Historical Document
Kansas Agricultural Experiment Station

EXPERIMENT STATION

OF THE

KANSAS STATE AGRICULTURAL COLLEGE,

MANHATTAN.

BULLETIN No. 59—AUGUST, 1896.

FARM DEPARTMENT.
C. C. GEORGESON, M. S.,
Professor of Agriculture and Superintendent of Farm.
F. C. BURTIS, M. S., Assistant.
D. H. OTIS, B. S., Assistant.

EXPERIMENTS WITH WHEAT.

But little upon wheat has been published since 1893. In 1895 the crop was a complete failure, owing to winter-killing, and no bulletin was issued on the subject. In 1894 the crop was likewise a failure, and those experiments which yielded anything worth publishing were reported upon in Bulletin No. 47. The present season can, on the whole, be said to have been favorable for the winter wheat throughout. The autumn was a little too dry, but rains fell early in October sufficient to give the wheat a good start before cold weather. The winter was mild, and the spring and summer of the present year have, in this region, been all that could be desired for the growth of the wheat. Chinch-bugs were numerous and did some damage, but frequent rains kept them in check. Rust likewise got a foothold, but too late in the season to do serious damage to the crop. In nearly all experiments here recorded the berry is well developed, plump and of good quality, and the yield a fair one.

The experiments are, in the main, a repetition of those under trial in former years. Owing to the variations in seasons and in the soil available for these experiments, it is necessary to repeat the

Historical Document
Kansas Agricultural Experiment Station

same experiments over and over again, before it is safe to draw conclusions as to the merits of the treatments under test. The methods of experimenting are likewise the same as those followed in former years. Except when otherwise noted, the plats have been one-twentieth of an acre in size, and five plats have been given to each method of treatment. It has been the aim to distribute these five plats among those they were to be compared with, so as to have the several series of plats share alike in the advantages and disadvantages of the situation. In some cases, where the soil has been under special treatment, as, for instance, the early and late plowing, and the subsoiled land, the plats have been larger than the regulation one-twentieth of an acre. The rate of seeding was increased in the last crop from 1¼ to 1½ bushels of seed per acre, our previous experiments having indicated that the latter rate gives the best returns. An exception was made in the case of the experimental acre, where it was thought best to continue seeding with 1¼ bushels, this having been the rate from the beginning.

"THE EXPERIMENTAL ACRE."

The acre which was set aside in 1880 for the continual culture of wheat without manure has become known by the above name. In the fall of 1894 it was seeded as usual, but, as already noted, that crop proved a complete failure, and the ground was, therefore, fallow during the summer of 1895. It was plowed July 9, 1895, and, with the exception of a few harrowings to suppress weeds, nothing further was done until it was seeded, September 17, with 1¼ bushels Currell wheat. The yield was 24.85 bushels of grain and 2,965 pounds of straw. This, it will be noticed from the table given herewith, is a trifle less than the average of the 13 crops which have been harvested in the 16 years the acre has been in wheat, and this, too, in spite of the fact that nothing was harvested in 1895, while the yield in 1894 was but a trifle over 6 bushels. The cropping of these two years could not have exhausted the soil appreciably. The yield is, indeed, falling off. The growth is beginning to be spotted, being invariably thinner and shorter in certain places than in others. This may be due in part to surface-washing, for unfortunately this very interesting experiment has been located on sloping ground, and when heavy rains occur while the ground is loose it will wash somewhat in places. But in part the spots of diminished fertility, which now seem to be permanent, are undoubtedly due to partial exhaustion. The experiment will, however, be continued. The accompanying table gives the yield from the beginning:

Historical Document
Kansas Agricultural Experiment Station

Table I.

WHEAT CONTINUOUSLY WITHOUT MANURE.

YEAR.	Variety.	Yield.		Remarks.
		Grain, bus.	Straw, lbs.	
1880–1881	Early May	9.00	.....	
1881–1882	"	47.00	7,845	
1882–1883	"	28.19	3,281	
1883–1884	Zimmerman	37.00	4,525	
1884–1885	"	12.30	2,238	
1885–1886	"	.....	.....	Winter-killed.
1886–1887	"	.....	.....	"
1887–1888	"	30.31	3,766	
1888–1889	"	37.00	3,619	
1889–1890	"	22.90	1,841	
1890–1891	"	30.75	3,435	
1891–1892	Currell	31.30	.....	
1892–1893	"	11.65	1,131	
1893–1894	"	6.05	496	Partly winter-killed.
1894–1895	"	.....	.....	Winter-killed.
1895–1896	"	24.85	2,965	
Produce of 16 years		328.30	.....	
Yearly average		20.51	.....	
Average of 13 crops harvested		25.25	.....	

EARLY AND LATE PLOWING.

This experiment was designed to test the value of early plowing for wheat. Four plats were laid out side by side. Two of each were plowed July 20, just after the previous crop of oats had been removed. The remaining two plats were plowed September 3. Several heavy rains occurred between these dates which caused a settling of the plowed ground. The ground was hard and rather weedy by the time the late plowing was done, and several workings with the disc were necessary to bring it to a good tilth. All plats were seeded September 18 with Zimmerman wheat, the wheat being put in with a shoe press drill. The wheat on the early plowed ground came up sooner and more uniformly than that on the late plowed, and it maintained this slight advantage all through the fall. The following table shows the details of the arrangement and yield of plats and averages of results:

Table II.

EARLY AND LATE PLOWING.

No. of plat.	TREATMENT.	Size of plat, square rods.	Yield of plat.		Rate per acre.	
			Grain, lbs.	Straw, lbs.	Grain, bus.	Straw, tons.
41	Late plowing	57.9	457.5	666.5	21.07	.92
42	Early plowing	54.2	472.5	671.5	23.24	.99
43	Late plowing	50.6	349.5	494.5	18.42	.78
44	Early plowing	47.0	424.5	719.5	24.08	1.22
AVERAGES:	Late plowing				19.74	.85
	Early plowing				23.66	1.10

Historical Document
Kansas Agricultural Experiment Station

SUMMARY OF AVERAGES FOR TWO YEARS.

TREATMENT.	Rate of yield per acre, in bushels.		
	Total average.	1896.	1893.
Late plowing	15.86	19.74	11.99
Early plowing	19.11	23.66	14.57

The yields for the two years this experiment has been tried, 1893 and 1896, are decidedly in favor of early plowing. These results would indicate that if our farmers would start their plows in July, instead of waiting until seeding time, as many do, they would, in all likelihood, be well paid for their forehandedness.

SUBSOILING VS. SURFACE-PLOWING.

SERIES I.

The value of subsoiling was tried in two series. Series 1 was located in the Williston field, on a gentle slope with a southern exposure. The plats numbered 12, each one-fourth acre in extent. All of the plats were plowed in the latter part of July, soon after the removal of the oats. The subsoiling was done on August 7 and 8. The plow used was the old-fashioned subsoiler with a broad shoe, which caused a very heavy draught. It was run 14 inches deep, and the furrows 14 inches apart, so that practically the whole layer of soil was thoroughly stirred to a depth of 14 inches. Plats 45, 47 and 49 were subsoiled without being preceded by the stirring plow, and on plats 51, 53 and 55 the subsoiler followed the stirring plow, the depth, however, remaining the same, 14 inches. In the latter part of August heavy rains fell, settling the ground, which would otherwise have been very loose. On August 8 and 9, just after the subsoiling was completed, the plowed plats were plowed the second time, because they had been compacted to a large extent, by the tramping of the horses in subsoiling the adjoining plats. All plats were seeded to Zimmerman wheat with the shoe press drill on September 18. The table following shows the results. It should be noticed that, in the heavy rains referred to, the subsoiled plats did not wash as badly as the plowed plats, and absorbed the rains more readily.

Historical Document
Kansas Agricultural Experiment Station

Table III.

SUBSOILING VS. SURFACE-PLOWING. SERIES I.—PLATS, ONE-FOURTH OF AN ACRE.

No. of plat.	TREATMENT.	Yield of plats.		Rate per acre.	
		Grain, lbs.	Straw, lbs.	Grain, bus.	Straw, tons.
45	Subsoiled	456.0	910.0	30.40	1.82
46	Surface-plowed	404.5	775.5	26.96	1.55
47	Subsoiled	450.0	828.0	30.00	1.65
48	Surface-plowed	390.5	727.5	26.03	1.45
49	Subsoiled	420.0	730.0	28.00	1.46
50	Surface-plowed	360.5	607.5	24.03	1.21
51	Subsoiled	413.0	691.0	27.53	1.38
52	Surface-plowed	420.5	753.5	28.03	1.50
53	Subsoiled	445.5	746.5	29.70	1.49
54	Surface-plowed	386.5	637.5	25.76	1.27
55	Subsoiled	438.5	719.5	29.23	1.43
*56	Surface-plowed	356.0	626.0	23.73	1.25
AVERAGES.	Subsoiled			29.14	1.37
	Surface-plowed			25.75	1.54

*Badly washed before planting.

In this instance the subsoiled plats gave a decidedly better yield than the surface-plowed plats.

SERIES II

The second series of this experiment was planned in 1894, when 10 plats were laid out, five of which were subsoiled, and alternating with them five plats which were surface-plowed. All the plats were duly seeded to wheat in the fall of 1894, but as the crop was completely winter-killed, the experiment had to be abandoned. In the spring of 1895 all the plats were planted to field peas. The pea crop was harvested the middle of July, and on the 27th of July all plats were plowed alike with an ordinary surface plow. On September 17 all plats were seeded to Zimmerman wheat with a shoe press drill. It will thus be seen that the subsoiling was done a year previous to the seeding of the present crop. The results are given in table IV. The subsoiled plats in this case averaged half a bushel per acre less than plowed plats. In the light of the experiment (series I) cited above, there is no apparent reason for the inferior yield of the subsoiled plats in this case.

Historical Document
Kansas Agricultural Experiment Station

Table IV.

SUBSOILING VS. SURFACE PLOWING. SERIES II.—PLATS 48 x 110 FEET.

No. of plat.	TREATMENT.	Yield of plat.		Rate per acre.	
		Grain, lbs.	Straw, lbs.	Grain, bus.	Straw, tons.
1	Subsoiled	203.0	474.0	27.91	1.95
2	Surface-plowed	227.0	551.0	31.21	2.27
3	Subsoiled	232.5	539.5	31.96	2.22
4	Surface-plowed	230.0	608.0	31.61	2.50
5	Subsoiled	211.0	483.0	29.00	1.99
6	Surface-plowed	208.5	519.5	28.66	2.14
7	Subsoiled	210.0	472.0	28.87	1.94
8	Surface-plowed	224.5	531.5	30.86	2.19
9	Subsoiled	197.5	500.5	27.15	2.06
10	Surface-plowed	182.0	426.0	25.01	1.75
AVERAGES.	Subsoiled			28.97	2.03
	Surface-plowed			29.47	2.17

TIME OF SEEDING WHEAT.

Forty one-twentieth acre plats were seeded to wheat on eight different dates, as shown in the table herewith. Of these 40 plats, eight were on a piece of ground where the soil washed badly, and where the washings were deposited the wheat grew rank and lodged. These plats were therefore abandoned, and the averages given herewith are based on four plats with the same treatment. The land was in soy-beans during the summer of 1895. These beans were harvested in the latter part of August, and, as the surface was loose and perfectly free of weeds, the ground was not plowed, but thoroughly disced until put in good condition for the wheat. The first series of plats was seeded September 13, and every seven days thereafter a series was seeded until November 1. The detailed yields and the average are shown in table V.

It will be noticed that September 20 gave the best average yield, and that the seedings after that date decreased in yield with remarkable regularity until November 1. But not only was there a decrease in yield; there was in like manner a decrease in the quality of the wheat, from the seeding of September 27 to November 1, the grain being smaller and more and more shriveled with each successive seeding. Thus, while the crop from the seeding of October 4 was but little inferior to the early seedings, the seeding of October 11 had only about 50 per cent. of plump kernels, and so on down until the seeding of November 1, which yielded nothing but small shriveled grain. The experiment thus shows a decided disadvantage in the late seeding. The same results have been reached in former years with similar experiments.

Historical Document
Kansas Agricultural Experiment Station

Table V.

TIME OF SEEDING WHEAT. PLATS ONE-TWENTIETH OF AN ACRE.

No. of plat.	Date of Seeding.	When headed.	When ripe.	Yield of plat.		Rate per acre.	
				Grain, lbs.	Straw, lbs.	Grain, bus.	Straw tons.
*9	September 13	May 6	June 8	77.5	112.5	25.83	1.1
10	" 20	" 6	" 8	69.5	90.5	23.16	.9
11	" 27	" 8	" 9	68.5	91.5	22.83	.9
12	October 4	" 11	" 11	68.0	92.0	22.66	.9
13	" 11	" 13	" 13	52.0	86.0	17.33	.8
14	" 18	" 15	" 13	37.0	65.0	12.33	.6
15	" 25	" 19	" 16	31.5	56.5	10.50	.5
16	November 1	" 19	" 16	20.5	59.5	6.83	.5
17	September 13	" 6	" 8	56.5	153.5	18.83	1.5
18	" 20	" 6	" 8	79.0	131.0	26.33	1.3
19	" 27	" 8	" 9	81.0	119.0	27.00	1.1
20	October 4	" 11	" 11	65.5	114.5	21.83	1.1
21	" 11	" 13	" 13	46.5	93.5	15.50	.9
22	" 18	" 15	" 13	40.5	63.5	13.50	.6
23	" 25	" 19	" 16	36.5	71.5	12.16	.7
24	November 1	" 19	" 16	29.5	72.5	9.83	.7
25	September 13	" 6	" 8	88.5	139.5	29.50	1.3
26	" 20	" 6	" 8	93.0	137.0	31.00	1.3
27	" 27	" 8	" 9	69.5	84.5	23.16	.8
28	October 4	" 11	" 11	42.0	131.0	14.00	1.3
29	" 11	" 13	" 13	36.5	103.5	12.16	1.0
30	" 18	" 15	" 13	29.5	79.5	9.83	.7
31	" 25	" 19	" 16	28.0	102.0	9.33	1.0
32	November 1	" 19	" 16	29.5	98.5	9.83	.9
33	September 13	" 6	" 8	65.5	88.5	21.83	.8
34	" 20	" 6	" 8	78.0	132.0	26.00	1.3
35	" 27	" 8	" 9	53.5	90.5	17.83	.9
36	October 4	" 11	" 11	46.0	142.0	15.33	1.4
37	" 11	" 13	" 13	52.0	90.0	17.33	.9
38	" 18	" 15	" 13	43.5	90.5	14.50	.9
39	" 25	" 19	" 16	32.5	85.5	10.83	.8
40	November 1	" 19	" 16	28.5	85.5	9.50	.8
AVERAGES.	September 13	May 6	June 8	.....	.....	23.99	1.2
	" 20	" 6	" 8	.....	.....	26.62	1.2
	" 27	" 8	" 9	.....	.....	22.70	.9
	October 4	" 11	" 11	.....	.....	18.45	1.1
	" 11	" 13	" 13	.....	.....	15.58	.9
	" 18	" 15	" 13	.....	.....	12.54	.7
	" 25	" 19	" 16	.....	.....	10.70	.7
	November 1	" 19	" 16	.....	.....	8.99	.7

* Plats 1 to 8, inclusive, abandoned.

SEEDING AT DIFFERENT RATES.

This experiment was tried in seven series of five plats each; beginning with one-half bushel per acre, the rate was increased by one peck for each series until the two-bushel rate was reached. The land was plowed in July and harrowed at intervals of about two weeks until sceded, September 19. The variety used was the Zimmerman, and all the plats were put in with a shoe press drill. Table VI gives the details and averages of this experiment. It also shows the number of stalks in 20 feet of drill row as the average of the five plats in each seeding. The first count was made the first week in October, when the plants were all up but before they had tillered any, and the second count was on May 14, when the wheat had headed, the same rows being counted both times. This shows that the thin seeding tillered very much more than the thick seeding.

Historical Document
Kansas Agricultural Experiment Station

Table VI.

AMOUNT OF SEED WHEAT TO THE ACRE. PLATS, ONE-TWENTIETH OF AN ACRE.

No. of plat.	Rate of Seeding per Acre.	Yield of plat.		Rate per acre.	
		Grain, lbs.	Straw, lbs.	Grain, bus.	Straw, tons.
57	.50 bushels.	62.0	100.0	20.66	1.00
58	.75 "	71.0	127.0	23.66	1.27
59	1.00 "	80.0	112.0	26.66	1.12
60	1.25 "	83.0	130.0	27.66	1.30
61	1.50 "	100.0	184.0	33.33	1.84
62	1.75 "	83.5	108.5	27.83	1.08
63	2.00 "	88.0	140.0	29.33	1.40
64	.50 "	65.5	86.5	21.83	.86
65	.75 "	66.0	112.0	22.00	1.12
66	1.00 "	73.0	75.0	24.33	.75
67	1.25 "	66.0	112.0	22.00	1.12
68	1.50 "	56.5	73.5	18.83	.73
69	1.75 "	71.5	110.5	23.83	1.10
70	2.00 "	87.0	105.0	29.00	1.05
71	.50 "	73.0	119.0	24.33	1.19
72	.75 "	86.0	120.0	28.66	1.20
73	1.00 "	86.5	127.5	28.83	1.27
74	1.25 "	76.5	87.5	26.56	.91
75	1.50 "	94.0	146.0	31.33	1.46
76	1.75 "	96.5	143.5	32.16	1.43
77	2.00 "	93.0	149.0	31.00	1.49
78	.50 "	83.5	100.5	27.83	1.00
79	.75 "	75.5	114.5	25.16	1.14
80	1.00 "	66.0	96.0	22.00	.96
81	1.25 "	81.0	139.0	27.00	1.39
82	1.50 "	87.0	163.0	29.00	1.63
83	1.75 "	74.5	131.5	25.14	1.33
84	2.00 "	82.0	132.0	27.33	1.32
85	.50 "	88.5	115.5	29.50	1.15
86	.75 "	94.0	146.0	31.33	1.46
87	1.00 "	100.5	153.5	33.50	1.53
88	1.25 "	90.5	144.5	31.37	1.50
89	1.50 "	87.5	105.5	29.16	1.05
90	1.75 "	101.5	184.5	33.83	1.84
91	2.00 "	98.5	171.5	32.83	1.71
Averages.	.50 bushels.			24.83	1.04
	.75 "			26.16	1.23
	1.00 "			27.06	1.12
	1.25 "			26.91	1.24
	1.50 "			28.33	1.34
	1.75 "			28.55	1.35
	2.00 "			29.89	1.39

SUMMARY OF AVERAGES FOR TWO YEARS.

Rate of Seeding per Acre.	Rate of yield per acre, in bushels.		
	Total average.	1896.	1892.
.50 bushels.	22.64	24.83	20.46
.75 "	28.99	26.16	31.83
1.00 "	30.91	27.06	34.76
1.25 "	30.98	26.91	35.05
1.50 "	32.66	28.33	36.99
1.75 "	32.35	28.55	36.16
2.00 "	33.90	29.89	37.91

Historical Document
Kansas Agricultural Experiment Station

NUMBER OF STALKS IN 20 FEET OF DRILL ROW. AVERAGE OF FIVE PLATS.

RATE OF SEEDING PER ACRE.	Oct. 3. 1895.	May 14. 1896.	Per ct. inc. in stalks by tillering.
.50 bushels	178	428	140
.75 "	222	446	100
1.00 "	298	454	52
1.25 "	356	558	56
1.50 "	424	610	44
1.75 "	496	624	27
2.00 "	534	698	30

METHODS OF SEEDING.

Owing to the fact that the heavy rains in the fall of 1895 washed several of the plats of this experiment, the growth became irregular, and the results are, therefore, not satisfactory. The facts are given here, however, for what they are worth. The methods employed were broadcasting, listing, seeding with hoe drill, and seeding with shoe drill. The ground was plowed in July and all plats were seeded September 20, the broadcasted seed being covered with a harrow in the ordinary way. The listed plats were planted with the Hollinger lister drill, an implement resembling the hoe drill in all respects except that the hoes are 11 inches apart, are larger, go deeper into the ground and make a deeper furrow than the hoes on the ordinary drill. The listed rows being so far apart, less seed is required than when the rows are closer together, and the listed plats were, therefore, seeded at the rate of 1¼ bushels per acre, while the others were seeded at the rate of a bushel and a half.

Table VII.

METHODS OF SEEDING WHEAT. PLATS ONE-TWENTIETH OF AN ACRE.

No. of plat.	METHODS OF SEEDING.	Yield of plat.		Rate per acre.	
		Grain, lbs.	Straw, lbs.	Grain, bus.	Straw, tons.
92	Broadcasted	89.0	182.0	29.66	1.82
93	Listed	84.5	110.5	28.16	1.10
94	Hoe drill	102.5	201.5	34.16	2.01
95	Shoe drill	100.5	199.5	33.50	1.99
96	Broadcasted	87.0	151.0	29.99	1.56
97	Listed	107.5	178.5	35.83	1.78
98	Hoe drill	123.5	266.5	41.16	2.66
99	Shoe drill	113.5	242.5	37.83	2.42
100	Broadcasted	102.5	223.5	34.16	2.23
101	Listed	91.0	151.0	30.33	1.51
102	Hoe drill	95.5	168.5	31.83	1.68
103	Shoe drill	122.0	232.0	40.66	2.32
104	Broadcasted	98.5	187.5	32.83	1.87
105	Listed	101.0	213.0	33.66	2.13
106	Hoe drill	103.5	124.5	34.50	1.24
107	Shoe drill	118.0	230.0	39.33	2.30
108	Broadcasted	105.0	223.0	35.00	2.23
109	Listed	94.5	189.5	31.50	1.89
110	Hoe drill	76.5	185.5	25.50	1.85
111	Shoe drill	80.5	263.5	26.83	2.63

Historical Document
Kansas Agricultural Experiment Station

TABLE VII—CONCLUDED.

AVERAGES.	Rate per acre.	
	Grain, bus.	Straw, tons.
Broadcasted	32.32	1.94
Listed	31.89	1.68
Hoe drill	33.43	1.88
Shoe drill	35.63	2.33

SUMMARY OF AVERAGES FOR FOUR YEARS.

METHODS OF SEEDING.	Rate of yield per acre, in bushels.				
	Total average.	1896.	1893.	1892.	1891.
Broadcasted	25.02	32.32	10.95	24.03	32.78
Listed	26.97	31.89	19.62	27.03	29.36
Hoe drill	26.70	33.43	14.83	.....	31.86
Shoe drill	26.66	35.63	11.58	27.63	31.83
Summary of averages for three years:					
Broadcasted	25.35	32.32	10.95	.....	32.78
Listed	26.95	31.89	19.62	.....	29.36
Hoe drill	26.70	33.43	14.83	.....	31.86
Shoe drill	26.34	35.63	11.58	.....	31.83

GRADING SEED WHEAT.

For several years we have experimented with the separation of the wheat, as it came from the thrasher, into two grades, light and heavy, and these grades have been compared with the common, or not graded, seed. The present season a similar experiment was carried on, 15 plats being seeded with wheat of the three grades. The plats were located in a low portion of the field, on rich soil, and the wet season caused a heavy growth and large yield. It is probably due to these conditions that the three grades are not marked by the difference that has characterized similar experiments in former years. The variety used was the Zimmerman, and it was of rather poor quality. The common grade weighed 52.75 pounds to the bushel, and, after separation on the fanning-mill, the light and heavy grades weighed respectively 44.75 and 58 pounds to the struck bushel. The light seed was small and shrunken, whereas the heavy grade was tolerably plump seed. Seeded at the rate of a bushel and a half to the acre, there would, of course, be a much larger number of kernels of the light grade put on each plat than of the common and heavy grades. Table VIII shows the yield of the present year, the average for four years, and the average number of stalks in 20 feet of drill row of each of the three grades, soon after they germinated and again in the middle of May, after the plants had tillered all they would.

Historical Document
Kansas Agricultural Experiment Station

Table VIII.

GRADING SEED WHEAT. PLATS, ONE-TWENTIETH OF AN ACRE.

No. of plat.	Grade of Seed.	Yield of plat.		Rate per acre.	
		Grain, lbs.	Straw, lbs.	Grain, bus.	Straw, tons.
112	Light	93.0	171.0	31.00	1.71
113	Common	108.0	190.0	36.00	1.90
114	Heavy	97.0	143.0	32.33	1.43
115	Light	100.0	170.0	33.33	1.70
116	Common	108.5	203.5	36.16	2.03
117	Heavy	104.0	182.0	34.66	1.82
118	Light	107.0	193.0	35.66	1.93
119	Common	106.0	178.0	35.33	1.78
120	Heavy	108.5	175.5	36.16	1.75
121	Light	115.5	198.5	38.50	1.98
122	Common	112.0	196.0	37.33	1.96
123	Heavy	115.5	200.5	38.50	2.00
124	Light	108.0	182.0	36.00	1.82
125	Common	108.5	183.5	36.16	1.83
126	Heavy	106.0	192.0	35.33	1.92
AVERAGES:	Light			34.89	1.82
	Common			36.19	1.90
	Heavy			35.39	1.78

SUMMARY OF AVERAGES FOR FOUR YEARS.

Grade of Seed.	Rate of yield per acre, in bushels.				
	Total average.	1896.	1893.	1892.	1891.
Light	27.60	34.89	15.46	27.37	32.69
Common	28.97	36.19	17.46	28.60	33.66
Heavy	29.15	35.39	17.43	28.88	34.93

NUMBER OF STALKS IN 20 FEET OF DRILL ROW. AVERAGE OF FIVE PLATS.

Grade of Seed.	Oct. 3, 1895.	May 14, 1896.	Per cent. increase in stalks by tillering.
Light	454	738	62
Common	426	766	79
Heavy	374	748	100

EFFECTS OF PASTURING WHEAT.

Fifteen plats were laid out alongside of the preceding experiment, on low ground of good quality. Ten of these plats were fenced so as to allow them to be pastured, while the five plats which were not pastured remained as a check on the others. They were seeded to Early Red Clawson, on September 20. Owing to dry weather in the fall, the plats designed for fall pasturage did not afford much feed. Nevertheless each plat was fed off by one cow with a good appetite, to the extent of 12 hours of actual grazing. In March the spring-pastured plats were subjected to the same treatment, though the cows were only 10 hours on each plat and the

Historical Document
Kansas Agricultural Experiment Station

growth was heavier, so they did not eat it down very close, nor was it eaten down evenly over the several plats. Table IX shows that this amount of pasturing did the wheat no harm. In fact, the spring-pastured plats gave a better yield than those not pastured.

Table IX.

EFFECTS OF PASTURING WHEAT. PLATS. ONE-TWENTIETH OF AN ACRE.

No. of plat.	Treatment.	Yield of plat.		Rate per acre.	
		Grain, lbs.	Straw, lbs.	Grain, bus.	Straw, tons.
127	Fall pastured	74.5	131.5	25.14	1.33
128	Spring "	94.5	186.5	31.50	1.86
129	Not "	105.5	242.5	35.16	2.42
130	Fall "	104.0	226.0	34.66	2.26
131	Spring "	105.0	235.0	35.00	2.35
132	Not "	95.5	254.5	31.83	2.54
133	Fall "	110.5	299.5	36.83	2.99
134	Spring "	105.0	269.0	35.00	2.69
135	Not "	72.5	208.5	24.16	2.08
136	Fall "	79.0	283.0	26.33	2.83
137	Spring "	82.0	202.0	27.33	2.02
138	Not "	94.0	294.0	31.33	2.94
139	Fall "	104.5	255.5	34.83	2.55
140	Spring "	103.5	230.5	34.50	2.30
141	Not "	102.5	201.5	34.16	2.01
Averages.	Fall pastured			31.55	2.39
	Spring "			32.66	2.24
	Not "			31.32	2.39

SUMMARY OF AVERAGES FOR THREE YEARS.

Treatment.	Rate of yield per acre in bushels.			
	Total average.	1896.	1892.	1891.
Fall pastured	28.27	31.55	.....	25.00
Spring "	30.27	32.66	33.03	25.13
Not "	31.98	31.32	38.06	26.57
Summary of Averages for Two Years: Fall pastured	28.27	31.55	.....	25.00
Spring "	28.89	32.66	.....	25.13
Not "	28.94	31.32	.....	26.57

WHEAT IN ROTATION.

Somewhat extensive rotation experiments were begun in 1890-'91. The detailed plan of these experiments was published in Bulletin No. 33. The accompanying table gives in condensed form the rotations and the yields of wheat from each plat up to date; and it also gives the average yield of each rotation for the years named, and the average for all the years. As yet the rotations have not progressed far enough to pronounce judgment as to which is the best. Some points are becoming apparent, however. The rotation calling for 20 tons manure per acre, tested on plats 1, 6, 11, 16, and 21, has yielded a smaller average than the rotation designed for continuous cropping without manure. The apparent reason for this is that the yearly heavy manuring has made the soil

Historical Document
Kansas Agricultural Experiment Station

too rich. The straw grows so rank that it lodges, and the heads are consequently not well filled with grain. Thus, for the present year, the manured plats averaged only 16 bushels per acre, while the unmanured plats alongside averaged over 27 bushels per acre. The harvests of 1893 and 1895 were failures, and several rotations are, therefore, represented in the average by but one year, which, of course, is of no value in the comparison of relative merits; and the harvest of 1894 was so nearly a failure that it is of but little value in a general comparison.

Table X.

WHEAT IN ROTATION. PLATS ONE-TENTH OF AN ACRE EACH.
The figures given apply to the yield of wheat only.

No. of plat	ROTATION.	Rate of yield of grain per acre, in bushels.							
		Total ave.	1896.	1895.	1894.	1893.	1892.	1891.	1890.
1	Wheat continuously with 20 tons manure per acre yearly.	24.86	12.33	.....	7.50	Plats 1-25 were planted to red Kaffir-corn, which failed.	33.08	30.58	40.8
2	Wheat continuously without manure	26.02	31.00	.....	4.25	..	36.33	31.25	27.3
3	Fallow and wheat in alternation	36.83	Fallow	.....	Fallow	..	Fallow	36.83	Fallow
4	Corn and wheat in alternation	15.58	10.83	.....	1.66	..	25.25	Corn	24.6
5	Oats and wheat in alternation	32.08	Oats	.....	Oats	..	Oats	32.08	Oats
6	Same as plat 1	25.48	17.25	.....	4.16	..	39.41	31.00	35.6
7	" " 2	26.06	30.00	.....	5.12	..	37.41	29.17	28.6
8	" " 3	19.63	Fallow	.....	Fallow	..	Fallow	19.63	Fallow
9	" " 4	33.17	Corn	.....	Corn	..	Corn	33.17	Corn
10	" " 5	24.19	28.25	.....	3.58	..	34.33	Oats	30.6
11	" " 1	25.36	17.58	.....	5.00	..	36.66	31.17	36.4
12	" " 2	27.77	29.16	.....	7.41	..	40.75	28.33	33.2
13	" " 3	31.58	Fallow	.....	Fallow	..	Fallow	31.58	Fallow
14	" " 4	28.38	28.25	.....	7.75	..	38.33	Corn	39.2
15	" " 5	29.25	Oats	.....	Oats	..	Oats	29.25	Oats
16	" " 1	24.53	17.83	.....	2.91	..	33.00	28.41	40.5
17	" " 2	28.79	31.58	.....	6.33	..	39.66	29.92	36.5
18	" " 3	25.33	Fallow	.....	Fallow	..	Fallow	25.33	Fallow
19	" " 4	29.33	Corn	.....	Corn	..	Corn	29.33	Corn
20	" " 5	30.21	30.75	.....	6.66	..	39.66	Oats	43.8
21	" " 1	25.16	15.08	.....	4.83	..	32.41	27.42	46.1
22	" " 2	30.69	30.75	.....	7.91	..	43.91	29.50	41.4
23	" " 3	21.42	Fallow	.....	Fallow	..	Fallow	21.42	Fallow
24	" " 4	29.19	28.66	.....	8.16	..	36.66	Corn	43.3
25	" " 5	29.17	Oats	.....	Oats	..	Oats	29.17	Oats
26	Wheat, corn, oats	26.33	"	.....	10.50	Oats	Corn	42.17	.....
27	" " " beans	40.00	Corn	.....	Beans	"	'	40.00	.....
28	" " roots, oats	41.54	"	.....	Oats	Roots	"	41.54	.....
29	Wheat, corn, oats, grass 2 years	33.25	22.83	.....	Grass	Oats	Corn	43.67	.....
30	Wheat, corn, roots, oats, grass 2 years	42.83	Grass	.....	Oats	Roots	Corn	42.83	.....
31	Same as plat 26	17.33	25.33	.....	Corn	9.33	Oats	Corn	.....
32	" " 27	3.00	Oats	.....	3.00	Beans	"	"	.....
33	" " 28	16.16	Roots	.....	16.16	Oats	Roots	"	.....
34	" " 29	.....	Corn	.....	Grass	Grass	Oats	"	.....
35	" " 30	32.25	32.25	.....	"	Oats	Roots	"	.....
36	" " 26	36.75	Corn	.....	Oats	Corn	36.75	Oats	.....
37	" " 27	17.75	Beans	.....	Corn	17.75	Clover	"	.....
38	" " 28	.....	Oats	.....	"	*	Oats	Roots	.....
39	" " 29	10.41	"	.....	10.41	Grass	Grass	Oats	.....
40	" " 30	.....	Corn	.....	Grass	"	Oats	Roots	.....
41	" " 26	30.91	Oats	.....	19.16	Oats	Corn	42.67	.....
42	" " 27	27.87	20.16	.....	Oats	Corn	35.58	Clover	.....
43	" " 28	32.99	28.58	.....	Roots	"	37.41	Oats	.....
44	" " 29	.....	Grass	.....	Corn	*	Grass	Grass	.....
45	" " 30	9.25	Roots	.....	9.25	Grass	"	Oats	.....
46	" " 26	23.75	23.75	.....	Corn	*	Oats	Corn	.....
47	" " 27	41.42	Corn	.....	Beans	Oats	Corn	41.42	.....
48	" " 28	37.67	"	.....	Oats	Roots	"	37.67	.....
49	" " 29	22.66	Grass	.....	"	Corn	22.66	Grass	.....
50	" " 30	3.00	Oats	.....	Corn	3.00	Grass	"	.....

Wheat completely winter-killed

Historical Document
Kansas Agricultural Experiment Station

TABLE X—CONCLUDED.

AVERAGES.	Rate of yield of grain per acre, in bushels.							
	Total ave.	1896.	1895.	1894.	1893.	1892.	1891.	1890.
Wheat continuously with 20 tons manure per acre yearly	25.08	16.01	Wheat winter-killed.	4.88	.....	34.91	29.71	39.88
Wheat continuously without manure	27.87	30.49		6.20	Wheat failed.	39.61	29.63	33.40
Fallow and wheat in alternation	26.96	Fallow		Fallow		Fallow	26.96	Fallow
Corn and wheat in alternation,	26.01	23.87		5.86		33.41	31.25	35.70
Oats and wheat in alternation,	27 79	29.50		5.12	.....	36.99	30.16	37.20
Wheat, corn, oats	25.57	24.54		14.83	9.33	36.75	42.42	.....
" " " beans	23.44	20.16		3.00	17.75	35.58	40.71	.....
" " roots, oats	30.44	28.58		16.16	.....	37.41	39.60	.....
" " oats, grass 2 yrs	26.89	22.83		10.41	.....	22.66	43.67	.....
Wheat, corn, roots, oats, grass 2 years	21.83	32.25	.....	9.25	3.00	.....	42.83	.....

* Wheat failed.

TEST OF VARIETIES.

Thirty-five varieties were tested on 47 plats, each one twenty-fifth of an acre in extent. These plats were located side by side, in the order indicated by the plat numbers in table XI. The soil was of uniform quality, as can be seen by the uniform yield of the Zimmerman plats, located near each end and in the middle of the series. The varieties grew well, without serious drawbacks of any kind, and the yields given for the present year may, therefore, be fairly taken as a measure of the yielding power of the several varieties in so far as this can be tested in a single year.

The Turkey wheat is rapidly coming to the front as a heavy yielder. It has, moreover, the merit of being, perhaps, the hardiest wheat of any we have tested. Of some 40 varieties under test last year, the severe winter of 1894-'95 completely killed all except the Turkey, the Zimmerman, and a variety called the Reliable Minnesota. The latter showed a few green spears in the spring. The Zimmerman showed a stand of about 10 per cent., while the Turkey had about 25 per cent. of the plants alive in the spring. None of the others showed a single green spear by the latter part of April. The Turkey is a bearded wheat and, therefore, somewhat less pleasant to handle than a smooth wheat, and it is sometimes discriminated against by dealers on account of being a hard wheat.

Historical Document
Kansas Agricultural Experiment Station

Table XI.

TEST OF VARIETIES. PLATS, ONE TWENTY-FIFTH OF AN ACRE.*

No. of plat	Variety.	Bearded or smooth.	When headed.	When ripe.	Height of stalk	Length of head	Yield of plat. Grain, pounds	Yield of plat. Straw, pounds	Rate per acre. Grain, bushels	Rate per acre. Straw, tons	Weight of struck bushel, pounds
					Ft.	In.					
1	Penquite's Velvet Chaff	B	May 10	June 16	3.6	2.7	74.0	207.0	30.83	2.58	60
2	Extra Early Oakley	S	" 10	" 13	3.6	2.4	75.5	182.5	31.45	2.28	59
3	Fultz	S	" 10	" 13	3.7	2.8	75.0	163.0	31.25	2.03	59⅗
4	Ramsey	S	" 10	" 13	3.6	2.7	78.5	173.5	32.70	2.16	59
5	Currell	S	" 11	" 16	3.6	2.4	84.0	141.0	35.00	1.76	60½
6	Turkey	B	" 12	" 19	3.5	2.4	100.5	207.5	41.87	2.59	61
7	Zimmerman (College)	S	" 6	" 8	3.3	2.5	76.0	160.0	31.66	2.00	60
8	Zimmerman (fanned)	S	" 6	" 8	3.3	2.4	76.5	159.5	31.87	1.99	60
9	Zimmerman (not fanned)	S	" 6	" 8	3.2	2.5	71.0	147.0	29.58	1.83	59
10	Red May	S	" 11	" 16	3.6	2.8	68.5	155.5	28.54	1.94	60
11	Farquhar	S	" 10	" 16	3.6	2.8	76.0	174.0	31.99	2.19	58
12	Diehl-Egyptian	S	" 12	" 16	3.5	2.6	71.0	167.0	29.78	2.10	60
13	Bissell	B	" 10	" 16	3.7	2.6	83.5	210.5	35.15	2.65	59½
14	Tasmanian Red	B	" 13	" 19	3.5	2.3	81.0	165.0	33.90	2.07	59
15	Theiss	B	" 11	" 19	3.6	2.5	67.5	232.5	28.28	2.92	60
16	Bearded Monarch	B	" 11	" 18	3.7	2.7	67.0	149.0	27.91	1.86	59
17	Big Frame	S	" 6	" 6	3.2	3.0	63.5	156.5	26.45	1.95	60
18	Deitz	B	" 11	" 16	3.7	2.8	79.5	166.5	33.12	2.08	59½
19	Velvet Chaff	B	" 11	" 16	3.5	3.3	71.0	161.0	29.58	2.01	59
20	Diehl-Mediterranean	B	" 15	" 20	4.0	2.8	71.0	181.0	29.74	2.27	59
21	Big English	S	" 15	" 20	3.9	2.7	78.5	196.5	32.70	2.45	59
22	Currell	S	" 11	" 16	3.8	3.0	69.5	130.5	28.95	1.63	60
23	Turkey	B	" 12	" 19	3.6	2.3	103.5	198.5	43.12	2.48	61½
24	Zimmerman (College)	S	" 6	" 8	3.3	2.7	73.0	137.0	30.41	1.71	60
25	Zimmerman (fanned)	S	" 6	" 8	3.3	2.6	82.0	170.0	34.16	2.12	60½
26	Zimmerman (not fanned)	S	" 6	" 8	3.3	2.8	75.0	143.0	31.25	1.78	60
27	Lancaster	B	" 13	" 20	3.7	2.7	82.0	199.0	34.16	2.48	60
28	Buckeye	S	" 13	" 20	3.9	2.9	74.0	147.0	30.83	1.83	58
29	Andrews's No. 4	B	" 14	" 20	4.0	2.1	79.5	180.5	33.12	2.25	60
30	Boyer	B	" 13	" 20	3.8	2.9	79.5	157.5	34.00	2.02	60
31	Dallas	B	" 13	" 20	3.6	2.6	70.0	185.0	29.16	2.31	60
32	Gold Medal	S	" 16	" 21	3.7	2.5	58.0	130.0	24.16	1.62	59½
33	Democrat	B	" 14	" 20	3.8	2.9	52.0	97.0	21.66	1.21	60
34	Fulcaster	B	" 13	" 20	3.7	3.1	96.0	136.0	40.00	1.70	60
35	Valley	B	" 14	" 20	3.6	2.8	86.0	168.0	35.83	2.10	60
36	Seneca Chief	B	" 16	" 20	4.0	2.7	72.5	153.5	30.20	1.91	59½
37	White Track	S	" 16	" 21	4.1	4.0	64.0	80.0	26.66	1.00	60
38	Emporium	S	" 16	" 20	3.8	3.6	59.5	140.5	24.79	1.75	58
39	Currell	S	" 11	" 16	3.3	2.6	74.5	140.5	31.04	1.75	60
40	Turkey	B	" 12	" 19	3.6	3.0	100.5	123.5	41.87	1.54	61½
41	Zimmerman (College)	S	" 6	" 8	3.2	2.9	80.5	159.5	33.54	1.99	61
42	Zimmerman (fanned)	S	" 6	" 8	3.1	2.6	83.0	143.0	34.58	1.78	60
43	Zimmerman (not fanned)	S	" 6	" 8	3.2	2.9	79.0	152.0	32.91	1.90	60
44	German Emperor	S	" 15	" 20	3.9	2.7	76.5	199.5	31.87	2.49	58
45	Early Red Clawson	S	" 14	" 16	4.0	3.2	88.5	191.5	36.87	2.39	57½
46	Rudy	B	" 14	" 20	3.9	3.6	89.0	175.0	37.08	2.18	60
47	Jones's Winter Fife	S	" 14	" 20	3.8	3.3	82.5	113.5	34.37	1.41	59
Average of similar plats.											
	Currell	S	May 11	June 16	3.6	2.7	76.0	137.3	31.66	1.71	60⅛
	Turkey	B	" 12	" 19	3.6	2.6	101.5	176.5	42.28	2.20	61⅓
	Zimmerman (College)	S	" 6	" 8	3.3	2.7	76.5	152.1	31.87	1.90	60⅜
	Zimmerman (fanned)	S	" 6	" 8	3.2	2.5	80.5	157.5	33.53	1.96	60⅝
	Zimmerman (not fanned)	S	" 6	" 8	3.2	2.7	75.0	147.3	31.24	1.83	59⅔

*Several plats were reduced somewhat from the above size by washes.

Historical Document
Kansas Agricultural Experiment Station

Table XII shows the average yield of the varieties named for the time they have been grown here at the Station, together with the rank each variety took each year.

Table XII.

VARIETIES OF WHEAT ARRANGED ACCORDING TO AVERAGE YIELD.

VARIETY.	Average of 6 years.		1896.		1894.		1893.		1892.		1891.		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.
Andrews's No. 4	33.30	1	33.12	11	13.08	18	20.88	7	49.13	2	50.31	1	.....	..
Turkey	32.20	2	42.28	1	27.41	1	28.36	1	48.02	3	14.94	31	.....	..
Valley	31.14	3	35.83	5	17.00	7	21.75	4	39.30	16	41.83	10	.....	..
Tasmanian Red	30.32	4	33.90	10	15.50	11	20.24	10	42.37	9	40.62	14	29.33	6
Ramsey	30.13	5	32.70	13	16.50	9	16.06	29	37.66	19	47.75	4	.....	..
Currell	29.87	6	31.66	18	12.89	20	15.47	31	40.29	14	41.42	12	37.50	1
Fulcaster	29.77	7	40.00	2	11.49	16	18.79	19	35.60	27	39.99	17	.....	..
Boyer	29.75	8	34.00	9	10.08	28	20.36	8	34.22	31	50.08	2	.....	..
Zimmerman	29.74	9	31.87	16	14.92	13	13.09	34	49.62	1	34.65	24	34.33	2
Penquite's Velvet Chaff	28.84	10	30.83	21	11.50	25	18.84	18	41.69	11	41.34	13	.....	..
Bearded Monarch	28.81	11	27.91	30	14.74	14	18.96	16	38.01	18	44.42	7	.....	..
Emporium	28.72	12	24.79	33	14.99	12	17.05	25	42.15	10	44.61	6	.....	..
Gold Medal	28.62	13	24.16	34	22.23	2	20.18	11	47.31	4	29.12	29	.....	..
Red May	28.58	14	28.54	28	14.50	15	15.67	30	34.88	29	48.19	3	29.70	5
Buckeye	28.55	15	30.83	22	10.83	26	19.66	14	36.17	24	43.68	9	30.17	4
Fultz	28.52	16	31.25	20	17.00	8	17.45	24	35.32	28	41.61	11	.....	..
Big Frame	28.29	17	26.45	32	18.16	5	21.34	6	44.83	5	30.68	27	.....	..
Dallas	28.14	18	29.16	27	7.83	34	22.79	2	40.45	12	40.49	16	.....	..
Democrat	27.80	19	21.66	35	14.49	17	21.40	5	37.19	22	44.27	8	.....	..
Big English	27.59	20	32.70	14	16.16	10	18.09	22	40.45	13	30.55	28	.....	..
Extra Early Oakley	27.49	21	31.45	19	12.16	23	14.48	32	36.03	25	39.75	18	31.10	3
Theiss	27.48	22	28.28	29	17.83	6	22.44	3	42.90	8	25.98	30	.....	..
Farquhar	27.44	23	31.99	15	12.08	24	18.05	23	40.29	15	34.79	23	.....	..
Lancaster	27.08	24	34.16	8	9.16	31	16.53	28	37.25	21	38.33	19	.....	..
German Emperor	27.06	25	31.87	17	12.99	19	20.01	12	35.91	26	34.52	26	.....	..
Deitz	27.04	26	33.12	12	8.08	33	17.05	26	36.35	23	40.61	15	.....	..
Seneca Chief	26.83	27	30.20	23	12.66	22	20.36	9	34.70	30	36.26	21	.....	..
Diehl-Egyptian	26.73	28	29.78	24	8.66	32	18.47	21	30.60	32	46.17	5	.....	..
Bissell	26.65	29	35.15	6	6.99	35	19.70	13	44.76	6	.....	....	.....	..
Diehl-Mediterranean	26.56	30	29.74	25	9.66	29	12.52	35	42.91	7	37.96	20	.....	..
Velvet Chaff	26.39	31	29.58	26	9.33	30	18.68	20	39.05	17	35.30	22	.....	..
White Track	25.70	32	26.66	31	10.41	27	19.48	15	37.31	20	34.63	25	.....	..
Jones's Winter Fife	24.87	33	34.37	7	21.33	3	18.92	17	.....	....	.....	....	.....	..
Rudy	23.92	34	37.08	3	20.33	4	14.36	33	.....	....	.....	....	.....	..
Early Red Clawson	22.20	35	36.87	4	12.83	21	16.90	27	.....	....	.....	....	.....	..

SUMMARY OF RESULTS.

1. The acre which has been in wheat for 16 years past is beginning to show signs of exhaustion.

2. Early plowing for wheat, which will allow the soil to settle before it is seeded, shows a decided advantage over plowing just before seeding.

3. The plats which were subsoiled six weeks before seeding produced a better yield than the plats which were plowed in the ordinary way at the same time; but the plats which were subsoiled a year before seeding, and which had in the meantime been cropped with peas, gave no increase over the plowed plats.

Historical Document
Kansas Agricultural Experiment Station

4. In an inquiry as to the best time to seed wheat, in which a series of plats was seeded every seventh day from September 13 to November 1, the seeding of September 20 gave the best yield, 26.62 bushels per acre, and successive seedings showed a constantly diminishing yield, till the seeding of November 1, which yielded but 8.99 bushels per acre of very inferior grain. Experience and experiments agree on about the middle of September as the best time to seed wheat in this region.

5. Experiments with different amounts of seed per acre indicate that about 1½ bushels per acre give the best returns for this region.

6. As to methods of seeding tried, the shoe press drill gave this year better yields than seeding with the hoe drill, lister drill, or broadcasting. But it must not be overlooked that whether this or that method will give the best yield will depend largely on the character of the season.

7. There was no marked difference in yield of the grades, light, common and heavy seed wheat the present year, though the average of the experiments for four years is in favor of heavy seed.

8. Pasturing the wheat did not affect the yield injuriously the present year. Former experiments have given the best yields when the wheat was not pastured.

9. Wheat land manured with 20 tons barn-yard manure per acre yearly has given decidedly smaller yields than land in wheat continuously without manure. The wheat on the manured land lodges and fails to fill.

10. The best yielding six varieties, based on an average of several years, are the following, in the order named: Andrews's No. 4, Turkey, Valley, Tasmanian Red, Ramsey, and Currell.