimlinge*.

Zur Erzielung möglichst deutlicher Unterschiede in der Färbung der Keimlinge wird der Versuch bei einer *Temperatur von 15° C. und bei zerstreutem Tageslicht* (bei einem Nordfenster) durchgeführt. Die *angegebene Temperatur muss eingehalten werden*. Zur Ankeimung verwendet Pieper viereckige Kästen aus Blech, welche man bis 1 cm. unter den Rand mit vorher angefeuchtetem feinen Flussand oder feuchter dunkler Gartenerde füllt. Von der dunklen Erde heben sich die Farben der Keimlinge besser ab. In den Sand oder die Erde werden mit einer Schablone sechzig 2 cm. tiefe und je 2-5 cm. voneinander entfernte Löcher gedrückt. In die beiden äusseren Querreihen werden Knäule einer als echt und rein bekannten Zuckerrübensaat gelegt, in die restlichen 50 Löcher legt man Knäule von der zu prüfenden Samenprobe. Hierauf werden die Löcher geschlossen und der Kasten mit einer farblosen Glasplatte bedeckt.

Nach etwa 8 Tagen erscheinen die Keimlinge an der Oberfläche. Sobald sie an den Glasdeckel stossen, wird dieser entfernt, damit sich die Pflänzchen frei entfalten können. Nach Bedarf werden dann die Kästen gewässert. In etwa 14 Tagen kann der Abschluss des Versuches erfolgen. Wenn die Temperatur tiefer war als 15° C., muss man noch warten, bis die Keimlinge etwa 2 cm. hoch über der Erde stehen, längstens 3 Wochen. *Bei höherer Temperatur als 15° C. strecken sich die Keime zu schnell, werden sehr lang und fallen leicht um.*

Die zu einem Knäuel gehörenden Keimlinge werden mit den Würzelchen herausgezogen und nach Abwaschen auf eine *schwarze Glasplatte* gelegt.

Die Stengel der Zuckerrübenkeimlinge sind rosa und grünlich weiss gefärbt. Die Zahl der rosafarbenen Keimlinge überwiegt (80 %) die Zahl der weisstengeligen. Die Anzahl der Knäule, die nur weisstengelige Keimlinge liefern, beträgt nur 8 %. *Die Färbung der rosa Keimlinge wird nach oben zu intensiver, so dass sie unterhalb des Blattansatzes am intensivsten ist.* Der unterirdische Teil des Stengels ist fast farblos.

Die Keimlinge der gelben und orangefarbenen Futterrübensorten sind ganz gelb oder orange gefärbt.

Die Keimlinge der roten Futterrübensorten sind karminrot gefärbt, und die Färbung wird von oben nach unten zu kräftiger, wobei sich die

Färbung auch auf den in der Erde steckenden Stengelteil erstreckt. (Auf die Wurzel übergeht diese Färbung immer nicht.)

Die weissen Futterrübensorten von ausgesprochenem Futterrübentyp haben ausnahmslos weisstengelige Keimlinge, die sich allerdings von den weissen Zuckerrübenkeimlingen nicht unterscheiden lassen. Da jedoch in reinem Zuckerrübensamen nur vereinzelte Knäule mit ausschliesslich weissen Keimlingen vorkommen (die Mehrzahl ist rosa), so kann man aus dem Auftreten grösserer Menge weisskeimender Knäule mit grosser Wahrscheinlichkeit auf Beimischung von Futterrübensamen schliessen. Dabei sei noch bemerkt, dass die Futterrübenkeimlinge ganz allgemein ein *stärkeres Längenwachstum aufweisen* als die Keimlinge der Zuckerrübe.

Die Keimlinge der weissen Futterrübensorten, die in Form und Zuckergehalt den Zuckerrüben nahe stehen (Lanker Substantia) haben rosa und weisstengelige Keimlinge, und man kann sie von der Zuckerrübe nicht unterscheiden.

Nach den Versuchen des Instituts für Zuckerindustrie in Berlin sind die Färbungen der Keimlinge *fluktuierender Variabilität* unterworfen, so dass Übergänge in der Färbung vorkommen. Ausserdem kommen bei Futterrüben in einer gewissen Menge auch farblose Keimlinge vor.

Vítek ("Věstník I. sjezdu československých botaniků v Praze." Praha, 1923, p. 34) hat durch seine Versuche festgestellt, dass die Unterscheidung der Farben bei der Methode nach Pieper bedeutend erleichtert wird, wenn man die *farbigen*, von Reisek kombinierten *Filter* benützt. Zur Unterscheidung der Zuckerrübenkeimlinge von denen der weissen Futterrüben kann man nach Vítek die verschiedene Intensität der *katalytischen Fähigkeit der Keimlinge* benützen. Nähere Angaben wurden noch nicht veröffentlicht.

In unserer Anstalt in Brünn wird diese von Pieper angegebene Methode sehr oft benützt und dieselbe stellt ein gutes Hilfsmittel dar. Wenn aber die Anstalt die Echtheit oder Reinheit einer bestimmten Sorte beurteilen soll, muss zuerst die Färbung der Keimlinge dieser Sorte genau bekannt sein. Dies ist nur dann möglich, wenn man sich diese Sorte direkt beim Züchter besorgt und untersucht. Es wird aber noch nötig sein durch Feldversuche festzustellen, inwieweit die Färbung konstant bleibt, und ob und wie oft die Übergangsformen auftreten. Da es sich um einen Fremdbefruchter handelt, kommen auch bei Züchtern zuweilen die Folgen einer Fremdbestäubung vor.

Bei der Bestimmung der Sortenreinheit durch einen Feldversuch ist es nötig, genau die Zahl der einzelnen Typen festzustellen. Dies geschieht auf einer besonderen Parzelle, wo man jeden Knäuel separat einsetzt, damit das ursprüngliche Verhältnis der Typen erhalten bleibe und nicht durch Vereinzeln der Rüben verschoben werde.

Ausserdem muss man die Pflanzen gleich wie in einer normalen Feldkultur einsetzen, damit man normal entwickelte Wurzel für die chemische Feststellung des Zucker- und Trockensubstanzgehalte erhalte. In der Čechoslovakei benützt man für Zuckerrüben und Futterzuckerrüben 45×30 cm., für Futterrüben 50×35 cm. Wenn der Zuckergehalt durch heisse wässrige Digestion mit einer Genauigkeit von 0.1 % festgestellt werden soll, so ist es nötig nach den Versuchen der Versuchsanstalt für Zuckerindustrie in Prag 3×40 mit der Perner-Staněkschen Rübenreihe zerkleinerten Rüben zu analysieren, wobei man eine vier-normale Breimenge benützt (Cukrovarnické Listy 1909/10, S. 461; deutsch in Blätter für Zuckerindustrie, 1909/10, S. 625).

Die für die Probe bestimmten Pflanzen sollen aus vollem Feldbestande genommen werden.

Zur Bestimmung der Zucker- und Futterrübensorten muss man noch genau den Charakter des Blattwerkes kennen. Eine Systematik der Futterrübensorten und ihrer Eigenschaften gibt zum B. Rümker an (K. v. Rümker: "Über Sortenauswahl bei Hackfrüchten und Hülsenfrüchten und die Methodik der Sortenprüfung." 5. Ausg. Berlin, 1923).

(2) *Kreuzblütler*.—Für die Bestimmung, ob die Probe einer weiss- oder gelbfleischigen Sorte angehört, wird in Dänemark die Methode von Dr. *Hallquist* benützt. Man lässt die Pflanzen sich *im Dunkeln* entwickeln bis zur Entwicklung der Keimblätter und je nach dem, ob diese zitrongelb oder orangegelb gefärbt sind, kann man bestimmen, ob sie zu einer weissfleischigen, gelbfleischigen Sorte oder einem Bastarde gehören. Nähere Angaben über diese Methode konnte ich nicht feststellen (das angegebene zitiere ich nach einem Bericht von K. Dorph Petersen).

(3) *Die Kartoffeln*.—Die Bestimmung der Sorte bei den Kartoffeln ist schwierig, da die Anzahl der Sorten sehr gross ist und beständig wächst und weiter, weil eine ganze Reihe von Sorten nahe verwandt ist.

Ein sehr gutes Hilfsmittel ist die in der letzten Zeit durchstudierte Färbung der im *zerstreuten Tageslicht erwachsenen Keime oder Lichtkeime* (*Snell'sche Methode*; siehe K. Snell, "Kartoffelsorten." 2 Aufl. Berlin, 1922).

Snell benützte zur Unterscheidung der Kartoffelsorten die Farbe der im zerstreuten Licht erwachsenen Keime. Diese Keime sind kurz, etwa 1 cm. lang, der untere Teil ist stark angeschwollen. Dieser Teil trägt die Wurzelanlagen und ist fast immer violett gefärbt. Bei den rein grünen Keimen ist dieser Teil von unbestimmt dunkler Färbung, bei allen anderen ist er rot oder blau violett. Nur die Wurzelspitzen sind im allgemeinen ungefärbt. Der auf den breiten Unterteil aufgesetzte dünne Oberteil ist unten stets grün. *Nur die Spitze dieses Oberteiles ist verschiedenartig gefärbt und zwar entweder hellgrün, dunkelgrün, rotviolett oder blauviolett.* Man unterscheidet also am Keim, der in diffusum Licht erwachsen ist, drei Farbzonen: Die Spitze, den Mittelteil und den Unterteil. Je schwächer das Licht ist, desto länger der Keim. Der grüne Farbstoff wird in der Dunkelheit überhaupt nicht gebildet. Das Anthocyan entsteht aber auch im Dunkeln. Der Farbstoff verteilt sich aber im Dunkeln auf den sehr gestreckten Unterteil der Keime und erscheint dann heller. Der Mittelteil ist im Dunkeln ebenfalls stark gestreckt, bleibt aber farblos. Die Spitze, die aus den Blättchen des Vegetationspunktes gebildet wird, entwickelt sich im Dunkeln nur sehr wenig und ist nur sehr schwach gefärbt. Die Intensität der Färbung im Licht ist einer teilweisen Schwankung unterworfen. Die rotviolette Färbung wird bei starkem Licht dunkler, meist rotblauviolett, dagegen bei schwächerem Licht deutlich rotviolett ausgebildet. *Man muss deshalb die Farbe der Keime auf der dem Lichte abgewendeten Seite der Knolle beobachten.* Dunkelgrüne Färbung an der Spitze kann bei schwachem Licht durch Ausbleiben der Chlorophyllbildung rotviolett erscheinen. Grüne Färbung wird bei starkem Licht dunkelgrün, bei schwachem Licht hellgrün bis gelbgrün. Für die Praxis unterscheidet *Snell* nur drei Gruppen von Lichtkeimen, die deutlich erkennbar sind:—

(1) *hellgrüne*, die höchstens am Grunde eine undeutliche dunkle Färbung aufweisen.

(2) *rotviolette*, die ausser mehr oder weniger grünem vor allem rotvioletten Farbstoff aufweisen; hierzu würden auch die purpurroten Keime von *Mirabilis* zu rechnen sein.

(3) *blauviolette*, bei denen nur das Mittelstück grün, Spitze und Basis aber dunkelblauviolett gefärbt sind.

Snell hat bei einer grossen Anzahl von Sorten die Farbe der Lichtkeime festgestellt und diese Sorten dann in einer Liste in drei Gruppen eingeteilt:—

(I) *Lichtkeime hellgrün, am Grunde undeutlich dunkel.* Zu dieser Gruppe gehören vorwiegend frühe und mittelfrühe Sorten. *Snell* gibt für diese Gruppe 26 Sorten an.

(II) *Lichtkeime mehr oder weniger rotviolett.* Für diese Gruppe gibt *Snell* 106 Sorten an.

(III) *Lichtkeime blauviolett.* Zu dieser Gruppe gehören 50 Sorten.

Die im Dunkeln erwachsenen Keime sind je nach der Sorte verschieden dick. Dünne Keime haben z. B. Nieren, dicke Keime dagegen z. B. Parnassia und Deodara.

Die Snellsche Methode benützt unsere Anstalt mit gutem Erfolg. Sie erfordert natürlich eine gewisse Uebung besonders bei grüner Färbung.

Die in der Cechoslovakei oftgebauten Frühkartoffeln "Gipfler" haben an der Spitze eine typische dunkelrotviolette Färbung (etwas ins Blaue übergehend), aber die *Basis hellgrün*. Wo die Färbung der Lichtkeime nicht genug entscheidend ist, wird als ein Hilfsmittel die Farbe der im Dunkeln erwachsenen Keime benützt (nach *Vilmorin*).

Auch bei der Snellschen Methode wird es für ihre praktische Benützung nötig sein aufs genaueste die Färbung der Keime bei allen gezüchteten Sorten festzustellen, wie es Snell bei den deutschen und einigen fremden Sorten durchgeführt hat. Ausserdem wird es nötig sein festzustellen, ob die Färbung konstant bleibt, und ob bei derselben Sorte Übergänge auftreten. Diese Versuche sind an unserer Anstalt im Gange.

Snell hat eine Systematik der Kartoffelsorten (allgemeine und spezielle Sortenkunde) in der angeführten Schrift ausgearbeitet. Dabei hat er auch die früheren Arbeiten berücksichtigt.

Er hat die Kartoffelsorten in Typen nach ihren oberirdischen Teilen (Staudentypus) und auch nach ihren Knollen (Knollentypus) geteilt. Für eine annähernde Sortenbestimmung hat er eine Bestimmungstabelle zusammengestellt. Als wichtigste Unterscheidungsmerkmale führt er in dieser Tabelle die Farbe der Schale, die Farbe des Fleisches, die Form der Knollen, die Farbe der Lichtkeime und die Blütenfarbe an. Teilweise gibt er auch die Kochfähigkeit an. Alle Eigenschaften der Knollen und der Stauden werden kritisch behandelt. Bei der Knollenform betrachtet er das Verhältnis der Länge zur Breite des Umrisses (Umrissform) als entscheidend und gibt 6 Typen von Knollenformen an. Für die Farbe der Schale führt er die farbigen Typen an und betont, dass die Intensität der Färbung (lichter oder dunkler) von der Bodenart abhängig ist. Für die Fleischfarbe führt er farbige Tafeln an, wobei er aber aufmerksam macht, dass unreife Knollen von gelbfleischigen Sorten eine bedeutend hellere Farbe haben, dass die Intensität der Farbe mit dem Reifungsprozesse und mit der Lagerung zunimmt, und dass die im Lichte schwach grün gewordenen Knollen den Eindruck einer schwachen Gelbfärbung des Fleisches erwecken.

Den Stengel beurteilt er nach der Farbe (oft verschieden nach dem Entwicklungsstadium und nach der Sonnenseite), nach dessen Höhe und Dicke.

Bei den Blättern hält er ausser einer vollständigen Beschreibung für ein wichtiges Merkmal bei einigen Sorten die Blattverwachsungen oder Efeublätter, die Stellung des Endblättchens, die Form der Spitze und die Farbe des Blattstieles.

Bei dem Blütenstande hält er bei sonst *gleichen Bedingungen* die Menge der Blütenstände für ein Sortenmerkmal. Ein gutes Hilfsmittel bei dem Blütenstande ist das Auftreten von Hochblättern.

Die Blüte ist ein sehr wichtiges Hilfsmittel zur Unterscheidung der Sorten und, Snell führt deshalb die Typen der Blüte in einer farbigen Tafel an. Es kommt hauptsächlich die verschiedene Form und Länge der Kelchzipfel in Betracht. Die durchschnittliche Grösse der Blüten verschiedener Sorten (gemessen von der Spitze eines Blütenzipfels durch die Mitte der Blüte nach der gegenüberliegenden Einbuchtung) ist charakteristisch. Die Farbe der Blüten soll man im Schatten beobachten. Auch die Form der Strahlen des Saftmales auf den Blütenblättern ist charakteristisch. Die äusseren oder die inneren Doppelkronen sind auch ein gutes Hilfsmittel. Bei den Staubbeuteln ist die Neigung zum Spreizen oft charakteristisch. Die verschiedene Form des Griffels ist jedenfalls als Sortenmerkmal zu verwenden.

Aus den biologischen Merkmalen führt er hauptsächlich die Reifezeit an.

Vilmorin ("Catalogue méthodique et synonymique des principales Variétés de Pomme de terre." Paris, 1902) benützt zur Bestimmung der Kartoffelsorten diese Eigenschaften:—

- (1) die Farbe der Knollen,
- (2) die Form der Knollen,
- (3) die Farbe der Keime,
- (4) die Farbe des Fleisches,
- (5) die Farbe der Blüten.

Die Farbe der Keime teilt er in violett, weiss, und rosa ein, und zwar versteht er darunter die Farbe der *im Dunkeln erwachsenen Keime*.

Fitsch ("Identification of Potato Varieties." Iowa State College of Agriculture. Ext. Bull. Nr. 20, 1914) benützt zur Beschreibung von amerikanischen Sorten die Form und die Farbe der Knollen und Augen, die Farbe der Keime und der Würzelchen, des Stengels, der Blätter und der Blüten.

Stuart ("Group Classification and Varietal Description of some American Potatoes." U.S.A. Dep. of Agr. Bull., Nr. 176, 1915) behandelt als Hauptunterscheidungsmerkmal die Knolle mit den im Dunkeln erwachsenen Keimen.

Klein (*Ill. landw. Zeitung*, Bd. 43, 1923, S. 79) hat noch weitere Details, welche man zur Unterscheidung der Sorten benützen kann, an den Blättern festgestellt. Es sind dies die *Mittelblätter*, welche sich zwischen je zwei Fiederblättchen befinden, *Spitzenmittelblätter*, welche zwischen dem endständigen Spitzenfiederblatt und dem ersten Fiederblättchenpaar vorkommen, weiter *Achsenblätter*, die in dem Scheitelpunkt des Winkels, der von der Blattachse und den Fiederblättchen erster Ordnung gebildet wird, stehen und schliesslich die Fiederblättchen zweiter Ordnung (Abspaltungen).

Staudte (*Ill. Landw. Zeitung*, Jhrg. 43, 1923, S. 411) hat im Innern der Fruchtknoten bei den Längsdurchschnitten einzelner Blüten bei Sorten mit farbigen Schalen (rot, violett) Konturen oder Punkte der gleichen Farbe festgestellt.

Parow (*Zeitschrift für Spiritusindustrie*, Jhrg. 45, S. 103, 1922) hat durch neue Untersuchungen die Angaben von *Saare* (1897), dass die Menge von grossen Stärkekörnern eine Sorteneigenschaft ist, bestätigt und das Verhältnis von grossen, mittleren und kleinen Stärkekörnern bei einer Reihe der heutigen Sorten festgestellt. Seinem Mitarbeiter Prof. *Lindner* in Berlin ist es gelungen durch eine besondere Präparationsmethode den Stand der Stärkekörner mikrophotographisch darzustellen.

Volkart (*Landw. Jahrbuch der Schweiz*, 1922) führt eine objektive Beschreibung der Knollenform auf Grund der relativen Breite und relativen Dicke ausgedrückt in Prozenten der Länge, welche durch Messungen an der breitesten Stelle der Knolle festgestellt wird, an.

Für die Bestimmung der Echtheit von Kartoffelsorten braucht man vor allem eine Sammlung von Knollen der neueren Sorten, weiter Herbarien mit Blättern und Blüten, eventuell eine Sammlung von getrockneten Blüten mit gut erhaltener ursprünglicher Farbe. Für die Bestimmung durch einen Vegetationsversuch ist es nötig im agrobotanischen Garten wenigstens die wichtigsten und typischen Sorten anzubauen. Dabei muss man darauf achten, dass man nur gesunde Knollen zur Saat verwendet und den Boden entsprechend vorbereitet, damit man einen normalen Wuchs und normales Aussehen erhält.

(4) *Die Getreidearten*.—Bei den Rüben und Kartoffeln unterscheiden sich die Sorten häufig durch morphologische Eigenschaften. Bei den Getreidearten ist dagegen die Züchtung schon soweit vorgeschritten, dass eine ganze Reihe von Sorten vorkommt, welche sich nur durch biologische oder physiologische Eigenschaften, wie durch die Schnelligkeit der Entwicklung, Vegetationsdauer, Empfindlichkeit gegen Krankheiten, Auswinterung und Lagerung, chemische Zusammensetzung u.

ähnlich, unterscheiden. Es ist schwierig diese Eigenschaften festzustellen, und es ist dazu eine grosse Erfahrung und eine Reihe von sorgfältigen Versuchen nötig.

Die Präcipitinreaktion hat sich für die Unterscheidung von *verwandten* Linien bei Getreide als unbrauchbar erwiesen, da sie bei genetisch verwandten Formen ergebnislos geblieben ist. Ein weiterer Umstand erschwert die Sortenbestimmung, nämlich der, dass bei Bastarden Formen auftreten, von welchen wir oft nicht mit Sicherheit sagen können, ob es sich um Aufspaltung oder um eine Beimischung handelt.

Bei den an Fremdbefruchtung angewiesenen Pflanzen (Roggen) sind wieder die Formen unbeständig und wechselnd. In der letzten Zeit macht man Versuche zu einer Linienmischung zurückzukehren (Linienmischungen waren die ursprünglichen Landsorten), natürlich zu künstlichen Populationen, welche aus mehreren individuell gezüchteten und gegenseitig sich ergänzenden Linien von gleicher Reifezeit zusammengestellt wären. Diese Umstände und die grosse Anzahl immer neu auftretenden Sorten erschweren sehr die Bestimmung der Echtheit und Reinheit der Sorte bei Getreide.

In dieser kurzen Übersicht kann ich nicht auf alle Fragen eingehen, und ich werde mich an die Betonung einiger wichtigeren Tatsachen und zwar nur bei den Hauptgetreidearten der Mitteleuropa: Weizen, Gerste, Roggen und Hafer beschränken.

Kritische Bemerkungen zur Bestimmung von Getreidesorten und über abweichende Formen und Beimischungen bei den Getreidearten haben *Fruwirth* ("Die Saatenanerkennung," II. Aufl., Berlin, 1922) und der *Referent* (Chmelař: "Zkoušení odrůd obilních." Praha, 1924) zusammengestellt. Hier mache ich deshalb nur darauf und auf die in diesen Schriften angegebene Literatur aufmerksam.

Percival ("The Wheat Plant," London, 1921) hat eine Monographie über Weizen; *Zade* ("Der Hafer," Jena, 1918) über Hafer; *Quante* ("Die Gerste," Berlin, 1913) über Gerste geschrieben. Eine Gesamtübersicht der Getreidesorten führt *Rümker* an ("Über Sortenauswahl bei Getreide," VI. Aufl. Berlin, 1923), der auch namentlich die *biologischen* und die *wirtschaftlichen* Eigenschaften der Sorten angibt, und *Baumann* (1922).

Beim Weizen hat *Pieper* (*Deutsche landw. Presse*, Jhrg. 49, S. 438, 1922) zur Unterscheidung von Sorten die *verschieden starke* und *verschieden schnelle Färbung* der Körner beim Beizen durch ein Quecksilberchlorfenolhaltiges Präparat ("Präparat Nr. 778" von der Firma Ludwig Meyer, Mainz) benützt. Die Körner werden 24 Stunden im Wasser geweicht, dann mit der Bauchseite auf Filtrierpapier, der mit 1 % Lösung des Präparates Nr. 778 angefeuchtet wurde, in eine Schale gelegt. Die Schale wird mit einer Glasplatte bedeckt und nach 6 Stunden wird die Färbung notiert. Es wird nur die Fruchtschale gefärbt. Die Verschiedenheiten in der Färbung sind Sorteneigenschaften und werden nach *Pieper* durch Provenienz und Alter der Samen nicht beeinflusst. Er unterscheidet diese Farben:

- (1) gelb (= ungefärbt),
- (2) gelb bis hellbraun,
- (3) hellbraun bis braun,
- (4) braun,
- (5) braun bis dunkelbraun,
- (6) dunkelbraun,
- (7) schwarzbraun.

Bastarde haben ungleiche Färbung. Ein Teil färbt sich nach der Vater-, ein Teil nach der Muttersorte. Bei Sorten, welche keine reinen Linien darstellen, färben sich oft nicht alle Körner gleichmässig. Im Jahre 1923 und 1924 habe ich eine Nachprüfung dieser Methode durchgeführt und zwar bei *österreichischen* Sorten und ich habe dabei konstatiert, dass es besser ist wenn zum Weichen *destilliertes Wasser* benützt wird. Die Färbung geht zwar langsamer vor sich, die *Unterschiede*

sind aber deutlicher, und bei Bastarden ist die gelbe Farbe (ungefärbt) heller :

Von den 47 geprüften (meist čechoslovakischen) Winterweizensorten haben nach 6 Stunden (im destill. Wasser 24 Stunden geweicht), diese Färbung aufgewiesen :

(1) ungefärbt (nach Pieper "gelb")	-	8 Sorten
(2) hellbraun	- -	1 "
(3) braun	- -	14 "
(4) dunkelbraun	- -	19 "
(5) Farbungemisch	- -	5 "

In der letzten (fünften) Gruppe handelt es sich wirklich um Bastarde und die Anzahl der abweichend gefärbten Körner war 25–40 %. Reine Linien haben dagegen sehr einheitliche Färbung der einzelnen Körner gehabt.

Bei denselben 47 Winterweizensorten und bei 14 Sommerweizensorten habe ich die Farbe der *Keimscheide* (*Koleoptile*) beobachtet (*Chmelář*, "Zkoušení odrůd obilních." Praha, 1924). Diese Färbung wurde schon am 4. Tage bei Körnern, die auf Filtrierpapier gelegt am Lichte keimen gelassen wurden, konstatiert und es wurde folgende Färbung der Koleoptile festgestellt :

(1) bei allen Keimen rotbraun	-	11 Sorten
(2) bei allen Keimen ungefärbt	- -	33 "
(3) bei einigen Keimen gefärbt, bei anderen ungefärbt	- -	17 "

Näheres Studium dieser Frage ist Gegenstand meiner weiteren Versuche.

Kondo (*Landw. Jahrb.*, Bd. 45, 1913, S. 763) in seiner sehr umfassenden Arbeit führt neben anderen zwei wichtige Merkmale, die man zur Unterscheidung von Weizensorten benützen kann, an. Das Weizenkorn ist am Scheitel behaart. *Die Länge dieser Haare* ist nach den Sorten verschieden. Die Länge der Haare ist deshalb ein Sortenmerkmal. Die Fruchtschale von *Triticum*arten besteht aus 4 Schichten und zwar :

- (a) der Epidermis,
- (b) der Mittelschicht,
- (c) Querzellenschicht und
- (d) Schlauchzellenschicht.

Die Mittelschicht ist ein wichtiges Merkmal für die Arten- und Sortenbestimmung, und zwar ist *die Reihenzahl* der dickwandigen, epidermisähnlichen *Zellen in der Mittelschicht* je nach Arten und Sorten verschieden. Zum Beispiel bei *Triticum vulgare* je nach den Sorten eins bis zwei, bei *Triticum Spelta* gewöhnlich Null, manchmal aber eins.

Beim *Roggen* ist die Bestimmung der Sortenechtheit und Sortenreinheit sehr schwierig, da es sich hier um einen Fremdbestäuber handelt. Es ist aber wieder die Anzahl der Sorten verhältnismässig klein. Zur Unterscheidung kommen die unsicheren Merkmale : Aehrendichte, Aehrenform, Kornform, vorherrschende Kornfarbe, Spindellänge, Art der Begrannung und die biologischen Eigenschaften in Betracht.

Gerste.—Als häufigster Fall bei Samenprüfung bei Gerste kommt die Unterscheidung der Körner der zweizeiligen nickenden Gerste (*Hordeum distichum nutans* Schübl) und der zweizeiligen aufrechten Gerste (*H. d. erectum* Schübl) vor. Diese Unterscheidung geschieht nach Ausbildung der Kornbasis, nach Form der Basalborsten und Schüppchen (*lodiculæ*). Die Unterscheidung von *Nutans*- und *Erectum*-Formen ist wegen des Vorkommens von nickenden Gersten mit *Erectum*-Merkmalen und *Erectum*-Gersten mit *Nutans*-Merkmalen wissenschaftlich nicht mehr berechtigt (*Broili*, *Deutsche landw. Presse*, 1906, S. 658, und *Journal für Landw.* Jahrg. 56, 1908). Auch die Aehrendichte bietet kein genaues Merkmal zur Unterscheidung. Trotzdem bleiben aber diese Merkmale ein wertvolles *praktisches Hilfsmittel*, besonders für einen geübten Fachmann, wenn eine grössere Anzahl von Körnern und Aehren benützt wird.

Noch häufiger ist die Bestimmung der *Typenreinheit bei lockeraarigen zweizeiligen Gersten* (H. d. nutans Schübl.) und zwar der Landgersten ("a" Typus) und Chevalier-Gersten ("c" Typus). Dabei dient als hauptsächlichstes und sicheres Unterscheidungsmerkmal der mittels Mikroskop festzustellende Umstand, dass die Basalborstenhaare bei dem a-Typus einzellig, bei dem c-Typus zwei- und mehrzellig, letztere auch verzweigt sind (Lerner und Holzner, von Ubisch, Ziegler, Fruwirth). Eine weitere Unterscheidung nach dem Atterberg-Neegardschen-System auf α , β , γ , δ . Typus ist nach den neueren Arbeiten unsicher (Broili).

Holmgaard (*Tidsskrift for Planavevl*, 27 Bd. 1921) benützt zur Unterscheidung der Sorten bei der nickenden Gerste den *Umriss eines auf die Seite gelegten Kornes*. (Bei Tystofte Prentice verengt sich das Korn regelmässig gegen beide Enden, bei Svalöfer Guldbyg verengt sich das Korn gegen die Enden sehr plötzlich.) Ausserdem beschreibt er die *Blätter* in der Zeit knapp vor dem Schossen.

Als Unterscheidungsmerkmal der sechszeiligen Gersten von den zweizeiligen führt Holmgaard den Umstand an, dass bei den mittleren Körnern der sechszeiligen Gerste ihre grösste Breite gegen die Spitze verschoben ist, dagegen bei den zweizeiligen sich in der Mitte befindet. Weiter haben die seitlichen Körner der sechszeiligen Gerste schräge Flächen, die Blätter der sechszeiligen Gerste sind nach dem Auskeimen kurz und breit, wogegen bei der zweizeiligen schmal und lang.

Es ist interessant, dass es gelungen ist, zweizeilige Wintergerstensorten zu züchten, die durch ihre Korngrösse den Braugersten sich nähern (*Tschermak*). Einen Versuch zwei reine Gerstenlinien zu unterscheiden haben Engledow und Wadham durchgeführt (*The Journ. of Agric. Science*, 1923, Vol. XIII, p. 412) und haben dabei u. a. als konstantes Unterscheidungsmerkmal die bei einer Wasserkultur festgestellte Länge der Koleoptile festgestellt.

Die *Hafersorten* kann man leichter nach dem Korn als nach den Rispen unterscheiden. Die Unterscheidung geschieht am besten an dem Aussenkorn, d. i. an dem untersten Korn im Aehrchen. An diesem ist kennzeichnend die Ausbildung der Basis und der Spitze, die Form des Stielchens, die Begrannung, die Behaarung der Kornbasis, endlich Breite, Länge und Dicke der Frucht und die Gesamtterscheinung derselben, die durch die Grössen-Verhältnisse und die Ausbildung der Spitze bedingt ist (Böhmer, Broili).

Bei Spelzenfarben kommen nach Witterungs- und Bodenverhältnissen kleine Veränderungen vor. Es kommen auch Farbenmutationen vor. (Nilsson-Ehle).

Schwierig ist die Bestimmung der Zwischenformen zwischen Kultur- und Flughafers, welche durch spontane Variation oder durch Kreuzung entstehen können.

Holmgaard hat die Farbe des ersten Blattes 8–12 Tage alter Keimpflanzen (bei einer Sorte hat er eine braunviolette Färbung festgestellt) und die Behaarung an den Rändern der niedrigsten Blätter zur Unterscheidung der Sorten benützt.

Jakushkine und Vavilov haben bei reinen Linien des Hafers (*Avena sativa*) von Sorten aus West-Russland und Deutschland anatomische Unterschiede und zwar in der mittleren linearen Grösse der Spaltöffnungen (Ref. *Bot. Centralblatt*, Bd. 123, 1913, No. 19, S. 481) gefunden.

III.—Die Hilfsmittel zur Bestimmung der Sortenechtheit und Sortenreinheit.

Für die Bestimmung der Sortenechtheit ist eine Sammlung von Samen, Knollen, Aehren, ein Herbarium der Sorten und ein agrobotanischer Garten der Sorten unentbehrlich (*Sortengarten*).

Est ist am besten das Material für die Sammlungen direkt von dem Züchter, der die betreffenden Sorten züchtet, zu gewinnen, denn in diesem Falle bekommen wir nicht nur garantiert echtes sondern auch typisches Material aus dem ursprünglichen Standorte. Snell hat bei seinen Unter-

suchungen der Kartoffelsorten die einzelnen Sorten direkt bei den betreffenden Züchtern studiert und beschrieben, um ihren richtigen Charakter zu finden.

Bei der Aehrensammlung ist es praktisch, dieselbe so einzurichten, dass aus derselben zugleich die typische Aehrenform von vorne und von der Seite, weiter der Querschnitt der Ähre, der Aehrentypus, die Spelzenform, das Aussehen des Kornes von der Bauchseite, von der Rückenseite und von der Seite ersichtlich ist.

Die Knollensammlung soll eine grössere Anzahl von typischen ausgereiften Knollen (z. B. in einer Formalinlösung in einem Glaszylinder) und einen typischen Längs- und Querschnitt enthalten.

Das Herbarium hat sich, ausser bei den Futterpflanzen, besonders bei den Kartoffeln für die Bestimmung nach den Blättern, Blüten u. ähnl. bewährt.

Ein Sortengarten ist unentbehrlich und bietet derselbe stets eine Menge von Material zum Studium. Es ist aber nötig, darauf zu achten, dass die Kultur der Feldkultur entsprechend wäre, damit das Aussehen der Pflanzen den Verhältnissen der Praxis entspreche. In dem Jahre 1923 habe ich in dem Sortengarten der Sektion für die Samenprüfung der Mährischen landwirtschaftlichen Landes-Versuchsanstalt in Brünn 801 Sorten von verschiedenen landwirtschaftlichen Kulturpflanzen gehabt. Darin waren alle tschechoslovakischen gezüchteten und viele fremde Sorten. Bei allen diesen Sorten werden auch die Hauptentwicklungsstadien vorgemerkt, so dass wir dann zur eventuellen Sortenbestimmung auch die nötigen Angaben über die *biologischen* Eigenschaften besitzten.

Nach dem Gesetze vom 21. März 1921, Nr. 128, ist unsere Anstalt berechtigt und verpflichtet die gezüchteten Sorten zu prüfen, um einen Vorschlag zur Einschreibung in das bei dem Ministerium für Landwirtschaft geführten "Register der bewährten Sorten" geben zu können. Die eingetragene Sorte darf dann als "bewährte Sorte" bezeichnet werden. Es werden deshalb von der Anstalt genaue vergleichende Sortenanbauversuche an verschiedenen typischen Orten ihres Gebietes durchgeführt. Diese Tätigkeit ist eine gute Ergänzung der Prüfungen im Laboratorium und ermöglicht dieselbe eine Beurteilung der Qualität der einheimischen und auch der eingeführten Sorten.

Für die Sortenbestimmung fehlt uns noch ein geeignetes *Handbuch*, wo eine genaue *Beschreibung möglichst aller Sorten* enthalten wäre. Die Sortensystematik ist auch noch nicht vollkommen. Es könnte in dieser Hinsicht einen grossen Fortschritt bedeuten, wenn die Samenkontrollanstalten eine Beschreibung der in ihren Staaten gezüchteten und gebauten Sorten zusammenstellten. In der Tschechoslowakei wird dazu schon das Material bei den Sortenanbauversuchen gesammelt, und es werden für die Erleichterung der Beschreibung Tabellen zusammengestellt, wo die Merkmale ziffermässig ausgedrückt sind (nach den Tabellen von *Jelínek*). An den Fragen der Sortenbestimmung und Sortenbeschreibung wird sehr intensiv seitens der staatlichen Samenkontrollanstalt in Kopenhagen gearbeitet. Auch eine Reihe von anderen Versuchsanstalten (z. B. Berlin-Dahlem, Dresden, Wageningen, etc.) beschäftigt sich mit diesen Fragen. Die Arbeit der einzelnen Anstalten könnte *durch gegenseitigen Austausch des Materials* für die Sortensammlungen bedeutend erleichtert werden. Es kann eine einheimische Anstalt dieses Material bei den einheimischen Züchtern viel leichter gewinnen als eine auswärtige Anstalt.

IV.—Schluss.

Ich glaube, dass die Forderung einer Garantie der Sortenreinheit und Sortenechtheit immer häufiger auftreten wird, da der moderne Landwirt immer mehr und mehr nur die gezüchteten und bewährten Sorten verlangen wird.

Es wird also eine der Aufgaben der Europäischen Vereinigung der Samenkontrollanstalten sein, sich ausser mit den Methoden und Normen für die Samenprüfung auch mit Methoden und Normen für die Bestimmung

der Echtheit, Reinheit und eventuell auch der Qualität der Sorten zu beschäftigen.

Ich möchte die übrigen Kollegen bitten ihre Ansichten und Erfahrungen über diesen Gegenstand auszusprechen, um durch gegenseitigen Austausch der Erfahrungen diese interessanten Fragen zu klären.

Es folgte eine Diskussion über die vielen Bestimmungsmethoden der Pflanzenarten und Sorten, nämlich: die biologische, biometrische, morphologische, pathologische, physikalisch-chemische, und über das, was von dem polnischen Delegierten als Bertillon-Methode bezeichnet wurde.

Professor Showky Bakir erwähnte den Nutzen der pathologischen Methode und *Professor Kuleschoff* teilte mit, dass die Unterscheidung zwischen Winter- und Sommerweizen an seiner Station mit Hilfe der Behaarung des ersten Keimblattes der letztgenannten Sorte vorgenommen würde.

Herr Dorph-Petersen gab eine ausführliche Mitteilung über die Arbeit der Dänischen Staatssamenkontrolle in dieser Hinsicht und bezog sich auf zwei auf Englisch verfasste Broschüren, nämlich: "Danish Experiments in Plant Culture and Details about the Trade in Controlled Danish Seed" und "Some Prominent Danish Varieties and Strains of Agricultural Plants," welche unter die Anwesenden verteilt wurden. Er schlug vor, einen Ausschuss zu bilden, der sich mit den von Dr. Chmelar angeregten Fragen beschäftigen solle.

Professor Kuleschoff legte einen Bericht mit verschiedenen Keimungstabellen samt einer graphischen Darstellung der Standorte der Samen vor und bat um eine internationale Regulierung dieser Fragen. (Zwei Berichte von Herrn Kuleschoff: "Programme and Organisation of, and Results obtained by the Kharkow Seed Testing and Control Station" und "A brief Sketch of the Development and Present Conditions of Seed Control in the Ukraine"; und ein Bericht von Professor Issatschenko: "Essais de Semences dans la Russie" werden in dem "International Review of the Science and Practice of Agriculture" —Rom, publiziert werden.)

Herr Brown sprach einen ähnlichen Wunsch aus. Im Zusammenhang mit dieser Frage müsse eine Kontraktformel ausgearbeitet werden, zufolge welcher der Vorsteher der offiziellen Samenprüfungsanstalt des betreffenden Einfuhrlandes in Fällen von Nichtübereinstimmungen zum Schiedsrichter ernannt werden solle.

Professor Munn las seinen Bericht über: "Die Arbeit der Vereinigung der offiziellen Samenanalytiker in Nordamerika" (siehe den englischen Vortrag Seite 110–112) vor.

Dr. Gentner hielt danach einen mit Lichtbildern illustrierten Vortrag über: "Die Feststellung von Pflanzenkrankheiten, die vom Saatgut ausgehen."

Die Feststellung von Pflanzenkrankheiten, die vom Saatgut ausgehen.

G. GENTNER, München.

Es ist eine wichtige Aufgabe der Samenkontrollanstalten, neben der Prüfung der Reinheit und Keimfähigkeit auch den Gesundheitszustand des Saatgutes zu untersuchen. Die Schädlinge und Krankheitserreger können an den Sämereien nachgewiesen werden bei der Prüfung der Reinheit, bei der Prüfung der Keimfähigkeit und durch besondere Methoden.

Bei der Prüfung der Reinheit kann man im Saatgut finden: *Aplanobacter Rathayi* auf *Dactylis*, *Ustilago laevis* in *Avena*, *Ustilago Jensenii* in *Hordeum*, *Tilletia tritici* in *Triticum*, *Ustilago perennans* in *Arrhenatherum*, *Ustilago bromivora* in *Bromus*, *Tilletia Holci* in *Holcus*, *Sklerotien* von *Claviceps* in *Secale*, *Phleum*, *Holcus*, *Poa*, *Agrostis*, von *Typhula trifolii* in *Trifolium* und *Lotus*arten, *Sklerotien* von *Sclerotinia trifoliorum*, von *Botrytis cinerea* und noch unbestimmbaren Arten in *Trifolium*, *Anthyllis*, *Medicago*.

Die Prüfung der Samen auf ihren Gesundheitszustand im Keimbett geschieht in der Weise, dass man sie möglichst voneinander getrennt auslegt und nach dem Auskeimen im Keimbett belässt. Es kann sich dann das etwa vorhandene Pilzmycel weiter entwickeln, Konidien, Pykniden oder Perithezien ausbilden, an denen der Pilz identifiziert werden kann. Am einfachsten ist es, die Samen in Petrischalen auf feuchtes Filtrierpapier oder in Kartonschälchen zu legen. Die Pilzentwicklung wird gefördert, wenn die Samen möglichst feucht, warm und dunkel gehalten werden. Ausserdem ist auf die im Keimbett gefaulten Körner zu achten, da diese die krankheitserregenden Organismen oft in besonders guter Entwicklung zeigen. 5–10 tägige Beobachtung genügt in den meisten Fällen.

Zur zahlenmässigen Bestimmung des Pilzbefalls, namentlich beim Fusariumbefall des Getreides dient die Hiltner'sche Ziegelgrusmethode. Hiernach bringt man die Samen in grob gemahlenen, sterilisierten Ziegelsteingrus (Korngrösse 2 mm.) zum Auskeimen. Hierbei entwickelt sich das Pilzmycel teils an der Oberfläche um die heraustretenden Keime, teils färbt es die Blattscheiden braun. Da jedoch *Helminthosporium* und *Cephalosporium Acremonium* eine ähnliche Braunfärbung hervorrufen, so empfiehlt es sich, in Zweifelsfällen die aus dem Ziegelgrus herausgenommenen Keime 1–2 Tage auf feuchtes Filtrierpapier in Glasschalen auszu legen. Auch die Botrytiserkrankungen des Saatgutes lassen sich durch diese Methode leicht prozentual bestimmen.

Phoma oleracea an Brassicaarten und *Phoma lini* an *Linum* kann man an den befallenen Kotyledonen erkennen, wenn man die Samen in Erde keimen lässt.

Durch diese Methoden konnte ich folgende krankheitserregende Organismen am Saatgut feststellen:—

Bakterien: *Bacillus cerealium* an *Hordeum*, *Triticum*, *Secale*, *Zea*, *Pisum*; andere Bakterienarten an *Avena*, *Cucumis*, *Vicia Faba*, *Brassica*, *Solanum Lycopersicum*.

Helminthosporium an *Hordeum*, *Avena*, *Lolium*, *Agrostis*.

Macrosporium und *Pleospora* an *Avena*, *Hordeum*, *Medicago sativa*, *Trifolium pratense*, *Lotus*, *Onobrychis*, *Ornithopus*, *Glycyrrhiza*, *Galega*, *Pisum*, *Brassica*, *Spinacia*, *Cannabis*, *Daucus*, *Apium*, *Petroselinum*, *Lactuca*, *Cichorium*.

Alternaria an *Triticum vulgare*, *Phleum*, *Spinacia*, *Brassica*, *Sinapis alba*, *Onobrychis*, *Vicia Faba*, *Daucus*, *Petroselinum*, *Cucumis*, *Lactuca*, *Scorzonera*, *Cichorium*.

Fusarium an *Secale*, *Hordeum*, *Triticum*, *Avena*, *Zea Mais*, *Medicago*, *Trifolium*, *Lotus*, *Ornithopus*, *Lupinus*, *Pisum*, *Phaseolus*, *Atriplex*

hortense, Brassica, Linum, Daucus, Nicotiana, Borrago, Cucumis, Lactuca, Scorzonera, Cichorium.

Botrytis cinerea an Secale, Avena, Trifolium pratense, Lotus corniculatus, Ornithopus, Lupinus, Vicia sativa, Pisum, Spinacia, Cannabis, Brassica, Daucus, Nicotiana, Cucumis, Lactuca, Scorzonera, Cichorium.

Diplodia Maydis an Zea Mais.

Mycosphaerella hordei an Hordeum.

Phoma an Brassica, Linum, Trifolium pratense, Medicago sativa, Lupinus, Apium.

Gloeosporium Lindemuthianum an Phaseolus.

Gloeosporium lini an Linum.

Ascochyta Pisi an Pisum sativum.

Ascochyta graminicola an Secale.

Septoria graminum an Hordeum.

Cephalosporium Acremonium mit *Melanospora damnosae* an Triticum, Hordeum, Avena.

An Hand von Lichtbildern wurden diese Krankheitserreger und verschiedene durch sie erzeugte Krankheiten vorgeführt und erläutert.

Professor Showky Bakir teilte mit, dass die Gleichia gossypella an der Baumwolle in Ägypten grossen Schaden verursache. Er beschrieb die verschiedenen Bekämpfungsmethoden, die jetzt zu Gunsten der Autoregulator-Methode aufgegeben seien.

Der Redner legte eine Reihe von Photographien, Abbildungen u.a. vor und bat in dem erwähnten Kampfe um die Hilfe der anderen Länder, die an dieser Frage interessiert sind.

Nachmittags-Sitzung.

Der geänderte Entwurf für die Statuten der Internationalen Vereinigung für Samenkontrolle wurde dem Kongress von Sir Laurence Weaver unterbreitet. Jeder einzelne Paragraph wurde mit einigen Änderungen angenommen.

Statuten der Internationalen Vereinigung für Samenkontrolle.

1. *Name und Zweck.*—Unter dem Namen: "Internationale Vereinigung für Samenkontrolle (International Seed Testing Association = I.S.T.A.)" besteht, mit Rechtsitz am Wohnorte des Präsidenten, eine Vereinigung amtlicher Samenkontrollstationen zur Förderung aller mit der Untersuchung und Beurteilung von Saatgut zusammenhängender Fragen. Die Vereinigung sucht diesen Zweck zu erreichen durch

(a) vergleichende Untersuchungen und Erhebungen zur Erreichung genauer und gleichförmiger Untersuchungsergebnisse.

(b) die Vereinbarung einheitlicher Methoden und Bezeichnungen in der Begutachtung von Saatgut im internationalen Handel.

(c) Veranstaltung von internationalen Kongressen von Vertretern der amtlichen Samenkontrollstationen zum Zwecke der gemeinsamen Beratung und gegenseitigen Belehrung, die Herausgabe von Abhandlungen und Berichten über Samenkontrolle und gegenseitige Unterstützung in der Ausbildung von technischen Beamten.

2. *Mitglieder.*—Mitglieder der Vereinigung können werden

(a) staatliche Kontrollstationen, die sich ausschliesslich oder in einem erheblichen Umfange mit Samenuntersuchungen beschäftigen und unmittelbar der Regierung ihres Landes unterstehen.

(b) ähnliche amtliche Anstalten, die durch Institute oder Körperschaften unterhalten werden und dadurch tatsächlich den Regierungen ihres Landes unterstellt sind.

(c) Vereinigungen von Beamten amtlicher Samenkontrollstationen.

Jedes Mitglied verpflichtet sich an der Arbeit der Vereinigung tätigen Anteil zu nehmen. Jedes zahlende Mitglied erhält unentgeltlich die Veröffentlichungen der Vereinigung.

3. *Mittel.*—Das Einkommen der Vereinigung setzt sich zusammen aus

(a) den ordentlichen Jahresbeiträgen ihrer Mitglieder.

(b) ausserordentlichen Einnahmen.

Die Höhe des Jahresbeitrages ist von der Generalversammlung für wenigstens 3 folgende Jahre zu genehmigen. Dieser Beitrag kann geleistet werden entweder durch

(c) eine Regierung für alle amtlichen Anstalten ihres Landes und zwar eine Summe von nicht mehr als 50 Pfund Sterling im Jahr, oder

(d) eine amtliche Anstalt oder ein Institut, oder

(e) eine Vereinigung von Beamten von Samenkontrollstationen.

Wenn der Beitrag nach litt. c bezahlt wird, so werden damit alle amtlichen Anstalten des betreffenden Landes Mitglieder und erhalten mit den in Ziffer 8 vorgesehenen Einschränkungen Stimmrecht. Der Beitrag ist so zu bemessen, dass er genügend ist, um die Kosten (a) der Publikationen der Vereinigung, (b) der vergleichenden Untersuchungen und anderer Erhebungen, (c) der Bureaukosten zu decken.

4. *Versammlungen, Ausschüsse und Verwaltung.*—Die Vereinigung beruft in der Regel jedes dritte Jahr einen Kongress ein. Gleichzeitig findet die Generalversammlung der Vereinigung statt. An dieser Versammlung sollen folgende Mitglieder des engern Vorstandes gewählt werden :—

(a) der Präsident.

(b) der Vicepräsident.

(c) nicht weniger als 3 und nicht mehr als 5 ordentliche Mitglieder des engern Vorstandes.

(d) zwei Stellvertreter dieses Vorstandes.

(e) zwei Rechnungsrevisoren und ein Stellvertreter, die alle nicht Mitglieder des engern Ausschusses sind.

Alle diese Vorstandsmitglieder müssen technische Beamte von Samenkontrollstationen sein.

Die Generalversammlung hat ferner weitere Ausschüsse zu wählen, wenn solche für das Rechnungswesen, die gemeinsamen Untersuchungen und Erhebungen, die Veröffentlichungen, etc., nötig sein sollten. Alle diese Ausschüsse und Mitglieder des Vorstandes sind mit Amtsdauer bis zur nächsten Generalversammlung zu wählen.

Die Generalversammlung bestimmt Ort und Zeit des nächsten Kongresses, genehmigt die Höhe der Jahresbeiträge und ernennt als Ehrenmitglieder Männer, die in Anbetracht ihrer Leistungen auf dem Gebiete der Samenkontrolle oder ihrer Verdienste um die Vereinigung diese Auszeichnung besonders verdient haben.

Durch Beschluss des engern Vorstandes kann eine Generalversammlung zu jeder andern Zeit als zu der des alle 3 Jahre wiederkehrenden Kongresses einberufen werden.

Die Generalversammlung ist beschlussfähig, wenn 20 stimmberechtigte Mitglieder anwesend sind.

5. *Geschäftsführung.*—Der engere Vorstand besteht aus dem Präsidenten, dem Vizepräsidenten und den ordentlichen Mitgliedern. Wenn ein ordentliches Mitglied infolge Todes oder durch andere Umstände längere Zeit verhindert ist, an der Geschäftsführung teilzunehmen, so kann der

Präsident an seine Stelle den einen oder beide Stellvertreter einberufen. Die Rechnung der Vereinigung soll durch die beiden Rechnungsrevisoren jedes Jahr geprüft und die geprüfte Rechnung alljährlich allen Mitgliedern mit dem Jahresbericht des engern Vorstandes zugestellt werden.

Der engere Vorstand beschliesst über die Ausgaben, wählt Unterausschüsse und genehmigt die Arbeit des Kongresses. Wenn die Generalversammlung nicht beschlussfähig ist, so hat der engere Vorstand endgültig in allen Rechnungsfragen Beschluss zu fassen und den nächsten Versammlungsort des Kongresses zu bestimmen. Bei Stimmengleichheit im engern Vorstand hat der Präsident den Stichentscheid.

6. *Der Präsident.*—Der Präsident führt den Vorsitz in der Generalversammlung, im engern Vorstand und in den Versammlungen des Kongresses, in denen wichtige technische Beschlüsse gefasst werden.

Er wird, als Vorsitzender des engern Vorstandes und mit dessen Kenntnis und Zustimmung, die Vereinigung im Verkehr mit den Regierungen und andern Vereinigungen, sei es von amtlichen Samenkontrollstationen oder von Kontrollbeamten oder von Samenhändlern, vertreten. Er ordnet zusammen mit den Vertretern des Landes, in dem der nächste Kongress abgehalten werden soll (a) das Programm des Kongresses, (b) die Vorschläge für den Vorsitz des Kongresses, (c) die Zulassung von Beobachtern und Gästen zum Kongress. Er beruft die Sitzungen des engern Vorstandes ein, ist *ex officio* Mitglied aller Ausschüsse und Unterausschüsse der Vereinigung und überwacht die Veröffentlichung der Berichte der Vereinigung.

Der Präsident ist ermächtigt, zu seiner Hilfe einen Sekretär-Kassierer anzustellen, dessen Entschädigung durch den engern Vorstand zu genehmigen ist. Der Präsident ist verantwortlich für (a) die sichere Verwahrung des Eigentums der Vereinigung, (b) die richtige Verwendung ihres Vermögens, (c) die Unterbreitung einer richtigen Abrechnung an die Rechnungsrevisoren.

7. *Der Vizepräsident.*—In der Abwesenheit des Präsidenten von Sitzungen der Generalversammlung oder des engern Vorstandes soll der Vizepräsident seine Stellvertretung übernehmen.

8. *Versammlungen und Kongresse: Abgeordnete und Abstimmung.*—Jedes Mitglied der Vereinigung ist berechtigt, den Generalversammlungen und den Kongressen beizuwohnen. Der engere Vorstand setzt vor jedem Kongress unter Berücksichtigung (a) des Beitrages der verschiedenen Länder und Mitglieder und (b) der Bedeutung der Arbeit ihrer amtlichen Samenkontrollstationen, die Zahl der Stimmen, die fünf nicht überschreiten soll, fest, die den Delegierten jedes Landes zukommt bei Abstimmungen über Berichte und Anträge der Ausschüsse der Vereinigung oder der Anträge der Delegierten. Wenn es verlangt wird, soll die Abstimmung geheim sein; andernfalls wird sie durch Handmehr festgestellt. Beschlüsse werden durch eine Mehrheit der Anwesenden und Stimmenden gefasst. Bei Stimmengleichheit hat der Präsident den Stichentscheid.

9. *Urabstimmung.*—Wenn zwischen zwei Generalversammlungen eine wichtige Frage aufgeworfen werden sollte, so kann sie der engere Ausschuss einer schriftlichen Abstimmung der stimmberechtigten Mitglieder unterbreiten. Der Ausschuss kann hierauf nach Massgabe des von der Mehrzahl der Stimmenden ausgedrückten Wunsches vorgehen.

10. *Austritt, Auflösung etc.*—Austritt von Ländern und Mitgliedern kann nur auf Schluss des Kalenderjahres erfolgen, und der Präsident soll von der Absicht des Rücktrittes vor dem 1. Oktober jedes Jahres benachrichtigt werden.

Auflösung der Vereinigung kann nur stattfinden, wenn eine Generalversammlung, die zu diesem Zwecke zusammengerufen wird, dies mit $\frac{2}{3}$ Mehrheit der Anwesenden und Stimmenden beschliesst.

Jede Änderung dieser Statuten soll vom engern Vorstand vorberaten und den Mitgliedern wenigstens 2 Monate vor der Generalversammlung,

an der sie zu behandeln sind, schriftlich mitgeteilt werden. Beschlüsse, die solche Änderungen betreffen, müssen durch eine Zweidrittelmehrheit der Anwesenden und Stimmenden unterstützt werden.

11. *Beziehungen zum internationalen Institut für Landwirtschaft.*—Die Vereinigung wird inbezug auf Veröffentlichungen und auf jedem andern Weg, der vom engern Vorstand als geeignet erachtet werden sollte, mit dem Internationalen Institut für Landwirtschaft in Rom zusammenarbeiten. Im Falle der Auflösung der Vereinigung soll ihr Vermögen dem Internationalen Institute ausgehändigt werden.

12. Bei jedem aus der Nichtübereinstimmung der Texte entstehenden Zweifel soll die englische Fassung als massgebend betrachtet werden.

Der zu wählende engere Vorstand wurde bevollmächtigt :—

(1) falls es notwendig sei, kleinere Hinzufügungen vor dem Druck der Statuten vorzunehmen,

(2) die jährlichen Beiträge der Vereinigung in Übereinstimmung mit dem Paragraph 3 der Statuten festzusetzen, weil die Zeit des Kongresses nicht genügte. Das Komitee sollte den verschiedenen Regierungen, Anstalten und Vereinigungen Mitteilung über die Beiträge zugehen lassen.

Herr Kirotar schlug vor, die Beiträge mit Rücksicht auf die Valutaverhältnisse der verschiedenen Länder festzusetzen. *Sir Lawrence Weaver* bemerkte dazu, dass dies selbstverständlich von dem Komitee in Betracht gezogen würde. Er meinte ferner, dass der Titel der Vereinigung in den drei Hauptsprachen festgesetzt und dies dem engern Vorstand übertragen werden solle.

Auf *Sir Lawrence Weavers* Vorschlag wurde danach den engern Vorstand gewählt. Die Namen der Mitglieder des Komitees sind in dem englischen Bericht Seite 118 angeführt.

Auf Antrag des *Herrn Dorph-Petersen* wurden *Sir Lawrence Weaver* und *Dr. Volkart* einstimmig als Ehrenmitglieder der Internationalen Vereinigung für Samenkontrolle erwählt.

Herr Dorph-Petersen schlug nun vor, die weiteren speziellen Ausschüsse zu wählen.

Die angenommenen Ausschüsse sind in dem englischen Bericht auf Seite 119–120 angeführt.

Die Frage des nächsten Kongresses wurde nun aufgeworfen und *Fräulein Yeo* teilte mit, dass sie befugt sei, im Namen ihres Institutes den Kongress nach Rom einzuladen.

Nach einer kurzen Diskussion nahm der Kongress diese Einladung mit Dank an. Es wurde beschlossen, die nächste Konferenz in der ersten Hälfte des Monats Mai des Jahres 1927 abzuhalten.

Ein herzlicher Dank wurde nun von den Kongressteilnehmern an Herrn Chambers und sein Hilfspersonal gerichtet, und auf Antrag von *Professor Johannsen* sprachen die Teilnehmer *Sir Lawrence Weaver* ihren Dank für seine ausgezeichnete Leitung des Kongresses aus.

Schluss des Kongresses.

**Einige Untersuchungen über das Vorkommen und die Lebensfähigkeit
mehrerer Unkrautsamenarten unter verschiedenen Verhältnissen, unter-
nommen an der Dänischen Staatssamenkontrolle in den Jahren
1896-1923.**

*Das Manuskript dieses Berichtes wurde im Anschluss an
Professor Bussards Vortrag über die Unkrautfrage unter die Delegierten
verteilt, aber nicht vorgelesen.*

VON

K. DORPH-PETERSEN,
Direktor der Dänischen Staatssamenkontrolle.

In der dänischen Zeitschrift "*Tidsskrift for Landbrugets Planteavl*" (Zeitschrift für den Pflanzenbau der Landwirtschaft) befindet sich in dem 17. Band (1910) ein von dem Verfasser dieses Artikels verfasster Bericht, "Nogle Undersøgelser over Ukrudsfrøes Forekomst og Levedygtighed, udført ved Statsanstalten Dansk Frøkontrol 1896-1910" (Einige Untersuchungen über das Vorkommen und die Lebensfähigkeit der Unkrautsamen, unternommen an der dänischen Staatssamenkontrolle in den Jahren 1896-1910).

In diesem Bericht wird teils eine summarische Übersicht über frühere in derselben Zeitschrift veröffentlichte Versuchsergebnisse gegeben, teils werden diese mit den Resultaten späterer Untersuchungen suppliert, und endlich werden darin Untersuchungen erwähnt, die nicht früher veröffentlicht sind.

Der gegenwärtige Artikel ist im wesentlichen ein Referat des oben-erwähnten Berichtes, wessen Einteilung des Stoffes deshalb beibehalten ist. Während aber die Abschnitte, von denen man annehmen muss, dass sie für einen weiteren Leserkreis Interesse haben, ziemlich ausführlich angeführt sind, sind Abschnitte, die hauptsächlich Lokalinteresse haben, nur ganz kurz referiert. In einigen Fällen sind im gegenwärtigen Artikel Auskünfte angeführt, die nicht in dem erwähnten Bericht vorhanden sind, sondern welche man in früheren Bänden von "*Tidsskrift for Landbrugets Planteavl*" suchen muss; ausserdem sind mehrere der Versuchsserien mit den Ergebnissen, die in den Jahren nach 1910 erzielt sind, suppliert worden, indem ein Teil der erwähnten Versuche an diesem Zeitpunkt noch nicht abgeschlossen waren.

I.—Wie viele Unkrautsamen sind in Klee- und Grassaaten vorhanden ?

In diesem Abschnitt wird die Aufmerksamkeit darauf hingeleitet, dass die anscheinend kleinen Gewichtsmengen (meistens 0.1-1.0 %) von Unkrautsamen, die im allgemeinen in den Proben von Gras- und Kleesaaten, welche an der Staatssamenkontrolle untersucht werden, vorhanden sind, eine bedeutende Zahl von Unkrautsamen pr. kg. der Ware repräsentieren, sodass selbst mit guter Saatware, wenn ca. 25 kg. des Saatgutes pro ha. verwendet werden, oft 13-25 Unkrautsamen pro m.² ausgesät werden. "Unkontrollierter Samen," d. h. Samen von Firmen verkauft, deren Lieferungen nicht einer regelmässigen Kontrolle der Staatssamenkontrolle unterworfen sind, und welcher ohne das Wissen und Erlaubnis des Verkäufers untersucht wird, enthält nicht selten kolossale Mengen von Unkrautsamen.

In drei der Jahresberichte der Staatssamenkontrolle, die in "*Tidsskrift for Landbrugets Planteavl*," Band 7, Seite 23-42; Band 8, Seite 23-25 und Band 10, Seite 22-23 zu finden sind, hat Magister O. Rostrup eine Übersicht gegeben, über welche Samen der nichtgebauten Arten bis 1902 in den an der Staatssamenkontrolle untersuchten Proben von Klee-, Gras- und Rübensamen u. a. vorhanden waren. Ein entsprechender

Bericht über das Vorkommen der Unkrautsamen in den Proben, die in den letzten Jahren an der Staatssamenkontrolle untersucht sind, wird voraussichtlich in der nächsten Zukunft in der Zeitschrift des Internationalen Landwirtschafts-Institutes veröffentlicht.

II.—Der Verlauf der Keimung und die Keimfähigkeit der Samen einiger wildwachsenden Pflanzen.

Untersuchungen, wie Samen wildwachsender Pflanzen keimen, wurden in grossem Umfange unter der Leitung O. Rostrups in den Jahren 1896–1902 vorgenommen, wonach sie unter dem Berichterstatter weitergeführt sind. Die Ergebnisse dieser Untersuchungen befinden sich in "*Tidsskrift for Landbrugets Planteavl*," Band 6, Seite 158–169; Band 8, Seite 27–30; Band 9, Seite 26–29; Band 10, 24–28; Band 11, Seite 172–175, Band 12, Seite 43–49 und Band 13, Seite 38–41.

Bei den Versuchen sind völlig reife Samenkörner, die kurz nach der Ernte zum Keimen gelegt sind, verwendet worden, wonach man diese auf den Keimapparaten liegen liess, bis entweder alle Samenkörner gekeimt hatten oder ganz verfault waren. Der Jacobsensche Keimapparat* wurde zu fast allen Samenarten benutzt; nur Samen von Wasserpflanzen wurden zum Keimen in Wasser gelegt. Die Keimapparate standen auf einer ungeheizten Glasveranda, wo die Samen einer Temperatur ausgesetzt waren, die nur wenig von der Temperatur der freien Luft abwich.

Der Verlauf der Keimung war sehr verschieden, was die verschiedenen Arten betrifft. O. Rostrup hat Gruppen aufgestellt, in welchen alle untersuchten Arten—nur mit Ausnahme ganz einzelner—eingeordnet werden können (siehe die Listen, Seite 130–133).

Die Zahl, die nach dem Artsnamen angeführt ist, bezeichnet die Gesamtkeimfähigkeit. Es ist ersichtlich, dass diese, was fast alle Arten betrifft, sehr hoch ist; der Grund dazu ist zweifelsohne darin zu finden, dass die Keimuntersuchung ungefähr bei derselben Temperatur, der die Samen in der Natur ausgesetzt sind, unternommen ist. Ein Vergleich zwischen den Keimergebnissen einiger Arten, die auf geheizten Keimapparaten, wie sie an der Staatssamenkontrolle für die Kultursamen verwendet werden, erzielt sind, und denjenigen auf ungeheizten Keimapparaten auf offener Veranda erzielt, hat nachgewiesen, dass die untersuchten Arten—mit Ausnahme einer einzelnen—am schnellsten und am besten unter den letzterwähnten Bedingungen keimten. O. Rostrup leitet die Aufmerksamkeit darauf hin, dass wenn Nobbe und Haenlein bei ihren entsprechenden Versuchen (siehe: "*Die landw. Versuchsstationen*," Band XX., S. 74 und Band XXV., S. 465) sehr niedrige Keimergebnisse erzielten, ist der Grund möglicherweise, dass sie zu hohe Temperaturen verwendet haben.

Von einer kleinen Anzahl der betreffenden Arten wurde mehr als eine Probe untersucht. Der Verlauf der Keimung war indessen nicht in allen Fällen gleich für verschiedene Proben derselben Art. Es ist zu vermuten, dass der Jahrgang, der Grad der Reife, die Herkunft und vielleicht auch Stamm- oder Rasseneigentümlichkeiten des Samens ihren Einfluss auf den Verlauf der Keimung ausüben. Es wäre darum bei zukünftigen Untersuchungen auf diesem Gebiete wünschenswert, Samenproben zu verwenden, die von einzelnen Pflanzen geerntet sind. Selbst mit dieser Verbesserung des Versuchsmaterials würde man nicht immer Samen, die gleichmässig keimen, erhalten. Professor Correns hat nämlich nachgewiesen, dass der Platz der Samenkörner in der Frucht oder im Blütenstand in einigen Fällen seinen Einfluss auf die Keimfähigkeit ausübt; dementsprechend hat sich die Keimfähigkeit der Randblüten bei vielen Compositen abweichend von derjenigen der Scheibenblüten gezeigt (siehe: *Jahresbericht der Vereinigung für angewandte Botanik*, 8. Jahrgang, 1910, Seite 258).

* Siehe; Seite 32–33 in "*Statsfrøkontrollen 1871–1896–1921*" (Die dänische Staatssamenkontrolle 1871–1896–1921) von K. Dorph-Petersen.

III.—Der Einfluss des Grades der Reife auf die Keimfähigkeit der Unkrautsamen samt der Dauer der Keimfähigkeit.

Zur Erläuterung der obenangeführten Frage veranstaltete der Berichterstatter folgende Versuche:

In 1904 wurden teils "reife" und teils "unreife" Samen der in der Tabelle 1 (Seite 133) angeführten Arten eingesammelt. Die unreifen Samenkörner waren noch grünlich, und ihr Samenweiss war noch ganz zähe. Die Samenkörner sassen so fest an der Mutterpflanze, dass sie abgepflückt werden mussten. Die reifen Samenkörner liessen sich dagegen durch eine leichte Berührung von der Mutterpflanze entfernen, und die Samenhülse oder das Samengehäuse hatte das Aussehen, welches die Reife charakterisiert. Reifer und unreifer Samen wurden in derselben Parzelle im Versuchsgarten geerntet, doch nicht von absolut derselben Pflanze.

Die Samen wurden in Papiertüten in Schubladen in einem Lokal, das im Winter geheizt wurde, aufbewahrt, sodass man voraussetzen konnte, dass der Wassergehalt, der bei der Ernte am grössten in dem unreifen Samen war, in den zwei verschiedenen Kategorien von Samen schnell ungefähr gleich wurde.

Von jeder Samenart wurden kurz nach der Ernte—und danach jeden nachfolgenden Herbst—100 Körner von beziehungsweise reifem und unreifem Samen zum Keimen gelegt. Die Keimung ging vor sich auf einem Jacobsenschen Keimapparat, der auf einer offenen Veranda stand wie auf Seite 222 beschrieben. In der Tabelle No. 1 sind die Hauptergebnisse dieser Untersuchungen angeführt.

Die reifen Samen haben unter den gegebenen Verhältnissen am längsten ihre Keimfähigkeit bewahrt; die unreifen keimten, was fast alle Arten betrifft, schneller als die völlig reifen, namentlich war dies der Fall in den ersten Jahren nach der Ernte der Samen.

In der Tabelle 2 (Seite 134) ist eine Übersicht angeführt, wie einige andere Samenarten ihre Keimfähigkeit durch eine Reihe von Jahren bewahrt haben. Die Aufbewahrung der Samen und die Keimuntersuchungen haben unter ganz denselben Bedingungen wie voran beschrieben stattgefunden (trockene Aufbewahrung und Keimung auf ungeheiztem Apparat).

IV.—Wie viele Unkrautsamen sind in Erde zu finden? (Samt einigen Angaben darüber, wie viele Samenkörner verschiedene Unkrautpflanzen geben können).

Die Samen einiger Pflanzen von verschiedenen wildwachsenden Arten sind gelegentlich gezählt worden. ("*Tidsskrift for Landbrugets Planteavl*," Band 13, Seite 35-37).

Von den Resultaten sollen hier folgende angeführt werden:—

Daucus carota: Eine freistehende Pflanze gab 110,000 Samenkörner, während 7 Pflanzen auf einem Grasfelde durchschnittlich ca. 4000 Samen pro Pflanze gaben.

Plantago lanceolata: Eine kräftige Pflanze auf einem Grasfelde gab ca. 15,000 Samenkörner; 6 kleinere Exemplare auf demselben Grasfelde gaben im Durchschnitt ca. 2,500 Samenkörner.

Chrysanthemum leucanthemum: Eine kräftige Pflanze auf einem Grasfelde gab 26,000 Samenkörner; 6 kleinere Pflanzen auf demselben Ort gaben von 1,300 bis 4,000 Samen pro Pflanze.

Sonchus arvensis: 6 Pflanzen auf einem Haferfeld gaben im Durchschnitt 3,000 Samenkörner pro Pflanze. Auf ca. 4 m.² waren 70 solche Pflanzen vorhanden.

Matricaria inodora: Ein besonders kräftiges, freistehendes Exemplar gab ca. 310,000 reife Samenkörner, die in 6 Tagen mit 97 Prozent keimten; diese Pflanze gab also ca. 300,000 keimfähige Samen. Eine andere freistehende Pflanze gab ca. 130,000 Samenkörner. Bei später unternommenen Untersuchungen hat der Berichterstatter zweimal Pflanzen gefunden, die je ca. 300,000 keimfähige Samenkörner gaben.

Cirsium arvense: In einer Kolonie dieser Pflanzenart wurden pro 0.4 m.² 25 kräftige Stengel aufgezählt; einige von diesen (die männlichen Pflanzen) gaben keine Samen, während auf den weiblichen Pflanzen im Durchschnitt ca. 4,500 Samenkörner pro Stengel vorhanden waren.

Zur Erläuterung davon, *wie viele Unkrautsamen man in dänischer Ackererde finden kann*, wurde im Frühjahr 1907 Erdeproben von 4 Feldern in Jütland gezogen. Das Probeziehen ging vor sich mittels eines 15 cm. hohen, quadratischen Eisenrahmens, sodass die Proben eine Erdschicht von 15 cm. Dicke umfassten, welches genau der Erdschicht entspricht, die in der betreffenden Gegend der direkten Behandlung von Pflug und Egge ausgesetzt war.

Es war im voraus anzunehmen, dass die betreffenden Felder viel Unkrautsamen enthielten, und die Ergebnisse dürfen daher nicht als Ausdruck dafür betrachtet werden, wie viel Unkrautsamen dänische Felder im Allgemeinen enthalten.

Die Proben wurden mittels Sieben mit so geringer Maschenweite ausgewaschen, dass alle Unkrautsamen zurückbehalten wurden. Durch Untersuchung sorgfältiger den Sieben entnommenen Durchschnittsproben wurden die Art und Menge der Unkrautsamen in den Erdeproben bestimmt. Samen von folgenden Geschlechtern und Arten kamen in grösster Menge vor: *Chenopodium* sp., *Scleranthus* sp., *Spergula* sp., *Polygonum lapathifolium* und *Rumex acetosella*. Aus den Untersuchungsergebnissen wurde berechnet, dass die betreffenden Felder in der obersten Schicht von 15 cm. beziehungsweise 193,600; 116,600; 88,200 und 141,900 Unkrautsamen pro m.² enthielten. Die in einer der Probe gefundenen Samen von *Chenopodium* keimten mit 70 Prozent, während der grösste Teil der übrigen Arten, die auf Keimfähigkeit untersucht wurden, mit zwischen 20 und 30 Prozent keimte. Wenn man mit einer durchschnittlichen Keimfähigkeit von 25 Prozent rechnet, kann man, vorausgesetzt, dass die Samen in der ganzen Erdschicht gleichmässig verteilt sind, aus den angeführten Zahlen berechnen, dass in den obersten 2.5 cm. Erde der vier Felder folgende Anzahl keimfähiger Unkrautsamen pro m.² vorhanden waren: Probe 1—8,066; Probe 2—4,855; Probe 3—3,674, und Probe 4—5,913.

V.—Wie bewahren die Unkrautsamen ihre Keimfähigkeit in Erde?

Das Verfahren bei den obenerwähnten Versuchen ist in allen Fällen dies gewesen, dass bei Anfang des Versuches kleine Blumentöpfe, in deren Mitte 100 Samenkörner der betreffenden Art mit Erde gemischt angebracht waren, vergraben wurden. Jedes Frühjahr wurden einige der Töpfe aufgegraben und die Samen auf Keimfähigkeit untersucht, indem der Inhalt eines Blumentopfes in einer Tonschale, die im voraus beinahe mit Gartenerde gefüllt war, welche einem Ort entnommen wurde, wo die betreffenden Unkrautarten seit Menschengedenken nicht angetroffen waren, ausgebreitet wurde. Zum Vergleich wurden in ganz entsprechender Weise jedes Jahr 100 Samen derselben ursprünglichen Probe, die in der Zwischenzeit in den Lokalen der Samenkontrolle trocken aufbewahrt war, ausgesät. Die Hauptergebnisse der ersten Versuchsreihe dieser Art sind in der Tabelle 3 (Seite 135) zu finden.

Bei dem in der erwähnten Tabelle besprochenen Versuch wurde nur Eingraben in einer Tiefe von 30 cm. versucht. Weil es indessen von bedeutendem Interesse ist zu sehen, wie Samen ihre Keimfähigkeit in Tiefen, zu welchen die Erde im Allgemeinen bearbeitet wird, bewahren, und inwiefern die Lebensfähigkeit der Samen in den verschiedenen Tiefen verschieden ist, wurden im Jahre 1903 Versuche nach obenstehenden Prinzipien angefangen, jedoch so, dass von jeder Samenart Portionen à 100 Samen in Tiefen von 8, 20 und 30 cm. eingegraben wurden. Jedes Frühjahr wurde eine Probe von jeder Tiefe samt eine Portion, die auf der Samenkontrolle trocken aufbewahrt war, zum Keimen gelegt. Die Hauptergebnisse dieses Versuches sind in der Tabelle 4 (Seite 136) angeführt.

Die Ursache der ziemlich bedeutenden Schwankungen der Keimfähigkeit derselben Probe von Jahr zu Jahr ist zweifelsohne darin zu

finden, dass jedes Jahr nur eine relativ kleine Anzahl Samenkörner (100) zum Keimen gelegt sind. In einigen Fällen hatten Regenwürmer und andere Tiere die Erde in den eingegrabenen Blumentöpfen durchwühlt und dadurch die Ergebnisse weniger sicher gemacht, und endlich sind die Bedingungen der Keimung wegen der verschiedenen Wetterverhältnisse der verschiedenen Jahren nicht ganz gleich gewesen.

Wie es zu erwarten sei, bewahrt die Keimfähigkeit, was alle untersuchten Arten betrifft, sich am schlechtesten in einer Tiefe von 8 cm., wo der Zugang von Sauerstoff am reichlichsten ist, und wo die Temperatur und die Feuchtigkeit am stärksten wechseln. Samen von *Daucus carota* und *Cirsium arvense* sind nur in einer Tiefe von 20 cm. eingegraben gewesen. Ausser der in der Tabelle angeführten Arten sind Samen von *Secale cereale*, *Avena sativa*, *Avena elatior*, *Lolium perenne* und *Agrostemma githago* in entsprechender Weise untersucht worden. Mit Ausnahme einzelner Samen von *Avena elatior* und *Lolium perenne* waren alle eingegrabene Samenkörner dieser Arten schon in dem ersten Winter abgestorben.

Im Ganzen bewahren die Kultursamen die Keimfähigkeit schlechter in der Erde als die Unkrautsamen. Selbst ölhaltiger Samen wie *Brassica campestris rapifera* bewahrt seine Keimfähigkeit viel schlechter in der Erde als sein naher Verwandter *Sinapis arvensis*.

VI.—Wie viele Unkrautsamen sind im Futtergetreide bevor und nach dem Mahlen, in importiertem Futtergetreide, Spreu des Getreides, Reinigungen u. dgl. vorhanden?

In 1907 wurden 37 Proben von Futtergetreide sowohl vor als auch nach dem Mahlen auf den Gehalt an Unkrautsamen untersucht. Es wurde nachgewiesen, dass die allgemeine Auffassung, dass die Unkrautsamen beim Mahlen des Getreides zerdrückt und dadurch unschädlich gemacht werden, absolut nicht richtig ist. Durchschnittlich enthielten die untersuchten Proben vor dem Mahlen 16,400 Unkrautsamen pro kg. und nach dem Mahlen 9,300 unbeschädigte Samenkörner pro kg. Es wurden also durchschnittlich nur etwas über ein Drittel der Unkrautsamen in der Mühle zerdrückt. In den Proben waren im Ganzen 54 verschiedene Unkrautsamenarten vorhanden. Wie es zu erwarten sei, sind es besonders Samen der Arten, deren Samenkörner klein und hart sind, die in dem Getreide nach dem Mahlen wieder gefunden werden (siehe Tabelle 5, Seite 137).

Es sind danach mehrere Beispiele darüber erwähnt, dass Reinigungen der in Dänemark von den Ländern um das Schwarze Meer importierten Gerste, die als Futter für fast denselben Preis wie die reine Gerste verkauft werden, nicht selten grosse Mengen von Unkrautsamen enthalten; in einem Fall 55·8 Prozent und in einem anderen 41 Prozent.

Gleichfalls ist erwähnt, dass Reinigungen und Spreu von Getreide oft so viele Unkrautsamen enthalten, dass man bei der Verwendung dieser Abfallsprodukte vom Dreschen in hohem Grade die Aufmerksamkeit darauf hingewendet haben muss, zu verhindern, dass die darin vorkommenden Unkrautsamen auf die Felder verbreitet werden.

VII.—Wie keimen die Unkrautsamen, welche den Darmkanal der Haustiere passiert haben?

Über diesen Gegenstand ist Mitteilung in "*Tidsskrift for Landbrugets Planteavl*," Band 8, Seite 33–35, und Band 12, Seite 51–53 (die Jahresberichte der dänischen Staatssamenkontrolle für 1899/1900 und 1903/1904) gegeben.

In dem ersterwähnten Bericht hat O. Rostrup Auskunft über das Ergebnis einer Untersuchung des Düngers einer Kuh, die mit samen tragenden Pflanzen von 10 verschiedenen Arten gefüttert war, gegeben. Es wurden keimfähige Samen von 8 von diesen in dem Dünger gefunden; diese keimten mit folgenden Prozenten:—

<i>Solanum nigrum</i>	-	-	-	-	52 Prozent.
<i>Stellaria media</i>	-	-	-	-	49 „
<i>Sonchus asper</i>	-	-	-	-	27 „
<i>Senecio vulgaris</i>	-	-	-	-	5 „

<i>Capsella bursa pastoris</i>	-	-	-	-	24	Prozent.
<i>Urtica urens</i>	-	-	-	-	11	„
<i>Atriplex patula</i>	-	-	-	-	8	„
<i>Polygonum aviculare</i>	-	-	-	-	35	„

Die Kuh hatte ausserdem noch Pflanzen von *Sinapis arvensis* und *Silene inflata* gefressen, es wurden aber merkwürdigerweise keine Samen dieser Arten in dem Dünger gefunden. Wahrscheinlich sind die betreffenden Samen in dem Futter nicht völlig reif gewesen. Ausser den Samen der obenerwähnten Arten wurden in dem Dünger Samenkörner von 26 anderen Arten gefunden, von welchen man annehmen muss, dass sie in dem Heu, womit die Kuh gefüttert wurde, vorhanden gewesen sind.

Bei einem späteren von dem Berichtersteller angestellten Versuch (*„Tidskrift för Landbrugets Planteavl,”* Band 17, Seite 618-626) wurde eine Kuh mit abgewogenen Mengen von *Plantago lanceolata* und *Matricaria inodora* samt im übrigen mit Futter, welches keine Unkrautsamen enthielt, gefüttert. Der Dünger wurde in den 5 darauf folgenden Tagen eingesammelt. Die Probe jedes einzelnen Tages wurde ausgewaschen und danach untersucht. Das Hauptergebnis dieser Untersuchung geht von der Tabelle 6 (Seite 137) hervor.

Die Fütterung mit den Unkrautsamen wurde um 7 Uhr morgens vorgenommen, und die Hauptmenge der Unkrautsamen wurde im Dünger des nächsten Tages gefunden. Samen, die 2 Tage brauchten, um durch die Kuh zu passieren, zeigten sich bei diesem Versuche eine etwa 20 Prozent geringere Keimfähigkeit zu haben, als Samen die sich nur einen Tag in dem Darmkanal befunden hatten.

Ein Versuch mit einem Schwein (von ca. 70 kg.) wurde in der Weise vorgenommen, dass das Schwein täglich mit 2-8 kg. eines Futters, welches grosse Mengen von Unkrautsamen enthielt, gefüttert wurde. Nachdem diese Fütterung einige Zeit durchgeführt war, wurde der Dünger von 4 aufeinander folgenden Tagen untersucht. Die Fütterung mit dem unkrauthältigen Futter wurde auch in diesen Tagen fortgesetzt. Der Dünger jedes einzelnen Tages wurde für sich untersucht, und die Untersuchungen gaben übereinstimmende Ergebnisse. In der Tabelle 7 (Seite 138) sind die Durchschnittszahlen für die 4 erwähnten Tage angeführt.

Die Ergebnisse eines entsprechenden Versuches mit Fütterung von Hühnern sind in der Tabelle 8 (Seite 138) angeführt.

Die im gegenwärtigen Artikel referierten Versuche zeigen:—

(1) Dass die für Aussaat bestimmten Samen und besonders Klee- und Grassamen oft grosse Mengen von Unkrautsamen enthalten.

(2) Dass Futtergetreide und besonders Spreu des Getreides und Reinigungen öfters bedeutende Mengen von Unkrautsamen enthalten.

(3) Dass Unkrautsamen in der Regel eine gute Keimfähigkeit haben, dass sie häufig mehrere Jahre hindurch langsam keimen, und dass viele Arten, sowohl bei trockener Aufbewahrung als auch in der Erde, ihre Keimfähigkeit viele Jahre lang bewahren.

(4) Dass die Unkrautsamen durch das Passieren der Mühle oder des Darmkanals der Haustiere bei weitem nicht zerstört werden.

In den letzten Jahren sind an der Staatssamenkontrolle eine Reihe von Untersuchungen vorgenommen worden, zur Erläuterung davon, wie die Unkrautsamen ihre Keimfähigkeit im Düngerhaufen bewahren. Diese Versuche sind indessen noch nicht abgeschlossen. Es kann doch mitgeteilt werden, dass das Hauptergebnis ist, dass die Unkrautsamen auch im Düngerhaufen die Keimfähigkeit teilweise bewahren können, falls sie sich in den lockeren oberen Schichten befinden, während es scheint, dass die untersuchten Arten in ziemlich kurzer Zeit zerstört werden, falls sie sich in den Schichten eines wohlgepflegten Düngerhaufens befinden, die fest zusammengepresst sind, sodass dieser sich feucht hält und Wärme aufnimmt.

WEITERE SUPPLEMENTARISCHE BERICHTE.

Dr. *M. Kondo*, Kurashiki: "Untersuchungen von Samen der Landwirtschaft, besonders mit Bezug auf die Verhältnisse in Japan" (siehe die englische Abteilung, Seiten 121-124).

Dr. *A. v. Degen*, Budapest: "Die Lebensfähigkeit der Samen" (siehe die englische Abteilung, Seiten 139-143).