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EXPERIMENTS WITH WHEAT

HARDINESS OF SORTS—A CHINCH-BUG EXPERIENCE—
WHEAT CONTINUOUSLY WITHOUT MANURE—
PASTURING WHEAT—MANURING, HOEING,
AND HARROWING WHEAT

BY ORDER OF THE COUNCIL:

E. M. SHELTON, *Director*

MANHATTAN, KANSAS
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EXPERIMENTS WITH WHEAT.

by E. M. Shelton

For several years experiments with wheat have been in progress at the College farm, having for their object (1) to show the comparative values of common and unusual sorts, and (2) to give expression to varying methods of treatment.

The results of our experience with something over one hundred sorts of winter wheat have abundantly satisfied me that the Kansas farmer can rely only upon the fine, early ripening red sorts — often of southern origin — of which early May and Zimmerman are types. These are usually reckoned light yielding sorts, but in Kansas soils, during favorable seasons, they often yield enormously. The coarse-growing, late-maturing sorts, like Clawson, Lancaster and Egyptian, sometimes do remarkably well, but much oftener they fail miserably.

On October 1, 1887, fifty-one varieties of winter wheat were sown — twenty-two in contiguous plats in field B, and twenty-nine in a connected series in field No. 6. The following is a complete list:

- | | | |
|----------------------|-------------|-----------------|
| Bearded King. | Democrat. | Egyptian. |
| Big English. | Deitz. | Farquahar. |
| Deitz Longberry. | Early May. | Finley. |
| Deihl-Mediterranean. | Early Rice. | French Prairie. |

Text of this bulletin
is from Annual Report,
content is same but page
numbers are different.

WHEAT VARIETIES.

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Fulcaster.	Missouri Blue Stem.	Royal Red.
Fultz.	New Monarch.	Sibley's New Golden.
Genoese.	Nigger.	Silver Chaff.
German Emperor.	Oregon.	Surprise.
Gipsey.	Patagonian Trego.	Tasmanian Red.
Golden Prolific.	Poole.	The Good.
High Grade.	Raub's Black Prolific.	Theiss.
Hungarian.	Red Fultz.	Tuscan Island.
Jennings.	Red Line.	Valley.
Martin's Amber.	Red Odessa.	Velvet Chaff.
McGary.	Red Russian.	Walker.
Michigan Amber.	Rocky Mountain.	Wicks.
Miller's Prolific.	Royal Australian.	

Of these, Hungarian, Red Russian, Red Line, Genoese (wholly killed), Sibley's New Golden, The Good and Surprise suffered most from winter killing, the loss amounting to fully one-half of all the plants, in most cases. The varieties that sustained the least injuries were Theiss, Big English, Tuscan Island, Deihl-Mediterranean, Gipsey, Fultz, and Finley.

A CHINCH BUG EXPERIENCE.

Early in the spring chinch bugs began to congregate upon the vivid green wheat plants in great numbers, so that it was soon apparent that the complete destruction of the wheat was only the question of a very short time. Following the general practice, all the plats were plowed under on May 9th and 10th, and shortly afterwards harrowed and repeatedly rolled. This work was very thoroughly done, the wheat having been turned to the depth of eight inches. Nevertheless, thus imprisoned, an enormous brood of young bugs hatched, a large proportion — apparently — reaching the surface of the ground and passing directly to the adjacent crops, which received great damage from them. In the case of this brood of insects only, hatched under such peculiar circumstances, was noticeable damage done by chinch bugs upon the College farm the present year, although these pests were everywhere threatening in numbers and voracity.

WHEAT CONTINUOUSLY.

In the fall of 1880 a measured acre was prepared and sowed to wheat. This acre has, during each succeeding year, been sowed to winter wheat; and during all this time no fertilizer or renovating treatment of any kind has been given it. The results obtained with this acre are given by years in the subjoined tabular statement:

	<i>Yield, bushels.</i>	<i>Straw, pounds.</i>	<i>Straw to bushels of grain.</i>
1880-1—Variety, Early May—yield, estimated...	9.00		
1881-2—Variety, Early May.....	47.00	7,845	167
1882-3—Variety, Early May.....	28.19	3,281	112
1883-4—Variety, Zimmerman.....	37.00	4,525	122
1884-5—Variety, Zimmerman.....	12.30	2,238	181
1885-6—Crop winter killed.....			
1886-7—Crop winter killed.....			
1887-8—Variety, Zimmerman.....	30.31	3,766	124
Produce of seven years.....	163.80	21,655	
Average yearly yield.....	23.40	3,092	132

We see from the above that during the past eight years this acre has made two complete failures with its crop, has given two light yields and four large ones. The average of nearly twenty-three and one-half bushels of wheat for seven years, obtained from an acre of upland, from a Kansas standpoint not naturally fertile, and which has received the worst possible treatment, shows in a rather striking way the “natural strength” of Kansas soil as well as the suitability of both soil and climate to wheat culture.

PASTURING WHEAT.

With the object of learning the effect of moderately grazing winter wheat, both in fall and spring, a portion of field No. 3, a fair average of the entire wheat field, was selected for the purpose of this experiment. Here a measured acre was parti-

tioned off from the remainder of the field by a barbed wire fence, and adjoining it, later on, an exact half acre, the former for fall grazing, and the latter for a like use in the spring. For the purpose of comparison, a quarter acre, uniform in growth and appearance with the pastured portion, was selected, and of course was not grazed.

Of the actual amount of grazing furnished by these areas, I have accurate data regarding only the half acre used for grazing in the spring. This area furnished the equivalent of 115 hours' steady grazing for one cow. This "steady grazing," it should be remembered, stands for much more than ordinary pasturing, which includes the time occupied by the cattle in rest. In grazing the half acre, cattle were held upon the wheat only so long as they fed. As soon as they seemed sated they were driven to the barn. I am confident that this half acre furnished the equivalent of one-half month's pasturing for one cow. The acre supplied more than twice that given by the half acre; from one to three cows — I cannot speak more accurately — having been kept upon it during nearly every day of November. In the tabular statement given below, the results of this experiment are concisely stated:

ITEMS.	YIELD PER ACRE.		Straw, lbs., to bush. of grain.
	Grain, bushels.	Straw, pounds.	
One acre grazed in fall.....	25.70	3,766	146
One-half acre grazed in spring—yield, 13 1 bushels grain, 1,662 pounds straw.....	26.20	3,324	127
One-fourth acre not grazed—yield, 6.4 bushels grain, 825 pounds straw.....	25.60	3,300	128

It is not supposed, for a moment, that these figures *prove* that the grazed plats were not injured in their ultimate crop by the grazing. They do, however, establish a strong presumption that such was the case. The fact that, to the eye, the pastured areas, when cut, showed, in all respects, as strong and vigorous a growth of wheat as that borne by the ungrazed area,

strengthens this view. There was only this noticeable difference — and this was slight — between the grazed and ungrazed areas: the former, particularly that used for fall pasturage, bore a considerably more leafy straw, as indicated in the table, and it seemed a little slower in ripening, although the time of cutting the three areas was the same.

It savors somewhat of attempting to “eat one’s cake and have it,” in pasturing growing wheat without diminishing its yield of grain. However, the practice can only be recommended in the case of wheat that was sown early in the fall and thus has been enabled to make a luxuriant growth. It is a matter of common observation and experience, that this excess growth is often a cause of disaster to the crop. A further precaution that will occur to most practical men: pasturing of the wheat fields ought never to be permitted when the ground is muddy or even soft from rains.

CULTIVATION AND USE OF FERTILIZERS.

Twenty-one plats, each an exact one twenty-fifth of an acre, were laid off in a connected series, ranging north and south, in field No. 3. with the object of noting the effects of different fertilizing substances and methods of cultivation upon growing wheat. Field No. 3 grew a light crop of oats in the season of 1887. Early in September it was plowed, and on the 22d seeded to winter wheat of the Zimmerman variety. Seed to the amount of one and a quarter bushels per acre was used; drilled in rows five inches apart. The field is a strong clay of moderate fertility, having a quite pronounced easterly slope.

A few facts additional to those given in the plan of the experiment figured further on remain to be stated. The “zero” plats, which, through the entire series, alternate with those specially treated, received only ordinary field treatment. They furnish the criteria by which to estimate the influence of the special treatment accorded the adjacent plats.

Plats 2 and 4 received an application of salt at the rate of 300 pounds per acre; plats 6 and 8 were top-dressed with rich, partly-rotted dung at the rate of 30 tons per acre; and land

plaster was sown on plats 10 and 12 upon the basis of 200 pounds to the acre.

These fertilizers were applied March 30th and 31st. Plats 14 and 16 were thoroughly harrowed twice with the smoothing harrow.

From the "hoed" plats — 18 and 20 — each alternate row of wheat was removed, preliminary to the hoeing, leaving the inter-spaces of the rows ten inches wide; these were thoroughly hoed three times at intervals of ten days, beginning April 5th. The subjoined table gives the yield of every plat, omitting unimportant fractions, together with a summary of the results of the special treatment in each case in comparison with the zero plats adjacent:

	YIELD OF PLAT.		YIELD PER ACRE.		<i>Straw, lbs., to bushel of grain.....</i>
	<i>Cleaned grain, pounds.....</i>	<i>Straw, lbs.....</i>	<i>Cleaned grain, bushels.....</i>	<i>Straw, lbs.....</i>	
Plat 1—Zero.....	83	165	34.00	4,125	121
Plat 2—Salt, 300 pounds per acre.....	96	212	40.00	5,300	132
Plat 3—Zero.....	86	173	36.00	4,325	120
Plat 4—Salt, 300 pounds per acre.....	92	177	38.00	4,415	126
Plat 5—Zero.....	80	149	33.00	3,725	112
Plat 6—Manure, 30 tons per acre.....	86	153	36.00	3,825	106
Plat 7—Zero.....	84	170	35.00	4,250	121
Plat 8—Manure, 30 tons per acre.....	92	178	38.00	4,450	117
Plat 9—Zero.....	88	176	36.00	4,400	122
Plat 10—Plaster, 200 pounds per acre.....	89	180	37.00	4,500	121
Plat 11—Zero.....	87	181	36.00	4,525	125
Plat 12—Plaster, 200 pounds per acre.....	89	184	37.00	4,600	121
Plat 13—Zero.....	88	180	36.00	4,500	125
Plat 14—Harrowed.....	78	145	33.00	3,625	109
Plat 15—Zero.....	87	166	36.00	4,150	112

	YIELD OF PLAT.		YIELD PER ACRE.		Straw, lbs., to bushel of grain.....
	Cleaned grain, pounds.....	Straw, lbs.....	Cleaned grain, bushels.....	Straw, lbs.....	
Plat 16 — Harrowed.....	79	168	33.00	4,200	127
Plat 17 — Zero.....	93	176	38.00	4,400	116
Plat 18 — Hoed, alternate rows removed...	75	109	31.00	2,725	88
Plat 19 — Zero.....	83	155	34.00	3,875	114
Plat 20 — Hoed, alternate rows removed...	76	132	31.00	3,300	106
Plat 21 — Zero.....	89	164	37.00	4,100	110
SUMMARY.					
Plats 2 and 4 — Salt applied.....	94	194	39.00	4,857	124
Plats 1, 3 and 5 — Adjacent 2 and 4.....	83	162	34.00	4,058	119
Differences — Gains and losses*.....	11	32	4.58	799
Plats 6 and 8 — Manured.....	89	165	37.00	4,137	111
Plats 5, 7 and 9 — Adjacent 6 and 8.....	84	165	35.00	4,125	117
Differences — Gains and losses.....	5	2.08	12
Plats 10 and 12 — Plastered.....	89	182	37.00	4,550	123
Plats 9, 11 and 13 — Adjacent 10 and 12...	88	179	36.00	4,475	124
Differences — Gains and losses.....	1	3	.41	75
Plats 14 and 16 — Harrowed.....	79	156	33.00	3,912	118
Plats 13, 15 and 17 — Adjacent 14 and 16.	89	174	37.00	4,350	117
Differences — Gains and losses.....	-10	-18	-4.16	-438
Plats 18 and 20 — Hoed.....	76	120	31.00	3,012	97
Plats 17, 19 and 21 — Adjacent 18 and 20.	88	165	36.00	4,125	114
Differences — Gains and losses.....	-12	-45	-5.00	-1,123

*The minus sign (-) preceding a number indicates a loss for the particular method.

PLAN OF EXPERIMENT.—Size of Plots, 87 feet 1 1-2 inches by 20 feet = 1-25 acre.

21—Zero.
20—Hoed, alternate rows removed.
19—Zero.
18—Hoed, alternate rows removed.
17—Zero.
16—Harrowed.
15—Zero.
14—Harrowed.
13—Zero.
12—Plaster, 200 lbs. per acre.
11—Zero.
10—Plaster, 200 lbs. per acre.
9—Zero.
8—Manure, 30 tons per acre.
7—Zero.
6—Manure, 30 tons per acre.
5—Zero.
4—Salt, 300 lbs. per acre.
3—Zero.
2—Salt, 300 lbs. per acre.
1—Zero.

The general average of these experimental plats proves that the soil was rich and productive, furnishing every element needed for the development of the wheat plants. In such soils it is impossible to make many applications "tell" for what they are really worth, however carefully we may guard the experiment from extraneous influences. The problem in such cases is a simple one in appearance only. Take, for example, the manured plats: they gave so slight an increase as compared with the adjacent zero plats that we are forced to conclude that the application in every case was not a benefit to the crop. The soil, or rather the crop, needed neither the gypsum nor the manure. No one will suppose that a like answer would have been received had the same questions been put to poor, "hungry" soils. It is not unlikely, too, that had the special applications been made in the fall, at the time of seeding, the effects would have been much more strikingly shown. This scheme, with some added features, will be given effect the coming year, the fertilizers having been applied just before sowing the wheat.

The application of the salt was an undoubted benefit to the crop, as the tables plainly show. The effect of the salt was also strikingly shown in the peculiar bright color of the straw of the salted plats. This brightness of the straw was noticeable upon the haulm weeks after the wheat had been harvested.

The injury evidently done by the harrowing was perhaps chiefly due to the fact that the weighted harrow was dragged across the wheat rows, it being impossible, from the arrangement of the plats, to work the harrow in line with the rows of wheat. The use of the hoe in plats 18 and 20 was apparently strikingly influential with the crop. In these plats alternate rows were cut out early in April, leaving inter-spaces ten inches wide. These were thoroughly flat-hoed April 5th, 12th and 17th. That these hoed plats, with one-half the wheat plants of the adjacent zero plats, should fall short of them, in yield, only five bushels of grain and 1,125 lbs. of straw per acre, proves that the zero plats were too thickly seeded, or else the hoeing was most beneficial. The heads of wheat were better filled and fully one-third larger than those of the adjacent zero plats.