EXPERIMENT STATION

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CHEMICAL DEPARTMENT.

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SUGAR BEETS.

The work upon sugar beets reported on in Bulletin 78 has been continued the last season with such efforts at improvement in the manner of investigation as experience suggested, and opportunity afforded. In Bulletin 78 it was recommended, "that in localities possessing a considerable area of similar soil, and otherwise favorably situated for sugar manufacture, a number of farmers unite in a co-operative experiment" in the growth of sugar beets for testing. The farmers of three localities took action in harmony with this suggestion, i. e., those in the vicinity of Nickerson, Reno county, Mulvane, Sumner county, and Inman, McPherson county. It is much to be regretted, however, that very many of those who received seed, even in those localities, failed to send in any beets upon request, and in the majority of such cases did not reply in any way. The policy of supplying seed to isolated farmers was continued, but not encouraged. Next season no beet seed will be sent from this Station for the purpose of making isolated tests, except under very unusual circumstances. Where a number of farmers will unite to make a test of their locality, will acquaint themselves with the

methods of growth and culture which have been found essential to success elsewhere, and undertake to follow them, the Station will be glad to co-operate to the extent of furnishing seed and analyzing samples of the beets.

Beet seed was sent last spring to 251 different men. Of these, 128 have not been heard from in answer to a request to send in beets for analysis, or at least report why beets could not be sent, altho each was provided with a blank and a franked envelope for the purpose. Of those who did not send beets because of failure of the crop, 31 reported. Ninety-two sent in one or more samples of beets for analysis. It will be seen that there are great difficulties in the way of obtaining much valuable information in regard to the sugar beet producing capacity of our state by means of voluntary culture for experimental purposes. The press of farm work is such as to lead to, almost unavoidable, neglect of the beet plat. We desire to tender our hearty thanks to all who have assisted us this year by growing beets and forwarding samples of them, and to include with these those whose efforts have been rendered fruitless by untoward conditions.

The failures reported this year have been very largely due to the weather. Heavy rains or floods washed out or covered over the young plants. Hail destroyed some and insects others. In many cases the beets sent in this year bear evidence of having been grown on land not suited to them or not properly prepared. This is shown by their stumpy form, and large proportion above the surface of the ground. The growers in comparatively few cases followed the directions for culture as to distance between the rows. It is a well ascertained fact that to produce a beet rich in sugar it must be kept down in size. One and one-half pounds is about right. This with a perfect stand would give over thirty tons to the acre, if the rows were eighteen inches apart and the beets eight inches apart in the row. Large yields are possible, therefore, without sacrificing quality to weight. To plant and till rows as close as eighteen inches, on the large scale, special drills and cultivators are used. For experimental plats hand work must be depended on. A fair test of our state can never be made until those engaging in the work follow the methods which experience has shown to be essential to the highest success. The modern sugar beet is a product of seed breeding with the plants growing under the most favorable conditions, and, like live stock, it will at once deteriorate if put into less favorable conditions.

The treatment required for the best success with sugar beets doubtless varies somewhat with soil, latitude and season, but the

general principles must remain the same. That any contemplating growing experimental plats next year may see what will be expected in the way of culture, the directions given last spring are reprinted below. These directions are based upon our own experience, combined with a careful study of the methods in use in Nebraska, Utah and California for producing beets on the large scale for actual sugar production. It is believed that these directions so nearly represent the procedure that will lead to the best results in this state, that one is not justified in departing from them without much experience.

DIRECTIONS FOR GROWING SUGAR BEETS.

Preparation of the Soil.— If soil deeply plowed last fall and suitable otherwise is available, use that. It is necessary that the soil be readily penetrable by the growing beet to a depth of ten or twelve inches. If the soil has not hitherto been plowed to that depth, plow an inch or two deeper than before and loosen the subsoil in each furrow by a subsoil plow or a spade. Two rods square well prepared will be of more service than more improperly prepared. The soil must be in perfect tilth, well pulverized by repeated disking and harrowing, and as free of weed seeds as practicable. Soil that runs together and packs with rain is not suitable. Thruout the growth of the beet the soil must be permeable to the air, and this should be in mind in selecting it. The soil must not be handled when too wet or too dry, it should have been under cultivation at least two years, and must have no stable manure applied this spring.

Planting.— Just previous to planting the final harrowing of the soil should be given so as to kill all weeds that may have started. It is well to roll the ground then. Plant by hand or with a seed drill in rows from sixteen to eighteen inches apart. The seed should not be covered deeper than one inch, and the soil above the seed must be well firmed by the press wheel of the drill or otherwise. Most failures to secure good germination are due to leaving the surface so loose as to dry out. Beet seed must be planted shallow but must have moisture. If planted by hand, the seed may be dropped three or four together at the intervals desired for the beets. This almost insures an even stand. About twenty pounds of seed per acre is required in field planting. The time of planting varies with the latitude and the season, but should be about the same as early corn-planting, so that the plants may be well grown before the summer drouths.

Thinning.— When the beets have four leaves they must be thinned. If left more than a week longer the roots of the plants left

are injured in pulling out the others. The distance apart that the plants should be left depends upon the richness of the soil—the richer the soil, the closer they may be grown. Six to ten inches will include all cases, and with most of our soils seven or eight inches is about right. It must be borne in mind that the mature beets are to be of about two pounds weight and that very large size is not desirable. Where the beets have been sown uniformly thruout the row, thinning is begun by "bunching" the plants by means of a narrow-bladed hoe, with which the beets are cut out entirely excepting bunches of three or four at the proper intervals for the mature beets. The bunches are thinned by hand, leaving the strongest plant, and at the same time pulling up any weeds near it.

Cultivation.— In cultivation, the conditions to be met are perfect freedom from weeds, looseness of soil, and guarding against injury to the leaves or roots of the beets. If the ground becomes crusted by heavy rain before the beets are up, it should be hoed, following the marks left in firming the soil; otherwise a first shallow hoeing should be done as soon as the beets break thru. A second hoeing must follow the thinning; this should be to a depth of three inches. Similar hoeings will be necessary later. The space between the rows may be cleaned with a suitable cultivator, but loosening the soil between the plants in the rows will require the hoe.

Irrigation.— For such as are able to try the growth of beets by irrigation, a few words based upon information kindly furnished by Mr. George Austin, Agricultural Superintendent for the Utah Sugar Company, Lehi, Utah, may not be amiss. Beets should not be watered too freely. Let them suffer a few days before irrigating. The water must be applied by means of little furrows made by a six-inch furrower attached to the rear of the cultivator, taking care not to flood the ground. Unless the soil has considerable slope, or is very sandy, watering in alternate rows is sufficient. The second time, the water is run down the rows left without water the first time. Cultivate as soon as practicable after each irrigation, to a depth of five or six inches. Two to four irrigations are given during the season, in Utah, the last one three or four weeks before harvesting.

Taking and Forwarding Samples.— Directions for this will be sent in due time to all taking part in this test, and the beets are to be left in the ground until such directions are received. Some of the beets will be called for early, others quite late. Inquiries at any time will be gladly received and promptly attended to.

The Department of Agriculture at Washington has continued its work in investigation of the sugar beet question in this country,

and we are indebted to it for the liberal supply of seed made available, for the printing of blanks, for literature relating to beet culture, which was distributed to those taking part in the test, and for authority to use the penalty envelopes and tags in correspondence, and in sending samples of beets for analysis. For the last named purpose the chemist of the Station was appointed a special agent of the Department.

The influence of climate upon the production of beets rich in sugar is undoubtedly of the highest importance, and this Station has always held the view that it is very probable that most, if not all, of our state has too high a summer temperature, and too little summer rainfall in most parts of the state to allow of the successful production of beets high in sugar. The Department of Agriculture, in its special report on the beet sugar industry, publishes a map of the United States, showing the location of a belt across the country in which the mean temperature for the months of June, July and August is between 69° and 71° Fahr. This temperature is higher than that of the great beet sugar regions of Europe during the same months, but for various reasons is selected by Dr. Wiley as a probable southern limit of successful sugar beet production in this country. This view is not, however, regarded as positively established, but as one which at present affords the best working basis until actual experience supplies sufficient data for an accurate generalization. This belt lying each side of the isotherm of 70° for the months named, does not touch Kansas at all. Its nearest approach is to within about sixty miles of the northwest corner. In this region the belt has in general a northeasterly and southwesterly direction. As we have insufficient data to enable us to locate isotherms thruout the counties of the state, we have in the principal table of analyses in this bulletin, arranged the counties as nearly as practicable in belts from northwest to southeast across the state. The counties in each belt are named from north to south. As one goes north in the state he reaches a cooler latitude; as he goes west, he reaches a higher altitude, which causes a lower temperature; the resultant of these two tendencies is to make the northwest corner the coolest, and the southeast corner the warmest of the state. It is thought, therefore, that this arrangement of counties will give them in the order of their probable favorableness of temperature for the production of sugar beets. Such arrangement can be but approximate, as the altitude does not vary uniformly as we cross the state, valleys and water-sheds coming in the same belt.

Temperature is not the only climatic consideration of importance in beet production. Rainfall, or other water supply, is an

equally as doubtful point as temperature in our state. In the western part irrigation would be necessary, and if an abundant water supply were available would afford ideal conditions in this respect. The sugar beet requires a good supply of water during the early and middle parts of the season, followed by a period of scanty water supply before harvest during which it may ripen, elaborate sugar and concentrate its juice, rather than increase in size and in leaf-growth. Irrigation seems, therefore, to present the best opportunity for controlling this important factor. In the parts of the state where the rainfall is sufficient in quantity it is liable to be badly distributed. A period of drouth in July and August, during which the growth of the plants is checked, is followed by copious rains in September and October, which start a second growth of leaves with the beets, which uses to a considerable extent the sugar already formed, instead of allowing it to increase as it should at this season. It seems highly probable that if sugar beets are to be successfully produced in our state, it will be done by irrigation in the western and northwestern parts.

TABLE SHOWING ANALYSES OF SUGAR BEETS.

Serial number.	Name of Grower.	Postoffice	County	Date of planting.	Kind of Soil	Date of analysis.	Number of beets.	Form of beets.	Average weight in pounds. Gross.	Net.	Specific gravity of juice.	Total solids in juice.	Cane sugar in juice.	Purity of juice.
65	C H Price	Jaqua	Cheyenne	Apr 10	Black loam	Oct 29	6	Good		62	1 071	17 22	14 81	86
53	F. H. Graves	St. Francis	"	May 11	Dark sandy loam	Oct 24	6	"	1 31	1 10	1 063	15 39	10 70	70
98	Mrs. J. R Caldwell	Kanona.	Decatur	May 28	Black loam	Nov. 9	5	"		2 19	1.065	15 85	12 61	80
92	L. J Hedstrom.	Macon.	Wallace	Apr 25	Prairie upland.	Nov. 5	6	"		1.84	1 064	15 62	12.52	80
90	T. J Flanagan.	Poe	Logan.	May 12	Black loam, sandy.	Nov. 4	6	"	1 02	85	1 080	19 26	14 75	77
112	"	"	"			Dec 9	6		1.35	1 17	1 075	18 13	12 94	71
105	J. W Knodle	Woodruff.	Phillips	Apr. 5	Black loam	Nov. 17	6	Fair	78	66	1 059	14 46	11.86	82
68	J. E Milliken	Hill City	Graham	May 21	Black calcareous loam	Oct. 31	6	"	.77	65	1.067	16 31	12 77	78
50	James Baird	Morland	"	May 14	Dark clay loam	Oct 24	6	Good	1 70	1 32	1 051	12 59	11 25	89
78	"	"	"			Nov 2	10	"	2.00	1 53	1 055	13 52	10 92	81
52	M J McCulley	Gove	Gove	May 15	Black sandy loam	Oct 24	6	Fair	95	82	1 058	14 23	10 50	74
106	J. H Sargent	Cora	Smith	Apr 20	Upland prairie	Nov. 17	6	Poor.	.79	.64	1 087	21.05	16 89	80
31	Ernest Ruby	Stockton	Rooks	May 24	Black sandy loam.	Oct. 10	6	Fair	1 47	1 31	1 062	15 16	12 43	82
95	"	"	"	"	" " "	Nov. 7	10	"	1 60	1 21	1 063	15 39	12 67	82
77	Ira W. White	Mankato	Jewell	May 2	Black loam	Oct. 31	3	Poor	..	50	1 066	16 08	13.14	82
88	L. Houston	Alton	Osborne	Apr. 17	Sandy loam	Nov. 3	6	"	89	69	1 062	15 16	11 49	76
66	G. H. Rice	"	"	Apr. 15	Gravel, clay and loam	Oct. 31	6	Fair.	1 62	1.25	1 063	15 39	13 05	85
2	J W. Longstreth	Lakin	Kearny			Sept. 6	10	Good.	1 26	96	1 067	16 31	13.55	83
21	"	"	"	Apr. 12	Sandy loam.	Oct. 1	6	"	1 67	1 53	1 073	17 68	16 30	92
37	"	"	"			Oct 19	6	"	1 71	1 46	1 071	17 22	14 67	85
85	"	"	"			Nov. 3	10	"	1 66	1 36	1 074	17.90	14 49	81
57	H. G. Nicholls	"	"	June 1	Sandy marl.	Oct. 26	6	Fair	.89	.79	1 077	18 58	16 18	87
96	O. A. Perdue	Beloit	Mitchell	May 20	Deep black loam	Nov 7	6	Poor	.87	.50	1 064	15 62	13 38	86
38	Herman Constein	Hanover	Washington	May 6	Sandy loam.	Oct. 19	6	Fair.	...	1 38	1.069	16.77	14.41	86
73	P. Haverty.	"	"	May 15	Bottom land	Nov 1	3	Good.	1.98	1 67	1.062	15 16	12 08	80
74	"	"	"			"	3	"	1 48	1 30	1 072	17 45	15.28	86
6	A. Munger	Hollis	Cloud	Apr. 29	Sandy clay.	Sept 24	6	"	67	57	1 079	19 04	17 21	90
23	"	"	"			Oct 4	6	Fair.	.65	.55	1 074	17 90	16 59	93
81	"	"	"			Nov. 2	10	"	58	.43	1.072	17.45	14 96	86
64	D. M. Dougherty	Ness City.	Ness	May 1	Black loam, creek bottom	Oct. 28	6	Good	1 75	1 38	1 054	13.29	9 34	70
19	N. J Mosher	Centralia	Nemaha	May 23	Black loam	Sept. 30	6	Very good	90	68	1.053	13 05	9.79	75
25	Wm. A Lamb	Manhattan.	Riley	May 5	Black loam, clay subsoil	Oct 5	6	Good	1 75	1 18	1 051	12.59	9.02	72
84	F D. Randall.	"	"	May 16	Black upper bottom.	Nov. 3	6	Fair.	1.76	1 06	1.055	13 52	10 19	75
94	Adam Diller.	Clay Center	Clay.	May 6	Light sandy loam	Nov. 5	8	Fair, small.	.73	.67	1 053	13 05	10 25	79

TABLE SHOWING ANALYSES OF SUGAR BEETS (CONTINUED).

Serial number.	Name of Grower.	Postoffice	County.	Date of planting.	Kind of Soil	Date of analysis.	Number of beets.	Form of beets.	Average weight in pounds		Specific gravity of juice.	Total solids in juice.	Cane sugar in juice.	Purity of juice.
									Gross.	Net.				
76	Fred Bork	Idana	Clay	May 1	Sandy loam.	Nov. 1	10	Good		2 00	1 060	14.70	11 81	80
13	" "	"	"	"	" "	Sept 27	6	"	1 79	1 25	1 052	12 82	10 39	81
59	John Perry	Bennington.	Ottawa	May 4	" "	Oct 27	6	Poor	1 20	82	1.057	13 99	10 77	77
75	J. A. Scheibeler.	Delphos	"	Apr. 12	Black sandy loam	Nov 1	6	"	1 01	75	1 070	17 00	13 41	79
61	J. A. Fisher.	Wilson	Ellsworth	May 16	Good black soil.	Oct. 27	3	Good		.89	1 058	14 23	10 45	73
62	" "	"	"			"	3	Fair.	....	1 00	1 058	14 23	10 57	74
60	B B. Gillett	Garfield	Pawnee	May 20	Black loam	"	6	Good.	1 15	98	1.052	12 82	9 53	74
55	E. Landes	Reserve	Brown	May 14	Black sandy loam	Oct 24	6	Fair		17	1 053	13 05	9 65	74
87	Andrew Powell.	Salina	Saline	Apr. 20	Black upland.	Nov 3	6	"		74	1 060	14 70	10 57	72
107	M. M. Sherman	Geneseo	Rice	"	Upland, hard subsoil	Nov. 19	2	Poor.		2 52	1 074	17 90	15 29	85
58	Richard Gerety	Monrovia	Atchison	Apr 27	Black loam	Oct. 27	6	Good.	2 05	1 73	1 053	13 05	9 95	76
83	F. H. Suffold.	Canton	McPherson	June 3	Deep sandy loam	Nov. 2	10	Fair		84	1 065	15 85	13 32	84
70	W. W. Martin	Galva...	"	May 9	Black loam, little sand	Oct 31	6	Fair	1 27	1.01	1 063	15 39	11 85	77
54	J. S. Falk.	Ashland	Clark	May 1	Black.	Oct. 22	1	"	2 91	2 85	1 071	17 22	13 87	81
108	M. O'Keefe	Meriden	Jefferson	May 25	Sandy loam, new land	Nov 19	6	Good	1 42	1 12	1 058	14 23	11 51	81
69	Geo. B. Bell.	Wakarusa	Shawnee	Apr.	Black bottom land	Oct. 31	6	Fair.	1 36	1 16	1 056	13 76	10 50	76
44	W. J. McColm	Waveland.	"	May 25	Black loam	Oct 24	6	Good.	1.86	1 37	1.046	11 40	8.04	71
111	Geo Goodyear	Marion	Marion	Apr. 10	Dark loam, little sand	Nov 25	6	"		1.70	1.054	13.29	10 52	79
49	J. R. Clinton.	Hutchinson	Reno.	May 13	Dark sandy soil.	Oct. 24	6	Poor	96	87	1 073	17 68	15 81	90
15	J. K. Beck	Nickerson	"	Apr. 20	Black sandy, river bed	Sept. 28	6	Good	1.73	1 20	1.052	12 82	9 47	74
33	G. W. Benjamin	"	"	"	Sandy loam	Oct. 11	6	Fair	1 12	.78	1.060	14.70	10 85	74
16	C M. Booth	"	"	Apr 11	" "	Sept 28	6	"	1 73	1.26	1 054	13 29	9 54	72
14	G. B. Brooks	"	"	May 10	Heavy, sandy.	"	2	Good	2 06	1 37	1 050	14 46	9 09	63
29	" "	"	"			Oct. 15	3	"	1 62	1.53	1 056	13.76	9 19	66
1	I. J. Byers	"	"	Apr. 8	Black sandy loam	Aug. 6	9	Poor	1 46	1 09	1 064	15 62	13.34	85
3	" "	"	"			....	3	Fair.	2 75	2 22	1 061	14 93	12.90	86
67	" "	"	"			Oct 31	10	Good	1 51	1 22	1 061	14 93	11 64	78
27	Percy Byers.	"	"	Apr. 11	Slightly sandy.	Oct. 6	6	"	1.63	1 33	1 060	14 70	11 81	80
8	Wm. H Clark	"	"	Apr. 14	Black sandy loam.	Sept 24	6	Fair.	1 62	1 25	1.057	13 99	10 62	76
34	J. Fossey.	"	"	May 2	Heavy black,	Oct. 11	6	Good		1.62	1 061	14 93	10 57	71
4	A P Gibson.	"	"	Apr 7	Dark loam, sandy	Sept. 23	6	Med'm good	1 50	1 06	1.041	10 20	7.36	72
11	Austin Hickle	"	"	May 10	Black land.	Sept 27	6	Fair	72	39	1 056	13 76	9 88	72
12	" "	"	"			"	3	"	1 13	71	1 055	13 52	10 23	76
7	Chas. H. Huffman	"	"	Apr. 12	Black, sandy	Sept 24	6	"		1 26	1 057	13 99	10 17	73
97	J. F. Justus	"	"	May 10	Sandy	Nov 7	10	"	1 41	1 38	1 064	15 62	13 38	86
36	J. W. Karr.	"	"	May 15	Heavy black, some sand.	Oct 19	6	"	1.48	1 19	1 051	12 59	9.79	78

9	M. McCormick..	"	"	Apr. 15	Light sandy loam..	Sept 26	2	"	3 05	2 02	1.055	13 52	10 46	77
10	" "	"	"			Sept 27	4	Medium	3 21	2.04	1.057	13 99	11 21	80
20	O. Peed..	"	"	Apr. 23	Dark sandy loam.	Oct. 1	6	Good..	1 37	1 14	1.065	15 85	13.67	86
5	W. H. Ritcha	"	"	Apr. 15	Heavy black.	Sept. 24	1	"	2.49	2.05	1 055	13 52	10.52	78
45	J. E Solenberger	"	"	May 6	Sandy loam.	Oct. 24	6	Fair	1 55	1.23	1 055	13 52	9 54	71
17	Chas. Wagerle.	"	"	Apr. 25	Heavy black	Sept. 29	6	Very good	1 83	1 50	1 057	13 99	11.65	83
71	J. D Yaggy	"	"	May 10	Sandy	Oct 31	6	Good		1 00	1.065	15 85	13 02	82
40	Chas. Matney	Argentine	Wyandotte	May 8	Blk sandy loam, timberland	Oct 20	5	Poor	66	50	1 063	15.39	13.02	85
102	Henry Butternick	Kansas City	"	June 1	Clay	Nov. 14	6	Good	1 49	1 31	1 065	15.85	12.32	78
110	C F. Horstman.	" "	"	May 1	Clay loam.	Nov. 25	5	Poor	1.85	1.52	1 068	16 54	12 53	76
101	P. W. Service.	" "	"	Apr. 15	Sandy	Nov. 14	6	"	.79	65	1 068	16 54	13 58	82
18	A Herning	Lawrence	Douglas	May 6	Sandy, river bottom	Sept. 30	6	Fair	1 41	1 00	1 050	12 35	10.42	84
63	B. H. Schultze	Melvern.	Osage	May 15	Prairie	Oct 26	3	"	1 29	94	1.049	12 11	7.70	64
39	B. L. Grover.	Burrton	Harvey	"	Loam over hard-pan.	Oct. 19	6	Poor	83	59	1 035	8.75	4 13	47
24	John T. Moulds	Halstead	"	Apr. 20	Sandy loam	Oct. 6	6	Fair.	1 47	1.18	1 070	17 00	13 82	81
26	Robert Moulds	"	"	"	Sandy	"	6	Medium	1 40	1.18	1 073	17 68	14.96	85
82	" "	"	"			Nov. 2	8	Good	1 80	1 29	1 068	16 54	14 76	89
38	A. H. Dart	Newton.	"	May 20	Sandy loam.	Oct. 6	6	Poor	1 65	1 03	1 057	13.99	9.19	66
41	Eli Chapman	Reece.	Greenwood	Apr. 26	New land, second sod	Oct. 21	6	Fair		76	1 066	16 08	13 96	87
80	J T Oldham	Eldorado	Butler	June 5	Manured upland	Nov. 2	6	Good	1 60	1 11	1.061	14.93	10 16	68
91	J. C. Rich	Whitewater	"	May 25	Heavy loam	Nov. 4	6			.31	1.066	16 08	12.55	78
104	" "	"	"			Nov. 16	6	Good	1 33	1 10	1.054	13 29	10 82	81
22	Chas. Lambky	Waco.	Sedgwick	Apr. 12	Sand and loam	Oct. 3	6	"	1.65	1.32	1.057	13 99	12.07	86
109	" "	"	"			Nov. 25	10	Fair	.98	.85	1.072	17 45	14.84	85
48	Walter Soules	Colony	Anderson	May 26	Loose loam	Oct 24	6	Good.	1 65	1.49	1 056	13 76	10.97	80
99	F. A Kirkpatrick.	Westphalia	"	June 15	Sandy loam	Oct. 10	6	"	1.55	1.11	1 051	12.59	8.75	70
56	G A Blair	Mulvane	Sumner	May 15	" "	Oct. 25	6	"	1 58	1 22	1.059	14 46	11.51	80
35	P. S. Brown	"	"	Apr. 25	Black	Oct. 11	6	"	1 74	1.00	1 057	13 99	9.58	68
86	W. A. Eagon	"	"	Apr. 15	Sandy loam.	Nov. 3	6	Poor	1 67	1 38	1 067	16 31	13 06	80
30	J. W. Farber.	"	"	Apr. 8	Sandy, with loam.	Oct. 8	6	Good	2.00	1 70	1 056	13 76	10 71	78
79	" "	"	"			Nov. 2	10	"	1 84	1 34	1.058	14 23	11 33	80
93	L. E Ladd	"	"	Apr. 19	Dark, sandy loam	Nov. 5	6	Medium	1 49	1 02	1.056	13.76	10 53	77
46	Andrew McDonald	"	"		Black	Oct. 24	6	Good	1 51	1 22	1 063	15 39	11 74	76
47	Samuel Belong	Parker.	Linn	Apr 20	Red	"	6	Fair	90	73	1.046	11.40	7 83	69
32	W. J. Burtis	Fredonia.	Wilson	May 9	Red clay upland	Oct. 11	6	Poor	78	47	1 053	13 05	10 69	82
72	H. G. Markle.	New Albany	"	May 15	Clay loam	Oct. 31	6	"	1 36	99	1 050	12 35	8 42	68
51	W P. Spence.	Marmaton	Bourbon	Apr. 26	Ordinary upland	Oct 24	6	Fair	1 20	.88	1 046	11 40	7 83	69
100	O. H. Wills	Cherryvale	Montgomery	May 11	Sandy loam, clay subsoil	Nov 14	6	"	1 20	97	1 050	12 35	10 00	81
42	E Bourquin	Bartlett.	Labette	Apr. 10	Dark, slope	Oct. 21	6	Medium		99	1 025	6 30	3 86	61
43	H. J. Painter	Galena	Cherokee	Apr. 12	Sandy	"	6	Fair	96	66	1.035	8 75	3.28	38
89	M T. Long.	Alva	Oklahoma	May 1	Light alluvial	Nov. 3	6	"	1 38	1 04	1 069	16 77	12.88	77
103	G R Burbridge	Lohmarsburg	Berry Co., Mo	May 10	Gravel, timber; clay subsoil	Nov. 14	6	"	51	.45	1 052	12 82	10 10	79

CONSIDERATION OF RESULTS.

Altho explanations have been given in previous bulletins, it is probably necessary that some statement should be made here also in regard to the various data tabulated on the preceding pages. The kind of soil as there given is as designated by the growers of the beets, and the same expressions cannot be assumed to indicate exactly the same kind of soil in all cases. The gross weight is the weight of the beets with the leaves removed. The net weight is the weight of that part remaining after the part of the root which grew above ground had been removed. This should be as large as possible in proportion to the net weight of the untrimmed beet. The specific gravity of the juice shows its weight compared with the weight of water, water being taken as 1. The more the figures for the specific gravity exceed 1, the more the juice has in solution. These substances in solution may be sugar or other things, and there is always more or less of things besides sugar. The percentage that the sugar is of the total solid matter in solution in the juice, is called the coefficient of purity. The higher the coefficient of purity, the better the juice for sugar manufacture, as the other things in the juice interfere more or less with the successful extraction of the sugar from the juice.

The averages deduced from the preceding table are presented below, and with them the corresponding figures for the previous year:

COMPARISON OF RESULTS OBTAINED IN 1897 AND IN 1898.

	1897.	1898.
Average gross weight, in pounds	1.51	1.45
Average net weight, in pounds	1.09	1.12
Average specific gravity of juice	1.064	1.060
Average total solids in the juice	15.52	14.71
Average percentage of sugar in the juice	11.88	11.56
Average coefficient of purity of the juice	76.1	77.8

The average percentage of sugar found in 1891, when 147 samples were analyzed, was 10.54. The percentage of sugar last season is thus seen to be less than the preceding year, but more than in 1891.

The results of last season's analyses have been tabulated in various ways, and subjected to careful examination to learn what connection, if any, exists between the variations in the per cent of sugar and the other variations. While it does not seem profitable to

print in full these tabulations, some of the deductions made therefrom will be of interest.

INFLUENCE OF LOCALITY.

If a line be drawn across the state from Washington to Stanton county, it will cut off rather less than one-third of the state to the northwest. The line will be approximately parallel to the isotherm of 70° for the months of June, July and August, and about 200 miles distant from it. Twenty of those sending in beets live northwest of this line; of these, 5, or 25 per cent, sent beets containing over 14 per cent of sugar; 11, 55 per cent of them, sent beets containing over 13 per cent of sugar; 15, 75 per cent, sent beets containing over 12 per cent of sugar. Ninety of the growers live southeast of the line named; of these, only 4 sent in samples containing 14 per cent or more of sugar, or 4.4 per cent of them; 16 sent in beets with over 13 per cent of sugar, that is, 17.8 per cent of them; 20 sent beets containing over 12 per cent, that is, 22.2 per cent of them. A study of these figures alone would seem to show that the chances of getting rich beets are over three times as great to the northwest of the line as to the southeast.

These figures were so suggestive that a re-examination was made of the results obtained in previous years when a considerable number of samples had been analyzed. The figures for those years do not bear out the opinion that might be formed by a consideration of last year's only. Thus, in 1891, of the 36 living northwest of the line, 8 per cent sent beets with over 14 per cent of sugar; 14 per cent with over 13 per cent of sugar; 17 per cent with over 12 per cent of sugar; while of the 89 living southeast of the line, 7 per cent sent samples with over 14 per cent of sugar, 11 per cent with over 13 per cent of sugar, and 19 per cent with over 12 per cent of sugar. In this case it will be seen that there was very little difference between the two regions. In 1897, of the 49 living northwest of the specified line, 4 per cent sent beets having over 14 per cent of sugar, 22 per cent with over 13 per cent of sugar, and 35 per cent with over 12 per cent of sugar; while of the 103 living southeast of the line, 17 per cent sent beets with over 14 per cent of sugar, 31 per cent with over 13 per cent, and 55 per cent with over 12 per cent of sugar. That year's results, therefore, would lead to conclusions entirely at variance with those that might be drawn from the results of last year, and compel us to adhere to former expressions, and say that no positive conclusions can yet be formed as to the influence of climate upon Kansas beets.

The validity of any general conclusion based on observations,

depends largely on the number of observations, and the liability to errors due to the influence of other factors than those under immediate consideration. It is quite probable that the number of our analyses of beets last season was insufficient to base positive conclusions upon in respect to any point. As in the case of climatic influence, so with others about to be mentioned, more extended observations may require a revision of our present views.

INFLUENCE OF SIZE.

It has been taught constantly that beets of high sugar content cannot be expected, if they are allowed to grow to a large size. Yet the prevailing feeling among farmers growing beets is, that if they have a crop of large beets—the larger the better—they have made a success of raising sugar beets. Comparisons were, therefore, made in several different ways calculated to bring out the facts, and to impress them if possible. All the samples in which the gross weight was above one and one-half pounds were considered by themselves, and those below that size by themselves. It was found that the first group, with an average weight of 1.87 pounds, gave juice with 11.23 per cent of sugar, and purity 77.6. The second group averaged 1.09 pounds in weight, and their juice had 11.76 per cent of sugar and a purity of 78. The differences observed are in favor of the smaller beets, but are not as large as might have been anticipated. It must be recognized, however, that even the largest beets sent in were not very large, considering the size that beets sometimes attain, when allowed to become as large as they may.

INFLUENCE OF THICKNESS OF PLANTING.

The size of the beets depends largely on the closeness of the plants to each other, and to control size in part we have always prescribed closer planting in the rows on rich land than in poor. We have always directed that rows be from sixteen to twenty inches apart. Only a part of the growers have followed these directions. A compilation has been made to show the influence of distance between the rows. Forty-three samples were from beets grown in rows sixteen to twenty-one inches apart. These showed 12.39 per cent of sugar, and a purity of 80.4. The remaining samples were grown at distances of two to three feet or more between the rows, and showed but 11.04 per cent of sugar, and a purity of 76.2.

INFLUENCE OF CONDITIONS OF SOIL AND CULTURE.

The fact that beets grown under such conditions that much of the root projects above the surface of the ground, are not so good as those which are grown wholly below the surface, is well shown by a

study of the table. The percentage that the net weight is of the gross weight has been calculated for each of the samples. The larger this percentage is, the more of the beet that grew below the surface, and the better the beet might be expected to be. We find that with 21 of the samples the net weight was 85 or more per cent of the gross weight, and the per cent of sugar was 12.81, and the purity 80.8. With 26, the net weight was between 80 and 85 per cent of the gross weight, and in them the per cent of sugar was 12.47, and the purity 80. With the remaining 46, in which the net weight was from 54 to 79 per cent of the gross weight, the average percentage of sugar was only 10.51, and the purity 74.6. It is thus plainly seen that a system of culture, or a soil, which produces beets which grow largely above the surface, not only brings a crop which requires heavy topping, but what is left is of much inferior quality.

INFLUENCE OF TIME OF PLANTING AND DATE OF HARVESTING.

The sugar beet requires a long season for maturation; early planting is to be strongly recommended. A compilation of our results from this point of view discloses the fact that about one-half of our growers planted the seed before May 1, and that their beets had 12.12 per cent of sugar in the juice. Those produced from seed planted after May 1, yielded juice with only 11.04 per cent of sugar in it. There is thus shown a very distinct advantage in the early planting.

Closely connected with the preceding topic is that of date of analysis. Beets analyzed at later dates have had longer time for maturation, and the latter part of growth has been at a season in which, in our state, the temperature might be supposed to be better adapted to sugar elaboration than the heated summer is. Examination of our results shows that one-half of the samples were analyzed before October 25, and these gave an average percentage of sugar of 10.96. Those analyzed after October 25 contained 12.11 per cent of sugar in the juice, showing a distinct advantage in the later samples.

CONCLUSIONS.

It will not be lost sight of, it is hoped, that in each of these comparisons the results are tabulated with reference to a single condition, and that the highest returns would be obtained only by the co-operating influence of several or all of the conditions tending to the production of beets rich in sugar. For example, a man may have planted the seed early, but because of having the rows too far apart, and the soil or culture being such that the beets grew largely out of the ground, and possibly other unfavorable condi-

tions, a poor quality of beets may have been produced. The differences shown by the comparisons made above probably represent minimum differences. If all conditions except the particular one which we wish to study could be the same in the entire number of samples, we would doubtless bring out much more striking differences than those shown above. Even as it is, however, it is believed that the comparisons made are based upon a sufficient number of analyses to indicate that last year beets planted before the first of May, in rows sixteen to twenty-one inches apart, in soil such that they could be kept from growing to any considerable extent above the surface of the ground, and allowed to remain until the latter part of October or the first of November, had a much better opportunity to become rich in sugar than those grown under conditions varying from these in one or more particulars.

RESULTS ON LARGER PLATS.

An effort was made the past season to have a number of farmers grow one-fourth to one-half an acre of beets, keeping an accurate account of all the expense attached thereto, with the object of learning at what cost beets could be produced in the state. The results of these experiments have not been all that could be wished, as some of the growers have made no estimate as to cost, and others have made estimates of the price at which they would be willing to grow beets by the ton, but have not furnished us with the data upon which the estimates are based. It is not deemed best, therefore, to present any definite figures on the cost of production at present. It may be stated, however, that with a good yield, beets can be produced at a profit at a moderate price, probably as low in this state as anywhere. The results obtained in growing beets on as large a scale as one-fourth or one-half acre plats may be supposed to represent more fairly the possibilities of our state in this line than the results obtained on one or two square rods. The following table is therefore presented, into which the principal results with these plats are collected. In the case of most of the growers, more than one sample was analyzed, and the figures given are the averages for each grower. The general average is the mean of these averages. It will be seen that the percentage of sugar and the coefficient of purity are both materially higher than the general averages of all analyses as given in the principal table. The reason for this greater average is probably to be found in part in the greater interest that one growing a larger plat might feel, and the better care given it in consequence. Perhaps it is possible to give better preparation and cultivation to the soil on the larger scale also.

TABLE SHOWING ANALYSES OF SAMPLES OF BEETS GROWN ON LARGE PLATS.

	Number of samples	Average weight in pounds.		Specific gravity of juice.	Total solids in juice.	Per cent of cane sugar in the juice.	Coefficient of purity
		Gross.	Net.				
James Baird	3	1.85	1.42	1.053	13.06	11.09	90
Ernest Ruby	2	1.54	1.26	1.063	15.28	12.55	82
J. W Longstreth	4	1.57	1.33	1.071	17.28	14.74	85
A. Munger	3	.63	.52	1.075	18.13	16.18	90
Fred Bork	2	.....	1.63	1.056	13.76	11.10	81
M. M. Sherman	1	.....	2.52	1.074	17.90	15.29	85
F. H. Suffold	1	.....	.84	1.065	15.85	13.32	84
J. K. Beck	1	1.73	1.20	1.052	12.82	9.47	74
I. J. Byers	3	1.91	1.51	1.062	15.16	12.63	83
W. H. Clark	1	1.62	1.25	1.057	13.99	10.62	76
J. F. Justus	1	1.41	1.38	1.064	15.62	13.38	86
M. McCormick	2	3.13	2.03	1.056	13.76	10.84	80
Robert Moulds	2	1.60	1.24	1.071	17.11	14.86	87
Charles Lambky	2	1.32	1.09	1.065	15.72	13.46	86
J. W. Farber	2	1.92	1.52	1.052	14.00	11.02	79
Averages	.....	1.69	1.38	1.062	15.29	12.70	83

The returns realized from a crop of sugar beets will depend largely upon the yield, as well as upon the market value per ton. If a perfect stand were obtained, and the plants were eight inches apart in the rows and the rows eighteen inches apart, there would be 43,560 beets. If these had a net weight of but one pound each, the yield per acre would be over twenty-one tons. As the size may be considerably above this without much risk to the quality, it is evident that very high tonnage is possible. The estimates of yields made by our growers vary from three and one-half to thirty-five tons per acre, the average being 15.9 tons. In the case of those growing the large plats, the average yield was eighteen tons. The very low yields were doubtless due to poor stand and to too great distance between the rows.

PLANS FOR 1899.

In planning experiments for the coming season, it seems necessary to announce a departure to a certain extent from the practice of previous years. This season seed will be furnished to but two classes of applicants, unless the circumstances are very exceptional in other individual instances. We desire to have a number of farmers in representative regions of the state grow one-fourth or one-half acre of beets, keeping an accurate account of all the attendant expense, carefully itemized, and a record of the weather. We also want groups of farmers in all parts of the state, six or more in each locality, who will co-operate to test their respective neighborhoods

as to their beet-producing power. In all cases it is expected that the beets will be grown according to directions furnished by us, and which will be essentially the same as those of last year. Early planting is especially urged. Seed is already on hand and will be sent promptly to the right kind of applicants. Let the wide-awake farmers of any locality where there is a compact body of land likely to be suitable for beet culture, unite in sending in their applications for seed. Do not send names without the consent of their owners, and do not ask to have seed sent for distribution. The seed will in all cases be sent directly to the grower, as we must have a perfect record of the entire distribution in our office. The seed sent has been supplied by the United States Department of Agriculture. The beets required for samples will be transmitted thru the mails free of charge when mailed with tags provided for that purpose. The growers will, therefore, be at no expense beyond the labor of producing the crop, which will, we think, be amply repaid by the feeding value of the crop. Many of those who have raised them regard them as very superior beets for table use.

SUMMARY.

It was hoped that the results of last year's experiments might be so conclusive that they might conclude our investigations in this line. This has not proved to be the case. In too many instances experiments from which much was expected have come to naught. The average results for the season are 11.56 per cent of sugar in the juice, the coefficient of purity being 77.8. Separating from the others the samples grown in plats of one-fourth or one-half acre, the per cent of sugar was 12.70, and the purity was 83. This shows a considerable advantage in favor of the larger plats. These plats have produced beets that could be used very well in sugar-making. A study of the results obtained with the object of learning the effect of the several variations in conditions, leads to the conclusion that the chances for production of rich beets are greatest when the seed is planted before the first of May, in rows sixteen to twenty-one inches apart, in soil such that the roots could be kept from growing above the ground to any extent. Allowing the beets to stand in the ground till late in the fall seems to favor sugar elaboration also. The yield of beets on our plats seems to be about sixteen tons per acre, though those who grew the larger plats had an average yield of eighteen tons. Experiments for the coming season are outlined. Seed will be furnished to groups of six or more farmers conducting a joint test of localities, or to individual farmers wishing to grow one-fourth to one-half acre under certain conditions.