

EXPERIMENT STATION
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FARM DEPARTMENT.

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EXPERIMENTS WITH OATS.

The experiments hereinafter detailed cover the two years 1894 and 1895. Neither season was favorable to the oat crop but of the two, 1894 was the best, i. e., it produced somewhat better yields than 1895. The '94 crop had to be re-seeded, owing to the killing frost which occurred between the 20th and 26th of March and which destroyed from 75 to 85 per cent of the plants. The first seeding took place during the first and second week of March, the re-seeding a month later. This made the crop somewhat late and it failed to develop as it would have done under more favorable conditions.

In 1895 the seeding was done in the latter part of March. The crop did not meet with reverses from cold weather, but the rainfall in the growing season of the oats was comparatively light, and it did not suffice for the growth of a normal crop.

As has been our practice heretofore each series of experiments is repeated on five plats these plats being distributed among those with which they are to be compared the purpose being to so locate them that the five plats in each series shall, as far as possible, represent the average of the quality of the soil on which the several series are grown, and thus equalize any inequality in

the fertility which might not be apparent by inspection. These plats are one-twentieth of an acre in extent, accurately laid out with compass and chain.

The 1895 crop began to suffer from the dry weather about the middle of May. It had been dry during the preceding three or four weeks but it was not until about May 15th that the crop really suffered for rain and from that time to the end of the month it suffered so severely that it never recovered. The ground became hard and cracked open and on the 27th and 28th of May hot winds prevailed and nearly killed the crop. On the 30th a moderate rain fell which saved the oat crop in this region from utter failure. During June the rains were more seasonable but the yields were only from one-third to one-half of what they would have been under favorable conditions. The following experiments were carried out:

- I. Oats on land fall-plowed, spring-plowed and not plowed.
- II. Time of seeding oats.
- III. Treating oats with hot water for smut.
- IV. Effects of quality of seed.
- V. Methods of seeding oats.
- VI. Seeding different amounts to the acre.
- VII. Time of harvesting oats.
- VIII. Variety test.

In the following only the average of the five plats in each series is shown, and when an experiment has been continued for several years the average result for each year and the final average of all results in that experiment is given. In all cases unless otherwise stated the variety used was the Red Rust Proof.

I. OATS ON LAND FALL=PLOWED, SPRING=PLOWED AND NOT PLOWED.

Thirty-five plats were devoted to this experiment in each of the two years. They were divided into seven series each year as follows:

- Five plats were spring-plowed, seed drilled in.
- Five plats were fall-plowed, seed drilled in.
- Five plats were not plowed, seed drilled in.
- Five plats were not plowed, seed cultivated in.
- Five plats were not plowed, seed disced in.
- Five plats were not plowed but ground disced, seed drilled in.
- Five plats were not plowed, seed sown with a lister drill.

The land was in corn the year preceding the oat crop for both 1894 and 1895, the treatment of the soil in each case having been the same. In 1894, the experiment was in field No. 5, and in 1895 in the Williston field. The same experiment but less extensive was also carried out in '93 and published in bulletin 42. With some variations in treatment, this line of experiment has been under way since 1890.

TABLE I.
ON LAND FALL PLOWED, SPRING PLOWED AND NOT PLOWED.
AVERAGES OF FIVE PLATS FOR EACH TREATMENT FOR 1895.

Treatment of Ground and Method of Seeding.	Rate per Acre.	
	Grain bushels.	Straw tons.
Ground spring plowed, seed drilled in	15.48	.44
Ground fall plowed, seed drilled in	12.52	.34
Ground not plowed, seed drilled in	14.49	.47
Ground not plowed, seed cultivated in	12.93	.35
Ground not plowed, seed disced in	14.32	.40
Ground disced, seed drilled in	16.41	.50
Ground not plowed, seed listed in	13.97	.30

SUMMARY OF YEARLY AVERAGES.

Treatment of Ground and Method of Seeding.	Rate of Yield per Acre in Bushels.						
	Total Average	1895.	1894.	1893.	1892.	1891.	1890.
Ground spring plowed, seed drilled in.	31.48	15.48	24.81	36.75	20.53	57.81	33.50
Ground fall plowed, seed drilled in....	32.88	12.52	24.62	34.93	.....	59.47	.....
Ground not plowed, seed drilled in....	24.99	14.49	24.75	33.06	18.16	.....	34.52
Ground not plowed, seed cultivated in	27.81	12.93	24.31	33.31	14.06	52.72	29.55
Ground not plowed, seed disced in	20.03	14.32	25.68	.....	.....	.....	.....
Ground disced, seed drilled in	19.58	16.41	22.75	.....	.....	.....	.....
Ground not plowed, seed listed in ...	20.23	13.97	26.50	.....	.....	.....	.....

AVERAGES FOR THREE YEARS.

Treatment of Ground and Method of Seeding.	Rate of Yield per Acre in Bushels.			
	3 Years Average	1895.	1894.	1893.
Ground spring plowed, seed drilled in.....	25.68	15.48	24.81	36.75
Ground fall plowed, seed drilled in.....	24.62	12.52	24.62	34.93
Ground not plowed, seed drilled in	24.10	14.49	24.75	33.06
Ground not plowed, seed cultivated in.....	23.51	12.93	24.31	33.31

Table I gives, first, the rate of yield per acre of grain and straw for 1895, second, a summary of yearly averages of all the years this line of experiment has been under way, and thirdly, the averages for the three years '93, '94 and '95. This last average is rather more reliable than the one containing

the averages for six years. It will be noted that in '90 and '92 the fall plowed plats were abandoned, leaving blanks for those years, and in '91 the ground "not plowed, seed drilled in," was in like manner abandoned. This is a disturbing element in the averages. It will be seen that in '91 the yields are larger than for any of the other years, while in '92 they are comparatively light. This has the effect of increasing the total average unduly in the series including the '91 crop where the ground is fall plowed and the seed drilled in and in like manner of depressing the total average for the series of ground not plowed seed drilled in. Where this year is omitted, since the value of this experiment is only apparent when the averages are compared together, the averages convey an erroneous Idea unless all the years are represented. In the averages for the three years '93, '94 and '95, no series has been omitted in any year, and the comparison of the four methods of preparing the land covered by those years is, therefore fairly indicative of their respective merits. The spring plowed land on which the seed is drilled in, in nearly every instance, gave the best results. The drill used in these experiments is the Richmond Champion Shoe Drill with press wheels.

II. TIME OF SEEDING.

Table II shows the results of an experiment in seeding oats at different dates, from March 1st, to April 26th, at intervals of one week. The table for 1895 also shows the date of heading, date of ripening, the height of the straw in feet and the length of the head in inches. Second, the table shows the summary of the yearly averages for three years.

TABLE II.
TIME OF SEEDING.
AVERAGE OF FIVE PLATS FOR EACH TREATMENT.

Date Seeded.	Date of heading.	Date when ripe.	Height of Stalk, feet.	Length of Head, inches.	Rate per Acre.		Per cent of Light Seed
					Grain bushels	Straw tons.	
March 1	May 29	June 26,	1.21	3.83	10.62	.32	10.00
" 8	June 1.....	" 30.....	1.30	3.67	10.49	.31	10.71
" 15.....	" 1.....	" 30.....	1.19	3.95	8.81	.38	9.22
" 22.....	" 3.....	July 4.....	1.23	3.90	9.43	.27	5.95
" 29.....	" 13.....	" 6.....	1.32	3.97	10.49	.28	5.35
April 5.....	" 15.....	" 6.....	1.37	3.92	11.75	.36	5.37
" 12.....	" 18.....	" 9.....	1.39	3.86	8.57	.53	7.50
" 19.....	" 21.....	" 10.....	1.30	3.66	5.53	.44	6.82
" 26.....	" 25.....	" 14.....	1.11	3.10	3.42	.39	9.26

The last column, headed per cent of light seed, shows the per cent of light seed obtained by running through a fanning mill turned at a uniform speed.

SUMMARY OF YEARLY AVERAGES.

Date of Seeding.	Rate of Yield per Acre in Bushels.			
	Average.	1895.	1894.	1893.
Seeded March 1.....		10.62		
“ “ 8.....	23.74	10.49		37.00
“ “ 15.....	22.62	8.81	22.56	36.50
“ “ 22.....	19.66	9.43	18.06	31.50
“ “ 29.....	20.41	10.49	21.37	29.37
“ April 5.....	17.14	11.75	15.68	24.00
“ “ 12.....	15.48	8.57	15.38	22.50
“ “ 19.....	13.26	5.53	17.02	17.25
“ “ 26.....	9.64	3.42	14.21	11.31
“ May 3.....	8.26		11.66	4.87

In 1894 this experiment was located in field No. 4 on fall plowed land. The seedings of March 1st and March 8th were killed by the frost, and the plats were re-seeded on April 26th and May 3d respectively. The later March seedings were not up when the freeze came and therefore not injured. In 1895 the experiment was in the Williston field also on fall plowed land. It will be noticed that the late seeding invariably gives the poorest yields, while the seedings in March show the best averages. In 1895 the seeding made April 5th was a little better than seedings made earlier but later seedings fall off rapidly in yield. Aside from the evidence furnished by the experiment, it is a matter of common observation that oats sown as early in the spring as the land can be worked to advantage usually give the best crop. Should the weather be hot and dry during the growing season, late seedings are stunted so badly that they never yield much.

III. TREATING OATS WITH HOT WATER FOR SMUT.

We have record for five years on this experiment. The College oat crop having had the smut killed by this method for several years, the oats were not smutty enough to be of use in the experiment, and we have of late years obtained seed from neighboring farmers who did not practise this method of killing the smut, in order to show the efficacy of the treatment. The following table gives the yield for '95 and the yearly average for five years.

TABLE III.
TREATING OATS WITH HOT WATER FOR SMUT.
AVERAGES OF FIVE PLATS FOR EACH TREATMENT.

Treatment of Seed.	Per cent of Smut Heads	Rate per Acre.	
		Grain bushels	Straw tons.
Treated.....	0.0	12.65	.41
Not treated.....	6.08	13.45	.40

SUMMARY OF YEARLY AVERAGES FOR FIVE YEARS.

Treatment of Seed.	Rate of Yield per Acre in Bushels.					
	Average.	1895.	1894.	1893.	1892.	1891.
Treated.....	27.12	12.65	34.75	30.56	30.12	37.56
Not treated	25.16	13.45	33.18	29.24	20.28	29.69

The treatment of seed oats by this method has been described with much detail in bulletin 29, page 177, and in bulletin 42, page 185. It is, therefore, not deemed necessary to repeat it here further than to say that the seed oats are immersed in hot water at a temperature of 133° Fahrenheit from five to ten minutes, when they are taken out, cooled off by dipping in cold water and then drying sufficiently to admit of seeding. From the results in '95 it appears that the seed was soaked too long. The smut was completely killed but the treated seed was injured and did not germinate quite as well as the untreated. In former years the treatment appeared to give evidence that the yield would be increased by the soaking, wholly aside from the elimination of smut. The average for the five years show a gain of two bushels to the acre in favor of the treatment.

IV. EFFECTS OF QUALITY OF SEED.

This experiment has now been under way for six years. The seed is graded into three qualities. The term "common" is here employed to designate seed oats as they come from the thresher without further cleaning. The "light" and "heavy" grades are obtained by running the "common" grade through a fanning mill.

TABLE IV
 EFFECTS OF QUALITY OF SEED.
 AVERAGE OF FIVE PLATS FOR EACH TREATMENT.

Grade of Seed.	Rate per Acre.		Per cent of Light Seed...
	Grain bushels.	Straw tons.	
Light.....	24.37	.68	7.83
Common.....	26.82	.72	5.91
Heavy	25.48	.76	*3.12

* Average of two plats.

SUMMARY OF AVERAGES FOR SIX YEARS.

Grade of Seed.	Rate of Yield per Acre in Bushels.						
	Total Average.	1895.	1894.	1893.	1892.	1891.	1890.
Light....	28.48	24.37	18.31	34.12	21.87	50.63	21.62
Common....	29.85	26.82	18.06	41.37	23.59	45.27	24.03
Heavy.....	30.76	25.48	17.50	38.75	26.40	46.44	29.93

Table IV shows first the average results in '95 of these three grades, and secondly the summary of averages for six years. The per cent of light seed as obtained from '95 seems to indicate that the light grade produced a larger per cent of light seed than the other grades. The averages for the six years show that the heavy seed has given the best yields during that period. In '91 the light seed averaged the best yield and in '93 and '95 the common seed averaged the best, but in spite of this the result is, nevertheless, in favor of the heavy seed.

V. METHODS OF SEEDING OATS.

This line of experiments has now been carried on for five years and the averages for each of these years and the general average for the five years are given in table V.

TABLE V.
METHODS OF SEEDING OATS.
SUMMARY OF AVERAGES FOR FIVE YEARS.

Method of Seeding.	Rate of Yield per Acre in Bushels.					
	Average.	1895.	1894.	1893.	1892.	1891.
Broadcast.....	26.18	7.93	26.37	28.18	24.87	43.56
Hoe drill.....	27.51	7.50	26.18	28.88	29.00	45.99
Shoe drill with press wheels....	30.31	11.08	22.43	31.25	35.06	51.73
Shoe drill without press wheels....	28.72	9.03	25.12	32.81	26.00	50.64

The results are given for four methods of seeding, namely: Broadcast, seeded with a hoe drill, with a shoe drill with press wheels, and shoe drill without press wheels. The general average is decidedly in favor of the shoe drill with press wheels. The shoe drill without press wheels comes next, then the hoe drill, and the broadcast last in the order of merit. It will also be noticed that this order is maintained for most of the years under review.

VI. SEEDING DIFFERENT AMOUNTS TO THE ACRE.

This experiment was located in field No. 4 in 1894 and the plats were re-seeded April 4th after having been killed by the frost the latter part of March. The land was fall-plowed and as in other cases the seeding was done with a press shoe drill. In 1895 the experiment was located in the Williston field and seeded March 27th. The manner of treatment for the two years was the same in all particulars. We have averages now for five years of this experiment. These are given in table VI. The rate of seeding begins with one bushel to the acre and increases by half a bushel to four bushels to the acre.

TABLE VI.
SEEDING DIFFERENT AMOUNTS TO THE ACRE.
SUMMARY OF AVERAGES FOR FIVE YEARS.

Rate of Seeding per Acre.	Rate of Yield per Acre in Bushels.					
	Average.	1895.	1894.	1893.	1892.	1891.
1.0 bushels.....	23.64	13.59	22.31	30.31	20.78	31.25
1.5 ".....	26.48	15.17	23.35	30.93	28.79	34.19
2.0 ".....	27.41	12.85	18.12	30.75	32.08	43.26
2.5 ".....	29.51	13.18	23.98	30.93	34.36	45.12
3.0 ".....	28.03	10.79	20.54	32.25	31.76	44.84
3.5 ".....	27.79	8.61	19.50	31.12	34.26	45.50
4.0 ".....	30.90	7.77	19.60	33.25	47.63	46.25

It will be noticed that in the years '91 to '93 inclusive the heaviest seeding gave the best yields. In '94 and '95, for some reason not readily explained, this appears to be reversed, four bushels of seed per acre producing lighter yields than one and a half to two and a half bushels. The general average, however, is in favor of thick seeding.

VII. TIME OF HARVESTING OATS.

In 1894 an experiment was tried of cutting oats at different times in order to ascertain the loss in yield by cutting before the grain is mature. The oats were cut in three stages: in the dough, in the hard dough and when fully ripe. The average result of five plats of each of these stages of cutting is as follows, in bushels per acre and tons of straw.

	Grain bushels.	Straw tons.
Cut in the dough	17.85	.75
Cut in the hard dough.....	21.08	.92
Cut when ripe.....	26.37	.62

It was found impossible to cut these plats when all the heads were in the dough and hard dough stage respectively. The first cutting took place June 29th; some heads were then in hard dough and others in the milk. The straw and leaves were still green. The second cutting took place July 3rd. Some of the heads were ripe but the majority were in the hard dough and some were still in the soft dough. Most of the straw was still green. The last cutting did not take place until the grain was dead ripe and the straw had all turned yellow. The results show that there is a great loss in the weight of grain by early cutting.

VIII. TEST OF VARIETIES.

The following table of thirty-nine varieties arranged according to the average yield for each year and the average of all the years they have been grown, is of interest in that it shows that there are a few varieties which are persistently near the top. It should be explained that these varieties have not been grown on so many plats as the other experiments for the lack of suitable soil, but the varieties have each year been grown side by side in long narrow strips, the width of the grain drill, and have during the same year received exactly the same treatment as to preparation of soil, time of seeding, etc. They have been harvested when fully ripe. As some ripened earlier than others, the harvesting of each has been done when it was ripe, though this may sometimes require the harvesting of an early variety two weeks or more before the late ones mature. The yield of those varieties which were grown only in '94 and '95, both of which were poor oat years, does probably not give them as high a standing as they would have had, had they been grown for a longer period in more favorable years. Thus Mammoth Cluster ranks fourth

SUMMARY OF RESULTS.

1. The results of experiments with fall plowing, spring plowing and not plowing land are that the averages for the same years show a gain in favor of spring plowing. It is a question, however, if this gain is sufficient compensation to pay for plowing the ground.

2. March seeding has given a better yield than later seedings.

3. Averages for five years show an increase of two bushels per acre in favor of treating oats with hot water for smut. It is evident that the more smut in the seed oats the more marked will be the effect of the treatment.

4. By separating oats as they come from the thresher into two grades, light and heavy, by means of a fanning mill, the averages for five years show a yield of two bushels per acre in favor of the heavy grade over the light, and one bushel in favor of the heavy grade over oats not fanned.

5. As to the methods of seeding, the averages for five years are in favor of the shoe drill with press wheels; second, the shoe drill without press wheels; third, the hoe drill; fourth, broadcast.

6. Experiments with different quantities of seed, varying from one to four bushels per acre, indicate from five years averages that two and a half bushels per acre are better than a less quantity, and in some years the heaviest yields were obtained from four bushels of seed to the acre.

7. An experiment in '94 showed a loss of 32.30 per cent in weight of the grain by cutting the oats when in the dough and a loss of 20.06 per cent in weight of grain by cutting the oats in the hard dough as compared to cutting when fully ripe.

8. As to a comparison of varieties an average of five years places the following six varieties at the head of the list in the order named; Northwestern White, Belgian, Pedigree Red Rust Proof, Board of Trade, Golden Sheaf and Brown Winter.