EXPERIMENT STATION

KANSAS STATE
AGRICULTURAL COLLEGE

MANHATTAN, KANSAS

BULLETIN NO. 7

JULY, 1889

EXPERIMENTS WITH WHEAT

THE ARGUMENT FOR WHEAT-RAISING—PASTURING WHEAT—GROWTH OF VARIETIES—THE BEST SORTS—FERTILIZERS ON WHEAT—SALT AS A FERTILIZER ON WHEAT AND OATS—LISTING WHEAT

TOPEKA
KANSAS PUBLISHING HOUSE: CLIFFORD C. BAKER, STATE PRINTER
1889

EXPERIMENTS WITH WHEAT.

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The position of wheat-raising in Kansas agriculture has always been a peculiar one; almost from the first, the acreage has been subject to wide fluctuations, unknown in the case of other staple grains, and due largely to the

Bulletin 7 was included in the Annual Report for the year of its publication. This version of Bulletin 7 is from the Annual Report.

changing opinions of farmers themselves. In Kansas, as in every other country where it is successfully grown, wheat is a favorite crop with the pioneer. In the central portions of the State, in the '70s, wheat was the universal crop; for various reasons the great wheat fields gave place to even larger corn fields, and a system of mixed farming. The short crops of '85, '86 and '87 intensified the general prejudice against wheat-raising, until in many of the counties of the State, like Riley, wheat has ceased to cut any considerable figure as an agricultural product. Lately, many signs of returning interest in wheat-raising are visible; the crop of last year was a very large one, and as the prices were good, it was highly remunerative; as a result, farmers talk of" going into wheat" very much as they did in '75 and '76. Almost certainly the assessors' returns for another year will show a very large increase in the area of wheat sown the present fall. All this seems to me a good deal unfortunate. Wheat is undoubtedly, taking the years together, a very profitable crop in Kansas when grown in connection with other crops, and as part of a system. It is equally true that to cultivate it as a specialty is to certainly invite all the disasters that twelve years ago resulted from the excessive wheat-raising.

THE ARGUMENT FOR WHEAT-RAISING IN KANSAS.

Few will question that Kansas soils, in general, are preeminently "wheat" lands. It may well be doubted if another State in the Union can show so large a proportion of its soils that are well adapted to the cultivation of the great staple. Moreover, wheat is, in many respects, well suited to the peculiarities of our climate. The usual abundant rains of early spring and summer come in ample time to mature the crop, while by its time of ripening it escapes the July drouth and the hot winds which often work so much damage to late-growing crops like corn.

The records of the College farm, for the last sixteen years, show conclusively enough that wheat is a profitable crop in Kansas. During this time I find that our average yield, including three total failures, has been 18¼ bushels per acre, which has been sold at the average price of eighty cents per bushel. To further show the success with which wheat is grown under the most unfavorable circumstances, I may here mention the case of the experimental acre, referred to in previous publications of this Station.* This acre was first sown to wheat in the fall of 1880, and has been seeded to the same crop every year since, without the addition of fertilizer or renovating treatment of any kind. Although the crop failed from winter-killing during two years (1886 and 1887), the average yield of wheat for eight years, including the two failures, has been 25.1 bushels per acre. Considering that this acre of land, from the Kansas standpoint, is quite below the average of fertility, the facts of this experiment show a wonderful natural adaptation of the soil and climate of this section to the wheat plant. Wheat-

*See Bulletin No. 4, page 44.

raising upon a large scale and carried on as a specialty deserves condemnation in Kansas, as elsewhere; but when the crop is grown as a part of a system in alternation with corn, oats, grass, and other crops, it is almost certainly a profitable one to the farmer. It is one of the few crops that give returns in actual cash, and this cash comes at a season when ordinarily there is little upon the farm that is salable. The indications now are, that Kansas farmers will again "go into wheat" extensively, and invite the disasters which have before followed the special cultivation, on a large scale, of this cereal. One of the most discouraging facts to those who are striving for real and substantial progress in agriculture is the almost constant need of attacking old fallacies in practice which it had been thought were safely disposed of years, perhaps generations, before.

THE CHINCH-BUG ARGUMENT.

But the objection constantly raised to wheat-growing in connection with other crops, in Kansas, is that wheat by its early growth furnishes shelter and support to chinch-bugs early in the season; and that these pests pass directly from the wheat to adjoining fields of corn and oats, which are likely to be more or less seriously damaged thereby. The reply to this familiar argument is, so far as my experience and observation have gone, that this danger from chinch-bugs has been greatly overestimated. During the sixteen years of my superintendence of the College farm, in every one of which a wheat crop has been sown, we have never lost a corn crop from the action of chinch-bugs. In a few cases, always in seasons of drouth, some damage has been done corn and oats by the bugs, but the action of these insects has always been to *emphasize the effects of drouth*. Chinch-bugs have never damaged our crops seriously in "good years."

PASTURING WHEAT.

An effort was made to repeat the experiment of last year, having for its object to test the influence of close pasturing growing wheat, by cattle. An accurately measured half-acre was fed off closely during the fall months. this half-acre was pastured, by a considerable herd, at different times, the total grazing amounting to 161 hours by a single animal. The wheat upon this pastured area seemed not to suffer much from the increased demands upon it; it was slightly shorter than the unpastured portion of the field, and the time of blossoming and ripening seemed to have been somewhat checked, although not enough to influence the time of harvesting. Comparing this pastured half-acre with an adjoining half-acre, unpastured, we find that the pastured area gave a yield of 11.23 bushels of grain and 1,156 pounds of straw, while the unpastured area gave 13.3 bushels of grain and 1,302 pounds of straw. These figures seem to show a loss for pasturing. The difference in yield, however, is clearly chargeable to another cause — the unpastured area had better soil and a thicker and more even stand to begin

with than that which was pastured. This deference is amply sufficient to explain the variation in yield of the two areas. This fact serves further strikingly to illustrate the difficulty experienced everywhere in using a few large plats to test a given point.

GENERAL PLAN OF THE EXPERIMENT WITH VARIETIES.

Outside of the crop grown in ordinary field culture, nineteen varieties were this year grown in small plats with the view to testing their fitness for this soil and climate. These varieties were selected, in part, because they were new to the agriculture of the section, but chiefly because many of them seemed to possess qualities which especially adapted them to this locality. Generally, the plats used were one-twentieth of an acre in area, although in some cases, on account of the difficulty in obtaining seed in proper quantities, smaller areas were used.

All were sown at the same time, September 18th, and in adjacent plats, except Maryland Track, the seed of which was not received until well along in October. The soil upon which the varieties were grown was a strong and fairly rich clay. All passed through the winter without much damage from freezing. All suffered a good deal in early May from lack of proper rains, and later the mature chinch-bugs, which were found in considerable numbers in every plat, did some damage, of which it is difficult to speak with accuracy. Arnold's Hybrid, Golden Drop, Red May, Purple Straw, Ontario Wonder and McCregan were the chief sufferers. The Maryland Track, above referred to, was grown at a considerable distance from the others, and upon a soil very different chemically and physically from that which bore the other sorts mentioned. The table on the following page gives in convenient statistical form the general facts of this experiment.

VARIETIES.	Date of ripening....	YIELD PER ACRE.		Weight of struck bushels, pounds...	Straw (pounds) to bushel of grain....	REMARKS.	SEED FROM—
		Grain, bushels..	Straw, pounds..				
Extra Early Oakley....	June 18,	31.83	2,080	58	65.34	Red; large berry, fair quality, shrunken..	R. T. Pierce, Monaskon, Va.
Arnold's Hybrid.......	" 20,	26.18	2,518	58	96.18	Dark amber; of good quality............	Philip Bork, Tiffin, Ohio.
Curwell..............	" 20,	39.23	2,354	60	60.00	Red; large berry, full and plump.........	R. T. Pierce.
Buckeye.............	" 20,	25.03	2,139	57	85.45	Red; coarse and badly shrunken.........	J. C. Suffren, Voorhies, Ill.
Badger...............	" 20,	20.33	1,180	58	58.04	Red; poor quality, badly shrunken.......	Philip Bork.
Golden Drop.........	" 25,	19.16	1,850	58	96.55	Red; fair quality, somewhat shrunken....	F. Barteldes & Co., Lawrence, Kas.
Purple Straw Red	" 20,	20.13	1.890	58	93.84	Red; good quality, somewhat shrunken...	Mark W. Johnson & Co., Atlanta, Ga.
Ontario Wonder.......	" 22,	19.13	2,040	56	106.56	Red; kernels very unequal in size........	Jas. Riley, Thorntown, Ind.
McCregan............	" 20,	21.52	2,914	....	135.40	Red; of poor quality..................	Philip Bork.
Nigger...............	" 20,	22.70	1,990	....	87.66	Red; poor quality, badly shrunken.......	J. C. Suffren.
Hybrid Mediterranean.	" 23,	25.66	2,220	59	86 51	Red; excellent quality, plump	F. Barteldes & Co.
Red Fultz............	" 23,	31.33	2,720	58	86.81	Red; somewhat shrunken................	Mark W. Johnson & Co.
Red Russian..........	" 26,	32.00	2,880	58	90.00	Red; shrunken, inferior quality..........	Samuel Wilson, Mechanicsville, Pa.
Reliable.............	" 24,	27.66	3,140	59	113.52	Dark amber; large berry, full and plump..	Samuel Wilson.
Red May.............	" 20,	31.50	2,710	59	86.03	Red; plump, of excellent quality.........	Mark W. Johnson & Co.
Zimmerman	" 20,	31.54	.....	60	......	Red; undistinguishable from Red May...	College Farm.
Tasmanian Red.......	" 22,	27.84	2,042	58	73.34	Red; poorly filled......................	J. C. Suffren.
Tuscan Island..... ..	" 24,	30.83	3,150	59	102.17	Red; fair quality	Samuel Wilson.
Maryland Track.......	" 29,	24.33	3,940	56	161.94	Red; coarse, poor, badly shrunken.......	P. S. Hargett, Frederickstown, Md.

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The testing of varieties is perhaps the most unsatisfactory work that comes to the experimenter. The experience of a single season is almost entirely worthless, because whatever results are obtained, where a long list is under examination, they are very likely to be contradicted by the experiences of another year. This tendency is made almost a certainty by the fact that but a very small number (usually only one) of small plats can, from the nature of the experiment, be used for each sort tested. On this account, the experience of years usually involves contradictions of soils, as well of seasons. It is only by 'striking a balance" of many of these opposing results that we get at an approximation to the truth. The reader is therefore cautioned against considering the facts of our table as being anything more than suggestively useful.

RED MAY, AND ZIMMERMAN.

For many years the main crop of the College farm has been one of the two sorts named in this caption. Both sorts, if they are separable, are extensively grown under these names throughout the State, and their reputation for earliness, productiveness and general suitableness to the conditions of Kansas agriculture is excellent. We have grown them side by side during the present and previous seasons, but by no fixed and definite characters have we been able to separate them. They ripen at the same time, have equal lengths of straw, and in form of head, arrangement of spikelets, color and texture of grain and general average of yield, they exhibit no noticeable differences. I am inclined to think that the Little May, Big May, Red May, Zimmerman, and perhaps others, are but local names for one and the same variety which quite likely shows slight variations, due to local causes. This wheat, call it by what name you choose, possesses many admirable qualities; it stools enormously under favorable conditions, ripens early, yields heavily, of excellent flouring wheat, and endures hot, dry weather wonderfully well. Its weak point, perhaps, is a susceptibility to winter-killing, from which it often suffers severely.

THE BEST SORTS.

The wheats that are really successful in Kansas, for a series of years, so far as my observation has extended, are reds, soft or hard, and all agree in the possession of the qualities, earliness, hardiness, and compactness of habit. The early-ripening sorts are liable to escape our too-fervent suns of late June and the ravages of the first brood of chinch-bugs; while their compact habit and abundant stooling furnish the dense, moist shade, which repels the mature "bugs" by which alone these varieties are likely to be damaged.

FERTILIZERS AND METHODS OF CULTIVATION.

Forty-five plats were laid off in field No. 6 for the purposes of the experiment here detailed. The soil used was a strong clay loam, of quite ordinary fertility. It bore a crop of millet in the summer of 1888, and for three years

previously it had been occupied by a light stand of alfalfa. The plats were arranged side by side in a single extended series. Each plat was 147x14 ft., 9.72 in. (one-twentieth acre). The ground, beginning with plat No. 1, rose gradually until plat 20 was reached, and as gradually declined from plat 20 to 40. As might be expected, the fertility of the land diminished in direct proportion to the increase of its altitude. The plats were all plowed, and plats 10, 12, 14 and 16 subsoiled during the last week in August. The seeding was done on September 22d, a roller-drill with eight-inch drill spacings having been used, except with plats 17 to 24, which were seeded with a drill which placed the rows of wheat ten inches apart.

All the fertilizers applied in the fall were sown broadcast, and harrowed in just before the time of seeding. The barn-yard manure had a most unfortunate effect: it loosened the upper soil, thus permitting it to dry out to such an extent that a large proportion of the wheat never germinated. On this account a poor stand was made on the manured plats. The salt applied in the spring, April 4th, was sown broadcast on the growing wheat. The variety of wheat used in this experiment was the Zimmerman, above alluded to. The "nothing" plats referred to in the table which follows, and elsewhere, are those which received no special treatment.

In the subjoined table the essential facts of the experiment are given in easily accessible form:

No. of plat.	TREATMENT.	YIELD OF PLAT, LBS.		Weight of struck bushel, lbs.	YIELD PER ACRE.		Pounds of straw to bushel of grain.
		Grain	Straw		Grain, bushels.	Straw, pounds.	
A	Nothing	143	247	63	47.66	4940	104
B	Salt, 300 lbs. per acre, applied in spring	140	250	63	46.66	5000	107
C	Nothing	145	255	63	48.33	5100	106
D	Salt, 300 lbs. per acre, applied in spring	145	265	63	48.33	5300	110
1	Nothing	129	196	63	43.00	3920	91
2	Salt, 300 lbs. per acre, applied in fall	92	143	63	30.66	2860	93
3	Nothing	81	109	64	27.00	2180	81
4	Salt, 300 lbs. per acre, applied in fall	74	106	62	24.66	2120	86
5	Nothing	83	107	63	27.66	2140	77
6	Salt, 300 lbs. per acre, applied in fall	91	139	62	30.33	2780	92
7	Nothing	105	130	63	35.00	2600	74
8	Salt, 300 lbs. per acre, applied in fall	100	145	62	33.33	2900	87
9	Nothing	107	143	64	35.36	2860	80
10	Subsoiled	89	131	64	29.66	2620	88
11	Nothing	92	128	64	30.66	2560	84

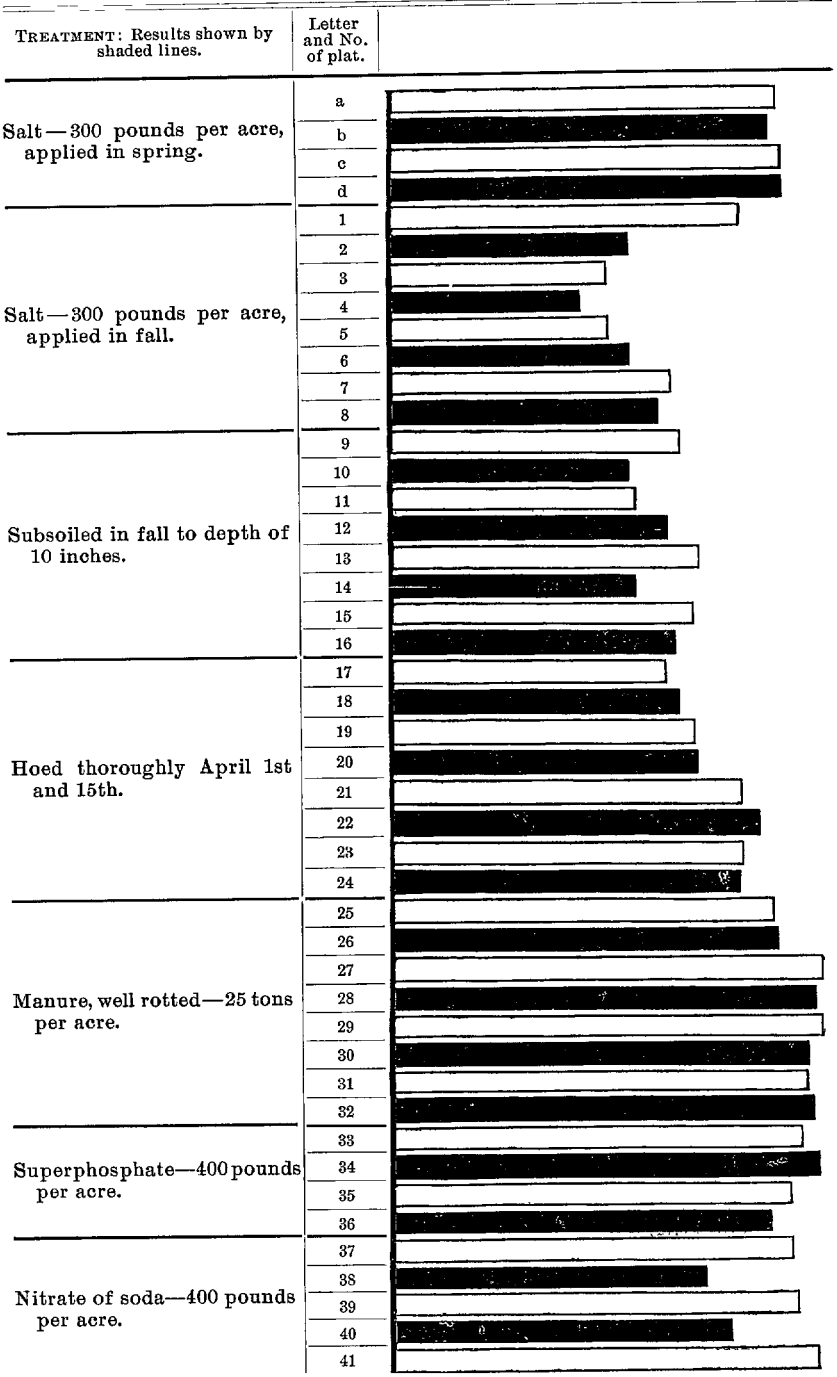
No of plat	TREATMENT.	YIELD OF PLAT, LBS.		Weight of struck bushel, lbs.	YIELD PER ACRE.		Pounds of straw to bushel of grain
		Grain	Straw		Grain, bushels.	Straw, pounds.	
12	Subsoiled	102	168	64	34.00	3360	99
13	Nothing	114	156	64	38.00	3120	82
14	Subsoiled	92	133	64	30.66	2660	87
15	Nothing	112	143	64	37.33	2860	77
16	Subsoiled	106	159	63	35.33	3180	90
17	Nothing	102	143	64	34.00	2860	84
18	Cultivated	107	163	63	35.66	3260	91
19	Nothing	112	158	63	37.33	3160	85
20	Cultivated	114	181	63	38.00	3620	95
21	Nothing	131	189	63	43.66	3780	87
22	Cultivated	135	215	63	45.00	4300	96
23	Nothing	131	194	63	43.66	3880	89
24	Cultivated	130	210	62	43.33	4200	97
25	Nothing	141	229	63	47.00	4580	97
26	Manure, 25 tons per acre	141	229	63	47.00	4580	97
27	Nothing	160	250	64	53.33	5000	94
28	Manure, 25 tons per acre	157	243	63	52.33	4860	93
29	Nothing	161	239	63	53.66	4780	89
30	Manure, 25 tons per acre	155	245	63	51.66	4900	95
31	Nothing	154	236	64	51.33	4720	92
32	Manure, 25 tons per acre	158	247	64	52.66	4940	94
33	Nothing	153	267	63	51.00	5340	105
34	Super-phosphate, 400 lbs. per acre	160	285	63	53.33	5700	107
35	Nothing	152	273	62	50.66	5460	108
36	Super-phosphate, 400 lbs. per acre	140	260	62	46.66	5200	111
37	Nothing	150	265	63	50.00	5300	106
38	Nitrate of soda, 400 lbs. per acre	119	221	62	39.66	4420	111
39	Nothing	153	247	63	51.00	4940	97
40	Nitrate of soda, 400 lbs. per acre	127	243	62	42.33	4860	115
41	Nothing	160	265	63	53.33	5300	99

SUMMARY.

	YIELD OF PLAT, POUNDS.		Weight of struck bushel.....	YIELD PER ACRE.		Straw (pounds) to bushel of grain...
	Grain.....	Straw.....		Grain, bushels...	Straw, pounds...	
Salt, applied in spring, Plats B and D....	142.5	257.5	63.0	47.5	5150	108
Nothing plats adjacent above.....	139.0	232.6	63.0	46.3	4652	100
Differences—Gains and losses*.....	3.5	24.9	0.0	1.2	498	8
Salt, applied in fall, Plats 2, 4, 6 and 8...	89.3	133.3	62.0	29.8	2666	89
Nothing plats adjacent above.....	101.0	137.0	63.0	33.6	2740	81
Differences—Gains and losses.....	–11.7	–3.7	–1.0	–3.8	–74	8
Subsoiled Plats 10, 12, 14 and 16.....	97.3	147.8	64.0	32.4	2956	91
Nothing plats adjacent above.....	105.4	142.6	64.0	35.1	2852	81
Differences—Gains and losses.....	–8.1	5.2	0.0	–2.7	104	10
Cultivated Plats 18, 20, 22 and 24.....	121.5	192.3	63.0	40.5	3846	95
Nothing plats adjacent above.....	123.4	182.6	63.0	41.1	3652	89
Differences—Gains and losses.....	–1.9	9.7	0.0	–.6	194	6
Manured Plats 26, 28, 30 and 32.....	152.8	241.0	63.0	50.9	4820	95
Nothing plats adjacent above.....	153.8	244.2	63.0	51.3	4884	95
Differences—Gains and losses.....	–1.0	–3.2	0.0	–.4	–64	0
Super-phosphate, Plats 34 and 36.....	150.0	272.5	62.5	50.0	5450	109
Nothing plats adjacent above.....	152.0	268.3	63.0	50.6	5366	106
Differences—Gains and losses.....	–2.0	4.2	–.5	–.6	84	3
Nitrate of soda, Plats 38 and 40.....	123.0	232.0	62.0	41.0	4640	113
Nothing plats adjacent above.....	154.0	259.0	63.0	51.4	5180	101
Differences—Gains and losses.....	–31.0	–27.0	–1.0	–10.4	–540	12

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

GRAPHIC PRESENTATION OF THE RESULTS OF THE EXPERIMENT.— The shaded spaces stand for the plats receiving the special treatment named in the left-hand column; the unshaded represent the "nothing" plats. The yield of grain per acre is indicated by the length of each space.



AN EXPLANATION OF RESULTS.

The above experimental facts show strikingly that the better class of Kansas soils, when well farmed, *during favorable seasons,* require little in the way of artificial stimulation. There are several facts, however, which have doubtless influenced the results here given, the exact amount of whose influence it has been impossible to ascertain. Thus there was a considerable sprinkling of chinch-bugs in most of the plats, but especially where the growth of the wheat plants was thin and feeble. The mildew also put in appearance in several plats, doing some damage, without doubt, in every case. Many of the plats "lodged" badly, particularly those to which the yard manure, super-phosphate and nitrate were applied. That the loss from this cause was considerable, can hardly be questioned.

SALT AS A FERTILIZER.

In our experiment, salt was applied at the rate of 300 lbs. per acre, to certain of the plats in the spring and to the others in the fall season. I have reason to believe that this 300 lbs. per acre is nearly the largest amount that can be applied without danger from the destructive sterilizing influence of the mineral. Certainly a dose applied at the rate of 450 lbs. per acre has proved quite destructive to vegetation in the case of certain small plats where it was tried. Great expectations have been raised regarding the influence of salt upon Kansas crops. That these hopes are for the most part extravagant and not likely to be realized in practice, I am fully persuaded. The recent discovery of salt in great abundance in several sections of the State has quite likely made "the wish the father of the thought," in the case of these extravagant expectations. In the experiments under examination it will be noticed that the plats treated with salt, taken as a whole, show no increase of grain, and only a very slight gain in straw, over the unsalted. In my experiment of last year, on the other hand, an average gain of nearly five bushels of grain and 800 lbs. of straw was recorded for the slated plats. These facts are in direct accord with previous experiences had with this fertilizer. Upon certain soils and during particular seasons salt has proved valuable, but quite as often it has been inert and worthless as a fertilizer. This fact doubtless explains why salt, which has been used as a fertilizer in all ages and countries, has yet no permanent place among the generally recognized manurial agents.

It is proper here to mention some of the known and established facts regarding salt and its use as a manure. Salt does not enter into the composition of plants as a necessary element: that is, plants may be grown and brought to perfection in a soil which contains none or only a very small proportion of this mineral. If salt then is beneficial to a crop, it must be due to the fact that it acts upon the necessary elements of plant-growth by which these are made more available to the plants. Salt has generally

proved much more beneficial to inland than coastwise countries, and its influence has been shown most markedly with cereal crops.

In the columns of the public press of the State much has been said of late of the effect of salt in warding off the attacks of chinch-bugs. Our experiments of the last two years give no support to this widely-current notion. During the year the unanimous reports of visitors, and of those whose duty it was to closely observe every fact in connection with these experiments, has been to the effect that the salted plats were suffering more than the unsalted from the attacks of these pests. The salt has this undoubted effect: it made a brighter, cleaner straw, which was noticeable in the haulm weeks after the grain had been cut.

Although the subsoiling in the case of this experiment was done upon land that theoretically ought to be greatly benefited by the process, it was of no benefit whatever; nor, I may add, has it ever been markedly beneficial when tried upon the College farm, where trials of subsoiling have been made by the dozen. The plats cultivated, *i. e.*, lightly hoed twice, were also plainly not benefited by the extra labor put on them. The yard manure, super-phosphate and nitrate of soda were certainly not beneficial in any case. They each stimulated the wheat plants — the present season most unnecessarily — giving an enormous growth of weak straw, which lodged so badly that it was impossible to gather it in harvesting. The result is seen either in slight losses, as where the yard manure or super-phosphate was used, or a very large loss, as in the case of the plats receiving the dose of nitrate.

SALT APPLIED TO OATS.

To further study the influence of salt as a fertilizer, an experiment was tried this year with oats, similar to that made with wheat as detailed above, For this purpose six plats each 2x8 rods (one-tenth acre) were used. These plats were all sowed with oats at the rate of two and a half bushels per acre, March 23d, The day following, salt at the rate of 300 pounds per acre was applied to each alternate plat in the series. The only differences noticed immediately afterwards in the salted and unsalted plats was a peculiar dryness of the soil of the salted plats, even directly after rains, and the bright color of the straw grown on the salted areas, before referred to in the case of the experiment with wheat. The crop of the experimental plats suffered a good deal from rust, the bushel only weighing twenty-eight pounds. The following are the essential facts of this experiment:

No. of plat.	TREATMENT.	YIELD OF PLAT, POUNDS.		Weight of struck bushel.	YIELD PER ACRE.	
		Grain.	Straw.		Grain, bushels.	Straw, pounds.
1	Nothing	112	198	28	34.3	1,980
2	Salt, 300 lbs. per acre	126	234	28½	39.3	2,340
3	Nothing	112	208	28	34.3	2,080
4	Salt, 300 lbs. per acre	127	263	27½	39.7	2,630
5	Nothing	124	246	27	38.7	2,460
6	Salt, 300 lbs. per acre	124	236	28	38.7	2,360
	Average of salted plats	125.6	244.3	28	39.2	2,443
	Average nothing plats	116	217.3	27½	36.3	2,173
	Differences, gains and losses	9.6	27	½	2.9	270

This oat experiment again illustrates the uncertainty of salt when used as a fertilizer. The figures show a gain for the use of salt of less than three bushels of grain and 270 lbs. of straw per acre. Even if this difference is to be credited directly to the use of the salt — which may well be questioned—the transaction was a most unprofitable one, considering the values involved.

LISTING WHEAT.

The question whether the advantages claimed for the methods of listing the corn crop have not an application in wheat culture, has long seemed to me worthy of experimental examination. If corn by being planted at the bottom of a deep furrow germinates more surely and better withstands the effects of drouth, thus making sure a larger yield, why may not as much be expected of wheat when treated in like manner? Moreover, the method of listing might be expected to have the additional advantage in the case of wheat that it would almost certainly enable wheat so planted to pass even the severest winters uninjured by winter-killing. Who has not noticed in fields of wheat, more or less completely destroyed by winter-freezing, that every plant fortunate enough to have root in some dead-furrow or other depression in the field has almost certainly passed the rigors of winter unharmed? If we put the entire crop beneath the surface, why may it not altogether escape winter-killing? seems at least a reasonable question.

To test this question, 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. The seed thus planted sent its shoots above-ground a day or more in advance or seed sown near by upon the surface. The listed wheat made a ranker and

more luxuriant growth, the plants having a much better color than those which grew upon the surface, where the seed had been sown at the same time in the familiar manner. The listed wheat rapidly covered the ground with its dense verdure; in color, height, and apparent vigor, it seemed from the first superior to that which had been seeded upon the surface. Of course, last winter furnished no test for the main question involved in listing — whether the new method of seeding would enable winter wheat to withstand freezing; so I have no report to make on this point. Our listed wheat seemed to show a tendency to lodge, which quite likely it would not show in less stimulating seasons than that of 1889. This experiment has seemed to me to involve a question of very great importance to Kansas wheat-growers, but I am compelled to await another season's experience before speaking more accurately and positively of the merits of the methods of listing as applied to wheat.