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FARM DEPARTMENT.

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EXPERIMENTS WITH OATS.

The present bulletin details results of experiments for the season of 1896.

It is pertinent to note first the conditions under which the crop was grown. With the exception of the experiment in the time of seeding oats, all the experiments were located in the Williston field. This field is rented from an adjoining farm. It has been cropped for many years without manure, and the land is naturally thin. The nature of the soil did not, therefore, promise a heavy crop. The land was in corn in 1895. The season of 1896 opened reasonably early and all the experiment plats were seeded in the latter part of March. The frosts which occurred in the middle of April did not harm the oats. The fall of 1895 and the winter following were dry, and the ground was, therefore, quite dry when the oats were seeded, but the rainfall in April and May was sufficient for the growth of the crop. The prospects were favorable for a good yield till the beginning of June, when rust appeared. From the 10th of June till the crop matured, hot weather and light showers favored the development of the rust to an extraordinary degree. By June 20 nearly every oat plant was covered with rust from top to bottom; even the glumes were affected. The result of this condition was

that the plants were weakened, the seed failed to develop; the yield, therefore, was very small, and the quality inferior.

These conditions prevailed over nearly the entire state. The writer has yet to learn of a farmer in Kansas who was satisfied with the yield and quality of his oats the past season. Such conditions, of course, vitiated the experiments, although for purposes of comparison of methods of treatment, these adverse influences did not destroy results, since they affected all plats and all experiments alike. The following are the lines of experiment:

- I. Oats on Land Fall Plowed, Spring Plowed, and not Plowed.
- II. Time of Seeding Oats.
- III. Effects of Quality of Seed.
- IV. Methods of Seeding.
- V. Different Amounts of Seed to the Acre.
- VI. Test to Ascertain the Effect of Changing Soils on the per cent. of Smut in Oats.
- VII. Comparison of Oats and Barley.
- VII. Test of Varieties of Oats.

Several of these lines of experiment have been tried for some years. It is only by an accumulation of data by repeated trials that we can arrive at reliable conclusions.

The size and number of the plats and their arrangement are in accordance with the plan which has been followed for several years; that is, unless otherwise specified, the plats are one-twentieth of an acre in extent, and there are five in each series of experiments, so distributed as to balance as far as possible any inequality in the soil.

The methods of procedure were the same as in former years, and no pains have been spared to have the work done accurately at every step, from the preparation of the ground to the weighing of the yield of each plat.

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

This experiment comprises seven series of five plats each, making a total of 35 plats. The series are as follows:

- A. Spring plowed, seed drilled.
- B. Fall plowed, seed drilled.
- C. Not plowed, seed drilled.
- D. Not plowed, seed covered with cultivator.
- E. Not plowed, seed covered with a disc harrow.
- F. Not plowed, ground disced, seed drilled.
- G. Not plowed, seed planted with lister drill.

The fall-plowed plats were plowed December 16, 1895. The spring-plowed plats were plowed March 16, 1896. These two series were harrowed March 16, immediately after the spring plowing. The other plats remained untouched until they were seeded. All plats were seeded March 21 with Red Georgia oats at the rate of three bushels per acre. Series A, B and C were drilled with a shoe press drill; series D was broadcasted and the seed covered with a cultivator; series E was broadcasted and the seed covered with a disc harrow; series F was seeded with a press drill but the ground was first prepared with a disc harrow; series G was seeded with a Hollinger lister drill, which has been described in previous bulletins.

On April 3 it was noticed that the drilled plats, series A, B, C, and F, were up uniformly, showing a good stand, while the other plats were irregular and slow in coming up. On April 22 it was noted that all the plats had made a satisfactory growth but that the stand was patchy on series D and E, a characteristic which distinguished these plats all through the season. On June 29 all plats had headed. Owing to the poor soil, the growth was short at that date, but seasonable weather favored the growth immediately after, and by June 8 there was an excellent prospect for a fine crop. About this time the rust began to appear, and increased daily until the crop matured. On June 27 the crop on all plats was dry and dead. Table I shows the yield of each plat, the rate of yield per acre, the average yield of each series, and also a summary of yearly averages. Taking the averages for the four years, 1893 to 1896, both inclusive, it will be seen that the spring plowing has yielded about two bushels more, than either fall plowing or no plowing; further, that the latter treatments show no difference; and, lastly, that seed cultivated in shows a yield of a bushel and a half less than fall plowing or drilling on land not plowed. It would appear from this that there is nothing gained by plowing the land in the fall. During the three years, 1894, 1895, and 1896, in which we have tried listing, covering with a disc harrow, and preparing the ground with a disc and drilling the seed in, the yields have been light, and these methods, therefore, do not average as well as other methods which have been tried longer. Spring plowing has given good results with considerable uniformity.

Table I.

OATS ON LAND FALL PLOWED, SPRING PLOWED, AND NOT PLOWED. Plats, one-twentieth of an acre.

No. of plat.	Treatment of ground and method of seeding.	Yield of plat.		Rate per acre.	
		Grain, pounds.	Straw, pounds.	Grain, bushels.	Straw, tons.
46	Ground spring plowed, seed drilled in	35.5	99	22.18	.99
47	Ground fall plowed, seed drilled in	32.0	100	20.00	1.00
48	Ground not plowed, seed drilled in	32.0	93	20.00	.93
49	Ground not plowed, seed cultivated in	21.5	97	13.43	.97
50	Ground not plowed, seed disced in	25.5	114	15.93	1.14
51	Ground disced, seed drilled in	30.5	90	19.06	.90
52	Ground not plowed, seed listed in	26.5	89	16.56	.89
53	Ground spring plowed, seed drilled in	31.5	80	19.68	.80
54	Ground fall plowed, seed drilled in	23.0	47	14.37	.47
55	Ground not plowed, seed drilled in	32.5	67	20.31	.67
56	Ground not plowed, seed cultivated in	22.0	68	13.75	.68
57	Ground not plowed, seed disced in	20.0	66	12.50	.66
58	Ground disced, seed drilled in	21.0	75	13.12	.75
59	Ground not plowed, seed listed in	24.5	79	15.31	.79
60	Ground spring plowed, seed drilled in	33.0	91	20.62	.91
61	Ground fall plowed, seed drilled in	31.5	106	19.68	1.06
62	Ground not plowed, seed drilled in	28.0	80	17.50	.80
63	Ground not plowed, seed cultivated in	21.5	52	13.43	.52
64	Ground not plowed, seed disced in	22.5	55	14.06	.55
65	Ground disced, seed drilled in	26.5	49	16.56	.49
66	Ground not plowed, seed listed in	27.5	48	17.18	.48
67	Ground spring plowed, seed drilled in	27.5	60	17.18	.60
68	Ground fall plowed, seed drilled in	27.0	69	16.87	.69
69	Ground not plowed, seed drilled in	25.5	52	15.93	.52
70	Ground not plowed, seed cultivated in	22.5	83	14.06	.83
71	Ground not plowed, seed disced in	21.5	68	13.43	.68
72	Ground disced, seed drilled in	28.5	59	17.81	.59
73	Ground not plowed, seed listed in	26.0	66	16.25	.66
74	Ground spring plowed, seed drilled in	28.5	69	17.81	.69
75	Ground fall plowed, seed drilled in	24.0	51	15.00	.51
76	Ground not plowed, seed drilled in	25.5	59	15.93	.59
77	Ground not plowed, seed cultivated in	19.0	37	11.87	.37
78	Ground not plowed, seed disced in	22.0	36	13.75	.36
79	Ground disced, seed drilled in	33.5	66	20.93	.66
80	Ground not plowed, seed listed in	25.5	35	15.93	.35
Average..	Ground spring plowed, seed drilled in			19.49	.79
"	Ground fall plowed, seed drilled in			17.18	.74
"	Ground not plowed, seed drilled in			17.93	.70
"	Ground not plowed, seed cultivated in			13.30	.67
"	Ground not plowed, seed disced in			13.93	.67
"	Ground disced, seed drilled in			17.49	.67
"	Ground not plowed, seed listed in			16.24	.68

SUMMARY OF YEARLY AVERAGES.

Treatment of ground and method of seeding.	Rate of yield per acre, in bushels.							
	Total av.	1896.	1895.	1894.	1893.	1892.	1891.	1890.
Ground spring plowed, seed drilled in	29.77	19.49	15.48	24.81	36.75	20.56	57.81	33.50
Ground fall plowed, seed drilled in	29.74	17.18	12.52	24.62	34.93		59.47	
Ground not plowed, seed drilled in	23.81	17.93	14.49	24.75	33.06	18.16		34.52
Ground not plowed, seed cultivated in	25.74	13.30	12.93	24.31	33.31	14.06	52.72	29.55
Ground not plowed, seed disced in	17.97	13.93	14.32	25.68				
Ground disced, seed drilled in	18.88	17.49	16.41	22.75				
Ground not plowed, seed listed in	18.90	16.24	13.97	26.50				

AVERAGES FOR FOUR YEARS.

Treatment of ground and method of seeding.	Rate of yield per acre, in bushels.				
	Four years' av.	1896.	1895.	1894.	1893.
Ground spring plowed, seed drilled in	24.13	19.49	15.48	24.81	36.75
Ground fall plowed, seed drilled in	22.31	17.18	12.52	24.62	34.93
Ground not plowed, seed drilled in	22.55	17.93	14.49	24.75	33.06
Ground not plowed, seed cultivated in	20.96	13.30	12.93	24.31	33.31

Table II.
TIME OF SEEDING OATS. Plats, one-twentieth of an acre.

No. of plat.	Date of seeding.	Date of heading.	Date when ripe.	Yield of plat.		Rate per acre.	
				Grain, pounds.	Straw, pounds.	Grain, bushels.	Straw, tons.
1.....	Mar. 2	May 23	June 20	72.0	182	45.00	1.82
2.....	" 9	" 25	" 20	60.5	177	37.81	1.77
3.....	" 16	" 29	" 22	28.0	71	17.50	.71
4.....	" 23	June 2	" 24	33.5	130	20.93	1.30
5.....	" 30	" 6	" 26	13.5	103	8.43	1.03
6.....	Apr. 6	" 10	" 29	5.0	88	3.12	.88
7.....	" 13	" 16	July 2	1.0	105	.62	1.05
8.....	" 20				90		.90
9.....	" 27				112		1.12
10.....	Mar. 2	May 23	June 20	65.0	177	40.62	1.77
11.....	" 9	" 25	" 20	62.5	168	39.06	1.68
12.....	" 16	" 29	" 22	72.5	131	45.31	1.31
13.....	" 23	June 2	" 24	34.0	109	21.25	1.09
14.....	" 30	" 6	" 26	22.0	141	13.75	1.41
15.....	Apr. 6	" 10	" 29	4.0	126	2.50	1.26
16.....	" 13	" 15	July 2	5.5	102	3.43	1.02
17.....	" 20				62		.62
18.....	" 27				70		.70
19.....	Mar. 2	May 23	June 18	59.0	161	36.87	1.61
20.....	" 9	" 25	" 18	71.0	159	44.37	1.59
21.....	" 16	" 29	" 20	47.0	91	29.37	.91
22.....	" 23	June 2	" 23	37.5	134	23.43	1.34
23.....	" 30	" 6	" 26	22.5	125	14.06	1.25
24.....	Apr. 6	" 10	" 29	13.5	115	8.43	1.15
25.....	" 13	" 15	July 2	7.5	82	4.68	.82
26.....	" 20				64		.64
27.....	" 27				40		.40
28.....	Mar. 2	May 23	June 18	64.0	141	40.00	1.41
29.....	" 9	" 25	" 18	57.5	138	35.93	1.38
30.....	" 16	" 29	" 20	38.5	113	24.06	1.13
31.....	" 23	June 2	" 23	35.0	158	21.87	1.58
32.....	" 30	" 6	" 26	9.5	98	5.98	.98
33.....	Apr. 6	" 10	" 29	9.0	140	5.62	1.40
34.....	" 13	" 15	July 2	7.0	85	4.37	.85
35.....	" 20				90		.90
36.....	" 27				60		.60
37.....	Mar. 2	May 23	June 18	47.0	159	29.37	1.59
38.....	" 9	" 25	" 18	60.0	164	37.50	1.64
39.....	" 16	" 29	" 20	55.0	136	34.37	1.36
40.....	" 23	June 2	" 23	40.5	131	25.31	1.31
41.....	" 30	" 6	" 26	27.0	139	16.87	1.39
42.....	Apr. 6	" 10	" 29	11.0	103	6.87	1.03
43.....	" 13	" 15	July 2	6.0	62	3.75	.62
44.....	" 20				70		.70
45.....	" 27				45		.45
Average.....	Mar. 2	May 23	June 19	61.4	164	38.37	1.64
"	" 9	" 25	" 19	62.3	161	38.93	1.61
"	" 16	" 29	" 21	48.2	108	30.12	1.08
"	" 23	June 2	" 23	36.1	132	22.55	1.32
"	" 30	" 6	" 26	18.9	122	11.80	1.22
"	Apr. 6	" 10	" 29	8.5	114	5.30	1.14
"	" 13	" 15	July 2	5.4	87	3.37	.87
"	" 20				75		.75
"	" 27				65		.65

SUMMARY OF AVERAGES FOR FOUR YEARS.

Date of seeding.	Rate of yield per acre, in bushels.				
	Average.	1896.	1895.	1894.	1893.
March 1 (March 2 for 1896).....	24.49	38.37	10.62		
" 3.....	28.80	38.93	10.49		37.00
" 15 " 16 ".....	24.49	30.12	8.51	22.56	36.50
" 22 " 23 ".....	20.33	22.55	9.43	18.06	31.50
" 29 " 30 ".....	18.25	11.80	10.49	21.37	29.37
April 5 (April 6.....	14.18	5.30	11.75	15.68	24.00
" 12 " 13 ".....	12.45	3.37	8.57	15.38	22.50
" 19 " 20 ".....	13.26		5.53	17.02	17.25
" 26 " 27 ".....	9.64		3.42	14.21	11.31
May 3.....	8.26			11.66	4.87

II. TIME OF SEEDING OATS.

This experiment was located in field A, on better ground than the rented land. The ground was in ensilage corn in 1895, having previously been manured with a good coat of barn-yard manure. The experiment comprised 45 plats, in nine series, each series being seeded one week later than the preceding one, and the first seeding took place March 2. The plats were drilled with a shoe press drill, at the rate of three bushels seed per acre. The variety used was the Pedigree Red Rust Proof. Table II gives details as to date of seeding, date of heading, date of ripening, with the yield of each plat, and it also gives a summary of seedings on similar dates for four years.

As will be seen in the above table, there is nothing to record from the seedings of April 20 and 27. They were complete failures. The plats failed to produce any seed, and many of the plants did not even head. They were, therefore, cut for hay on July 7. It will be seen, also, that the first two seedings in March have invariably given the best yields, and that from these dates there is a decided falling off with each successive seeding till it is a complete failure in the latter part of April. Early seeding is the only safe practice.

III. EFFECTS OF QUALITY OF SEED.

This is an experiment that has been tested for seven successive years. The oats are divided into three grades: light, common, and heavy. The common grade is the oats as they come from the thrasher. This grade is run through a fanning-mill, which separates them into the two others, the light and heavy. Each grade was seeded on five plats. The results are shown in table III. For some reason, which the writer is unable to explain, there is much irregularity in the yields of the plats of the present year, and the average of the heavy grade falls below that of the common grade. Owing to these irregularities of the present year, the average for the seven years turns out very nearly the same for both common and heavy grades, while the light seed averages two bushels less per acre. All plats were spring plowed, and seeded March 26. The crop was ripe and harvested June 30. Red Georgia oats was the variety used.

Table III.
EFFECTS OF QUALITY OF SEED. Plats, one-twentieth of an acre.

No. of plat.	Grade of seed.	Yield of plat.		Rate per acre.	
		Grain, pounds.	Straw, pounds.	Grain, bushels.	Straw, tons.
116.....	Light.....	28.5	99	17.81	.99
117.....	Common.....	40.0	96	25.00	.96
118.....	Heavy.....	25.5	80	15.93	.80
119.....	Light.....	19.0	65	11.87	.65
120.....	Common.....	41.0	77	25.62	.77
121.....	Heavy.....	26.5	53	16.56	.53
122.....	Light.....	32.0	84	20.00	.84
123.....	Common.....	29.5	78	18.43	.78
124.....	Heavy.....	27.0	43	16.87	.43
125.....	Light.....	19.0	39	11.87	.39
126.....	Common.....	25.5	42	15.93	.42
127.....	Heavy.....	25.0	107	15.62	1.07
128.....	Light.....	27.5	94	17.18	.94
129.....	Common.....	26.0	92	16.25	.92
130.....	Heavy.....	30.5	87	19.06	.87
Average..	Light.....			15.74	.76
"	Common.....			20.24	.77
"	Heavy.....			16.80	.74

SUMMARY OF AVERAGES FOR SEVEN YEARS.

Grade of seed.	Rate of yield per acre, in bushels.							
	Ave'ge.	1896.	1895.	1894.	1893.	1892.	1891.	1890.
Light.....	26.66	15.74	24.37	18.31	34.12	21.87	50.63	21.62
Common.....	28.48	20.24	26.82	18.06	41.37	23.59	45.27	24.03
Heavy.....	28.76	16.80	25.48	17.56	38.75	26.40	46.44	29.93

IV METHODS OF SEEDING.

This experiment has been tried for six successive years. All plats were spring plowed, and all were seeded on March 25 with Red Georgia oats, by the implements indicated in table IV. The experiment was, the present season, extended by a set of plats which were seeded by the Hollinger lister drill, which has been described in former bulletins. The plats suffered badly from rust, as in the case of the other experiments. The average for the six years, shown in table IV, is decidedly in favor of the shoe drill with press wheels, and with but one exception this method of seeding has given the best yield throughout. The listed plats yielded about the same as the plats seeded with the hoe drill, the shoe drill with press wheels being better than either.

Table IV.
METHODS OF SEEDING OATS. Plats, one-twentieth of an acre.

No. of plat.	Method of seeding.	Yield of plat.		Rate per acre.	
		Grain, pounds.	Straw, pounds.	Grain, bushels.	Straw, tons.
131	Broadcast	18.5	115	11.56	1.15
132	Hoe drill	31.0	99	19.37	.99
133	Shoe drill with press wheels	30.0	90	18.75	.90
134	Shoe drill without press wheels	32.5	93	20.31	.93
135	Listed	27.5	66	17.18	.66
136	Broadcast	30.0	74	18.75	.74
137	Hoe drill	32.0	100	20.00	1.00
138	Shoe drill with press wheels	42.0	83	26.25	.83
139	Shoe drill without press wheels	39.5	80	24.68	.80
140	Listed	33.5	70	20.93	.70
141	Broadcast	31.5	90	19.68	.90
142	Hoe drill	38.0	88	23.75	.88
143	Shoe drill with press wheels	37.0	67	23.12	.67
144	Shoe drill without press wheels	29.0	59	18.12	.59
145	Listed	28.0	110	17.50	1.10
146	Broadcast	30.0	72	18.75	.72
147	Hoe drill	27.5	51	17.18	.51
148	Shoe drill with press wheels	40.0	72	25.00	.72
149	Shoe drill without press wheels	36.5	83	22.81	.83
150	Listed	36.5	79	22.81	.79
151	Broadcast	18.5	41	11.56	.41
152	Hoe drill	31.5	37	19.68	.37
153	Shoe drill with press wheels	34.0	36	21.25	.36
154	Shoe drill without press wheels	32.5	65	20.31	.65
155	Listed	32.5	49	20.31	.49
Average..	Broadcast			16.06	.78
"	Hoe drill			19.99	.75
"	Shoe drill with press wheels			22.87	.80
"	Shoe drill without press wheels			21.24	.76
"	Listed			19.74	.74

SUMMARY OF AVERAGES FOR SIX YEARS.

Method of seeding.	Rate of yield per acre, in bushels.						
	Average.	1896.	1895.	1894.	1893.	1892.	1891.
Broadcast	24.49	16.06	7.93	26.37	28.18	24.87	43.56
Hoe drill	26.25	19.99	7.50	26.13	28.88	29.00	45.99
Shoe drill with press wheels	20.07	22.87	11.08	22.42	31.25	35.06	51.73
Shoe drill without press wheels	27.47	21.24	9.03	25.12	32.81	26.00	50.64
Listed		19.74					

V. SEEDING DIFFERENT AMOUNTS TO THE ACRE.

This experiment comprises 35 plats, in 7 series, the first series being seeded at the rate of one bushel per acre, and for each succeeding one the rate was increased by half a bushel, up to four bushels per acre. The plats were spring plowed, and all were seeded March 23, with a variety known as Red Georgia oats. The seeder used was the shoe drill with press wheels. The plats suffered from rust as in other cases, and the crop was matured and harvested on June 30.

TABLE V.
AMOUNT OF SEED OATS TO THE ACRE. Plots, one-twentieth of an acre.

No. of plot.	Rate of seeding per acre.	Yield of plot.		Rate per acre.	
		Grain, pounds.	Straw, pounds.	Grain, bushels.	Straw, tons.
81.....	1.0 bushels.....	18.5	29	11.56	.99
82.....	1.5 ".....	20.0	38	12.50	.98
83.....	2.0 ".....	16.5	33	10.31	.93
84.....	2.5 ".....	25.0	47	15.62	.47
85.....	3.0 ".....	32.5	67	20.31	.67
86.....	3.5 ".....	30.0	78	18.75	.78
87.....	4.0 ".....	32.0	56	20.00	.56
88.....	1.0 ".....	17.5	52	10.98	.52
89.....	1.5 ".....	18.0	38	11.25	.38
90.....	2.0 ".....	25.5	88	15.93	.88
91.....	2.5 ".....	25.0	47	15.62	.47
92.....	3.0 ".....	29.5	58	18.48	.58
93.....	3.5 ".....	26.5	51	16.56	.51
94.....	4.0 ".....	34.0	64	21.25	.64
95.....	1.0 ".....	15.5	40	9.68	.40
96.....	1.5 ".....	26.0	64	16.25	.64
97.....	2.0 ".....	26.5	69	16.56	.69
98.....	2.5 ".....	30.5	67	19.06	.67
99.....	3.0 ".....	28.5	73	17.81	.73
100.....	3.5 ".....	30.5	65	19.06	.65
101.....	4.0 ".....	31.5	64	19.68	.64
102.....	1.0 ".....	21.5	65	13.43	.65
103.....	1.5 ".....	30.0	81	18.75	.81
104.....	2.0 ".....	27.5	72	17.18	.72
105.....	2.5 ".....	29.5	58	18.43	.58
106.....	3.0 ".....	30.0	71	18.75	.71
107.....	3.5 ".....	32.0	73	20.00	.73
108.....	4.0 ".....	32.0	71	20.00	.71
109.....	1.0 ".....	20.0	72	12.50	.72
110.....	1.5 ".....	24.5	77	15.31	.77
111.....	2.0 ".....	28.5	73	17.81	.73
112.....	2.5 ".....	27.5	59	17.18	.59
113.....	3.0 ".....	31.0	93	19.37	.93
114.....	3.5 ".....	28.0	44	17.50	.44
115.....	4.0 ".....	31.0	65	19.37	.65
Average..	1.5 ".....			11.62	.53
"	1.5 ".....			14.81	.59
"	2.0 ".....			15.55	.67
"	2.5 ".....			17.18	.55
"	3.0 ".....			18.93	.72
"	3.5 ".....			18.37	.62
"	4.0 ".....			20.06	.64

SUMMARY OF AVERAGES FOR SIX YEARS.

Rate of seeding per acre.	Rate of yield per acre, in bushels.						
	Average.	1896.	1895.	1894.	1893.	1892.	1891.
1.0 bushels.....	21.64	11.62	13.59	22.31	30.31	20.78	31.25
1.5 ".....	24.54	14.81	15.17	23.35	30.93	28.79	34.19
2.0 ".....	25.43	15.55	12.85	13.12	30.75	32.05	43.26
2.5 ".....	27.45	17.18	13.18	23.98	30.93	34.36	45.12
3.0 ".....	26.51	18.93	10.79	20.54	32.25	31.76	44.84
3.5 ".....	26.22	18.37	8.61	19.50	31.12	34.26	45.50
4.0 ".....	29.09	20.06	7.77	19.60	33.25	47.63	46.25

It will be seen that beginning with one bushel there is a regular increase in the yield corresponding to the increase in seed up to three bushels per acre, which this year yields a little over half a bushel more than the three and a half bushels per acre, and over a bushel less than the four bushels per acre. In the average for the six years, the same holds true, except that two and a half bushels seed

per acre have yielded about a bushel more than either three or three and a half bushels, while four bushels per acre is ahead of all others. From the averages under each year, it will be seen that there is some fluctuation. On the whole, two and a half or three bushels per acre appear to give the best results. Although a heavier seeding in some years gives a larger yield, it seems to be more subject to fluctuation.

VI. TEST TO ASCERTAIN THE EFFECTS OF CHANGE IN SOILS ON THE PER CENT. OF SMUT IN OATS.

The argument is often advanced that a change in soils is all that is needed to kill the smut in oats, or, in other words, that if a farmer finds his crop infested with smut, the smutted oats will cease to be smutted if he can seed them on a soil of different character from that on which they grew. To test this question, we obtained eight varieties from the Ohio Experiment Station which in the year 1895, as grown at that station, were found to be infested with smut to a varying degree. Now, if the theory is correct, these oats would show no smut when changed from Ohio to Kansas and grown at this Station. Table VI gives the details of the experiment. There was but one plat of each variety. The per cent. of smut given for the year 1895 is the per cent. contained in the Ohio seed and the per cent. of smut given for the year 1896 is the per cent. found in the crop from that seed grown here. It will be seen that all varieties are badly infested with smut, that in five cases the per cent. increased rather than decreased, while in three cases there has been a decrease. The per cent. of smut was calculated by measuring off ten feet in length of the plat and counting the total number of heads on that area, and then counting the number of smutted heads to ascertain the per cent. of smut. If this experiment can be relied upon the theory is false. The smut is carried with the seed. The soil is not the source of infection, at least to any extent, and a change of soil does not deprive the smut spores of vitality.

There had been no oats on the land where this experiment was tried for several years.

Table VI.

VARIETIES OF OATS FROM OHIO EXPERIMENT STATION. Plats one-twentieth acre.

No. of plat.	Variety.	When headed.	When ripe.	Per cent. of smut in 1895.	Per cent. of smut in 1896.	Yield of plat.		Rate per acre.	
						Grain, lbs.	Straw, lbs.	Grain, bus.	Straw, tons.
52.....	Welcome.....	June 15	June 29	7.60	12.69	9.5	80	5.93	.80
53.....	Lincoln.....	" 16	" 29	32.29	18.83	11.0	109	6.87	1.09
54.....	Wideawake.....	" 16	" 29	16.94	17.10	16.5	99	10.31	.99
55.....	Seizure.....	" 17	" 30	3.48	10.12	7.5	84	4.68	.84
56.....	White Wonder.....	" 10	" 27	5.67	5.06	17.0	71	10.62	.71
57.....	Black Prolific.....	" 15	" 29	44.33	11.69	12.5	79	7.81	.79
58.....	Green Mountain.....	" 16	" 29	16.43	21.06	10.5	87	6.56	.87
59.....	Monarch.....	" 11	" 29	9.42	11.57	16.5	123	10.31	1.23

Table VII.
TEST OF VARIETIES. Plats, one-twentieth of an acre.

No. of plat.	Variety.	When headed.	When ripe.	Yield of plat.		Rate per acre.	
				Grain, pounds.	Straw, pounds.	Grain, bushels.	Straw, tons.
1	Belgian	June 2	June 22	29.5	63	18.43	.63
2	Golden Sheaf	" 8	" 26	35.0	95	21.87	.95
3	Burt's Extra Early Rust Proof	May 23	" 18	49.5	80	30.93	.80
4	Superior Scotch	June 8	" 26	14.0	105	8.75	1.05
5	Black Russian	" 2	" 24	24.0	56	15.00	.56
6	South Carolina Black	" 4	" 27	31.0	83	19.37	.83
7	Negro Wonder	" 2	" 24	33.0	113	20.62	1.13
8	Pedigree Red Rust Proof	" 2	" 24	26.0	100	16.25	1.00
9	Red Rust Proof	" 2	" 24	39.0	87	24.37	.87
10	Red Georgia	" 2	" 24	43.0	87	26.87	.87
11	Red Winter	" 2	" 27	26.0	82	16.25	.82
12	Texas Red	" 2	" 24	43.0	65	26.87	.65
13	Belgian	" 2	" 22	39.5	90	24.68	.90
14	Golden Sheaf	" 8	" 26	36.5	157	22.81	1.37
15	Stowell's Evergreen	" 13	" 29	38.0	130	23.75	1.30
16	Northwestern White	" 8	" 23	24.0	108	15.00	1.08
17	Black American	" 3	" 27	31.5	124	19.63	1.24
18	Board of Trade	" 8	" 27	34.0	80	21.25	.80
19	White Superior	" 9	" 29	22.5	97	14.06	.97
20	New Seneca Chief	" 9	" 29	31.0	49	19.37	.49
21	White Swede	" 9	" 29	25.5	30	15.93	.30
22	Great Northern	" 9	" 29	31.0	71	19.37	.71
23	Giant Side	" 15	" 30	15.5	64	9.68	.64
24	Lincoln	" 10	" 29	22.0	106	13.73	1.06
25	Belgian	" 2	" 22	37.0	77	23.12	.77
26	Golden Sheaf	" 8	" 26	35.0	153	21.87	1.53
27	Colorado Yellow	" 9	" 29	33.5	108	20.93	1.08
28	Probest	" 9	" 29	29.5	88	18.43	.88
29	White Schonen	" 9	" 29	28.0	100	17.50	1.00
30	Yankee Prolific	" 9	" 29	33.0	67	20.62	.67
31	Surprise	" 10	" 29	34.0	79	21.25	.79
32	White Side	" 8	" 29	37.5	100	23.43	1.00
33	American Banner	" 9	" 29	35.5	115	22.18	1.15
34	Blue Grazing Winter	" 6	" 26	34.5	85	21.56	.85
35	Race Horse	" 8	" 29	30.0	98	18.75	.98
36	Mammoth Cluster	" 8	" 29	25.5	90	15.93	.90
37	Belgian	" 2	" 22	38.0	60	23.75	.60
38	Golden Sheaf	" 8	" 26	33.0	79	20.62	.79
39	New Swedish	" 10	" 29	27.5	121	17.15	1.21
40	New Goanette Black	" 10	" 29	25.5	116	15.31	1.16
41	Black Mammoth Cluster	" 15	" 29	25.5	97	15.93	.97
42	Welch	" 10	" 29	30.5	109	19.06	1.09
43	Vick's American Banner	" 9	" 29	36.5	89	16.56	.89
44	Burt's Extra Early Rust Proof	May 23	" 18	49.5	114	30.93	1.14
45	Red Winter	June 3	" 27	25.5	76	15.93	.76
46	Texas Red	" 3	" 27	39.0	79	24.37	.79
47	Brown Winter	" 3	" 27	43.0	96	26.87	.96
48	Prince Edward's Island Black	" 17	" 30	17.0	103	10.62	1.03
49	Belgian	" 2	" 22	49.5	77	29.06	.77
50	Golden Sheaf	" 8	" 26	35.0	119	21.87	1.19
51	Winter Turf	" 18	" 25	11.0	107	6.87	1.07
Averages of similar plats:							
	Belgian	June 2	June 22	38.1	73.4	23.81	.73
	Golden Sheaf	" 8	" 26	34.9	116.6	21.81	1.16
	Burt's Extra Early Rust Proof	May 23	" 18	49.5	97.0	30.93	.97
	Red Winter	June 2	" 27	25.7	84.0	16.09	.84
	Texas Red	" 2	" 25	82.0	144.0	25.62	1.44

VII. COMPARISON OF OATS AND BARLEY.

This experiment proved practically worthless, owing to the damage to both oats and barley by rust. They were so badly rusted that it would not be fair to draw any conclusions from the experiment. The yield of Red Georgia oats was only 319 pounds to the acre, or a trifle less than 10 bushels, and the yield of Black Hullless barley

was only 327 pounds to the acre, or 5.5 bushels, at 60 pounds to the bushel. We have made tests of varieties of barley every year for several years, and the crop has invariably been a failure, chiefly from rust. This climate is not well adapted to the growth of barley.

Table VIII.—TEST OF VARIETIES.
VARIETIES OF OATS ARRANGED ACCORDING TO AVERAGE YIELD.

VARIETY.	Average of 6 yrs.		1896.		1895.		1894.		1893.		1892.		1890.	
	Rate per acre, in bushels.	Rank	Rate per acre, in bushels	Rank	Rate per acre, in bushels	Rank	Rate per acre, in bushels	Rank	Rate per acre, in bushels	Rank	Rate per acre, in bushels.	Rank	Rate per acre, in bushels	Rank
Belgian.....	37.03	1	23.81	6	21.71	18	48.92	1	39.59	1	50.25	12	37.9	10
Brown Winter.....	35.22	2	26.87	5	17.57	29	40.83	5	29.10	11	57.09	11	39.9	7
Board of Trade.....	35.20	2	21.25	12	23.82	13	37.00	4	36.25	3	53.59	5	34.3	16
Red Georgia.....	35.00	4	26.87	5	25.77	5	42.96	4	27.81	15	41.61	26	45.0	3
Pedigree Red Rust Proof.....	34.94	5	16.25	27	15.01	34	33.81	3	28.83	12	56.79	3	45.9	1
Golden Sheaf.....	34.70	6	21.81	10	23.84	17	38.71	6	27.57	16	52.42	9	43.9	4
White Side.....	34.29	7	23.43	8	24.60	11	38.58	11	32.81	5	55.75	7	32.6	17
Northwestern White.....	34.14	8	15.00	32	24.99	12	45.08	2	34.78	4	46.68	20	35.5	15
Red Rust Proof.....	33.62	9	24.37	7	15.83	30	37.00	10	31.65	7	51.43	11	38.9	11
Yankee Prolific.....	32.74	10	26.62	4	22.65	15	27.22	27	23.56	13	56.77	6	40.3	6
Welch.....	32.42	11	19.06	17	22.02	1	39.13	6	13.78	26	49.75	15	38.5	9
Black American.....	32.14	12	19.63	16	22.02	3	27.65	26	28.08	14	46.04	22	45.1	2
Probstair.....	31.91	13	18.43	23	25.17	3	34.45	14	38.09	2	47.42	19	32.5	18
South Carolina Black.....	31.76	14	19.37	18	18.74	25	27.22	28	26.55	18	49.40	16	36.2	13
White Schonen.....	31.28	15	17.50	24	29.85	2	31.60	19	23.09	21	51.83	10	35.6	14
Surprise.....	31.05	16	21.25	13	22.65	16	31.03	15	31.61	8	50.04	13	25.5	23
Race Horse.....	30.88	17	18.75	25	21.09	21	28.50	24	31.60	9	46.49	21	32.9	8
Vick's American Banner.....	30.52	18	16.55	26	21.09	21	28.50	24	29.15	10	44.52	24	36.4	12
Burt's Extra Early Rust Proof.....	30.21	19	30.93	1	11.52	37	32.75	23	27.06	17	43.98	17	28.1	20
New Seneca Chief.....	29.81	20	19.37	19	22.65	17	32.75	23	23.99	20	45.06	23	...	...
Colorado Yellow.....	29.03	21	20.93	14	24.99	9	30.20	22	20.05	25	59.96	1	28.6	19
White Swede.....	28.54	22	15.98	31	19.53	20	32.33	18	24.91	19	48.20	18	25.2	22
New Swedish.....	28.31	23	17.18	35	24.48	10	31.47	16	22.67	22	42.22	25	42.2	5
Black Russian.....	27.77	24	15.00	34	13.07	36	31.47	16	22.67	22	42.22	25	25.5	25
White Superior.....	26.19	25	14.06	36	25.38	7	39.13	7	...	...	...	...	...	...
Blue Grazing Winter.....	25.74	26	21.56	11	17.18	30	20.41	32	20.93	24	54.50	8	19.9	25
Texas Red.....	25.01	27	25.62	3	3.4	...	...	...	...	...	...	...	...	...
Prince Edward Island Black.....	25.01	27	10.62	34	16.79	32	28.07	25	21.27	23	49.81	14	23.5	24
American Banner.....	25.00	28	22.15	9	17.96	27	34.83	12	...	...	...	...	...	...
Great Northern.....	24.98	29	19.37	20	20.70	22	34.83	13	...	...	...	...	...	...
Mammoth Cluster.....	21.05	30	15.93	30	26.17	4	...	...	...	...	...	...	...	...
New Goanette Black.....	20.57	31	15.31	32	13.67	35	32.75	17	...	...	...	...	...	...
Stowell's Evergreen.....	20.46	32	23.75	7	17.18	31	...	...	...	...	...	...	...	...
Negro Wonder.....	20.30	33	20.62	16	19.99	23	...	...	...	...	...	...	...	...
Black Mammoth Cluster.....	18.15	34	15.93	31	11.32	38	27.22	30	...	...	...	...	...	...
Superior Scotch.....	17.81	35	8.75	42	18.74	26	25.94	31	...	...	...	...	...	...
Red Winter.....	...	...	16.09	28	...	...	...	...	...	...	...	...	...	...
Giant Side.....	15.67	36	9.68	41	21.67	19	...	...	...	...	...	...	...	...
Lincoln (college).....	15.08	37	13.75	36	16.42	33	...	...	...	...	...	...	...	...
Winter Turf.....	12.35	38	6.87	44	17.83	28	...	...	...	...	...	...	...	...
White Wonder.....	...	...	10.62	38	...	...	...	...	...	...	...	...	...	...
White Wonder.....	...	...	10.31	39	...	...	...	...	...	...	...	...	...	...
Wideawake.....	...	...	10.31	40	...	...	...	...	...	...	...	...	...	...
Monarch.....	...	...	7.81	43	...	...	...	...	...	...	...	...	...	...
Black Prolific.....	...	...	6.87	45	...	...	...	...	...	...	...	...	...	...
Lincoln (Ohio Exp. Sta.).....	...	...	6.56	46	...	...	...	...	...	...	...	...	...	...
Green Mountain.....	...	...	5.93	47	...	...	...	...	...	...	...	...	...	...
Welcome.....	...	...	4.68	48	...	...	...	...	...	...	...	...	...	...
Seizure.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...

VIII. TEST OF VARIETIES.

Table VII shows the list of varieties grown at the Station the past year, and gives data as to date of heading, date of ripening, yield in pounds per plat and in bushels per acre of each variety. The ground was spring plowed, and all varieties were seeded March 24

with a shoe press drill. All varieties suffered badly from rust, though the various kinds of red oats and Burt's Extra Early Rust Proof did better this year than most other kinds. The table tells its own story in regard to yields. Each variety was grown on but one plat.

Besides the varieties shown in the table, we also tested the following, the seed of which was obtained from the department of agriculture, Washington, D. C.: Shatiloski, Shelmuy, Kursk, Amur, and Joannette. All of these varieties were almost total failures. The straw of all was coarse and rank, and some of them lodged badly. They were attacked very severely with rust, and none of them developed heads so as to furnish normal, typical specimens for description.

Table VIII gives a summary of the average yields of the varieties which have been grown at the Station for six years. The table shows the yield of each variety each year, and to facilitate comparison the rank which each variety has taken in point of yield is also indicated. It will be noticed in the column which shows the average for six years that the 12 or 15 varieties nearest the top of the list have been very near the top in most of the other years, while those nearest the bottom have kept close to the bottom nearly all the time. There are some exceptions to this, but they are not numerous. We may, therefore, take it for granted that, all things considered, those giving the best averages for the six years are those which are most likely to yield well.

SUMMARY OF RESULTS.

1st. Time of Plowing Oat Land. In four successive years, the best yields of oats have been obtained on spring-plowed land, while, when the seed is drilled in, there has been practically no difference in the yield in these years between fall-plowed land and land not plowed at all. The oat land had in all cases been in corn the previous year and the corn had been well cultivated.

2d. Time of Seeding Oats. The past season, the seedings made the first and second week in March gave the best yields. While the time of seeding must necessarily depend upon the weather, as a rule it is best to sow oats as early in March as the ground can be put in order.

3d. The Quality of Seed Oats. Light, inferior seed is certain to produce less than seed of fair quality, but between a fair quality of seed oats and heavy, sifted seed there is not very much difference, the best yields during seven years having sometimes been produced

by one and sometimes by the other. The average for seven years is, however, in favor of the heavy seed.

4th. Methods of Seeding Oats. In an average of six years, no other method has produced so good results as seeding with a shoe drill with press wheels; next follow in order shoe drill without press wheels, hoe drill, and broadcasting.

5th. Amount of Seed Oats per Acre. The average of six years indicates that it is not advisable to sow less than 2.5 bushels per acre. Heavier seedings have in some years yielded more, in others less, than has that amount, but the increase in yield by heavier seeding does not appear to more than cover the additional amount of seed used over 2.5 bushels per acre.

6th. Smut in Oats. Smutted seed oats produce smut in the crop, even though the soil is changed. Of the eight varieties of smutted oats obtained from the Ohio station for this test, the per cent. of smut was increased above that contained in the seed in five varieties. The theory that a change in soils will clear the oats of smut is, therefore, false.

7th. Oats Compared with Barley, Barley has never, as yet, produced a satisfactory yield at this Station.

8th. Best Varieties of Oats. The average yield for six years past places the best yielding 12 varieties of oats tested here in the following order: Belgian, Brown Winter, Board of Trade, Red Georgia, Pedigree Red Rust Proof, Golden Sheaf, White Side, Northwestern White, Red Rust Proof, Yankee Prolific, Welch, and Black American.