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OATS.

AN ADDRESS

DELIVERED BEFORE A MEETING OF THE NEW HAMPSHIRE BOARD OF AGRICULTURE, HOLDEN AT
EPSOM, IN 1886.

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OATS.

“A grain which in England is usually fed to horses, but in Scotland supports the people.” — *Dr. Johnson.*

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I.

NATIVITY OF OATS.

OF the nativity of oats we have but an imperfect knowledge.* The Bible, while it speaks of wheat and barley, says nothing of oats. Indeed, I have found no mention of this grain previous to the Christian era. Since then it continually appears in agricultural history, and with increasing frequency as we approach modern times.

* “It was cultivated by the prehistoric inhabitants of Central Europe, and is found in the remains of the late habitations in Switzerland, but Prof. Heer states that it did not appear until the bronze age and long after the appearance of wheat and barley.” — U. S. Census, Vol. Agriculture, p. 493.

It may be considered, therefore, as a comparatively modern grain, developed very likely from the plant bearing the name of "wild oats" (*avena fatua*). I may, perhaps, be pardoned the remark that the sowing of wild oats by youthful hands has, at times, resulted in a type of manliness whose excellence ranks as high in the physical as do the finest varieties of *avena sativa* in the vegetable world. I would not, however, be understood as recommending the frequent sowing of such a crop by such hands.

We are told that that worthless Roman emperor Caligula (A. D. 12-41) fed his favorite horse, Incitatus, on gilded oats out of a golden cup. Suetonius says that "for this favorite animal, besides a marble stable, an ivory manger, purple housings, and a jeweled frontlet, he appointed a house, with a retinue of slaves and fine furniture, for the reception of such as were invited in the horse's name to sup with him. It is even said that he intended to make him consul." However valuable or cheap the horse may have been, he was, without any doubt, the superior of his master. Nevertheless, the folly of the latter has preserved for us the fact that oats were known in Roman agriculture at that remote period, but we have traced them no further.

II.

IMPORTANCE OF THE OAT CROP IN THE UNITED STATES.

Oats rank third in importance among our American cereals. The crop of 1879 was 407,859,999 bushels. They grow in almost all sections of the United States, from the southern frontier of Texas to the northern line of Oregon, and from the eastern side of Maine to the swamps of southern Florida. Indeed, their northern line of culture extends far beyond our Canadian frontier up to the great peninsula of our arctic territory of Alaska. In Europe they thrive luxuriantly in all parts of Ireland and Scotland. They are at home in Norway, Sweden, and all the northern countries of that continent. Their northern limit is continuous with that of rye and barley, reaching up to and even within the arctic circle.

III.

THE OAT CROP IN NEW HAMPSHIRE.

We should expect, therefore — as in fact we do — to find this cereal flourishing in this cold state of ours. If we cannot compete with Florida in the production of oranges and bananas, we can beat her and all the other Southern states in raising oats.

The oat crop, which has always been an important one in New Hampshire, is very largely a northern crop. The yield south of the Ohio River ranges from less than ten up to twenty-five bushels per acre. North of this line it varies from twenty-five up to sixty, seventy, and even ninety bushels. The amount of oats raised in 1879 north of the thirty-ninth parallel of latitude was over three hundred and sixty-three millions (363,020,399) of bushels, while south of it the crop amounted to less than forty-five millions (44,818,600). More than one half of all the oats raised in the United States grow where the July temperature is from 70° to 75°, and only about one quarter (27.7 per cent) where it is from 75° to 80°.

The seventeen Northern states — Connecticut (27.52), Maine (28.76), Massachusetts (31.23), Michigan (33.93), Minnesota (37.87), Nebraska (26.18), New Hampshire (34.51), New Jersey (27.00), New York (29.79), Ohio (31.49), Oregon (28.92), Pennsylvania (27.34), Rhode Island (28.58), Vermont (37.59), Illinois (32.24), Indiana (25.02), and Iowa (33.57) — gave in 1879 an average yield per acre of 36.79 bushels, while the seventeen Southern states — Alabama (9.36), Arkansas (13.33), California (26.85), Florida (9.76), Georgia (9.06), Kansas (18.77), Kentucky (11.35), Louisiana (8.56), Maryland (17.75), Mississippi (9.87), Missouri (21.34), North Carolina (7.67), South Carolina (10.39), Tennessee (10.08), Texas (20.56), Virginia (9.47), and West Virginia (15.04) — gave a yield of but 13.48 bushels.

In 1849	New Hampshire	raised	.	.	973,381	bushels.
In 1859	"	"	"	.	1,329,213	"
In 1869	"	"	"	.	1,146,451	"
In 1879	"	"	"	.	1,017,620	"

or about one fourth of one per cent of the whole crop of this country.

During the year last mentioned the crop occupied 29,485 acres, and yielded a return of 34.51 bushels per acre.

THE OAT CROP IN NEW HAMPSHIRE.

The following table gives the number of acres devoted to this crop in each county, the quantity raised in each, and the product per acre: —

OATS 1879.

COUNTIES.	Acres.	Bushels.	Bushels per acre.
Belknap	1,149	33,941	29+
Carroll	1,381	35,227	25+
Cheshire	2,535	90,774	35+
Coos	5,666	228,698	40+
Grafton	9,719	360,902	37+
Hillsborough	1,772	49,441	28+
Merrimack	2,692	75,039	27+
Rockingham	1,155	26,572	23+
Strafford	520	12,546	24+
Sullivan	2,896	104,480	36+
Whole state	29,485	1,017,620	Av. 34.51

It appears by this that the largest amounts were raised in Grafton and Coos, and the smallest in Rockingham and Strafford, the two first named having produced 589,600 bushels, more than one half (57 per cent) of the entire crop of the state, the former raising thirty-seven and the latter forty bushels to the acre; while the two last named produced but 39,118 bushels, raising, respectively, the first twenty-three and the last twenty-four bushels per acre.

IV.

VARIETIES OF OATS.

There are four general kinds or classes of oats in cultivation, each of which has marked characteristics. These are very easily distinguished from one another, and are: —

1. The Class *Avena Sativa* (Fig. 1), which embraces all those varieties in which the seed branches shoot out from the stalk on all sides and form a symmetrical and rounded top. This class is familiar to us all, and has a stalk varying in height, according to culture, soil, and climate, from one to four feet.

Fig. 1.

2. A class not common with us, *Avena orientalis* (Fig. 2), in which the seed branches shoot out from one side only of the stem

and form a kind of mane, resembling somewhat that upon a horse's neck. Hence the name of horse-mane oats which this class sometimes bears. It is a bearded oat, and more hardy than that first mentioned. It has a seed which is long in proportion to its size, and grows readily on poor soil, flourishing where the former would not live. It is sometimes called the Tartarean oat. It makes a good food for horses, but is not a desirable kind to grind into meal.

Fig. 2.

3. The naked oat (Fig. 3), *Avena nuda*, which bears its seeds loose in the surrounding husks. It is small, and has been considered a degeneration from the common oat. It is common in Austria, where its flour is considered important as a food for invalids.

Fig. 3.

4. The walking oat, *Avena sterilis*, whose seeds are inclosed in stiff, hairy husks, each having a long, hygrometric awn twisted often closely upon itself when dry, but which, upon absorbing moisture from dew or rain, slowly uncoils, and in that act imparts to the seed a movement over the ground and into any fissures which may chance to be open to receive it. From this characteristic it often has an animated appearance, and is perpetuated by self-planting. It is valuable only as a curiosity, and may doubtless be found in the seed stores by any one wishing to test its peculiar qualities.

Whether these four classes are distinct species, I will not undertake to say. They certainly possess marked and distinct characteristics. It is with the first that we are particularly concerned, and to this I shall largely confine what I may say upon the subject now under our consideration.

There is another division of oats into white, black, and dun, the latter being probably a hybrid from the two first. There is also another still into winter and spring oats. But it will hardly pay us to tarry to dwell upon these.

The number of different varieties under these general classifications are very numerous, particularly in oat-growing countries.

In his report upon British agriculture, made nearly fifty years ago, the Rev. Henry Coleman states that he found no less than fifty distinct varieties in the museum of the Highland Agricultural Society. Mr. John C. Morton, in his *Cyclopedia of Agriculture*, presents a list of as many, with accompanying descriptions of a part of them. This is as follows, viz. : —

CULTIVATED OAT (*Avena Sativa*), WHITE SPECIES.

1. Potato.	18. Capar Grange or Grange of Both-
2. Sandy.	19. Blainslie. [ric.
3. Hopetown.	20. Georgian.
4. Early Angus.	21. Early Kent.
5. Sheriff.	22. New Early Essex.
6. Barbachlan.	23. Blue Major.
7. Cumberland Early.	24. Malbiehill.
8. Friesland or Dutch.	25. London Dun.
9. Old Poland or Tam Finlay.	26. Danish.
10. Dyock or Davidson's.	27. Poland.
11. Flemish.	28. Three-grained.
12. Kildrummy or Halkerton.	29. Agyleshire.
13. Siberian Early White.	30. Cleland.
14. Strathallan Irish or Earish.	31. Lancashire Witches.
15. Late Angus.	32. Tuscany Early.
16. Gray Angus.	33. Church's or Churrick's.
17. Drummond.	34. Hanquiseide.

CULTIVATED OAT (*Avena Iativa*), BLACK, DUN, OR RED-COLORED AND PARTI-COLORED SPECIES.

35. Common or Old Black.	38. Brown or Archangel.
36. Common Dun.	39. Red Essex.
37. Winter Dun.	40. Orleans Early Brown.

CULTIVATED OAT (*Avena Orientalis*), WHITE SPECIES.

41. Common White Tartarean.	42. Early White Tartarean.

CULTIVATED OAT (*Avena Orientalis*), BLACK SPECIES.

43. Early Black Tartarean.

WILD OAT (*Avena Fatua*), OCCASIONALLY CULTIVATED FOR MAKING OAT HAY.

44. Common Wild.	45. Marked Bearded.

Avena Brevis.

46. Short.

NAKED OAT (*Avena Nuda*), NOT CULTIVATED.

47. Common Naked.

| 48. Small Naked.

Danthonia Strigosa.

49. Bristle-pointed.

Avena Sterilis, OCCASIONALLY GROWN AS A CURIOSITY.

50. Animal or Fly.

Still another division of oats is frequently made, designated as early and late oats, one little regarded by the average farmer, but not unfrequently of great importance to him. If summer droughts are common in his locality and must be avoided so far as may be, to secure a successful crop, he had better secure varieties maturing in the briefest periods, and sow them as early as practicable, thereby making sure to his crop the moisture which the spring and early summer are likely to afford. The early varieties are also best adapted to lands which cannot be worked until late and afford an abridged growing period. Such lands will often give good crops of early oats, while they would be quite unlikely to mature crops of the later varieties.

If droughts are not anticipated and the growing season is of good length, the late varieties will generally be preferable. As in the case of Indian corn, the farmer must suit his seed to the climatic character of his locality.

V.

BEST CLIMATE FOR OATS.

The fact that more than half of our oat crop should have grown in the two most northern counties of the state is a marked one, and suggests some inquiry as to the climatic preferences of oats.

The best authorities all agree that this grain delights most in a cool, moist atmosphere of pretty equable temperature. Some of the best oats of Europe are raised in Ireland and Scotland, where cool weather and much dampness prevail during the growing

season. While England is not warm enough to mature Indian corn, most parts of it are too dry and warm to produce as good oats as are produced in Scotland. The heaviest oats and the best come from high latitudes and moist localities. Four fifths of our oats are raised where the spring and summer rainfall is from fifteen to twenty-five inches.

If to a moist climate there be added a high temperature, the rapidity of growth would doubtless be hastened, a coarser straw would be produced, and, possibly, larger and heavier seeds of high quality. Further experimentation, however, is necessary to settle this last point. Thus far the best oats, either for cattle feed or for meal, have been found in countries having a cool summer climate. Where dry and hot summers prevail, subject to droughts, the oat crop does not attain a maximum yield or quality of either seeds or straw. The latter is likely to be short and thin; the former to be few and of light weight.

VI.

BEST SOIL FOR OATS.

While oats grow upon all kinds of soil, from sand to clay, they flourish most upon moist soils well pulverized and fairly enriched. One year with another, heavy oats cannot be raised on light and dry soils. Sooner or later the crop will languish, and the yield of straw and grain will both be light.* To be sure, the farmer must use such soils as he has, and if they are but indifferently adapted to this crop, he must seek new seed pretty often from cooler ground and climate. By this means he can maintain a higher standard of weight than he will be able to do by sowing continually seed of his own raising. If one aims for maximum crops of oats of high quality, he must seek them on moist, loamy ground and under such circumstances as will secure uninterrupted growth during the whole season from sowing to harvest.

* A little experience of my own during the past season illustrates this remark. My oat crop was raised upon a piece of land some sixty rods long, whose surface lay in slight alternate hollows and ridges running square across it. The former were moist all the while the crop was growing, but the latter, catching every ray of the sun and opposing every passing breeze, were dry, and became quite so during one or two periods of sharp drought. The consequence was that while the crop as a whole measured up thirty-six bushels to the acre, the hollows gave double the amount of straw and grain given by the ridges

If you will allow me to quote from my own experience, I will say upon this point that the highest yield of oats I have any record of having raised upon my farm was fifty-eight bushels to the acre. About the same time a neighbor of mine, on land very like my own, and not eighty rods distant, was wont to get ninety bushels with no better culture.* This fact simply shows that in the case of oats, as in that of grass, corn, and other crops, particular soils have special aptitudes for particular crops, and that it is for the farmer's interest, so far as he can, to raise his oats on such of his soils as are best adapted to their production.

VII.

CHEMICAL COMPOSITION.

The following table of the chemical compositions of oats, Indian corn, and rye shows at a glance the comparative feeding value of each of these. The calculations, which have been made water-free, are taken from the United States Census of 1880 : —

GRAINS.	Ash.	Albuminoids (protein).	Fiber.	Carbohydrates (Starch, Gum, etc.)	Fat.
Oats (average of 20 analyses) .	3.29	12.76	10.07	68.31	5.57
Indian Corn (8-rowed Flint) . .	1.65	13.86	2.61	76.30	5.58
Rye (New Hampshire variety) . .	2.12	13.24	2.34	80.65	1.65
Oat Straw (water-free)	2.07	2.63	68.96	30.19	1.15
Rye Straw (water-free)	9.18	7.88	39.08	40.82	3.04
Wheat Straw (water-free)	3.44	2.38	40.48	50.96	2.74
Corn Fodder (white Flint field-dried)	5.13	7.57	33.06	52.49	1.75
Ensilage (corn fodder from Mass.)	6.47	7.00	37.08	46.48	2.95

From these figures it appears that the percentage of albuminoids in oats is 1.10 less than in corn, and .48 less than in rye.

* Mr. George M. Smith, of Stark, showed the writer of this paper a bin of oats which he raised in 1886, and which yielded one hundred and twelve bushels per acre and weighed forty pounds per bushel.

Also that the percentage of carbohydrates is 7.99 per cent less than in corn, and 12.34 less than in rye; while the comparatively worthless fiber is almost four times as great in oats as in either of the other two.

It also appears that the percentage of albuminoids in oat straw is 5.25 per cent less than in rye straw, .25 per cent greater than in wheat straw, and 4.94 per cent less than in corn fodder. While the comparative values of these grains may agree with our experience in their use, those of their straws will generally awaken surprise.

Now, let us look a little further and see what are the comparative requirements of each of the three cereals, oats, corn, and rye. According to Mr. Joseph Harris, every thousand pounds (air-dried) of oats and of oat straw contain

	Pounds of Nitrogen.	Pounds of Potash.	Pounds Phos. Acid.
In grain	19.2	4.4	6.2
In straw	5.6	8.9	1.9
	<hr/> 24.8	<hr/> 13.3	<hr/> 8.1

and that a crop of fifty bushels of oats (weighing thirty-two pounds per bushel) and one and a half tons of straw per acre will require a supply of 50.50 pounds of nitrogen, 36.54 pounds of potash, and 16.74 pounds of phosphoric acid from each acre.

These, at the common prices of twenty cents a pound for nitrogen, four for potash, and eight for phosphoric acid, will amount to \$12.90.

The crop, at forty-five cents a bushel for the oats and ten dollars a ton for the straw, will come to \$37.50, leaving to pay for labor, etc., a balance of \$24.60.

But it will be really greater than this, as the atmosphere and the soil will supply a considerable percentage of the plant food required. Theoretically, this statement is not far from correct. Practically, it is not so, as we shall be unlikely to realize the fifty bushels per acre. At thirty, however, the profit would be a fair one.

I think it will be apparent upon any careful calculation, that a good oat crop is a paying crop, but that, as in the case of every

other, the profit will vary with the return per acre. While fifty, forty, or even thirty bushels will be profitable, twenty will hardly pay the cost of raising, as the straw and grain will be as poor in quality as the yield is in quantity. With oats as with all other grains, maximum crops are generally the most profitable.

Oats have generally been considered an exhausting crop. How they compare in this respect with corn can readily be determined by comparing the requirements of the oat crop as just mentioned with those of the corn crop.

Fifty bushels of oats and one and one half tons of straw require 50.50 pounds of nitrogen, 36.54 pounds of potash, and 16.74 pounds of phosphoric acid.

The product of an acre in corn, say sixty bushels of corn and two tons of stalks, will require 72.96 pounds of nitrogen, 50.83 pounds of potash, and 41.02 pounds of phosphoric acid, or about 40 per cent more of nitrogen, about 30 per cent more of potash, and a little over 100 per cent more of phosphoric acid.

So that a good corn crop is more exhausting than an average oat crop. We must not, however, forget that the value of the latter (oats) as figured above is \$37.50 an acre, while the former (corn), at eighty cents a bushel for the grain and \$6.00 a ton for the stalks, will amount to \$60.00. Value for value, therefore, they are about equally exhausting of the plant food in the soil.*

VIII.

FERTILIZATION.

The fertilization of an oat crop is a matter attended with some embarrassment. Too rich a soil will give an undue weight of straw without a corresponding yield of grain. Too poor a soil can afford only a scant crop of light straw and light grain. In

* This will appear from a simple comparison of the value of the nitrogen, phosphoric acid, and potash in these two crops with the value of the crops.

Their value in 60 bushels of corn and 2 tons of stalks is	\$19.92
“ 50 “ oats ” 2 “ straw is	13.72
Value of corn crop as stated above.....	60.00
“ oat “ “	37.50

In other words, the value of the fertilizers in the corn crop is thirty-three and one fifth per cent of the value of the crop, and the value of the same in the oat crop is thirty-six per cent. So that the value of soil exhaustion by an oat crop very little exceeds the same by a crop of corn.

the former case the oats are liable to lodge and fail to fill well. In the latter the grain will stand upright, for the simple reason that it is not heavy enough to fall down. In neither case is the crop a satisfactory one.

The amount of manure required for a good crop of oats depends, of course, upon the condition of the soil. This may be such as to demand none at all. But this is but rarely the case.

An acre of good oats, say of one and one half tons of straw and fifty bushels of grain, contains of

Nitrogen, 50.50 pounds, worth at 20 cents	.	\$10.10
Potash, 36.54	" 4 "	1.46
Phosphoric acid, 16.74	" 8 "	1.34
		<hr/>
		\$12.90

If the ground and atmosphere are in condition to afford these in the above amounts, it is evident that no fertilization will be necessary. If, however, it requires enrichment, the amount of this will depend upon the amount of plant food the soil unaided can afford. My own experience suggests that five hundred pounds of Bradley's X. L. Phosphate or its equivalent, applied to an exhausted soil, will not suffice. Twice that amount, affording

Nitrogen	.	.	.	.	.	28.66 pounds.
Potash	.	.	.	.	.	18.50 "
Phosphoric acid	.	.	.	.	.	104.50 "

costing, at \$35.00 a ton, \$17.50, might, perhaps, be sufficient. This would afford some six or seven times as much phosphoric acid as the crop could appropriate, and about one half as much nitrogen and potash as it must have. But whether sufficient or not, this could hardly be considered an economical application. Indeed, we may strongly suspect, until further experimentation demonstrates the contrary, that highly soluble, artificial fertilizers cannot be economically applied to an oat crop, except in formulas devised for that crop. It is pretty intricate and uncertain business for us common farmers to use exact percentages, particularly upon soils the exact conditions of which we may be unable to ascertain. I find, however, by rude experimentation on good

oat ground partially exhausted, that two cords and a half of good horse-manure, costing \$15.00, besides the expense of application, will secure under fair conditions a yield of from forty to fifty bushels per acre. If others here present have arrived at better results, I hope that they will report them before the close of this meeting.

IX.

WEIGHT AND VALUE OF OATS.

Different varieties of oats are valuable in proportion to their weights, which vary greatly, all the way from twenty to fifty pounds per bushel. Some of the Scotch oats reach the latter figure. So, also, do some of those raised by Oregon farmers.

In other words, the value of the oat kernel depends upon its amount of meat, and the heavy varieties yield more of this, proportionately, than the light ones. Says a writer in the last Census Report: "The strengthening or muscle-producing power of oats depends upon the amounts of their albuminoids, and, as a whole, the proportion of the albuminoids is greater in the heavy oats than in the light ones, amounting to but seven or eight per cent in some of the lighter varieties analyzed, and rising to more than fourteen per cent in some of the others."

Therefore, as oats are sold virtually by weight, the greater the weight of a crop, the greater, of course, will be its value. The legal weight of a bushel of oats varies in the different states all the way from twenty-six pounds in Maryland to thirty-six pounds in Oregon.* It is at once apparent, therefore, that it is for the farmer's interest to raise the heaviest varieties which his soil and climate will allow. In comparing different crops, the comparison should be between different weights rather than quantities raised upon equal areas.

Whenever the producer finds his oats growing lighter, he may

*The number of pounds required by statute in some of the different states and territories to make a bushel of oats is as follows: In Maryland, 26; in Maine, New Jersey, and North Carolina, 30; in California, Connecticut, Dakota, Delaware, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Massachusetts, Michigan, Minnesota, Missouri, New Hampshire, New York, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin, 32; in Nebraska, 34; in Montana and Utah, 35; in Oregon and Washington, 36.

It appears, therefore, that 32 pounds is the general requirement, twenty-six out of the thirty-five states above named requiring that number.

be sure that it is time to be changing his seed for a heavier variety from a more favorable region ; just as the vegetable or truck farmers on the irrigated lands in the vally of the Po introduce new seeds as fast as their products deteriorate, and thereby maintain their standard.

X.

DIFFERENT METHODS OF RAISING OATS.

During the last thirty years I have tried several of the more common methods of raising oats, to all of which experience suggests objections of more or less importance.

I. I began by including oats as the second crop in the rotation prevailing in my locality, viz., corn the first year, oats the second, and grass the following six ; upon sod ground broken for the first crop, and manured with ten cords of stable-manure per acre. Two serious objections to this method were soon developed.

First, the oats, owing to an excess of fertilization, grew very rank, giving a heavy, weak straw which was sure to cripple or lodge before time of harvest. You all know what the cutting of a piece of heavy, lodged oats means — much slow, tedious labor, unsatisfactory stooks, and an amount of coarse straw of inferior quality, out of all fair proportion to the yield of grain.

Second. Seeding down to grass with this crop was found objectionable. The catch was unsatisfactory, owing partly to the shading and smothering of many of the tender grass stalks in their infancy, and partly to their entire destruction upon the spots occupied by the stooks during their period of drying. This method was therefore abandoned.

II. I next resorted to the other extreme, and sowed oats without manure upon exhausted sod land broken up the previous fall. A few years' experience demonstrated fully that a condition of soil which will not produce a good crop of grass will fail to afford a satisfactory yield of oats. This method, after a few trials, was also abandoned.

III. It had become apparent that when one has an individual on his hands who cannot live satisfactorily with any others, he had best be provided for by himself. Of late years I have cultivated oats as a special crop, and had better success.

My oats are now raised upon sod ground broken up in the fall, and in the following spring thoroughly pulverized and manured with two and one half cords of good stable-manure per acre or its equivalent, either plowed or harrowed in according to its fineness. In either event it is thoroughly disseminated throughout the seed bed. On my ground, this amount of manure, yielding about twenty-seven pounds of nitrogen, twenty-six of phosphoric acid, and thirteen of potash, added to the natural fertility of the soil, has sufficed. Upon this, oats are sown by a seed-sower at the rate of three and one half bushels per acre, and rolled in. They have been found to lodge far less than when cultivated as first stated, and give a fair return. My crop the past season, which encountered several short droughts, was raised upon ground consisting of dry ridges and moist intervening hollows. The latter probably gave something over forty bushels to the acre: the former, less than thirty. The piece as a whole measured up at thrashing just thirty-six bushels to the acre. This rather moderate crop was due in part to the unsuitableness of portions of the land for an oat crop. To the remark that one should not raise oats on such land, it may be said in reply that the farmer must use for his crops such land as he has.

I am aware that this method is open to criticism. My old neighbor, Mr. Richard Bradley, now dead, after a prolonged life of active experience and observation, was wont to say that he had never met but three perfectly honest men in his life, and that one of those was not quite honest. So of this last method, I would say that it is not quite satisfactory, but it is the best I have yet attained unto. Some of you, very likely, have got further on towards perfection in this work, and I hope we may hear from you in a few moments. Of this, however, I feel sure, that maximum crops of oats of the best qualities require, besides good culture, either a moist soil or a damp climate, and that they prefer both.

Early sowing — say from the last part of April to the first part of May in the central part of this state — of early varieties will secure early maturity of crop, and help towards an escape from rust. A good seed bed will promote rapid growth, and invite the rain and moisture to penetrate the soil, thereby rendering assimilable the plant food in the ground, and the maintenance of an uninterrupted growth.

There is sometimes an advantage in sowing, instead of one, a mixture of several kinds of oats maturing at or very near the same time. This comes mostly from the dissimilar habits of different varieties. Some shoot up in single stalks at considerable distances from one another. Others produce several stalks from each seed, and cover the ground more densely. If this be in good condition, the yield of grain on a given area is generally governed a good deal by the number of stems. These, too, when standing thick, help support one another, and are better able to resist the force of wind and rain. Thick sowing, also, in a measure, shields the ground from the sun's rays and prevents rapid evaporation of the soil's moisture.

This has not been a common practice with us, but the experience of foreign farmers has been such as to commend it, and I am satisfied that we shall do well to test it by our own.

The question as to the proper quantity of seed per acre for a crop of oats has given rise to much discussion, and opinions and practices have been various, ranging all the way from the extremes of from one to eight bushels. The object sought is to fairly cover the ground with the growing crop, and a moment's reflection must convince any one that the quantity should vary with the variety sown and the condition of the ground. If it be one which sends up few stalks, more seed will be needed than if it be a kind which produces many. At the same time it is useless to over-seed land in low condition in the hope of getting a good crop by an undue number of stalks.

It is impossible, therefore, to establish any rule of universal application. The cultivator must study surrounding conditions, and adjust the quantity of seed to these as well as he can. Common sense and personal experience will generally guide a man aright. After successive trials every season for the last thirty years, I have found that most of my lands require a seeding of about three and one half bushels per acre. Your better or poorer lands than mine, as the case may be, may vary a good deal from this quantity. One may just as well attempt to fix the quantity of water to be mingled with a glass of toddy without regard to the strength of the "rotgut" or the coating of the "toper's" stomach who is to swallow it, as to settle arbitrarily upon one fixed quantity of seed for an oat crop.

With us, oats are usually sown by hand. Machine-sowing, however, has been practiced to some extent during the last ten years, and for various reasons is the preferable way. The work is more quickly accomplished, and the quantity scattered can be more accurately gauged during the progress of it. If the usual area is not large, say not over eight or ten acres, a little hand-sower, costing five or six dollars, is all the machine required, and a man of ordinary capacity can learn its use in ten minutes. If, however, the areas are extensive, and particularly if it be desirable to sow phosphates as well, a larger machine operated by horse-power becomes necessary.

XI.

ACCIDENTS TO THE OAT CROP.

There are three serious accidents to which the oat crop is peculiarly liable, viz., drought, rust, and lodging. Fortunately, however, it is rarely subjected to all three of these in a single season. If it be pinched with drought, it will not fall down, and rust seldom deems it an object to strike a light crop. But whether these come singly or by twos or threes, their presence is objectionable, and should be avoided if possible.

1. *Drought*. — The best remedy I know of for drought is early sowing, a favorable soil, a deep seed bed of fine tilth, manured as highly as the crop will bear, and no higher. These conditions will secure all the moisture the rains, dews, and fogs afford. The crop will be well advanced early in the season so as to shield the ground and prevent rapid evaporation, while its early maturity will abridge the period of its exposure to the dry spells to which the summer may be subjected.

2. *Rust*. — I do not know that we can do very much to prevent rust. The use of the very best and most healthy seed may aid somewhat in this direction. In fact, anything favoring a vigorous and rapid growth is a protection. In the vegetable as in the human family, the individuals of most abundant vitality and strength stand all exposures best. Early maturing oats are, as a general thing, most likely to escape this pest of the oat field, and such varieties should be carefully selected.

3. *Lodging*. — The means just suggested will be found in some degree efficient for the prevention of the lodging of an oat crop. The pretty frequent change of seed with a view to raising the greatest weight of grain upon the least amount of straw may also aid somewhat in the effort to keep the straw upright until it is ready to cut. So, also, will particular care as to the sufficient and least sufficient fertilization of the field. Too heavy manuring, resulting in heavy straw, will be quite sure, by the aid of some shower attended by wind, to lay the crop as flat as the lily-pads of a muck-pond, thereby preventing the full development of the heads and seriously diminishing the promised yield.* If one would secure a maximum crop of oats he must give himself to a meeting of the requirements of that one crop, and not treat it as part of a rotation, or sacrifice its particular wants to those of others coming before or after it.

XII.

CUTTING AND CURING.

The methods of curing oats will vary with the character of the ground and crop. If the area be large, tolerably level, and smooth, an oat crop may be most economically cut by a horse-power reaper and binder. If the reverse is the case, we must depend upon the sickle, the cradle, or the scythe. The high price of labor has rendered obsolete the first of these. The difficulty of finding men knowing how to use it is displacing the second, and in many sections the mowing of this crop has already become the general practice. This requires no skilled labor, and the crop may be removed from the field in a short time after it is cut — an important consideration if the land is to be seeded to grass the same season. The straw, of course, will be left in a tangled condition, but this is an objection of little weight with persons who have their oats thrashed by a machine. In that event all straw is left in uniform condition after thrashing, whatever this may have been before it was cut.

The time of cutting will vary, of course, according to the pur-

* It is the practice of some farmers to sow a small quantity of rye with their oats. The stiffer stalks of the former are supposed to give additional support to those of the latter, while a slight admixture of the smaller cereal rather increases than diminishes the value of the crop.

pose for which the crop has been raised. If designed for forage simply, it should be cut while in the milk, and dried like hay before it is housed. If grain be the main object sought, it should stand until the straw is nearly dry, particularly if it is to be housed soon after cutting. If it is to be bound in sheaves and stooked, it may be cut while the piece is partially green, as the grain and straw will both ripen in the shock. The scattering of loose seeds over the ground, incident to the mowing process, will also be largely avoided by early harvesting.

I have generally found that when land is sown to grass immediately after the removal of a mowed oat crop, a new growth springs up and covers the tender grass plants. This, if thick, had best be removed before the frost prostrates it, lest it smother them.

The binding and stooking of oats can be neatly and well done, or done very poorly. If the sheaves be large and the stooks built solid, the oats will dry imperfectly and slowly. In this case, if the ground has been previously sown down to grass, this will be killed upon the spots occupied by the stooks. The sheaves, therefore, should be small, neatly bound, and so arranged as to allow a free circulation of air around them. Care in this regard will abridge the period of drying, the stooks will touch but a portion of the ground they cover, and the limited spots of grass killed or retarded in growth will be restored by or before the next season by the advances of the surrounding plants.

Stooks of various styles are common. The sheaves may be set up a short distance apart and in a circle, all sloping toward a common center, and neatly capped (Fig. 4).

Fig. 4.

Sometimes, when the oats are nearly dry enough for the barn, and the weather seems permanently fair, the bundles may be left

Fig. 5.

unprotected (Fig. 5), or be set up a few together without any cap, covered sometimes, perhaps, by a single sheaf laid horizontally upon the top of them (Figs. 6 and 7).

Fig. 6.

The more common way, however, and probably the better one, all things considered, is to allow four bundles standing six inches

apart in a line to slant against four others similarly placed at an inclination of some seventy-five or eighty degrees. After placing

Fig. 7.

a single sheaf at each end of this collection, the whole may be covered with a neat cap formed of two inverted sheaves firmly bound together (Fig. 8). The ways of making sheaves are various,

Fig. 8.

and the best are those which most perfectly secure the protection and speedy drying of the grain.

XIII.

IS THERE ANY PROFIT IN RAISING OATS?

This question can generally be answered in the affirmative by the New Hampshire farmer. The amount of profit must depend, of course, upon the amount of his skill and energy, and upon the character of his ground and his climate. Almost anywhere in this state he can raise his oats at a less price than he can buy them.

In the central part of the state, where labor is high, the expense and return of an acre of oats on favorable ground are about as follows, viz. : —

Expense.

Breaking up one acre of sod ground . . .	\$3.00	
2½ cords of stable-manure	15.00	
Harrowing ground and applying manure . . .	5.00	
3½ bushels of seed, sowing, and rolling . . .	2.40	
Cutting and housing	3.50	
Thrashing 50 bushels at 8 cts.	4.00	
	<hr/>	\$32.90

Return.

50 bushels grain at 45 cts.	\$22.50	
1½ tons straw at \$10.00 per ton	15.00	
Unexpended manure left in soil unknown . . .		
	<hr/>	\$37.50
Profit		\$4.60

If it be urged that this is a small profit, it may be said in reply that on land worth fifty dollars an acre, this is a return of nine and one fifth per cent. This surely ought to pay a satisfactory interest and all reasonable taxes. The land is as safe an investment as United States consols, and the crop pays far better. Besides, by smart farming and favorable conditions, this return may be a good deal increased, while the expense of it may be somewhat diminished.

XIV.

OAT MEAL.

That conceited, intolerant, altogether disagreeable, learned, and glorious old fellow, Dr. Samuel Johnson, who lived in London and made the best dictionary of the English language ever made, up to his time ; and who was as little partial to a Scotchman as he was to a clean shirt, defined oats as a “ grain which in England is generally fed to horses, but in Scotland supports the people.” “ Yes,” retorted the canny Scotch Lord Elibank, “ and where else will you see such horses and such men ?” This badinage occurred a hundred years ago, and oat meal has now become an important article of food for “ the people ” of England and America as well as of Scotland ; and, to one who likes it, none can be more palatable, and certainly none can be more healthy.

We formerly got our oat meal from abroad, where the process of manufacture consisted —

1. Of kiln-drying the oats, that the shells of the kernels might the more readily be removed.

2. Of passing them through a mill where stones had been set sufficiently far apart to remove these shells from the meats within them by a kind of rolling process.

3. Of a sifting operation whereby the hulls and meats were separated from one another. This done, the latter were ground a second time, or not, according to the fineness of the meal desired, the coarser product being intended for porridge or “ parritch,” as the Scotch call it, and the finer for cakes.

But we are now making as good oat meal in the United States as is made in any part of Europe, and our processes of manufacture are not inferior to any in use abroad. Instead of restricting themselves to two, our American millers turn out at least three or four different kinds of meal, varying in fineness from the unbroken meats of the oat kernels down through successive grades to that of flour.

The three specimens I here submit to your examination (Figs. 9, 10, and 11) were found on sale at two of the Concord groceries, and more, doubtless, could have been collected had the

effort been made. But these suffice to illustrate what I have said, and persons wishing further information upon the subject can easily procure it. The specimen marked 9 is called "Pearled Oats," and is the coarsest variety manufactured, consisting simply of the unbroken seed with the hull removed. Those marked 10 and 11 are varieties in most common use.

Fig. 9.

Fig. 10.

Fig. 11.

The best oats yield about one half of their weight of meal, and from the meal standpoint are the most profitable for the farmer to raise. Very likely from every other the same may also be true.

The use of oat meal as an article of human food has largely increased during the last fifteen years. Hardly a grocer in our larger towns does not find it for his interest to keep a good supply of it in variety for his customers. As in Dr. Johnson's day, oats is still "a grain in England usually fed to horses," but is no longer restricted to these outside of Scotland. And, indeed, we can but believe that were the old fellow now living, he would

daily fill himself as full of oat-meal porridge, and with as much gusto, as he was wont to do with tea, when he had an opportunity, from Mrs. Thrale's teapot.

XV.

COMPARISON OF CEREALS IN THE UNITED STATES.

The whole number of our principal American cereals is but six, viz.: Barley, buckwheat, corn, oats, rye, and wheat. Rice is an important cereal, but its production is confined to but thirteen states. The relative importance of these, based upon acreage and production, is shown by the following table taken from the United States Census Report of 1880 : —

TABLE.

GRAINS.	Acres.	Bushels.
Barley	1,997,727	43,997,495
Buckwheat	848,389	11,817,327
Corn	62,368,504	1,754,591,676
Oats	16,144,593	407,858,999
Rye	1,842,233	19,831,595
Wheat	35,430,333	459,483,137

It appears from this that in point of acreage Indian corn ranks first, occupying nearly twice the area of wheat, and nearly four times that of oats. If looked at from the standpoint of production, the same order prevails, the corn yield being almost four times that of wheat and more than four times that of oats.

It is difficult to realize the significance of the figures in the above table. If, however, we apply to them some large unit of measurement it may aid us in that effort. The area of the oat crop is 16,144,593 acres. Were the thousands of fields aggregating this amount gathered in one and laid down upon New England, it would cover all of New Hampshire, all of Vermont, all of Connecticut, all of Rhode Island, and lap over nearly a million (920,180) of acres on Massachusetts. A very respectable field certainly as regards size. If the four hundred and eight

millions of bushels, equal to 497,587,978 cubic feet, which constituted the oat crop of 1879, were collected in one rectangular pile upon an area equal to that covered by the national capitol at Washington, it would rise to a height of more than three thousand feet, or six times that of the Washington monument.

XVI.

COMPARISON OF CEREALS IN NEW HAMPSHIRE.

The relative importance of oats among the cereals in New Hampshire is seen by a glance at the following : —

TABLE.

GRAINS.	Acres.	Bushels.	Value.
Barley	3,461	77,877	\$ 70,089
Buckwheat	4,535	94,090	47,055
Indian Corn	36,612	1,350,248	1,147,710
Oats	29,485	1,017,620	457,929
Rye	3,212	34,638	54,513
Wheat	11,248	169,316	169,316
	88,559	2,743,789	\$1,946,602

Of a total acreage of 88,559 acres devoted to cereals, 29,485, or thirty-four per cent of the whole, are given to oats. Of a total yield of 2,743,789 bushels of cereals, 1,017,620, or thirty-seven per cent, were of oats. Of a total value of \$1,946,602, the sum of \$457,929 attaches to the oat crop.

As regards acreage, production, and value of crop, oats in this state stands second to corn only, a fact which suggests the climatic adaptiveness of all parts of New Hampshire to the requirements of this grain. While even corn, our leading cereal, flourishes but indifferently in some sections, oats is at home in all. In the valleys and along the streams; upon the dividing ridges and tablelands; at the level of the sea and three thousand feet above it; everywhere, indeed, where useful vegetation is possible, from Indian stream to Massachusetts's line, oats are a reliable crop. And

for it there is a constant demand, which the farmers of the state but partially meet. Hundreds and hundreds of car-loads of oats come in from abroad to supplement our own deficiencies.

That the farmers of New Hampshire can supply these, without outside aid, there can be no reason to doubt. Our present average yield is but thirty-four and a half bushels per acre. Most of the varieties cultivated are of light-weights. Our oat acreage is less than three per cent of our arable area. The bestowal of increased thought and energy upon this crop, a considerable increase of its acreage and a wise care in the selection of seed, accompanied by an enterprising purpose to double it, would easily lead to the attainment of this end.

XVII.

AGRICULTURAL PROGRESS IN NEW HAMPSHIRE.

But not only as respects the oat crop ought we, as New Hampshire farmers, to make advances, but along the line of all the cereals as well ; indeed, of all the agricultural products with which we have to do ; of the root crops and grass crops, of the returns of our flocks and herds and dairies.

I have never despaired of the future of our New Hampshire agriculture. I have seen the populations of many of our farming towns diminishing year after year. I have seen farm after farm given up first to pasturage and afterward to forest. I have seen the product of many, still worked, growing less year by year, yet I have ever been confident of our future.

In the development of this great nation thousands of our best and ablest men and women have been called to other states to assist in laying there the same foundations their forefathers had helped to lay here. We have missed them, and their absence has been felt severely. Still, our dear old commonwealth has yet left to her sons and daughters just as good ; brains as active, eyes as keen, arms as strong, hearts as noble and heroic. To despair of our agriculture under the shadow of these fleeting clouds is to yield to a fear unworthy of our lineage, and to confess to a blindness as to what is transpiring all about us, of which we should all be ashamed. For the temporary dullness in the move-

ments of the great interest to which we are devoted is but the pause which always precedes transition, the preparation for a new departure, the taking of breath for a rise to a higher plane of life and enterprise.

During my agricultural life I have seen the mowing-machine and reaper appear for the first time in our fields to displace the scythe and cradle ; the wheel horse-rake, to substitute for tedious toil a pleasant recreation ; the hoe and clumsy spike-tooth harrow, slow in their imperfect work, yield to soil-pulverizers which do better work in half the time. I have had the pleasure to welcome the advent of the tedder, the manure-spreader and the seed-sower, which have changed the tedium of coarse labor to pleasant occupation. And just now we are all rejoicing at the coming of the sulky plow, upon which the farmer rides forth alone in the morning, and, after a short day's work, returns but little fatigued, leaving behind him in his field two acres of inverted sod as the result of his nine or ten hours' work. By the aid of this one implement he has broken up twenty-five per cent more ground in a day than he formerly did, and at one third of the expense. Surely, if any one has reason to bless the inventive genius which has done so much to increase the efficiency of the machinery employed in his occupation, it is the farmer.

But we must not forget that there is a moral progress, of far more value than any of a physical nature, which directs the latter and stimulates its activity. Our New England character has doubtless been a most important power in moulding for good the successive longitudinal belts of new states which from one decade to another have come into being upon our western frontier. Yet, the strength of this has been moral mainly, based upon intelligence, correct ideas of religious liberty and restraint ; clear convictions of right and wrong and of the personal obligations due from the individual to his Creator, to his neighbor, and to the state.

The strength of the state and the prosperity of its industries rest clearly upon the character of its citizens. It was their moral, and not their physical, power which enabled that little band of conscientious, liberty-loving men and women up in the valleys of the Waldensian Alps to defy for ages the assaults of the papal

power, until a united Italy called them down to the plains to establish everywhere, from the head-waters of the Po to the Strait of Messina, the great principles which they had preserved in purity to the appointed time.

Let us remember that we are not farmers only, but citizens as well, and a part of the state. The time is fast passing and, it is to be hoped, forever, when a tyrannical ruler can boast, "The state, it is I." The time is already here when its free-born citizens can say, "We are the state!" Let us read again, and thoughtfully, the words of Sir William Jones:—

"What constitutes a state?
 Not high raised battlements or labored mound,
 Thick wall or moated gate;
 Not cities proud with spires and turrets crowned;
 Not bays and broad armed ports,
 Where, laughing at the storm, rich navies ride;
 Not starred and spangled courts,
 Where low-browed baseness wafts perfume to pride.
 No! men, high-minded men,
 With powers as far above dull brutes endued,
 In forest, brake, or den,
 As beasts excel cold rocks and brambles rude;
 Men who their duties know,
 But know their rights, and knowing dare maintain."