

EXPERIMENT STATION,
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DEPARTMENT OF AGRICULTURE.

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EXPERIMENTS WITH WHEAT.

THE experiments hereinafter detailed were planned and for the most part executed under the direction of Prof. E. M. Shelton, who resigned at the close of 1889. The writer's connection with the College dates from January 1st of the present year. This is stated in order to give whatever credit the work deserves to the proper party.

THE WHEAT CROP

On the College farm has on the whole been very satisfactory this year. The general crop was grown in Field C, containing about 14 acres. It had been in grass from '86 to '89, inclusive; was broken July 24th to August 2d, and sown to wheat September 12, 1889. The variety which has been grown on the College farm for some years past is the Zimmerman, a red wheat with smooth heads, so closely resembling the Red May in all points that it is very difficult to tell one from the other. The yield will average 30 bushels to the acre. It did not winter-kill by the severe frosts of January and February, being protected by a carpet of snow during the severest weather, although some of the experimental varieties in the same field suffered much. Neither did the crop suffer to any extent from chinch-bugs or

the Hessian fly. Both were found, but in very limited numbers. Owing to the dry spring the straw was short; the grain, however, is plump and heavy, averaging 63 pounds to the struck bushel.

WHEAT CONTINUOUSLY.

In 1880 a measured acre was set aside for continuous culture in wheat, the crop to be grown year after year without manure or renovating treatment of any kind, the object being to test the ability of the soil to produce this rather exhaustive crop under these conditions. The acre is an upland, medium-heavy loam, with a pronounced slope toward the east, and it is not by any means a sample of the best soil in Kansas. The general method followed has been to plow it in from two to four weeks after harvest, and harrow it once in about ten days or two weeks until seeded. The time of seeding has varied with the season, but has usually occurred before or about the middle of September, when 1¼ bushels has been drilled in. The crop of the present season was seeded September 12th, 1889, and harvested June 17th, 1890. It yielded 22.9 bushels of wheat and 1,841 pounds of straw, giving only 82½ pounds of straw for every bushel of wheat. The following table shows the result of the ten years' cropping:

YEAR.	VARIETY.	YIELD.			REMARKS.
		<i>Bushels.</i>	<i>Straw, lbs.</i>	<i>Lbs. straw to bushel wheat.</i>	
1880-1...	Early May	9.00	Crop estimated.
1881-2 ..	" "	47.00	7,845	167	
1882-3...	" "	28.19	3,281	112	
1883 4...	Zimmerman.....	37.00	4,525	122	
1884-5...	"	12.30	2,238	181	Winter-killed. Winter-killed.
1885-6...	" .....	.....	.....	.....
1886-7...	" .....	.....	.....	.....
1887-8...	"	30.31	3,766	124	
1888-9...	"	37.00	3,619	98	
1889-90...	"	22.90	1,841	82	
	Produce of ten years...	223.70	27,115	
	Yearly average.....	22.37	2,711.5	121	

The average yield of 22.37 bushels for the ten years, including two complete failures, without manure, and on a very ordinary piece of land, speaks eloquently for Kansas as a wheat-growing State.

LISTED WHEAT.

A long, narrow plat in Field (2, measuring a little more than half an acre (more exactly, .584 of an acre), was listed with wheat of the Zimmerman variety, for comparison with an adjoining plat of drilled wheat. The method of listing is described by Prof. Shelton in his last annual report, from which I quote as follows: "Three small double-shovels—miniature listing plows—were secured to the frame-work of a 'Buckeye' one-horse

drill in such a manner as to make a six-inch-deep furrow in advance of the three discharge spouts of the drill. The implement thus improved put the seed wheat in furrows eight to ten inches deep and about fourteen inches apart." During the growing season there was but little apparent difference between this listed wheat and that which was drilled, with the exception of a slightly darker green color of the former, and that it attained the same degree of maturity about three days later than the drilled wheat. The previous year it was noticed that a similarly listed plat grew much more vigorously than drilled wheat, and that it had a decided tendency to lodge. This year it showed no tendency to lodge, nor was the straw taller to any noticeable degree. It was cut June 25th, with the following result:

	<i>Bushels per acre.</i>	<i>Straw per acre, lbs.</i>	<i>Straw per bushel, lbs.</i>	<i>Weight per struck bushel, lbs.</i>
Listed plat.....	35.34	3,380	95.6	63
Drilled plat.....	29.83	3,340	112.0	63
Gain by listing.....	5.51			

It will be seen that while the wheat sown in the ordinary fashion falls a little below 30 bushels, the listed wheat yielded 35 1/3 bushels to the acre. This is a gain of 5 1/2 bushels in favor of listing. Should further experience bear out this result, it will be a distinct step in advance in our method of cultivating wheat. It is a question if the listed plat would have done equally well had this been a wet year with consequently a heavier growth of straw. We might then expect it to lodge more or less, with the inevitable result of a light crop of grain. It would lodge more readily for the reason that having more space in which to spread, a large portion of the straw starts out at the base at an inclined angle, and if heavy it will the more easily break down. When we have an even stand of broad-casted or drilled wheat, the straw grows almost perpendicularly upward, and can thus better sustain its own weight. It is too early to expatiate on the benefits of this method of culture, but it seems reasonable to suppose that it will be a success in Kansas in ordinary seasons on all but very low land.

WHEAT IN ROTATION.

The following experiment was begun in the fall of 1889. A series of plats, twenty-five in number, of one-tenth acre each, were accurately laid out and marked permanently with iron stakes. The soil is a clay loam of a fairly even character, and for the most part with a gentle slope to the west. The experiment covers five plats, and to secure greater accuracy it is repeated five times in the series, so that plats 1, 6, 11, etc., through the whole series are treated exactly alike. See plan on opposite page.

PLAN OF ROTATION WITH WHEAT IN FIELD No. 4—BEGUN IN 1889.
 SIZE OF PLATS, 147 FEET BY 29.63 FEET=1/10 ACRE.

No. of plats.....	<div style="text-align: center;"> W. S. — T — N. | E. </div>
25	Wheat and oats in alternation.
24	Wheat and corn in alternation.
23	Summer fallow and wheat by alternation.
22	Without manure. Wheat continuously.
21	Manure, 20 tons per acre yearly. Wheat continuously.
20	Wheat and oats in alternation.
19	Wheat and corn in alternation.
18	Summer fallow and wheat by alternate years.
17	Without manure. Wheat continuously.
16	Manure, 20 tons per acre yearly. Wheat continuously.
15	Wheat and oats in alternation.
14	Wheat and corn in alternation.
13	Summer fallow and wheat by alternate years.
12	Without manure. Wheat continuously.
11	Manure, 20 tons per acre yearly. Wheat continuously.
10	Wheat and oats in alternation.
9	Wheat and corn in alternation.
8	Summer fallow and wheat by alternate years.
7	Without manure. Wheat continuously.
6	Manure, 20 tons per acre yearly. Wheat continuously.
5	Wheat and oats in alternation.
4	Wheat and corn in alternation.
3	Summer fallow and wheat by alternate years.
2	Without manure. Wheat continuously.
1	Manure, 20 tons per acre yearly. Wheat continuously.

From the nature of the experiment, it will gain in value with the length of time it is continued. The present year's results are of interest only in that they show the influence of the manure. The two tons of barnyard manure applied last fall to each of five of the plats is the only difference in the culture of the present crop, all the other plats being unmanured and so far treated alike. Zimmerman was the variety grown. It was drilled

in, September 12, 1889, at the rate of 1¼ bushels per acre, and harvested June 14, 1890, with the following results:

PRODUCE OF MANURED AND UNMANURED PLATS.

No. of plat.....	Yield of plat, lbs.		Weight of struck bu., lbs.....	Yield per acre.		Straw per bushel of grain, lbs.....	Treatment.
	Grain.	Straw.		Grain, bu.	Straw, lbs.		
1	245	370	64	40.8	3700	90	20 tons manure per acre.
2	164	226	64	27.3	2260	82	Without manure.
4	148	162	64	24.6	1620	66	Without manure.
6	213½	301½	64	35.6	3015	85	20 tons manure per acre.
7	172	395	63	28.6	3950	103	Without manure.
10	184	246	64	30.6	2460	80	Without manure.
11	218½	302½	63	36.4	3025	83	20 tons manure per acre.
12	199½	255½	62½	33.2	2555	77	Without manure.
14	235½	289½	64	39.2	2895	74	Without manure.
16	243	337	63	40.5	3370	75	20 tons manure per acre.
17	219	306	63	36.5	3060	84	Without manure.
20	263	407	63	43.8	4070	94	Without manure.
21	276½	419½	64	46.1	4195	91	20 tons manure per acre.
22	248½	391½	63	41.4	3915	94	Without manure.
24	260	400	62½	43.3	4000	92	Without manure.

SUMMARY.

	Ave. yield of grain per plat, lbs.	Ave. yield of straw per plat, lbs.	Ave. weight of struck bushel, lbs.	Average yield per acre.		Ave. lbs. straw to bushel of grain.
				Grain, bu.	Straw, lbs.	
Manured plats.....	239.3	346.1	63.8	39.88	3461	86.8
Unmanured plats.....	209.3	307.8	63.3	34.87	3078	88.2
In favor of manure...	30.0	38.3	.5	5.01	383	.....

This gives a difference of only five bushels to the acre as the increase from 20 tons of barnyard manure.

TEST OF VARIETIES

The following varieties of wheat have now been tested on the farm two years in succession. The plats the present year were one-twentieth of an acre each. The soil was a clay loam of an even character, and as a comparative test of the merits of these varieties and their adaptability to this climate and soil, the trial may be considered a fair one. The plats were seeded September 12, 1889, at the rate of one and one-quarter bushels per acre, and harvested June 21, 1890. They are all red wheats, and they are much alike, as regards appearance of straw and grain. The straw is bright yellow, slender, but of good strength, and the grain short and plump except where otherwise noted.

DESCRIPTIVE NOTES ON VARIETIES.

ARNOLD'S HYBRID.

Condition April 7th: Stand only fair, was slightly winter-killed; plants tillered but little.

Ripe June 14th. Height 2.9 feet, straw slender but thrifty. Head smooth, short and round, chaff white; grains in spikelet 2, plump.

Yield 23.16 bushels, and 2,110 pounds straw per acre; weight per bushel 61 pounds. Yield in '89, 26.18 bushels per acre; average yield in two years, 24.67 bushels.

BADGER.

Condition April 7th: Uninjured by the winter, plants tillered well and stand good.

Ripe June 14th. Height 2.9 feet, straw slender. Heads smooth, short, and round, chaff white; grains in spikelet 2, plump.

Yield 25.16 bushel, and 2,490 pounds straw per acre; weight per bushel, 62 pounds. Yield in '89, 20.33 bushels per acre; average yield in two years, 22.74 bushels.

BUCKEYE.

Condition April 7th: The stand only fair; has slightly winter-killed; not tillered much.

Ripe June 18th. Height 3.1 feet; straw coarser than Red May, and more leafy; growth has been vigorous. Heads smooth, short, and round, but larger than those of Red May; chaff brown; grains in a spikelet 2, plump.

Yield 30.17 bushels and 3,290 lbs. straw per acre; weight per bushel 62 lbs. Yield in 1889, 25.03 bushels per acre; average yield in two years, 27.6 bushels.

CURRELL.

Condition April 7th: Stand good, uninjured by winter, has tillered well.

Ripe June 13th. Height, 3.5 feet; straw strong, growth vigorous. Heads smooth, short and slender; chaff, light brown; grains in spikelet 3, plump.

Yield 37.5 bushels and 4,350 lbs. straw per acre; weight per bushel, 62 lbs. Yield in '89, 39.23 bushels per acre; average yield in two years, 38.36 bushels. This is the best yield obtained from any variety tried here at the College during that time.

EXTRA EARLY OAKLEY.

Condition April 7th: One-half winter-killed; plants not vigorous; tillered but very moderately.

Ripe June 20th. Height, 3.5 feet; straw moderately coarse. Heads smooth, of medium length, round; chaff, white; grains in a spikelet 2 to 3, plump.

Yield 31.10 bushels and 3,830 pounds straw per acre; weight per bushel, 62 pounds. Yield in '89, 31.83 bushels per acre; average in two years, 31.46 bushels.

GOLDEN DROP.

Condition April 7th: Stand good, uninjured by winter; tillered profusely; plants short, thick and very vigorous.

Ripe June 18th. Height, 2.9 feet; showing some irregularity in growth, in places very vigorous, in others weak; straw medium heavy. Heads smooth, short and round; chaff, brown; grains in spikelet 2, rarely 3, but lower spikelets shrunken and empty.

Yield 24.83 bushels and 3,410 pounds straw per acre; weight per bushel, 63 pounds. Yield in '89, 19.16 bushels per acre; average in two years, 21.99 bushels.

HYBRID MEDITERRANEAN.

Condition April 7th: Stand poor, plants two-thirds winter-killed, and what is left is weak; has tillered poorly.

Ripe June 20th. Height 2.4 feet, growth showing much irregularity; weak in places and stronger in others. Heads bearded, square and medium to long, chaff brown; grains in spikelet 2, plump.

Yield 13.70 bushels, and 1,480 pounds straw per acre; weight per bushel 61 pounds. Yield in '89, 25.66 bushels per acre; average yield in two years, 19.68 bushels.

M'CREGAN.

Condition April 7th: Stand good, uninjured by winter; plants short and vigorous, and tillered well.

Ripe June 16th. Height 2.3 feet, growth irregular and weak. Heads smooth, of medium size, with coarse, rather open spikelets, chaff white; grains in spikelet 3, plump.

Yield 16.66 bushels, and 1,400 pounds straw per acre; weight per bushel 62 pounds. Yield in '89, 21.52 bushels per acre; average yield in two years, 19.09 bushels.

NIGGER.

Condition April 7th: Not injured by the winter, stand fair, growth uneven but fairly vigorous; tillered but moderately.

Ripe June 17th. Height 3 feet. Heads bearded, of medium length and large in diameter, chaff brown; grains in spikelet 2, very plump and fine.

Yield 24.66 bushels, and 2,120 pounds straw per acre; weight per bushel 63 pounds. Yield in '89, 22.71 bushels per acre; average yield in two years, 23.68 bushels.

ONTARIO WONDER.

Condition April 7th: Stand not good, has been considerably winter-killed, plants weak, tillered poorly.

Ripe June 17th. Height 2.9 feet, growth irregular, about one-half the plants fairly vigorous. Heads nearly smooth, medium in length and large in diameter, with light-brown chaff; short beard on upper half of head; grains in spikelet 2, plump.

Yield 17.50 bushels, and 1,510 pounds straw per acre; weight per bushel

61 pounds. Yield in '89, 19.13 bushels per acre; average in two years, 18.31 bushels.

PURPLE STRAW RED.

Condition April 7th: Stand very poor; about nine-tenths of the plants winter-killed, the rest very weak; tillered but little.

Ripe June 21st. Height, 2.3 feet; ten per cent. of a stand, as in the spring, but the growth of the remaining plants has been fair. Heads smooth, large with white to light-brown chaff; grains in spikelets 2 to 3, small and shrunken.

Yield 4.33 bushels and 440 pounds straw per acre; weight per bushel, 54 pounds. Yield in '89, 20.13 bushels per acre; average in two years, 12.23 bushels.

RED FULTZ.

Condition April 7th: Stand fair; winter-killed slightly; tillered moderately, and showing moderate growth and vigor.

Ripe June 14th. Height, 2.5 feet; stand thin, growth irregular and weak. Heads smooth, short and small with white chaff; grains in spikelet 2.

Yield 20.50 bushels and 1,570 pounds straw per acre; weight per bushel, 63 pounds. Yield in '89, 31.33 bushels per acre; average in two years, 25.91 bushels.

RED MAY.

Condition April 7th: Stand fair; nearly 25 per cent. winter-killed, but plants very vigorous; leaves broad, and of a fresh green color. This variety is so nearly like the Zimmerman in appearance, that it is scarcely possible to tell them apart. As they appeared at this stage of growth, the only difference was that the Zimmerman was uninjured by the winter, while the Red May was killed to the extent of about one-fourth of the stand. Again, the leaves of the Zimmerman were narrower than those of the Red May.

Ripe June 17th. Height, 3.2 feet; straw slender, but has tillered well so as to occupy the ground, and has made an even, vigorous growth. Heads smooth, short and small; chaff, white; grains in a spikelet 2, very plump.

Yield 29.70 bushels and 3,220 pounds straw per acre; weight per bushel, 62 pounds; yield in '89, 31.50 bushels per acre; average in two years, 30.60 bushels.

RED RUSSIAN.

Condition April 7th: Stand poor, 50 per cent. winter-killed; has tillered poorly, and plants are feeble.

Ripe June 20th. Height, 2.9 feet; growth since spring has been fair, and it has spread so as to make a moderate stand. Heads long, large, flat, some partly bearded others not, chaff dark brown; grains in a spikelet 3, plump and handsome.

Yield 17.33 bushels and 1,660 pounds straw per acre; weight per bushel, 63½ pounds. Yield in '89, 32 bushels per acre; average in two years, 24.66 bushels.

RELIABLE.

Condition April 7th: Stand only fair, has winter-killed considerably; tillered moderately, and is fairly vigorous.

Ripe June 17th: Height, 2.9 feet; made a fair growth since spring. Heads bearded, of medium size, with light-brown chaff; grains in a spikelet 2, plump, shells out easily.

Yield 24 bushels, and 2,160 pounds straw per acre; weight per bushel, 62 pounds. Yield in '89, 27.66 bushels per acre; average in two years, 25.83 bushels.

TASMANIAN RED.

Condition April 7th: Stand good, not winter-killed at all; plants have tillered profusely, and are very vigorous.

Ripe June 15th. Height, 3 feet; growth since spring has been good; straw slender, but has tillered more than any of the other varieties. Heads bearded, of medium length but slender, chaff white; grains in a spikelet 2, plump.

Yield 29.33 bushels and 2,840 pounds straw per acre; weight per bushel, 63 pounds. Yield in '89, 27.84 bushels per acre; average yield in two years, 28.58 bushels.

TUSCAN ISLAND.

Condition April 7th: Stand poor, about 25 per cent. having winter-killed; plants not vigorous, and tillered moderately only.

Ripe June 15th. Height 3 feet. Has tillered some since spring, and growth has been vigorous; straw rather coarse. Heads short, bearded, chaff brown; grains in a spikelet 2, very plump, handsome.

Yield 19 bushels and 1,860 pounds straw per acre; weight per bushel, 64 pounds. Yield in '89, 30.83 bushels per acre; average yield in two years 24.91 bushels.

ZIMMERMAN.

Condition April 7th: Stand perfect, not winter-killed; plants vigorous, and have tillered well.

Ripe June 14th. Height 3 feet. Growth since spring has been vigorous, straw slender; resembles Red May, but straw is slightly brighter and less leafy than that variety. Heads smooth, short and slender, chaff white; grains in a spikelet 2, plump.

Yield on this plat at the rate of 34.33 bushels and 2,540 pounds straw per acre—a yield of grain which is exceeded only by the Currell; weight per bushel, 61 pounds. Yield on plat in 1889, 31.54; average yield in two years, 32.93 bushels. As already explained, the Zimmerman has been the main crop on the farm for several years, and seems especially adapted to this section. The only serious rival is the Currell, which the coming year will be tried on a somewhat more extended scale than is afforded by the experimental plats.

GERMAN EMPEROR.

This variety was tried last year on a small plat, only 1/60 of an acre in extent. Owing to late arrival of seed, it was not seeded till October 4th, 1889—a rather late date; and it may be that the poor results obtained are to some extent chargeable to the late seeding. It came through the winter in poor condition, and its growth was irregular and unsatisfactory all through the season. The yield from this plat was 8½ pounds grain and 16½ pounds straw, equal to 8.5 bushels grain and 990 pounds straw per acre. It is a favorite variety in some parts of the State, and it may vindicate itself here on another trial.

TABULAR STATEMENT OF VARIETIES.

NAME.	Date of ripening, 1890.....	YIELD PER ACRE, 1890.				YIELD PER ACRE, 1889.				AVERAGE FOR 1889-90.			Color of grain.....	Color of chaff.....	Smooth or bearded.....
		Grain, bu..	Straw, lbs..	Pounds of straw to bu. of grain.....	Wgt. per struck bu.	Grain, bu..	Straw, lbs..	Pounds of straw to bu. of grain.....	Wgt. per struck bu.	Grain, bu..	Straw, lbs..	Pounds of straw to bu. of grain.....			
1 Arnold's Hybrid.....	June 14	23.16	2110	91.10	61	26.18	2518	96.18	58	24.67	2314	93.79	Red	White	S.
2 Badger	14	25.16	2490	98.96	62	20.33	1180	58.04	58	22.74	1835	80.69	"	"	S.
3 Buckeye	18	30.17	3290	108.90	62	25.03	2139	85.45	57	27.60	2714½	98.35	"	Brown	S.
4 Currell	13	37.50	4350	116.00	62	39.23	2354	60.00	60	38.36	3352	87.38	"	"	S.
5 Extra Early Oakley	20	31.10	3830	123.15	62	31.83	2080	65.84	58	31.46	2955	93.93	"	White	S.
6 Golden Drop	18	24.83	3410	133.30	63	19.16	1850	96.55	58	21.99	2130	96.86	"	Brown	S.
7 Hybrid Mediterranean	20	13.70	1480	108.03	61	25.66	2220	86.51	59	19.68	1850	94.00	"	"	B.
8 McOregon	16	16.66	1400	84.63	62	21.52	2914	185.40	.....	19.09	2157	112.99	"	White	S.
9 Nigger	17	24.66	2120	85.97	63	22.70	1990	87.66	.....	23.68	2055	86.53	"	Brown	B.
10 Ontario Wonder	17	17.50	1510	86.28	61	19.13	2040	106.56	56	18.31	1775	96.94	"	"	S.
11 Purple Straw Red	21	4.33	440	101.10	54	20.13	1890	93.84	58	12.23	1165	95.25	"	"	S.
12 Red Fultz	14	20.50	1570	76.58	63	31.33	2720	86.81	58	25.91	2145	82.78	"	White	S.
13 Red May	17	29.70	3220	108.41	62	31.50	2710	86.03	59	30.60	2965	96.89	"	"	S.
14 Red Russian	20	17.33	1660	96.37	63½	32.00	2880	90.00	58	24.66	2270	92.05	"	Brown	B.
15 Reliable	17	24.00	2160	90.00	62	27.66	3140	113.32	59	25.83	2650	102.59	"	"	B.
16 Tasmanian Red	15	29.33	2840	96.83	63	27.84	2042	73.34	58	28.58	2441	85.41	"	White	B.
17 Tuscan Island	15	19.00	1860	97.89	64	30.83	3150	102.17	59	24.91	2505	100.56	"	Brown	B.
18 Zimmerman	14	34.33	2540	73.98	61	31.54	.....	.....	.....	32.93	.....	.....	"	White	S.
19 German Emperor*	25	8.50	990	116.47	.....	.....	.....	.....	.....	.....	.....	.....	"	"	S.

*Not grown in 1889.

THE BEST VARIETIES.

Of this list, those varieties which have averaged 30 or more bushels during the past two years are the following:

Currell	38.36 bushels.
Zimmerman	32.93 "
Extra Early Oakley	31.46 "
Red May	30.60 "

The Currell is so far ahead of all others as to be strikingly conspicuous. It shows plainly the merits of certain varieties over others, and points out indirectly the importance of testing and comparing varieties in order to learn which are the best yielders, and to sift out the unprofitable ones. Although the heads of the Currell were short and slender, they had almost invariably three grains to a spikelet, and the grains were of uniform plumpness.