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REPORT OF COMMISSION
ON
AGRICULTURAL RESEARCH

NOVEMBER, 1908

of public money for such purposes, to the end that such funds shall be applied in the most economical, efficient and worthy manner to results of permanent value.

It is not my place to give instructions to the Commission. The resolution allows the greatest latitude and freedom to the Commission. Since you desire it, however, I will express my understanding of the nature and scope of the inquiry; but these statements are to be regarded only as informal suggestions.

The Commission is in no sense an "investigating committee," as this term is commonly understood. It is not concerned with the scientific work of individuals. It is not concerned with the internal questions of research institutions, except as such questions may affect public policies and the reputation of the work.

The occasion for the creating of the Commission lies in the fact that in the very rapid evolution of experimentation and research in agriculture in the United States, there has not yet arisen a clear understanding of mutual limits and relationship or a settled policy in relation to many large public questions. We need to work out principles of action. There undoubtedly needs to be a correlating and harmonizing of subjects and methods; an understanding of the proper scope, function, and limitations of National and State agencies; a conception of the relation of institutions in the States to Federal appropriations and control; of the most effective distribution of investigation efforts among the different State and National institutions; consideration of the influence exerted on research in agriculture by the current methods of appropriations by legislatures; of the relation of the individual worker to institutional organization; discussion of what constitutes research that shall produce useful and worthy results; the relation of this research to the teaching and publicity functions of the institutions; consideration of the relation of research in agriculture to the general body of science and the coordination of these; and, in general, such a directing of experiment and research in the interest of agriculture as shall compact and economize the work, render it more fertile and effective, and integrate it with wise policies in the interest of the public welfare. It lies with the Commission to cover much or little of this field, but it will be essential to consider the best methods of organizing research work, the mutual relations of experiment stations and Federal agencies, and the general character of research that may issue from institutions founded on public money. The two members representing the Association are familiar with the questions that need most to be discussed.

If this is the scope of the field that the Commission is to enter, then its inquiries may well extend beyond what is narrowly known as agricultural science, and consider any other research supported by public money that promotes agricultural knowledge and efficiency.

While the sphere of the Commission is to consider experimentation and research, it can not neglect direct educational questions in so far as they touch the interrelation of experiment and teaching in the institutions, and particularly as they relate to the training of men to undertake research.

Inasmuch as the results of experimentation and research are made current chiefly through printed records, it will be proper for the Commission to consider the means and methods of publication.

A discussion of the attitude of the public towards research in agriculture would seem to be one of the consequences of the deliberations of the Commission.

It is desired that the Commission make a report of its opinions for the information and guidance of the Association. There are no instructions as to the extent or specific character of the report, or the time when it shall be presented. The Association wants the benefit of the opinion and advice of able and impartial men who have taken time to arrive at a conclusion.

The Association has purposely and wisely made up this Commission of three sets of men; one set having intimate knowledge of technical research in agriculture; one representing the policy of government and one looking at the questions from the outside from the standpoint of large, general attainment and wide public interest. The opinions of this Commission will have lasting effect on the trend and policy of agricultural research in the United States. This is the first united effort to study these great questions broadly and judicially. The Association will await with much interest the results of your deliberation; and in the name of the Association I wish to extend my thanks to the members for their willingness to serve in this new interest of American science, and to congratulate them on the pleasant and helpful relationships that I am sure will follow.

The Association has made no appropriation of funds for the use of the Commission, leaving this question in abeyance until the Commission should be organized and the necessities of the work should be apparent. The Association has no funds to appropriate to large new work. It was thought that about the only outlay would be traveling expenses of some of the members. I think that the Commission should discuss the subject of expenditure and make a report or recommendation of the subject, if necessary, for the consideration of the Association at its meeting next month. Doctor W. H. Jordan is a member of the Executive Committee of the Association and can inform you as to the policy and resources of the Association.

Yours with best wishes,

(Signed) L. H. BAILEY.

Your Commission submits the following report in two parts: Part one, dealing with investigation for the promotion of the art of agriculture, and part two, with the social and economic phases of agricultural research.

Part I. Investigation for the Promotion of the Art of Agriculture.

There is implied in the adoption of the resolution authorizing this Commission either a doubt as to whether the organization and policy now pertaining to agricultural investigation in the United States are

satisfactory or else the appearance of new problems along this line that demand serious consideration.

In the prosecution of its deliberations your Commission has proceeded with the understanding that the term "agricultural research" means the scientific investigation of unsolved problems that have a direct or indirect relation to agricultural practices or conditions and that it does not mean either academic or popular instruction or agricultural propaganda. Your Commission also understands that in the broad sense its inquiries should include:

1. The preparation of the investigator.
2. The environment under which the investigator can most efficiently do his work.
3. The functions and relations of the agencies to which agricultural research is entrusted.

A discussion of the status of agricultural investigation in the United States in the light of the conditions which are generally regarded as best promoting the efficiency of scientific inquiry, if made with a view to suggesting improvements, will necessarily require some emphasis upon whatever is regarded as unfavorable to agricultural research at the present time. To prevent misunderstanding arising from a critical analysis of the existing situation, any further statements should be prefaced by a merited recognition of the great benefits that have come to agriculture from the scientific agencies which either have arisen, or have been greatly developed and strengthened, during the past twenty-five years. It is hardly necessary to assert that the elevation of agricultural thought and practice and the more complete conservation of our fundamental resources are an abundant justification of whatever effort has been made.

In presenting the results of our deliberations it seems unnecessary to review in detail the steps which mark the rise and development of the agencies for agricultural education and research in this country. Briefly, the facts are that two systems have grown up side by side: First, the state system of agricultural colleges and experiment stations, sustained in part by the national government but controlled and to a large degree supported by the several states; and second, the national system, embodied in the United States Department of Agriculture, originally designed and still largely serving as an investigating agency, but to which very extensive executive functions have also been assigned in recent years and which likewise exercises important educational functions. All other agencies for agricultural research, while doing valuable work in individual cases, are in the aggregate of minor significance in a broad view of the subject.

With this hasty summary of facts, which are entirely familiar to the members of this Association, we may proceed at once to a consideration of the activities of these institutions and the work they have accomplished. These can be best understood, and any needed readjustments more clearly seen, in the light of the conditions which have so far prevailed.

Two main facts should be considered in this connection, namely, that this new effort of education and research was founded on an extensive scale among a people largely unprepared to maintain it efficiently, and that the agencies which have been established have developed materially with great rapidity. When the colleges of agriculture and the mechanic arts began their work late in the sixties, about the only men in this country with adequate preparation for teaching the sciences in their application to agriculture were the few who had sought the advantages of European study. For the succeeding twenty years, these institutions were largely dominated by the view that in order to secure popular approval their chief function should be to educate men to be farmers, and on this account as well as for financial reasons, they offered scanty opportunities for advanced study. The inevitable result was that when the experiment stations were established only here and there had men developed genius and training for the work of inquiry, combined with an interest in agricultural problems. Notwithstanding these limitations, the growth of agencies designed wholly or in part for research has been remarkably rapid, though at no time has it kept pace with the demands of the agricultural people for scientific aid. It is not too much to say that even in the last decade millions of dollars have been added to our resources for the promotion of science in its relation to agriculture, and hundreds, almost thousands, of men, have been called into a field of service where they are expected to add to the sum of agricultural knowledge. Associated with the growth of institutional facilities for agricultural education and research there has also come into existence an extensive and laborious effort for the spread of knowledge among the rural people, to which all agricultural agencies have sustained an intimate relation.

As is evident from the facts given, the past two decades, particularly the last one, may be fitly characterized as peculiarly a period of the promotion of the organization and material resources necessary to agricultural education and research. A few decades ago the majority of agricultural sentiment was indifferent or adverse to what was termed "book farming." This attitude has been reversed. Those familiar with the history of agricultural colleges and experiment stations and of the Department of Agriculture during this period are well

aware that a vigorous cultivation of public sentiment, as fundamental to legislative sentiment, has been going on as the only means of maintaining and increasing the financial support of these institutions, on whose part there has existed an expectancy of legislative aid, with a consequent watchfulness of public opinion and legislative good will.

Some of the results of the conditions that have been pointed out are intimately related to the progress and past efficiency of agricultural research in the United States and their discussion is pertinent to suggestions that are to follow.

1. The development of research effort has not been symmetrical and logical. Adequately trained men have not been provided in sufficient numbers to expend in the way of capable investigation the entire amounts of national and state appropriations that have been applied to agricultural research. This is one of the reasons why the more difficult agricultural problems have so largely remained untouched.

As to this matter we may quote from a personal letter of a well known investigator:

"The demand for agricultural research has been greater than the supply of men capable of carrying on research or educational work. The Agricultural Colleges and the agencies of research have been created by law, but the law cannot create men. The Agricultural Colleges have developed a considerable proportion of under trained men without poise or sustained judgment and under these conditions the personal element enters into the work of the state and national institutions and in the majority of cases most of the difficulties arising in the field may be traced to the personal equation of inadequate men."

It is here that the standards of education have a direct and immediate relation to the quality of research effort. In those colleges of agriculture in which high educational standards are maintained, the various forms of agricultural research are in general of high character, corresponding to the more elevated character of the academic administration. A debasement of educational ideals reacts with certainty upon the work of scientific inquiry. In these matters, college authorities are sometimes helpless in the face of uninformed popular opinion which rates the value of an institution by the number of names in its catalogue.

(2) Many persons nominally holding research positions have been investigators only in name, for their time and energy have been absorbed by other duties. In many institutions members of the faculty have combined routine teaching with experiment station duties, a policy due in part, at least, to the scarcity of specifically trained men. The disadvantages pertaining to this policy have

undoubtedly been felt by the departments of investigation rather than by those of instruction.

(3) The persistent and widespread promotion of popular education and of public good-will has unquestionably had a profound, and not always immediately healthful, influence on the extent and character of the activities of the national and state agencies established for agricultural research. A large amount of publicity work in the way of representation before legislative committees, public addresses and institute lectures, has been sustained by those holding positions of scientific responsibility. It is indisputable that a generous proportion of the energies of the national department of agriculture and of the experiment stations has been consumed in agricultural propaganda. While such efforts have been productive of good in other directions they could only be so consuming of time and energy as to count heavily against the work of inquiry.

(4) The urgent and natural call for results that would produce an immediate and favorable reaction upon the public mind has not only brought about an era of the diffusion, rather than of the acquisition, of knowledge, but has, quite generally, led to the study of problems admitting of prompt conclusions, more particularly problems of a business character directly related to financial benefit, rather than those that are fundamental. Indeed, because of an insistent demand from farmers for help in many directions there has been such a diffusion of effort on a great variety of problems as largely to preclude their study in a comprehensive and conclusive manner. Our scientific literature abounds in the details of unfinished and inconclusive observations which have added very little to the sum of our agricultural knowledge. The necessity of expedition in justifying the maintenance of scientific aid to agriculture has been essentially a coercing influence in the direction of superficial inquiry and immature conclusions. The standards of research in agriculture, as a whole, have not compared favorably with those prevailing in some other lines of inquiry nor have they always been on a par with the requirements of the problems to be solved.

(5) As one result of the close association of scientific inquiry and popular education a true conception of real and efficient research has not been fully maintained in the minds of all those engaged in the work of agricultural investigation. The effect of such a situation upon the progress of agricultural knowledge is obvious.

(6) There has been no well-defined general agreement as to what should be the relative functions of the two classes of agencies, state and national, in the promotion of agricultural research and therefore

no clear, definite policy has been developed regarding their correlation. This is due in part to the fact that the methods of agricultural research and the relation of agencies are still in the experimental stage. There has not been time to determine fully where the different institutions stand. Each is feeling its way. State institutions are undertaking work of the most varied nature while the United States Department of Agriculture is contributing to state agencies, co-operating with them, and engaging in independent work ranging all the way from undertakings of the broadest national character to almost purely local investigations. It is fair to say that all disagreements between different agencies of agricultural research have arisen mainly from this lack of a permanent policy in either state or nation. There has been an extensive overlapping of the fields of operation of the two classes of agencies in the study of questions similar in character and regional application.

The foregoing analysis of past efforts should not be received as attributing blameworthiness to institutions that under new and untried conditions have endeavored loyally and industriously to promote agricultural welfare. It should be remembered that all the agencies relating to agricultural science have been passing through a formative period, a day of experiments in a new field, during which time results of remarkable scope and benefit have been attained. But in justice to the truth, the past forty years must be regarded as having been devoted principally to agricultural education and propaganda rather than the discovery of new truth. While much valuable new knowledge has been secured, research has really occupied a secondary position. Perhaps this was necessarily so. But the years have brought their fruition. Investigation is now attaining a larger relative place and it would seem that the time has come for some readjustment of organization and effort and the establishment of a definite permanent policy. To this end the following suggestions are offered:

A. The training of investigators is a necessary antecedent to the efficient expenditure of research funds. In developing the work of inquiry this factor should be considered as fundamental and should be definitely provided for. Competent investigators are needed more than money. A large investigator and small means may do much, but a small investigator and large means will accomplish but little.

No problems demand for their solution methods more searching or profound than do those pertaining to agriculture. For this reason, agricultural investigators should be trained as broadly and severely as any other class of scientific men. In no field is "popular" research efficient. The agricultural colleges should recognize more clearly their

duty to train men for research work and to that end should provide high-grade graduate instruction as rapidly as possible. The appropriation of funds to this purpose is no less necessary and consistent than providing material equipment. Moreover, further progress in agricultural efficiency is fully as dependent upon the acquisition of new knowledge as it is upon the diffusion of information that we now possess. The body of knowledge that we call agricultural science needs clarifying of error on the basis of the most severe inquiry and many difficult problems must be solved before certain phases of agricultural practice can proceed on an established basis.

Universities and non-agricultural colleges might well offer special training along lines related to agricultural science, and devote more attention to some of the scientific problems important to agriculture, while the provision of some ready means by which graduate students of agriculture may learn what facilities are now offered by this class of institutions would be a useful service. No field is more promising of useful results.

B. The organization and policy of research agencies should be such as to render the career of investigation attractive and to ensure adequate returns of scientific truth for the efforts put forth.

(1) The immediate executive officer of a research agency should be a broadly trained scientist whose tenure of office should be permanent, subject only to the requirements of efficiency, and absolutely independent of political considerations, and whose time and thought should not be seriously absorbed by other duties. Such expert direction is essential to securing proper unity of work and the efficient coordination of the efforts of individuals.

If in any department or institution the administration of laws and the management of research are combined under the same head, who is a political officer, some form of organization should be adopted that will give continuity and coherence to the work of investigation so that its direction will not be subject to the influence of political changes.

(2) Wherever possible, the organization of research agencies should be on the basis of problems to be solved and not of processes used in their solution. In other words, the subdivisions of an agricultural research agency for administrative purposes should correspond with the recognized subdivisions of the subject of agriculture itself and not with the classification of the pure sciences.

The science of agriculture is an exceedingly complex one, and the investigation of a problem in any one of its subdivisions may require that the methods and processes of various primary sciences be concentrated upon it; and in a large organization each of its bureaus or divi-

sions should be permitted to employ, under its own control, all processes which can contribute to the solution of its problems. In organizations which are essentially single bureaus, the ungrudging cooperation of members of the staff on any single problem should be a fundamental requirement.

(3) With respect to departments and institutions, the welfare of research requires that it should be differentiated as far as possible from other functions, such as administration, teaching and propaganda. In the several states the tendency to assign executive functions to state departments, and education and research to other more or less distinct agencies, should be encouraged.

The same principle should be applied to the relations of the individual. It is highly important that the research worker shall be enabled to remain within the atmosphere of inquiry and shall not have his continuity of thought and effort frequently interrupted by activities foreign to the spirit and purpose of inquiry such as executive duties, routine classroom teaching, extension teaching, propaganda and the like.

(4) An essential requirement of the investigator is freedom of research. The investigator must be free from any coercion whatever. Scientific truth is a product of the individual mind through the exercise of its judicial capacity in the interpretation of data. Any bias that distorts the view or any influence that forces hasty or immature generalizations, is fatal to sound conclusions. Whenever the investigator is for any reason over anxious for popular approval, or is made to consider the relation of his conclusions to future support, or in any way is restrained from exercising his unbiased judgment in reaching, and in dealing with his results, he is subject to influences dangerous to the integrity of the teachings of science.

For this reason the research work of either a state or national agency should be as far removed from immediate and frequent dependence on legislation, with the consequent pressure for speedy results, as is consistent with due responsibility for the expenditure of public funds. The investigator should have such reasonable assurance of continued support as will enable him to formulate broad plans and impart continuity to his work. Real research cannot produce fruits in a day. Wheat is a valuable crop, but we may well plant a few apple trees and give them time to grow.

While, of course, the expenditure of public money in research should ultimately result in increasing prosperity in the largest sense, and while a legislative body must be the final judge of the efficiency of the agencies which it creates for the promotion of agriculture, such a body

should form its judgment on the broad basis of results obtained as a whole and over a length of time commensurate with the nature of the undertaking. It cannot wisely pass on details or exercise expert judgment on the value of single scientific results. In brief, the legislative body should determine how much shall be expended and for what general objects, and should make its appropriations for these purposes to the largest possible extent in the form of lump-sum appropriations, leaving it to the executive officer in general charge of the work to apportion the appropriation between different lines of investigation according to his expert judgment and holding him responsible, as it can only under those conditions, for results.

(5) The use of research funds should wait upon opportunity. They should be applied to important problems only when there is a conjunction of a problem and of a man or men fitted to attack it. The promiscuous appropriation of funds without a previous clear understanding as to how they can be used for the study of specific problems is not to be commended.

(6) The means available for agricultural research should be concentrated upon such a number of problems as can be studied comprehensively and carried to the point of well grounded conclusions. Progress in real aid to agriculture would in this way be much greater than is made through a larger number of fragmentary inquiries.

C. As has been pointed out, there is an extensive overlapping of the fields of effort of the United States Department of Agriculture and of the Agricultural Experiment Stations. It is evident that such a situation cannot wisely be allowed to continue. So far as possible, the functions and fields of operation of these agencies should be clearly outlined. This is essential to definiteness of aim, freedom of opportunity and the encouragement of the investigator. Moreover, when two or more public agencies are working toward the same general end, their efforts should be in well considered adjustment, this being a requisite for economy and efficiency of effort.

The relation that the national department and an experiment station as research agencies should sustain to each other and to the agriculture of the nation and of a given state is one that relates to a wise public policy rather than to scientific prerogatives. The real question is, how can public funds be distributed to render the greatest possible service in the aggregate; not merely in the promotion of material prosperity but especially in developing the ability of localities and individuals to deal intelligently with their own problems? This question touches a principle which underlies our federal system, the observance of which is necessary to preserve the efficiency and method of our demo-

cratic institutions. The principle is this: "Questions which concern primarily and chiefly the people of the locality are to be left to the determination of the locality; questions which concern primarily and chiefly the people of the nation are to be left to the determination of the nation."

No arguments are needed to uphold the assertion that a national research agency sustained by national funds and backed by national authority is an indispensable part of an efficiently organized and comprehensive research effort. There is offered to such an agency an almost unlimited field of large problems of national scope, calling for broad and extended inquiry from different points of view, and requiring heavy expenditures, elaborate equipment and long continued study, which state agencies can hardly enter upon. At the same time its efforts may be of special service, if wisely directed, in correlating the results reached by the state institutions and in bringing about a better understanding between workers in the same field, and it can also exert a strong influence in favor of high standards of scientific work.

On the other hand there is a field of service in the several states to which the experiment stations seem to be peculiarly adapted. In certain respects, such as their comprehension of local problems, their constant and intimate touch with their own people and the economy of effort through a nearby institution, the stations appear to have distinct advantages over more remote agencies.

It may be further said, that what might be called "individual scientific problems," i.e., problems whose investigation lies within the capacity of one or two investigators, may usually be taken up with great advantage by an experiment station. It is also true that when a station is connected with a large institution of learning and is therefore in close touch with well equipped departments of science, it offers an environment especially favorable to scientific spirit and opportunity.

If these premises are correct, not only should the national agency be enabled to exercise its peculiar functions with the highest efficiency but the policy of developing the state experiment stations should be continued in every possible way. The state should not be encouraged to shirk the duty of developing its own means for agricultural progress and defense. If the soils of a state are becoming depleted of their fertility on account of irrational systems of agriculture, so that the prosperity of the state is being threatened thereby, the state should be made to feel that it must bestir itself and care for its own resources. It would be an unwise policy for the national government to be continually stepping in to protect a state from the results of its own folly. Herbert Spencer observes that to protect men from the consequences

of their own folly is to fill the world with fools. The preservation of local initiative and the sense of local responsibility is a consideration of the highest importance. Statistics show clearly that many states have recognized their obligations, over half of the income of the Experiment Stations and a still larger proportion of that of the land grant colleges being derived from sources other than national. There can be no question in the mind of any one familiar with the trend of affairs that, unless a mistaken policy shall operate to encourage dependence on the national government, the states will increasingly care for their local agricultural problems, leaving the appropriations by the national government to be applied to the investigation of questions of general importance. Apart from the above considerations, a station should have the encouragement of full and unhampered opportunity in the field where it is established and the inspiration of knowing that its agricultural constituency is looking to it as the immediate source of assistance. Anything that diverts the attention of farmers from their home institution and lessens their interest in it is most discouraging to a station staff and it can but weaken its hold upon public interest.

The foregoing discussion relates mainly to progress in the art of agriculture, which is, after all, not the fundamental result that should be sought. The increasing dissemination of scientific knowledge of agriculture in the past twenty-five years has been so successful in adding to the agricultural wealth of the country that we are, perhaps, in danger of regarding this as its chief function. Such a materialistic idea is to be profoundly deprecated. The true field of operation of these governmental agencies is the whole circle of the farmer's life, not his acres alone. The prime object is to develop men, not merely to make crops.

The following quotation from an address by Professor L. H. Bailey of Cornell University, states this principle most clearly and emphatically:

"Every one of us, I am sure, feels that good institutions will not save us. Society can be saved and advanced only by increasing the number of competent persons who stand on their own feet. The purpose of every good country-life institution is to develop persons who are able to stand alone. We must be careful that we do not develop a man who will go about his farming leaning with one arm on the government and with the other on the college and experiment station, and at every turn asking for recipes in franked packages. It is not the business of the government to test every farmer's seeds, but to teach every farmer to test his own seeds."

"I think, therefore, that no agricultural work, public or private, no institution, state or national, no movement educational or philanthropic, has adequate justification unless its own purpose or effect is to allow native individual responsibility and initiative to develop in the man

who stands directly on the land; and if it is necessary to stimulate initiative, the effort should lie preferably with the institution or agency that is nearest to the man and his problem."

The same thought was evidently in the mind of President Roosevelt when writing his letter to the Syracuse Convention. He says:

"The chief instrumentalities in bringing this about must be the farmers themselves, in whose hands the ultimate solution of the problem lies, and whose agents and employees the various organizations, State and Federal, are. The grange, the farmers' club, the horticultural and dairy associations can do much."

"There must be help from without through the New York State Agricultural Department, the State Agricultural Colleges, the Experiment Stations, while the Chambers of Commerce and like organizations in cities and towns should work to the same end."

"Finally, the United States Department of Agriculture, in conjunction, if necessary, with the Department of Commerce and Labor, must do its full share."

We may lay down as fundamental principles, therefore, which should guide in the consideration of the question before us. First, that the responsibility for doing all that he can for himself should rest upon the individual; and second, that when outside stimulus or assistance is necessary, in matters not of national or interstate scope, the presumption is always in favor of the nearer, local agency as compared with that more remote.

But while it is easy to say that the national government should concern itself with problems that affect the general welfare in distinction from problems that are of local interest only, in practice many cases arise in which both national and state agencies are vitally interested and as regards which no strict classification is possible. Problems primarily local may take on an interstate or national aspect. In proportion as this is the case, they necessarily become national as well as state problems, and require a national agency for their efficient and proper handling. Thus, if some state by reckless waste of its forestry resources is threatening the water supply of neighboring states or the navigation of great streams, only a national agency can deal with the case. On the other hand, problems originally of national scope may give rise to local problems. The introduction of a new crop may be a piece of national work, but the development of this crop becomes of local importance when once its fitness is shown.

The inter-state or national character of a problem, however, increases rather than diminishes its local importance, while the local application may be after all the main end to be attained by the solution of a national problem. It seems evident, then, that certain classes of problems should be handled by national and state authorities acting

jointly. The extent and method of this co-operation must necessarily vary with circumstances. When a national agency takes hold of such questions, it needs to avail itself of the experience and the knowledge of local conditions possessed by local agencies, and, therefore, will wisely work through these agencies as far as possible, supplementing them where necessary, but employing its own agents directly only where the local agencies are insufficient. At present, effective means for the correlation of national and state agencies is lacking, and the want of it is a serious hindrance to the progress of agricultural research. As a means to that end we recommend the formation of a permanent board made up of representatives from institutions receiving federal aid, or jointly federal and state aid. This board should meet frequently to discuss the mutual relations of the different institutions and agencies, defining from time to time the principles that should govern each. The influence of such a board if properly organized might be considerable. It may be comparable with that of the Board of State Governors, recently in session in Washington.

Part II. Economic and Social Phases of Agricultural Investigation.

Thus far our agricultural investigation and teaching have been almost wholly in the field of applying modern science to the productive side of agriculture. But this side is only half the story. The other part should include an equally careful consideration of those business, economic, social, and governmental factors that forever play so large a part in the welfare of the farmer and which so frequently govern the conditions under which he produces and sells his crops, and which create the atmosphere of the community in which he lives out his life.

The field of work of an investigation which we consider advisable should at first be confined to our own country, but ultimately we might expect to learn much from careful study of conditions abroad, perhaps particularly in Europe.

The scope of the work should embrace all phases of rural social science. This term "Rural Social Science," should include substantially all that field of investigation not covered by the study of physical and natural sciences in their application to agriculture. "Rural Economics" means distinctly a study of economic questions with relation to the industry of agriculture. "Rural Social Science" considers those phases of community life which have to do with people who live under a rural environment as distinguished from those in an urban environment.

Our investigations should have an historical basis, but only so far as the development of movements may throw light on the existing status or on future prospects. The largest emphasis should be placed

upon the present status of the industry and the conditions surrounding the people who live on the land. There should be a study of the question of farm labor, as an example. The work should be exhaustive, avoiding the temptation to do something fairly good, that represents easy generalizations. To be worth while this work should be scientific and final.

The work should be planned on a permanent basis, not only because of the immensity of the field, but because of the permanence of these problems. The type of work should comprehend investigation which should be carried on continuously, carefully, and exhaustively along all lines of rural social science. There should be in addition to this the work of dissemination, or interpretation, of results through various channels like scientific publications of details for the use of students of social science, popular bulletins, and a somewhat extensive propaganda by word of mouth.

In the organization of work there should be set apart a bureau or division in the Department of Agriculture, care being taken to avoid duplicating work already under way in other divisions of the department. It is very important that there should be ample funds placed at the disposal of the bureau. There must be plenty of help, for the work is very extensive. Adequate salaries should be paid and there should be some cooperation with other agencies, as the Carnegie Institution, with Universities and Colleges, Normal Schools and similar institutions, boards or departments of agriculture and other state boards and commissions which may be interested.

SUMMARY.

The recommendations which your Commission has the honor to make are those which we believe should guide in the promotion, organization and prosecution of research in agriculture and which we regard as essential to bringing about the conditions that all friends of agricultural progress desire to see established. While these recommendations are in the main quite general, we believe that there will be no difficulty in discovering their force and manner of application.

In order to give conciseness to the results of our deliberations they are summarized briefly as follows:

(1) Every effort should be made to promote the training of competent investigators in agriculture both in the agricultural, and, so far as practicable, in the non-agricultural, colleges and universities, and their training should be as broad and severe as for any other field of research.

(2) The progress of agricultural knowledge now demands that agricultural research agencies shall deal as largely as possible with fundamental problems, confining attention to such as can be adequately studied with the means available.

(3) The work of research in agriculture should be differentiated as fully as practicable, both in the form of organization and in the relations of the individual investigator, from executive work, routine teaching, promotion and propaganda, and should be under the immediate direction of an executive trained in the methods of science who should not be hampered by other duties of an entirely unlike character.

(4) The investigator should be free from all coercion whatever. In reaching his conclusions he should be equally free from the prescription of received opinion and the temptation to exploit his results for the purpose of obtaining future support. To this end, his work should be as far removed from immediate dependence upon legislation as is consistent with due responsibility to the public, and his relations to the public and to the organization of which he is a member should be such as to promote individual initiative and not interfere with freedom of conclusion or utterance on scientific questions.

(5) There should be a clearer definition of the relative fields of work of the United States Department of Agriculture and the experiment stations. The dominance of the stations within their respective fields should be preserved and their growth fostered, as agencies for the investigation of local questions and of the more individual scientific problems. The federal agency, on the other hand, should cultivate the almost limitless field offered by questions having national or interstate relations and by those broad scientific problems requiring heavy expenditures, elaborate equipment, long continued study and the correlation of the results of many investigators, which efforts are usually beyond the means of an individual station. On many questions the harmonious co-operation of the two agencies is essential to the highest efficiency of effort.

(6) Any research agency charged with a single main line of investigation should be so organized that it may employ within itself all necessary processes in any branch of science. The cooperation of any or all the departments of an experiment station on a single problem, when necessary, should be a fundamental requirement.

(7) Research work, both national and state, should be provided for by separate, lump-sum appropriations, to be distributed according to the discretion of the responsible executive head of each agency.

(8) Investigation into the business, economic, social and governmental conditions affecting agriculture should be undertaken and should be maintained on a permanent and effective basis.

(9) An advisory board is suggested consisting of members appointed by the Secretary of Agriculture and by the Association of American Agricultural Colleges and Experiment Stations respectively, which shall confer with the Secretary of Agriculture regarding the mutual interests of the Department and the Stations and shall consider the promotion of agricultural investigation in general.

(10) As supplementary to the foregoing recommendations, it may not be out of place to add a suggestion upon the important subject of the publication of the results of investigation.

The contributions that the Department of Agriculture and the Experiment Stations are now making to scientific knowledge are widely scattered in special reports and bulletins of the Department and Stations. In this way these contributions are not easily consulted and are not as available to the scientific world as though they appeared in some single recognized medium. It seems that there should be some central publication in which the results of real investigation should appear after passing through the hands of a competent board of editors. This would be convenient not only to scientific men in the United States but also to those in other countries. Our work would receive a fuller and more intelligent appreciation under some such scheme of publication. Your Commission is unable to make recommendations as to details but suggests that a subsidized journal might be issued or an arrangement made with some existing journal. The board of publication, having full authority to criticise and reject or accept contributions, should be one authorized by the Department and Experiment Stations. Such a scheme of centralizing scientific productions obviously should not interfere with, or limit, the present method of distributing information through reports and bulletins.

(Signed) DAVID STARR JORDAN,
CARROLL DAVIDSON WRIGHT,
HENRY PRENTISS ARMSBY,
WHITMAN HOWARD JORDAN,
GIFFORD PINCHOT.

November, 1908

[Signed by Mr. Pinchot subject to exceptions noted on attached sheet.]

COMMENTS OF MR. PINCHOT ON THE REPORT OF THE COMMISSION ON AGRICULTURAL RESEARCH.

Much of the foregoing report I subscribe to. I am constrained to dissent from it in certain particulars, of which the following are the more essential:

1. It does not sufficiently recognize the necessity for the union of agricultural research with the application of its results.

The whole trend of modern science is toward the co-ordination of the search for knowledge with the application of knowledge. In any scientific organization the intimate association of the two is vital to both. Research divorced from application loses direction and effectiveness. Application divorced from research, as in the case of executive bureaus without investigation, loses its flexibility and spirit, tends to become formal and lifeless, and sinks almost inevitably into the labyrinth of red tape. Even if it were best for research itself to be separated from the application of its results, which I do not believe, the general good would still demand that the executive bureaus, State and National, which come into direct contact with the people, should be vitalized and kept effective by the indispensable stimulus of research. In such a matter at this we have no right to consider alone the separate advantage of a single branch of the public service, but, on the contrary, we are bound to base our conclusions on the general advantage of the whole Government machinery, and still more on the welfare of the people, for whose benefit it exists and for no other purpose whatever. The test of agricultural research is neither the prosperity of institutions nor the sacredness of the investigator, but the welfare of the man on the land. Research and its application must work together to reach the man on the land.

2. It does not sufficiently recognize the full responsibility of public research agencies to the people, by whom they are supported.

It is the business of Government science, in State and Nation, to produce results for the people. All institutions of research supported by taxation are responsible to the people through their representatives. They exist by public authority, and they are, and must continue to be, maintained by public funds. Research on public account must look to legislative aid, and we may frankly admit that fact. Every investigator should be unhampered, unbiased, and freed from harmful interruption in his search for truth, and in the formulation of his results,

so far as human nature and the social organization will permit. But to remove public research from the necessity for a direct accounting to the representative of the people would be to establish an irresponsible scientific aristocracy, which has no place in the United States.

3. The report does not sufficiently recognize that the welfare of each State is one with that of the Nation.

No man stands in more direct touch with our natural or National resources than the farmer. In the distribution of knowledge concerning them and their management, it is vitally essential to the future welfare of the Nation that no considerable body of farmers should be overlooked. In agricultural products no State consumes all it produces or grows all it uses. In this matter no State can stand alone. At the White House last May the Governors of the States unanimously said: "We declare the conviction that in the use of the National resources our independent States are interdependent and bound together by ties of mutual benefits, responsibilities, and duties." If one State suffers, the others suffer with it. To hold the contrary would be to disregard the whole economic structure of the Nation. To prefer that the citizens of a State should suffer rather than be relieved by assistance from outside its borders is to set the welfare of an organization above that of the people it was created to serve.

4. The report does not sufficiently recognize the obligations of State and National agricultural organizations to each other and to the people as contrasted with their separate rights, and thereby tends to perpetuate the present lack of thorough-going co-operation.

It is the clear duty of the State agricultural colleges and experiment stations on the one hand, and of the United States Department of Agriculture on the other, to lay aside their differences, if they have any, and to work unitedly for the common good of all the people. There is far more work to be done than all available means can possibly accomplish. Agricultural research does not need to wait on opportunity, for opportunity is already here in overwhelming measure. To meet the huge demand in this field requires united effort. To be effective, united effort must be organized. Instead of the unconvinced and unconvincing suggestion for an advisory board contained in the report, I desire for my own part to substitute the statement that the fundamental need of agricultural research in the United States is thorough-going co-operation between the State and National agencies, under a definite but not a rigid plan. In my judgment such co-operation can be best reached, and the necessary plan can best be pre-

pared and modified, through the agency of a co-operative board or similar body representing both State and Nation, created on the assumption that State and National agencies are simply parts of one great instrument which exists for the general good, and organized to give that view effect. Such a board should be required to make suggestions for the co-ordination and advancement of agriculture and agricultural research in the States and Nation, but it should be, wholly and altogether, without direct authority beyond what might be inherent in the value of the methods and the work it would suggest. It should give no orders.

One of the fundamental and most pressing needs of science in America is more and better research. I can conceive of no more effective way to promote research in agriculture than to bring about the active co-operation and co-ordination of existing agencies for the execution of a great general plan. The result will be felt in the increased scope, economy, and efficiency of both State and National organizations.

GIFFORD PINCHOT.

SUPPLEMENTARY STATEMENT FROM THE MAJORITY OF THE COMMISSION.

The majority of the Commission finds it difficult to understand what basis the report offers for the exceptions taken by Dr. Pinchot. In view of these exceptions, however, the following supplementary statement has been prepared.

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It is not contended that agricultural research should remain in academic seclusion and be separated from the application of its results. There is no dissent from the view that "the whole trend of modern science is toward the coordination of the search for knowledge with the application of knowledge," that "In any scientific organization the intimate association of the two is vital to both," that "research divorced from application fails of direction and effectiveness," and that "application divorced from research loses its flexibility and spirit and tends to become formal and lifeless." The contention is rather that the institutions, groups of men or single individuals charged with the work of inquiry shall sustain such relations in the system or organization of which they are a part as shall defend them against a wasteful diffusion of effort and at the same time permit the close coordination of research and the practical uses of its results.

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The investigator in our public institutions should not be allowed to forget, however, that the people through their representatives authorize and support his work, and that to the people he must be held responsible for an honest, industrious and effective use of his time and energy. His responsibility is commensurate with the confidence that is reposed in him in giving him means and opportunity to reach sound conclusions.

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In the discussion of the functions of agencies it is not intended to hold the welfare of the state as distinct from the welfare of the nation. In this respect, the majority of the Commission is not antagonistic to the general point of view which it understands to be expressed in the exceptions taken.

It has not been the intention, either, to present the relations of National and state agencies on the basis of rights, but rather on the basis of such an adjustment of effort as shall best promote efficient service by both those agencies and shall cultivate, on the part of the agricultural people in all sections of the nation, a sense of responsibility, both individually and socially, for their own progress and welfare. The immensity of the demand for effort in conserving and developing the material resources of this nation can hardly be exaggerated and this effort requires the united service of all organizations, both National and State. But we are confident that there is a wise differentiation of function on the part of the various agencies, and a regard for local spirit and development, that must be kept in view if the interests of all the people are to be most efficiently promoted.

Signed

DAVID STARR JORDAN
CARROLL DAVIDSON WRIGHT
HENRY PRENTISS ARMSBY
WHITMAN HOWARD JORDAN.

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