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Ohio Agricultural Experiment Station.

BULLETIN 67.

WOOSTER, OHIO, FEBRUARY, 1896.

.. OATS ..

COMPARISON OF VARIETIES IN 1895.

EFFECT OF SMUT.

METHODS OF SEEDING.

PREPARATION OF SEED-BED.

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BULLETIN

OF THE

Ohio Agricultural Experiment Station.

NUMBER 67.

February, 1896.

EXPERIMENTS WITH OATS.

BY J. FREMONT HICKMAN.

The several divisions under which the subject is treated will occur in the following order:

1. Comparison of varieties: (a) at the Central Station, (b) at Sub-Stations, including effect of smut.
2. Methods of seeding.
3. Preparation of seed-bed.

1. COMPARISON OF VARIETIES.

There is perhaps no subject upon which farmers are so likely to agree as the time of sowing oats; all admitting that the proper time is just as soon as the ground is in condition to work. The experimenter meets with one obstacle that prevents an early oat seeding, of at least a part of the crop, which is that it is essential to have the ground for variety testing all prepared at the same time and in the same manner. We cannot in any series of experiments prepare two or three acres and begin seeding at once, but must first fit the entire piece intended for the series before starting the drill; but when the seeding is once begun it is not stopped until that series is finished, except for rain or night. The plowing for the variety test of 1895, including nine acres, was begun on April tenth and completed on the sixteenth, and the varieties were all sown on the sixteenth and eighteenth.

The season was a very peculiar one. The several varieties made a good start, but, for lack of rain, the entire list soon gave every promise of failure, some of the sorts beginning to form heads when only eight or ten inches out of the ground; but during the last ten days of June nearly three inches of rainfall rescued the crop, which at harvesting time was the equal of any raised by the Station within the last four seasons.

The test of varieties during the season of 1895 included seventy differently named sorts, divided into four groups, each group having in common some well defined characteristics.

The first of these embraces twenty-one differently named sorts, having the open or spreading panicle, coarse, weak straw and short plump grain, of which the Welcome is the most familiar type.

The second group comprises fourteen kinds, in which the head or panicle is more or less one sided, and which are ordinarily classed as side oats. The Seizure is one of the best known representatives of this class.

The third group includes twenty-six varieties, similar in general form to the Welcome, except that the berry is longer and more pointed, the straw as a rule is stronger, and the grain lighter. We have designated the Wideawake as a fair representative of this class.

In the fourth and last group we have eight varieties, not so well defined in their characteristics, except that in their general growth they are similar to the Welcome class, but all have a colored berry, some black, some gray and some of a reddish tinge. Monarch and Rust Proof are representatives of this class.

THE SMUT OF OATS.

In our oats bulletin, published in January, 1892, attention was called to the possible decrease and ultimate damage to the oats crop if precautions were not used to check the smut, by treating the seed. The few varieties affected, then growing among our list, have been sown each year without treating, to prove or disprove the belief then expressed. No stronger proof of the statements then made is needed than a mere examination of Table I in this bulletin, which gives in detail the actual yield of each variety, the per cent. of smut, as determined by actual count of a large number of heads, and the possible yield, as obtained by adding to the actual yield of each variety the estimated loss from smut. The percentage of smut was determined in all of the seventy varieties grown except seven. Leaving these seven out of the consideration the following deductions are reached:

Eighteen varieties of the Welcome group have an average of 12.44 per cent. of smutted heads. Twelve varieties of the Seizure group have 12.47 per cent. Twenty-five varieties of the Wideawake group have 16.68 per cent., and eight varieties in the mixed group an average of 15.50 per cent.

The average of the sixty-three varieties counted shows 14.51 per cent. smutted heads. Taking the average of forty-nine varieties of white oats, we have 13.69 per cent., while fourteen varieties of black oats show 17.43 per cent. smutted heads. While not conclusive, this is taken as an indi-

cation that the black or colored varieties of oats may be more susceptible to smut than the white varieties. Taking the facts as we have them, there is reason to suspect that if smutted seed were to be sown continuously, year after year, it would ultimately result in the destruction of the crop. The variety, Black Prolific, illustrates this point. This variety had in 1891 three and two-tenths per cent. smutted heads; in 1892, two and eight-tenths; in 1893, thirteen and three-tenths; in 1894, thirty-four; and in 1895, forty-four and one-third per cent. The following varieties show similar results: Race Horse, Lincoln, Great Northern and White Superior Scotch.

If the theory that smut is produced only from and through seed sown is correct, there is abundant evidence that the disease is markedly prevalent over a large territory. This is clearly proven in the following varieties, sown this year for the first time on the Station grounds: No. 19, White Wonder, seed came from Zanesville, Ohio, and the crop contained almost three per cent. of smutted heads; Nameless Beauty, seed from LaCrosse, Wisconsin, over 23 per cent. smut in crop; Royal Doncaster, seed from Milwaukee, was over five per cent. smut; Mexican Gray, seed from St. Louis, Mo., and the crop contained above seven per cent. smutted heads. As the three varieties last named were sent out by seedsmen, we are left without definite information as to where the seed was grown, but that is of minor importance when compared with the distribution of that seed for growing the crop of 1895. From our results in the comparative tests there is evidence that from smutty seed we have a decreased crop, caused by weakened vitality, in addition to the loss from diseased heads; this we gather by comparing yields of recent years, with those of the same variety when compared with other varieties, in years when little or no smut existed among them. Leaving the matter of seed vitality out of consideration, the difference between sowing seed without and with smut is shown in the fourth column of Table I, in which a loss ranging from 1.38 bushels to almost 30 bushels per acre is clearly enough the result of sowing infected seed.

The first column in Table I represents the actual yield of the several varieties as harvested; the second column indicates the actual increase or decrease of the various sorts as compared with the average yield of the two plots of the standard variety between which they grew; the third column gives the percentage of smut, as found by actual count; the fourth column indicates the probable loss from smut in bushels per acre; the fifth column gives the estimated probable yield, had there been no smut; the sixth column, the estimated increase or decrease on the smut-free basis of comparison.

OATS—TABLE I—COMPARATIVE TEST OF VARIETIES.

Yield and Increase of Grain and Loss from Smut.

Plot number.	Variety.	Actual yield per acre.	Increase (+) or decrease (—) per acre.	Percentage of smut.	Probable loss from smut.	Possible yield per acre.	Smut-free crop-increase (+) or decrease (—) per acre.
	<i>Welcome Group.</i>	<i>Bushels.</i>	<i>Bushels.</i>		<i>Bushels.</i>	<i>Bushels.</i>	<i>Bushels.</i>
1	Welcome	57.18	.....	7.60	4.70	61.88	.....
2	American Banner	48.90	—7.65	.....	.....	.....	.....
3	Improved American.....	52.65	—3.90	.....	.....	.....	.....
4	Badger Queen.....	45.62	—10.93	6.72	3.29	48.91	—12.29
5	Welcome	55.93	.....	.....	4.60	60.53	.....
6	Barley	48.44	—8.97	9.39	5.02	53.46	—8.67
7	Colonel.....	55.80	—1.61	11.76	7.44	63.24	+1.11
8	Clydesdale.....	61.80	+4.39	3.65	2.34	64.14	+2.01
9	Welcome	58.90	.....	.....	4.84	63.74	.....
10	Hargett's White.....	40.78	—16.40	4.78	2.05	42.83	—19.05
11	Henderson's Clydesdale.....	52.81	—4.37	5.72	3.20	56.01	—5.87
12	Centennial.....	54.00	—3.18	7.54	4.40	58.40	—3.48
13	Welcome	55.46	.....	.....	4.56	60.02	.....
14	Race Horse.....	36.60	—20.11	34.36	19.16	55.76	—5.61
15	White Belgian.....	52.11	—4.60	11.56	6.81	58.92	—2.45
16	White Bonanza	43.60	—13.11	5.56	2.57	46.17	—15.20
17	Welcome	57.96	.....	.....	4.77	62.73	.....
18	¹ White Wonder.....	52.11	—5.38	5.67	3.13	55.24	—6.98
19	² White Wonder	45.80	—11.69	2.93	1.38	47.18	—15.04
20	White Victoria.....	32.65	—24.84	15.95	6.20	38.85	—23.37
21	Welcome	57.03	.....	.....	4.69	61.72	.....
22	Early Archangel	40.31	—16.25	34.23	20.98	61.29	+0.08
23	Drogheda.....	41.50	—15.06	.....	.....	.....	.....
24	Lincoln	40.31	—16.25	.....	.....	.....	.....
25	Welcome	56.09	.....	.....	4.61	60.70	.....
26	Heavy Weight	37.19	—18.90	29.81	15.79	52.98	—7.72
27	Pride of America.....	37.65	—18.44	16.16	7.26	44.91	—15.79
28	Bonanza King	48.67	—7.32	10.20	5.53	54.20	—6.50
	<i>Seizure Group.</i>						
29	Seizure	60.31	.....	3.48	2.17	62.48	.....
30	Excelsior	48.28	—11.80	.....	.....	.....	.....
31	White Swiss	51.09	—8.98	5.59	3.03	54.12	—8.12
32	Early Swedish	52.65	—7.42	.....	.....	.....	.....
33	Seizure	59.84	.....	.....	2.16	62.00	.....
34	Japan	56.40	—3.13	2.48	1.43	57.83	—3.85
35	Wilson's Prolific	56.25	—3.28	2.16	1.24	57.49	—4.19
36	Dakota Gray.....	50.86	—8.67	12.15	7.03	57.89	—3.79
37	Seizure	59.22	.....	.....	2.14	61.36	.....
38	Prince Edward's Island.....	52.10	—8.33	10.57	6.16	58.26	—4.35
39	Black Prolific.....	37.56	—22.87	44.33	29.91	67.47	+4.86
40	Giant Yellow Trench.....	59.37	—1.06	6.03	3.81	63.18	+0.57
41	Seizure	61.64	.....	.....	2.22	63.86	.....
42	Black Tartarian.....	48.25	—11.39	9.64	5.15	53.40	—8.39
43	Egyptian	56.87	—2.77	2.69	1.57	58.44	—3.35
44	Black Norway.....	44.84	—14.80	30.16	19.36	64.20	+2.41
45	Seizure	57.65	.....	.....	2.08	59.73	.....
46	Mammoth Cluster	46.72	—12.92	20.39	1.97	58.69	—1.04

¹Station seed.²Zanesville seed.

OATS—TABLE I—Concluded.

Plot number.	Variety.	Actual yield per acre.	Increase (+) or decrease (—) per acre.	Percentage of smut.	Probable loss from smut.	Possible yield per acre.	Smut-free crop-increase (+) or decrease (—) per acre.
	<i>Wideawake Group.</i>	<i>Bushels.</i>	<i>Bushels.</i>		<i>Bushels.</i>	<i>Bushels.</i>	<i>Bushels.</i>
47	Wideawake	39.06	.....	16.94	7.97	47.03	.....
48	Alabama	57.34	+18.75	6.17	3.77	61.11	+14.65
49	Banner	57.34	+18.75	3.69	4.11	61.45	+14.99
50	White California.....	57.18	+18.59	4.31	2.58	59.76	+13.30
51	Wideawake	38.12	.....	.....	7.77	45.89	.....
52	Early Prize Cluster.....	48.52	+10.79	6.37	3.30	51.82	+6.40
53	Scottish Chief.....	50.00	+12.27	9.44	5.21	55.21	+9.79
54	Currie's Prize Cluster.....	48.52	+10.79	6.46	3.35	51.87	+6.45
55	Wideawake	37.34	.....	.....	7.62	44.96	.....
56	Hopetown	30.07	—8.67	42.98	22.66	52.73	+6.08
57	Kansas Hybrid.....	46.01	+7.27	7.20	3.57	49.58	+2.93
58	Bolton.....	45.62	+6.88	21.64	12.60	58.22	+11.57
59	Wideawake	40.15	.....	.....	8.19	48.34	.....
60	Probesteier	48.00	+10.04	6.85	3.53	51.53	+5.32
61	State of North Dakota...	44.37	+6.41	5.33	2.49	46.86	+1.15
62	Nameless Beauty.....	36.93	—1.03	23.09	11.09	48.02	+2.31
63	Wideawake	35.78	.....	.....	7.30	43.08	.....
64	Yankee Prolific	31.87	—5.00	26.40	11.43	43.30	—1.09
65	Potato Oats	36.00	—0.87	21.75	10.01	46.01	+1.62
66	White Bedford.....	32.42	—4.45	6.96	2.42	34.84	—9.55
67	Wideawake	37.96	.....	.....	7.74	45.70	.....
68	Early Dakota	44.43	—4.99	6.70	3.19	47.62	+0.13
69	Green Mountain	45.93	+6.49	16.45	9.04	54.97	+7.48
70	Poland	35.62	—3.82	33.84	18.22	53.84	+6.35
71	Wideawake	40.93	.....	.....	8.35	49.28	.....
72	Early White Maine.....	44.85	+5.91	17.53	9.53	54.38	+7.50
73	New Baltic	40.78	+1.84	25.07	13.64	54.42	+7.54
74	White Superior Scotch...	26.40	—12.54	31.24	11.99	38.39	—8.49
75	Wideawake	36.95	.....	.....	7.54	44.49	.....
76	Great Northern	36.64	—1.05	35.22	19.92	56.56	+11.18
77	Royal Doncaster	44.22	+6.53	5.21	2.43	46.65	+1.27
78	American Beauty.....	42.34	+4.65	18.88	9.85	52.19	+6.81
79	Wideawake	38.43	.....	.....	7.84	46.27	.....
80	White Schoenen.....	36.26	—1.43	25.27	12.26	48.52	+2.25
	<i>Mixed Group.</i>						
81	Calgary Gray.....	36.90	—4.03	12.33	5.19	42.09	—1.21
82	Mexican Gray.....	39.22	—1.71	7.10	3.00	42.22	—1.08
83	Monarch.....	39.22	.....	9.42	4.08	43.30	.....
84	Australian Giant.....	47.14	+6.21	11.41	6.07	53.21	+8.02
85	Rust Proof.....	37.20	—3.73	23.00	11.11	48.31	+3.12
86	Black Russian.....	39.70	—1.23	12.15	5.49	45.19	0.00
87	Monarch	42.65	.....	.....	4.44	47.09	.....
88	Everitt's Negro Black.....	38.60	—3.50	24.73	12.68	51.28	+4.89
89	Black Beauty.....	36.71	—5.39	24.22	11.73	48.44	+2.05
90	Monarch	41.56	.....	9.05	4.14	45.70	.....

By this method of comparison we find that but two varieties in the Welcome group, namely, Colonel and Clydesdale, gave higher yield than the Welcome.

The average yield of the Welcome group in 1893 was 30.38 bushels; in 1894, 40.65; and in 1895, 48.85 bushels per acre. The average yield of this group for 1895, without the Welcome duplicates, was 46.14 bushels, while the average of the seven Welcome plots was 56.93 bushels.

In the Seizure, or side oats group, not a single variety gave a yield equal to the one used as a standard. In 1893 this group averaged 23.16 bushels; in 1894, 44.05 bushels, and in 1895, 53.32 bushels per acre. The average of the group in 1895, without the Seizure duplicates, was 50.70 bushels, the average of the five Seizure plots was 59.73 bushels per acre.

In the Wideawake group, the variety used as the standard of comparison falls below nearly all of its class in yield, but this is largely due to the large percentage of smut in this particular kind. All of the duplicate plots, it is assumed, have 16.94 per cent. of smutted heads, which is higher than the average of the group.

It is not always possible, in our system of grouping, to place the new varieties in their proper class, for the reason that the several characteristics are not always known until the variety has been grown at least one season. This accounts for an occasional change from one class to another.

Table II shows the yield of straw per acre, for each variety, the straw per hundred pounds of grain, color of grain, date of ripening and the weight of each kind per measured bushel, both before and after recleaning.

There is a striking contrast between the yield of straw per acre in 1895 and the two preceding years; thus the average of the Welcome group for 1893 was 1,653 pounds; in 1894, 1,684; in 1895, 1,511 pounds. Seizure group in 1893, 1,830 pounds; in 1894, 1,779; in 1895, 1,458 pounds. Wideawake group in 1893, 1,266 pounds; 1894, 1,219; in 1895, 1095 pounds.

In all the classes the low yields of straw in 1895 was a notable feature, as is the extremely low average weight of straw to each hundred pounds of grain, falling in all the groups below one hundred pounds. Contrasting the individual groups for the three years last past, we have the following: Welcome, average for 1893, 170 pounds; in 1894, 129; in 1895, 98 pounds. Seizure group, average for 1893, 246 pounds; 1894, 126 pounds; in 1895, 84 pounds. Wideawake group in 1893, 138 pounds; in 1894, 105 pounds; in 1895, 84 pounds. Mixed group in 1893, 169 pounds; in 1894, 89 pounds; and in 1895, 88 pounds of straw to each hundred pounds of grain. I find no better explanation for the above than is indicated in Table III, which gives the rainfall at this station for the first seven months of each year for the last seven years.

OATS—TABLE II.—COMPARATIVE TEST OF VARIETIES.

Plot number.	Variety.	Straw per acre.	Straw per 100 lbs. of grain.	Color of grain.	Date of ripening.	Weight of grain per bu.	
						Before reclin'g	After reclin'g
	<i>Welcome Group.</i>	<i>Lbs.</i>	<i>Lbs.</i>			<i>Lbs.</i>	<i>Lbs.</i>
1	Welcome	1,620	84	White..	July 29..	31.2	31.2
2	American Banner.....	1,635	104	" ..	" 29..	33.0	33.5
3	Improved American.....	1,315	79	" ..	" 29..	32.5	32.5
4	Badger Queen.....	1,790	122	" ..	" 29..	32.0	34.0
6	Barley	1,700	109	" ..	" 29..	30.5	33.0
7	Colonel.....	1,915	107	" ..	" 29..	33.0	33.5
8	Clydesdale.....	1,720	86	" ..	" 27..	31.0	31.5
10	Hargett's White.....	1,295	99	" ..	" 29..	36.5	38.0
11	Henderson's Clydesdale.....	1,460	86	" ..	" 29..	37.0	37.5
12	Centennial.....	1,872	108	" ..	" 27..	33.0	33.5
14	Race Horse.....	1,430	122	" ..	" 30..	36.0	36.5
15	White Belgian.....	1,282	76	" ..	" 30..	34.5	34.5
16	White Bonanza.....	1,155	83	" ..	" 29..	36.5	36.5
18	White Wonder.....	1,632	97	" ..	" 29..	36.5	37.0
20	White Victoria.....	865	83	" ..	" 29..	35.5	36.0
22	Early Archangel.....	1,360	105	" ..	" 27..	37.0	37.5
23	Drogheda.....	1,072	80	" ..	" 26..	38.0	39.5
24	Lincoln	1,610	124	" ..	" 28..	30.0	34.5
26	Heavy Weight.....	1,610	135	" ..	" 30..	31.0	31.5
27	Pride of America.....	1,245	97	" ..	" 30..	35.0	37.0
28	Bonanza King.....	1,142	73	" ..	" 27..	32.5	33.0
	<i>Seizure Group.</i>						
30	Excelsior	1,315	88	White..	July 31..	35.0	36.0
31	White Swiss.....	1,115	68	" ..	" 31..	37.0	37.0
32	Early Swedish.....	1,365	81	" ..	" 31..	35.0	36.5
34	Japan	1,545	85	Black..	Aug. 2..	34.5	36.5
35	Wilson's Prolific.....	1,450	80	White..	" 2..	35.5	36.0
36	Dakota Gray.....	1,572	97	Black ..	" 2..	32.0	33.5
38	Prince Edward's Island.....	1,352	80	" ..	" 1..	30.0	33.0
39	Black Prolific.....	1,597	132	" ..	" 1..	30.0	33.5
40	Giant Yellow French.....	1,680	88	White..	" 1..	32.0	32.0
41	Seizure	1,527	77	" ..	" 3..	31.5	31.5
42	Black Tartarian.....	1,445	94	Black ..	" 1..	32.0	33.0
43	Egyptian	1,280	70	White..	" 1..	35.5	36.5
44	Black Norway.. ..	1,215	85	Black ..	" 1..	32.5	33.0
46	Mammoth Cluster	1,360	91	" ..	" 2..	31.5	33.0
	<i>Wideawake Group.</i>						
47	Wideawake	900	80	White..	July 29..	.....	.....
48	Alabama	1,515	82	" ..	" 29..	34.0	35.0
49	Banner	1,465	80	" ..	" 29..	35.0	35.5
50	White California.....	1,290	70	" ..	" 28..	34.5	35.0
52	Early Prize Cluster.....	1,047	67	" ..	" 29..	31.0	33.0
53	Scottish Chief.....	1,050	65	" ..	" 28..	34.5	34.5
54	Currie's Prize Cluster.....	1,167	75	" ..	" 27..	33.5	34.0
56	Hopetown	1,337	139	" ..	" 27..	30.0	31.5
57	Kansas Hybrid.....	1,177	80	" ..	" 28..	33.0	33.5
58	Bolton	1,140	78	" ..	" 29..	31.0	31.5
60	Probsteier	1,235	80	" ..	" 29..	29.5	31.5
61	State of North Dakota.....	980	69	" ..	" 29..	30.5	31.0

OATS—TABLE II.—Continued.

Plot number.	Variety.	Straw per acre	Straw per 100 lbs. of grain.	Color of grain.	Date of ripening.	Weight of grain per bu.	
						Before recl'ng	After recl'ng
	<i>Wideawake Group—Continued.</i>	<i>Lbs.</i>	<i>Lbs.</i>			<i>Lbs.</i>	<i>Lbs.</i>
62	Nameless Beauty.....	1,117	94	White..	July 29..	30.0	31.0
64	Yankee Prolific.....	1,330	130	" ..	" 28..	30.0	31.0
65	Potato Oats.....	950	82	" ..	" 27..	29.0	31.5
66	White Bedford.....	813	78	" ..	" 23..	32.5	35.0
68	Early Dakota.....	1,127	79	" ..	" 29..	39.0	30.5
69	Green Mountain.....	1,120	76	" ..	" 29..	31.5	31.5
70	Poland	1,110	97	" ..	" 29..	30.0	31.0
72	Early White Maine.....	1,165	81	" ..	" 27..	30.0	31.0
73	New Baltic.....	1,045	80	" ..	" 27..	29.0	31.0
74	White Superior Scotch.....	905	108	" ..	" 23..	34.5	34.5
76	Great Northern.....	1,027	87	" ..	" 27..	30.0	30.0
77	Royal Doncaster.....	1,235	87	" ..	" 29..	34.0	34.5
78	American Beauty.....	845	62	" ..	" 29..	31.5	31.5
80	White Schoenen.....	1,090	94	" ..	" 29..	30.0	33.5
	<i>Mixed Group.</i>						
81	Colgary Gray	1,140	96	Black ..	July 28..	30.5	32.5
82	Mexican Gray	995	79	Gray ..	" 26..	33.0	33.0
83	Monarch.....	845	68	Black ..	" 29..	31.0	33.0
84	Australian Giant.....	1,490	98	Gray ..	" 30..	32.5	33.5
85	Rust Proof.....	910	76	Red	" 30..	33.0	33.0
86	Black Russian.....	1,080	85	Black ..	" 28..	33.5	34.5
88	Everitt's Negro Black.....	1,365	110	" ..	" 28..	33.0	33.5
89	Black Beauty.....	1,105	94	" ..	" 29..	32.5	33.0

OATS—TABLE III.—RAINFALL AT THE STATION FOR THE FIRST SEVEN MONTHS
OF THE YEAR FOR EIGHT YEARS.

Month.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.
January	4.04	3.90	5.50	3.13	2.67	4.01	2.19	3.92
February.....	1.71	0.81	5.93	5.26	3.38	6.33	3.37	1.00
March	4.33	1.00	4.84	4.38	2.44	1.89	2.36	1.98
April	2.39	1.11	3.99	2.02	7.69	5.66	1.74	1.69
May	6.67	3.44	4.69	2.82	7.89	6.28	4.41	1.38
June.....	2.43	2.08	5.43	3.83	4.73	2.51	2.23	4.20
July	4.72	2.85	1.37	4.41	2.69	1.38	1.38	2.19
Totals	26.29	15.19	31.75	25.85	31.49	28.06	17.68	16.36

I have included in this table more than what has direct bearing on the subject in hand for the purpose of showing the average rainfall for the first seven months of the year in comparison with that for the first seven months of 1895. The general idea exists that oats require considerable rain to make a maximum yield, while the crop of 1895 indicates that a good crop of oats may be grown with a relatively small rainfall if it comes seasonably.

The average cooler temperature of the month in which the oats matured may have had its influence. It is at least worth noting in this connection that the mean temperature for July 1893, was 73.3, for 1894, 71.4 and for 1895, 68.6 degrees.

Table IV gives the yield of the several varieties for each year for the last five years, together with the average yield for the same number of years; also the average yield of the several classes.

In finding the average yield of the several groups, only those are taken into account that have been grown the full five years. This table should be more valuable than any other given in this bulletin, for the reason that it shows what the several groups have done and also what the separate sorts have produced, not only each year, but for a series of years, under the varying conditions of early and later seeding, with abundance of rainfall and what seemed insufficient moisture during the growing season of the crop. Taking up the several groups we see from this table that the Welcome has averaged more than three bushels less per acre than the Seizure during the five years, and that the average of the individual varieties in the Welcome group, with the exception of three, have fallen below the forty bushel mark, while only two of the Seizure group have averaged as low as forty bushels per acre. The Wideawake group corresponds very closely with the Welcome and comparisons between it and the Seizure group show very similar results.

The two varieties giving the highest yields in 1895 were Colonel and Clydesdale, but the Improved American, in the five-year comparison, stands decidedly above all others of its class, followed closely by Colonel and White Belgian. In the Seizure group, Giant Yellow French gave the highest yield this year, but Japan still holds the lead in the series of tests, Prince Edward's Island and Dakota Gray standing next. In the Wideawake group the Alabama shows the highest average yield, with White California and Kansas Hybrid as close competitors.

OATS—TABLE IV.—AVERAGE YIELD FOR FIVE YEARS, 1890-1895.

Varieties.	Yield in bushels per acre.					Average.
	1890.	1891.	1893.	1894.	1895.	
<i>Welcome Group.</i>						
Welcome.....	18.7	46.2	24.8	42.3	56.9	37.7
Improved American.....	33.7	56.2	35.7	46.8	52.6	45.0
Badger Queen.....	19.0	45.3	33.6	46.1	48.6	38.5
Barley Oats.....	21.2	51.8	28.9	44.5	52.9	39.8
Colonel.....	29.6	50.9	32.3	44.5	62.3	43.9
Clydesdale.....	17.1	46.2	27.6	44.5	64.0	39.9
Hargett's White.....	16.5	43.4	30.1	37.6	42.7	34.0
Henderson's Clydesdale.....	16.2	40.3	28.2	40.1	55.8	36.1
Centennial.....	20.6	46.2	28.2	40.0	57.6	38.5
Race Horse.....	26.8	39.0	27.6	26.4	49.1	33.7
White Belgian.....	29.3	46.2	30.7	40.8	58.1	41.0
White Bonanza.....	15.0	42.5	37.9	40.8	46.0	36.4
White Victoria.....	27.5	49.3	31.4	43.1	37.8	37.8
Average of group.....						38.6
<i>Seizure Group.</i>						
Seizure.....	17.6	56.1	14.8	44.4	59.7	38.5
Early Swedish.....	27.1	56.2	29.6	49.1	52.6	42.9
Japan.....	20.9	56.2	35.4	49.8	57.7	44.0
Wilson's Prolific.....	18.4	51.5	35.3	46.6	57.4	41.8
Dakota Gray.....	33.4	60.3	22.6	41.8	57.0	43.0
Prince Edward's Island.....	24.0	63.1	26.2	46.9	57.6	43.5
Black Prolific.....	20.6	61.2	27.9	44.8	54.2	41.7
Golden Giant.....	24.3	57.5	17.2	38.3		*34.3
Giant Yellow French.....	26.2	57.8	18.2	36.9	62.9	40.4
Black Tartarian.....	32.8	61.8	23.5	28.6	52.9	39.9
Egyptian.....	28.1	54.3	31.7	44.8	58.3	43.4
Average of group.....						41.9
<i>Wideawake Group.</i>						
Wideawake.....	31.8	51.8	29.6	38.9	38.3	38.1
Alabama.....	31.2	46.8	22.7	50.3	60.8	42.3
Banner.....	20.4	51.2	26.1	43.6	61.1	40.5
White California.....	29.6	53.7	21.6	45.9	59.6	42.0
Early Prize Cluster.....	26.2	47.5	29.2	40.8	51.6	39.0
Scottish Chief.....	29.3	53.1	25.1	39.0	54.7	40.3
Currie's Prize Cluster.....	17.5	48.1	31.4	40.9	51.6	37.9
Hopetown.....	20.3	36.5	16.7	29.4	42.9	29.1
Kansas Hybrid.....	30.6	48.7	38.5	41.1	49.3	41.6
Probsteier.....	29.3	53.1	27.6	44.5	51.2	41.1
State of North Dakota.....	33.1	52.5	32.0	39.5	46.7	40.7
Welch.....	23.1	38.1	17.6	22.7		*25.4
Potato Oats.....	28.9	39.3	23.2	37.0	43.8	34.4
Early Dakota.....	32.3	51.8	29.2	34.5	47.4	39.0
White Russian.....	27.1	41.8	26.5	30.8		*31.5
White Schoenen.....	27.8	45.0	33.4	26.1	45.4	35.5
Yankee Prolific.....	26.5	41.8	43.2	32.3	40.2	36.8
Average of group.....						38.1

* Average of four years.

OATS—TABLE IV.—Concluded.

Varieties.	Yield in bushels per acre.					
	1890.	1891.	1893.	1894.	1895.	1896.
<i>Mixed Group.</i>						
Monarch	32.1	50.0	34.0	35.3	40.9	38.4
Black Russian.....	25.3	44.0	28.4	32.6	44.5	34.9
Rust Proof	21.7	57.8	31.2	35.5	45.7	38.3
New Red Rust Proof	25.9	37.1	26.2	30.1	.....	*29.8
Average of group.....	.....	.....	.....	.....	.....	37.2

*Average of four years.

Table V gives the weight per bushel of the several varieties given in Table IV, for each year grown, the average for the five years, and the average weight per bushel of all in each class. This table brings out the notable point that only three varieties in the entire list have weighed continuously above the standard weight of 32 pounds to the measured bushel. One of these, Hargett's White, is in the Welcome group and Early Swedish and Egyptian are in the Seizure group. Only fourteen of these varieties show an average weight of 32 pounds to the bushel.

OATS—TABLE V—WEIGHT PER BUSHEL FOR FIVE YEARS—1890-95.

Varieties.	Weight per bushel in pounds.					Average.
	1890.	1891.	1893.	1894.	1895.	
<i>Welcome Group.</i>						
Welcome	29.2	33.0	33.0	31.4	31.2	31.5
Improved American	29.0	30.0	30.0	30.0	32.5	30.3
Badger Queen	27.0	35.0	32.7	34.2	32.0	32.1
Barley	25.7	32.0	31.2	32.0	30.5	30.3
Colonel	29.5	30.0	30.5	32.7	33.0	31.1
Clydesdale	28.2	37.0	29.0	31.2	31.0	31.2
Hargett's White	37.7	38.0	41.2	37.5	36.5	38.1
Henderson's Clydesdale	28.7	32.0	38.5	37.5	37.0	34.7
Centennial	32.7	31.0	33.0	33.5	33.0	32.6
Race Horse	33.7	32.0	38.5	38.0	36.0	35.6
White Belgian	30.0	29.0	29.7	31.7	34.5	30.9
White Bonanza	30.7	37.0	36.0	37.5	35.5	35.3
White Victoria	30.5	34.0	35.5	33.5	35.5	33.8
Average of group						32.8
<i>Seizure Group.</i>						
Seizure	27.2	29.0	26.0	29.0	31.5	28.5
Early Swedish	34.5	33.0	34.5	36.2	35.0	34.6
Japan	35.2	32.0	35.0	35.5	34.5	34.4
Wilson's Prolific	27.7	31.0	31.0	34.2	35.5	31.9
Dakota Gray	24.7	28.0	27.0	32.2	32.0	28.7
Prince Edward's Island	29.2	31.0	31.0	31.2	30.0	30.5
Black Prolific	31.0	31.0	29.0	29.5	30.0	30.1
Giant Yellow French	27.0	29.0	25.0	28.2	32.0	28.2
Black Tartarian	30.0	29.0	29.0	29.7	32.0	29.9
Egyptian	37.5	35.0	37.0	37.2	35.5	36.4
Average of group						31.3
<i>Wideawake Group.</i>						
Wideawake	27.5	29.0	28.5	30.0		
Alabama	29.7	31.0	31.7	31.5	34.0	31.5
Banner	30.5	28.0	29.0	29.0	35.0	30.3
White California	30.5	29.0	31.2	31.2	34.5	31.2
Early Prize Cluster	31.3	31.0	34.5	32.7	31.0	32.1
Scottish Chief	32.7	32.0	34.2	33.0	34.5	33.3
Currie's Prize Cluster	35.2	32.0	34.0	32.5	33.5	33.4
Hopetown	27.7	31.0	30.0	31.5	30.0	30.0
Kansas Hybrid	30.2	32.0	37.2	31.2	33.0	32.7
Probsteier	29.7	30.0	32.2	30.2	29.5	30.3
State of North Dakota	29.0	31.0	31.5	29.5	30.5	30.3
Yankee Prolific	30.7	30.0	30.0	28.7	30.0	29.9
Potato Oats	30.2	29.0	33.7	30.0	29.0	30.4
Early Dakota	30.7	31.0	30.2	30.5	29.0	30.3
White Russian	29.5	28.0	31.5	29.0		*29.5
White Schoenen	27.5	31.0	31.5	29.0	30.0	29.8
Average of group						31.0

OATS—TABLE V—Concluded.

Varieties	Weight per bushel in pounds.					Average.
	1890.	1891.	1893.	1895.	1895.	
<i>Mixed Group.</i>						
Monarch.....	31.5	31.0	32.5	32.2	31.0	31.6
Black Russian.....	30.0	31.0	30.0	36.0	33.5	30.9
Rust Proof.....	29.2	30.0	30.5	31.2	33.0	30.8
New Red Rust Proof.....	27.5	25.0	28.5	31.0	.....	*28.0
Average of group.....	.....	.....	.....	.....	.....	30.3

TEST OF VARIETIES AT SUB-STATION.

In addition to the test of varieties at the Central Station, twenty-nine varieties were selected from the list and sent to the North-eastern Sub-station at Strongsville, Cuyahoga county, for trial. Inasmuch as the land there was not under control of the Station until after the first of April, and since it was necessary to complete draining and other preparatory work, the ground for this experiment was not ready for use until the first of May, and the oats were not sowed until the third of that month.

The land used for the experiment was a very thin, clay soil, which had been used as a pasture and not otherwise cropped for a number of years. During the season that the oats crop was growing, 9.46 inches of rainfall was recorded at the nearest station (Binola), some two miles or more distant. During the same months, 9.73 inches fell at the Central Station. Table VI gives the results of the test, and from it we gather that the Seizure and Wideawake groups have both done better on the thinner soil of Northern Ohio than the Welcome group; and comparing the Seizure and Wideawake groups, we find a slight difference in favor of the Seizure class. The average yield of the several duplicate plots of Seizure is above that of any other single variety. Comparing the three groups, grown both at the Central and Sub-stations, the following points are of interest: At the Central Station the average yield of the duplicate plots of Welcome was decidedly above the average of the crop; at the Sub-station there was no appreciable difference between the average of the Welcome duplicates and the average of the group.

The average yield of the Seizure duplicates, both at the Central Station and Sub-station, was higher than the average of that class, and higher than the yield of all other varieties.

In the Wideawake group the result was different, showing a higher average yield from the other varieties than from the variety used as the standard of comparison.

OATS—TABLE VI.—COMPARATIVE TEST OF VARIETIES AT SUBSTATION.

Plot No.	Varieties.	Yield per acre.			Weight per bushel.	Color of grain.
		Grain.	Straw.	Increase + Decrease —		
	<i>Welcome Group.</i>	<i>Bushels.</i>	<i>Pounds.</i>	<i>Bushels.</i>	<i>Pounds.</i>	
1	Welcome	18.20	555	.....	29.0	White.
2	Improved American	15.86	397	-2.72	29.5	"
3	Badger Queen	19.06	660	+0.48	30.0	"
4	Welcome	18.96	537	.....	29.5	"
5	Clydesdale	22.10	605	+1.18	29.5	"
6	Henderson's Clydesdale	20.86	692	-0.08	34.0	"
7	Drogheda	23.81	707	+2.89	40.0	"
8	Centennial	25.93	807	+5.01	31.0	"
9	Welcome	22.89	647	.....	28.5	"
10	Hargett's White	16.48	412	-5.31	35.0	"
11	White Wonder	18.67	432	-3.12	33.0	"
12	Welcome	20.70	582	.....	29.0	"
	<i>Seizure Group.</i>					
14	Seizure	23.51	787	.....	27.5	White.
15	Wilson's Prolific	24.39	850	-0.17	33.5	"
16	Dakota Gray	23.51	822	-1.05	30.0	Black.
17	Seizure	25.62	715	.....	27.0	White.
18	Golden Giant	22.57	610	-3.56	27.5	"
19	Giant Yellow French	19.30	652	-6.43	25.0	"
20	Seizure	26.64	662	.....	27.0	"
21	Black Tartarian	19.92	607	-8.16	28.5	Black.
22	Egyptian	30.07	772	+1.99	30.0	White.
23	Seizure	29.53	530	.....	27.5	"
24	Prince Edward's Island	19.45	787	-10.51	27.0	"
25	Black Norway	17.26	827	-12.70	26.0	Black.
26	Seizure	30.39	555	.....	27.0	White.
	<i>Wideawake Group.</i>					
27	Wideawake	23.82	747	.....	26.5	White.
28	Banner	29.14	497	+4.70	29.5	"
29	Mixed	26.17	962	+1.73	30.0	"
30	Wideawake	25.07	752	.....	30.0	"
31	Kansas Hybrid	23.98	747	0.00	28.0	"
32	Probsteier	31.32	747	+7.34	29.0	"
33	Wideawake	22.87	767	.....	28.0	"
34	Yankee Prolific	20.62	812	-3.12	35.0	"
35	White Bedford	25.39	717	+1.65	29.0	"
36	Wideawake	24.60	752	.....	28.0	"
37	Poland	25.46	585	+0.86	28.0	"
38	Early White Maine	20.78	1,080	-3.82	29.0	"
39	New Baltic	21.70	880	-2.90	28.5	"
40	Scottish Chief	27.92	797	+3.32	30.0	"

2. METHODS OF SEEDING.

Under this head we have deep and shallow drilling of the seed, sowing the seed broadcast, rolling the land before planting the seed and rolling after the seed is put in; then we have a series of plots in which the yields from plowed land are compared with yields from an equal area which was simply surface cultivated with the disk harrow.

Table VII gives the figures of these tests for 1895, and shows results which indicate that the shallower the seed was planted in 1895 the better, there being a constantly decreasing yield the deeper the seed was placed in the ground.

Sowing the seed broadcast and harrowing it in did not give quite as good returns as where the seed was drilled.

OATS—TABLE VII.—METHODS OF SEEDING AND PREPARATION OF SEEDBED.

Methods of seeding.	Yield per acre.		Weight per bushel.
	Grain.	Straw.	
	<i>Bushels.</i>	<i>Pounds.</i>	<i>Founds.</i>
Plot 1 plowed 6 to 7 inches deep.....	54.68	2,145	31.0
“ 2 disked 3 to 4 “	54.85	1,680	31.5
“ 3 plowed 6 to 7 “	54.29	2,147	31.0
“ 4 disked 3 to 4 “	55.07	1,552	31.0
“ 5 plowed 6 to 7 “	53.43	1,825	31.0
“ 6 disked 3 to 4 “	53.60	1,320	31.5
“ 7 plowed 6 to 7 “	55.46	1,840	32.5
“ 8 disked 3 to 4 “	54.29	1,680	31.5
<i>Deep and Shallow Seeding.</i>			
Drilled one inch deep	61.25	1,890	31.5
“ two inches deep	59.92	1,932	31.5
“ three “	58.90	1,865	31.0
“ four “	56.09	1,855	31.0
Sowed broadcast and harrowed.....	55.30	1,790	30.0
Drilled ordinary after rolling.....	53.70	1,690	31.0
Drilled ordinary then rolled	52.80	1,765	31.0
<i>Preparation of Seedbed.</i>			
Manured Feb. 12, 1894	72.96	1,915	31.5
“ April 15, 1894	69.84	1,865	30.0
Without manure.....	63.67	2,012	31.0
Manured February 12, 1894.....	71.95	1,797	31.5
“ April 15, 1894	69.53	1,775	30.0

Rolling or compacting the land, either before or after seeding, seems to have decreased the yield. These results are in harmony with those of similar experiments in previous years upon this soil, as indicated in Table VIII.

3. PREPARATION OF SEEDBED.

The five plots included in Table VII, under the head of "Preparation of Seedbed," were employed to study the residual effect of manuring land direct from the stable as against allowing the manure to remain in the barnyard until plowing time, then hauling out and immediately plowing under. The application, as may be seen from the date given, was made to land intended for corn and from which a crop of corn was taken the year previous to seeding to oats. Applications of fifteen tons of manure to the acre were made to a timothy sod upon the dates given; other treatment of the land was exactly the same; none of it was plowed until after the middle of April. A crop of corn was taken off in 1894, followed by a crop of oats in 1895, without additional manure.

The Seizure variety of oats was grown on these plots and gave on the manured plots an average yield above seventy bushels per acre.

The first eight plots given in Table VII show no appreciable difference in this year's grain results between plowing and disking the land preparatory to seeding, but indicate a marked increase in the amount of straw produced per acre.

OATS—TABLE VIII.—DIFFERENT METHODS OF SEEDING SHOWING AVERAGES.

Methods.	Grain per acre in bushels.				
	1891.	1893.	1894.	1895.	Average.
Plot 1 plowed 6 to 7 inches deep	51.8	55.9	41.7	54.68	51.0
" 2 disked 3 to 4 "	46.8	49.0	40.0	54.85	47.6
" 3 plowed 6 to 7 " .....	.....	54.0	44.2	54.29	50.8
" 4 disked 3 to 4 " .....	.....	49.3	38.5	55.07	47.6
" 5 plowed 6 to 7 " .....	.....	56.4	.....	53.43	54.9
" 6 disked 3 to 4 " .....	.....	47.3	41.4	53.60	47.4
" 7 plowed 6 to 7 " .....	.....	54.8	.....	55.46	55.1
" 8 disked 3 to 4 " .....	.....	49.2	.....	54.29	51.7
Drilled one inch deep	38.1	25.6	29.5	61.25	.....
" two inches deep	39.0	31.0	28.7	59.92	.....
" three inches deep	35.5	28.4	.....	58.90	.....
" four " .....	.....	.....	.....	56.09	.....
Rolled before seeding	43.8	.....	25.4	53.70	.....
" after "	42.3	.....	22.0	52.80	.....

Table VIII gives a summary of all the experiments made or conducted at this Station on these two methods of preparing land, and shows an increase of yield from plowing over disking or surface cultivation of nearly four and one-half bushels of grain per acre.

SUMMARY.

1. The Wideawake and mixed groups show a decidedly higher percentage of smutted heads than either the Welcome or Seizure groups; the Wideawake class showing about one-fourth more.

2. The average per cent. of smutted heads in forty-nine varieties of white oats is 13.69, while fourteen varieties of black oats show 17.43 per cent.

3. Continuing to grow oats from smutted seed may in five years time decrease the yield almost one-half, as indicated in the results given in the Black Prolific variety.

4. The highest yields in the Welcome group were from the following varieties: Clydesdale, Colonel, Welcome, White Belgian and Centennial.

In the Seizure group: Giant Yellow French, Seizure and Egyptian, while the four following gave results almost identical: Japan, Wilson's Prolific, Dakota Gray and Prince Edward's Island.

In the Wideawake group, the varieties giving highest yields were Banner, Alabama and White California.

5. The highest average yield was decidedly in favor of the Seizure group, which made over fifty bushels to the acre.

6. In the Sub-Station test the Seizure class out yielded both the other groups, and the Seizure variety made the highest yield per acre of any of the varieties tested, either at the Central or Sub-Station.

7. In the five year comparison, the varieties giving the highest average yields stand in the following order: Improved American, Japan, Colonel, Prince Edward's Island, Egyptian, Dakota Gray and Early Swedish; all except the first and third being from the Seizure group.

8. But three varieties in the entire list have weighed continuously 32 pounds to the bushel, and the Welcome group is the only one that averages up to and above the standard weight.

9. Manuring ground for corn direct from the stable during mid-winter, and manuring from the barn yard just before plowing corn ground left a residual effect, noticeable on the oats crop following, in favor of the application direct from the stable in midwinter.

10. The shallowest seeding gave the highest results in 1895; but the average for a series of years indicates better results from covering about two inches deep.

11. Compacting the ground, either before or after seeding, on our clay soil, has resulted in lower yields.

12. The experiments this year have not given yields showing any appreciable difference between plowing the land and surface cultivation, as a preparation for the seed; but a series of experiments show a marked difference in favor of plowing the land.