

EXPERIMENT STATION
OF THE
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C H E M I C A L D E P A R T M E N T .

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EXPERIMENTS WITH SORGHUM.

During the season just closed, the tests of sorghum and the efforts to improve sorghum by seed selection, begun in 1888, have been continued. Not all of the older sorts have been grown this year. Three previous years have shown which are the valuable sorts, and since it is well known that sorghum improves in quality until it is dead ripe, and maintains this high quality if left standing in the field until injured by frost, valuable work on sorghum seems narrowed down to testing new sorts and attempts to improve the best of the old ones.

Since the quality of sorghum varies with the season, we always grow some of the standard sorts as a basis of comparison. We grew several of the newer kinds that gave promise of possessing valuable qualities, and the results with these sorts appear with the others. But the greater attention has been given to the improvement of sorghum. Some of these trials are from

selections of seed continued since 1888; others date back only one and two years. Unless careful discriminations are made, the complexity of this work will swamp the experimenter. We have striven to plant the seed of the best stalks only, and to preserve the lineage of each strain. This cannot be made apparent in our table giving the sugar in the juice of selected stalks, but it is found in our note-books, and can be traced up at any time. In certain contingencies this will be of value, but the principal consideration is to secure the improved strains.

In addition to this work in improving sorghum by seed selection, we are testing fertilizers, to see to what extent, if any, the quality of sorghum is affected by fertilizers.

This is a continuation of experiments begun last year, when permanent plats were staked off, fertilizers being applied to the alternate ones. The unmanured plats served as standards of comparison. The same kind of seed has been used on all the plats the past two seasons. It may seem that seed from each plat should be used to seed it the next year, so that the effect of the fertilizer may be cumulative. If an improved sort is to be developed by the use of fertilizers, this is certainly the proper course, for by this means only may the effect of a fertilizer be carried over to the next year to be added to again by the same fertilizers. But without any information as to effects of the various manurial salts upon the sugar content of sorghum, it seemed better that preliminary trials should be made in which all the plats, the "nothing" plats as well as those receiving the several fertilizers, are treated alike as regards preparation of soil, seeding, and cultivation. They thus differ only in the one matter of manuring, the effects of which are to be tested. The other course may be taken up next year, and continued until the data obtained serve to base a decisive conclusion upon, even though an improved strain of sugar sorghum is not secured.

The season of 1891 has been an exceptionally good one for sorghum. The early summer was such as to give a good growth where the soil was kept clear of weeds, and the last portion of the season was favorable for perfect ripening of the plant. As a result, our sorghum has been the best we have ever grown. To what extent this may be the result of past selection of seed, it is impossible to tell. It seems evident, however, that it is not wholly due to this, and that the propitious season is to be credited with a large portion of the result.

Our sorghum ground had been plowed the previous autumn, and was in excellent condition in the early spring to receive the seed. The planting was done on the 8th and 9th of May. The seed germinated well, and the plants were thinned to give a proper but heavy stand. It was given good cultivation and a big crop resulted. All but some of the earlier analyses were of the fully mature cane. Those of the immature cane, as was to be expected, were of comparatively low sugar content for the variety. The

juice, as heretofore, was expressed by a one-horse, three-roll mill, run by man power, but in such way as to extract a fair per cent. of juice, as may be seen from the table.

The following brief explanation of terms used in the tabulated statement may be useful, although they are in common use in such connections, and their import will be obvious to most readers: The "dressed cane" implies the stalk after the seed-top and the blades and sheaths have been removed. These are the parts that are removed in preparing sorghum for the diffusers. Many determinations on numerous varieties have shown that the dressed weight is about two-thirds the total weight of the stalks. The per cent. of juice extracted is calculated upon this dressed cane.

The "cane sugar" is the sugar of commerce. It is sometimes known as crystallizable sugar. Chemists call it sucrose.

The "reducing sugar" is that which is often called glucose. It does not crystallize in sugar-making, and carries into the molasses with it a considerable portion of the real crystallizable sugar. A very desirable character in sorghum is a very small amount of this sugar.

The "coefficient of purity" is the percentage of cane sugar found in the total solids in the juice. The higher this is the more perfectly the cane sugar can be separated from the other constituents, and the more desirable, other things being equal, the sorghum is for sugar-making. For syrup, a high coefficient of purity is not necessary, and if the solids, other than cane sugar, consist chiefly of glucose, the cane will be quite as good if not even better for syrup, as it will not be as likely to crystallize.

The samples with the large number of stalks in the first table are made up of the juice extracted in making stalk selections. Because of the large number handled, data upon height, weight and weight of juice were not taken, since this would have been necessary with each stalk separately. Except as noted in the tables (on next page), the plants were ripe.

TABLE I.—ANALYSES OF GENERAL SAMPLES OF SORGHUM.

VARIETY.	Date of analysis.	Number of stalks in sample.	Average height in feet.	Average weight of dressed canes in grams.	Average weight of dressed canes in pounds.	Percent of juice extracted.	Specific gravity of juice.	Percent of cane sugar in juice.	Percent of reducing sugar in juice.	Coefficient of purity.
Black Sorgho, Nesbit.	Sept. 12*	10	9.5	397.0	.87	53.6	1.062	10 19	2.42	67
Black Sorgho, Nesbit.	Sept. 26	10	9.3	384.3	.85	46.8	1.076	13 99	1.66	76
Black Sorgho, Cawnpore.	Oct. 1	10	8.5	322.2	.71	44.1	1.078	13 80	1.29	70
Chinese Imphee.	Sept. 12*	10	9.5	434.0	.95	57.5	1.057	9 14	1.77	66
Chinese Imphee.	Oct. 1	10	10.0	363.4	.80	41.5	1.073	13 23	1.19	74
Chinese Sugar Cane, Shanghai.	Sept. 12	10	11.0	636.0	1.40	59.5	1.065	11 07	2.53	70
Chinese Sugar Cane, Shanghai.	Oct. 1	10	11.3	542.0	1.19	49.9	1.071	12 95	1.87	75
Cross of Orange and Amber.	Sept. 12	10	9.7	537.8	1.18	58.5	1.069	12 58	2.23	75
Cross of Orange and Amber.	Sept. 14	10	8.8	473.7	1.04	57.0	1.073	13 62	1.73	77
Cross of Orange and Amber.	Sept. 14	10	10.0	515.6	1.13	57.5	1.073	14 27	1.35	81
Cross of Orange and Amber.	Sept. 21	84	.....	.....	.....	.....	1.082	16 49	1.22	84
Cross of Orange and Amber.	Sept. 22	45	.....	.....	.....	.....	1.081	15 79	1.36	81
Cross of Orange and Amber.	Sept. 22	45	.....	.....	.....	.....	1.082	15 82	1.93	80
Cross of Orange and Amber.	Sept. 24	10	9.5	460.0	.99	47.8	1.089	17 07	1.70	80
Cross of Orange and Amber.	Sept. 25	90	.....	.....	.....	.....	1.080	15 70	1.32	82
Cross of Orange and Amber.	Sept. 26	44	.....	.....	.....	.....	1.083	16 20	1.49	81
Cross of Orange and India.	Sept. 14	10	10.3	485.5	1.07	53.8	1.066	11 91	1.80	74
Cross of Orange and India.	Oct. 1	10	10.2	475.5	1.05	53.9	1.073	13 09	2.03	74
Cross of Orange and Link's.	Sept. 14	10	9.9	427.5	.94	54.7	1.069	12 72	1.26	76
Cross of Orange and Link's.	Oct. 6	10	10.0	466.5	1.03	48.8	1.081	15 81	1.83	81
Cross of Orange and Link's.	Oct. 7	80	.....	.....	.....	.....	1.081	15 38	1.96	78
Dindemuka.	Sept. 12*	10	9.3	430.5	1.08	57.4	1.066	11 49	1.51	72
Dindemuka.	Oct. 1	10	9.0	493.4	.89	45.4	1.077	14 08	1.29	76
Early Amber.	Sept. 12	10	9.0	430.8	1.06	57.6	1.070	12 75	1.99	75
Early Orange.	Oct. 10	10	7.0	330.6	.73	50.5	1.080	13 98	2.99	72
Folger's Early.	Sept. 12	10	9.2	398.0	.85	53.1	1.071	13 05	1.44	76
Iowa Red Top.	Sept. 12*	10	9.5	412.0	.91	38.9	1.056	10 55	3.50	77
Iowa Red Top.	Sept. 26	10	9.8	425.0	.94	48.9	1.074	13 09	2.45	73
Kansas Orange.	Sept. 12	10	8.3	463.4	1.02	56.9	1.075	13 62	1.80	76
Kansas Orange.	Sept. 24	10	9.0	522.0	1.15	52.3	1.088	16 81	1.53	80
Kansas Orange.	Sept. 28	90	.....	.....	.....	.....	1.087	16 82	1.24	81
Link's Hybrid.	Sept. 12*	10	11.5	556.0	1.22	54.4	1.078	15 21	1.84	81
Link's Hybrid.	Oct. 5	83	.....	.....	.....	.....	1.084	16 37	1.51	82
Medium Orange.	Sept. 12	10	8.0	349.5	.77	56.0	1.064	11 05	1.23	71
Medium Orange.	Sept. 23	92	.....	.....	.....	.....	1.085	16 58	1.73	81
Medium Orange.	Sept. 24	10	8.0	324.2	.71	51.5	1.078	14 76	1.13	78
New Variety, Haswell.	Sept. 12*	10	8.8	401.5	.88	56.1	1.061	8 96	3 05	60
New Variety, Haswell.	Sept. 26	10	8.8	342.8	.75	48.0	1.074	13 20	2.22	74
Red Liberian (Imphee).	Sept. 14	10	9.0	500.8	1.10	56.6	1.070	11 14	4 06	66
Red Liberian (Imphee).	Oct. 1	10	9.0	457.7	1.01	51.5	1.080	13 96	2 81	72
Red Liberian (Imphee).	Oct. 5	90	.....	.....	.....	.....	1.080	13 31	3 19	69
Rio Blanco.	Oct. 14	10	9.5	516.5	1.14	56.9	1.063	10 27	3 92	67
Rio Blanco.	Oct. 6	10	9.2	489.0	1.08	54.8	1.061	8 51	3 94	58
Sorghum from Caracas, Ven.	Sept. 12*	10	10.7	540.0	1.19	56.1	1.061	10 45	2 69	67
Sorghum from Caracas, Ven.	Oct. 1	10	10.5	441.0	.97	46.0	1.064	6 81	4 52	52
Sorghum Orange, Hatif, Alg.	Sept. 12*	10	8.2	424.7	.93	58.4	1.054	6 81	4 52	52
Sorghum Orange, Hatif, Alg.	Sept. 24	10	8.7	394.8	.87	52.5	1.077	13 75	3 44	74
Sorghum Bicolor.	Oct. 6	10	9.0	334.0	.73	45.1	1.077	14 24	1 82	77
Sorghum from E. Link.	Oct. 1	10	9.5	464.4	1.02	51.6	1.077	14 24	1 86	77
Sorghum from E. Link.	Oct. 2	10	10.5	441.0	.97	44.9	1.080	14 34	.....	74
Swain's Early Golden.	Sept. 12	10	9.0	398.0	.88	54.5	1.065	12 44	1 02	78
Ufatane.	Sept. 14	9	9.0	478.5	1.05	55.6	1.066	12 10	1 56	76
Ufatane.	Oct. 1	10	8.9	.....	.....	.....	1.072	13 81	1 95	80
Ukubane.	Sept. 12*	10	10.8	569.0	1.25	56.9	1.058	9 21	2 70	65
Ukubane.	Sept. 24	10	10.8	560.0	1.23	52.8	1.071	12 38	2 12	72
Unkunjana.	Sept. 13*	10	10.5	539.0	1.19	55.9	1.063	10 41	1 10	68
Unkunjana.	Sept. 24	10	10.3	380.7	.84	47.3	1.076	14 24	1 33	77
Unkunjana.	Oct. 8	.....	.....	.....	.....	.....	1.077	15 52	1 13	83
Undendebule.	Sept. 12*	10	9.8	492.9	1.08	50.7	1.083	16 80	1 10	79
Undendebule.	Oct. 1	10	9.7	458.8	1.01	45.3	1.092	17 68	1 64	80
Undendebule.	Oct. 2	92	.....	.....	.....	.....	1.090	17 21	1 88	80
White Amber.	Sept. 12	10	9.5	428.0	.94	54.5	1.067	12 37	1 23	76
White Amber.	Sept. 24	10	9.0	334.0	.73	41.4	1.082	15 40	1 22	78
White Amber.	Sept. 24	52	.....	.....	.....	.....	1.072	13 34	1 87	77
White Imphee.	Sept. 1	10	8.8	222.3	.49	28.5	1.064	10 23	67	66
H. P. W.'s seed.	Sept. 26	10	9.3	348.2	.77	52.1	1.081	15 35	1 45	79
H. P. W.'s seed.	Oct. 1	10	9.0	384.7	.80	45.9	1.075	13 94	1 66	77

* Nearly ripe. † Quite green.

TABLE II.—ANALYSES OF SINGLE STALKS OF SORGHUM.

VARIETY.	Date of analysis.	No. of stalks from which sections were made.....	Specific gravity of juice.....	Per cent. of cane sugar in juice.....	Per cent. of solids in sugar in juice.....	Coefficient of purity.....
Cross of Orange and Amber.....	Sept. 21	94	1.092	18.16	.78	83
Cross of Orange and Amber.....	Sept. 21	94	1.091	18.25	.71	84
Cross of Orange and Amber.....	Sept. 21	94	1.090	18.25	.66	85
Cross of Orange and Amber.....	Sept. 21	94	1.089	18.15	.76	85
Cross of Orange and Amber.....	Sept. 22	90	1.091	18.23	.86	84
Cross of Orange and Amber.....	Sept. 22	90	1.088	17.91	.92	85
Cross of Orange and Amber.....	Sept. 22	90	1.088	17.88	.....	85
Cross of Orange and Amber.....	Sept. 22	90	1.086	17.63	.....	86
Cross of Orange and Amber.....	Sept. 22	90	1.090	17.72	.87	82
Cross of Orange and Amber.....	Sept. 22	90	1.089	17.63	1.15	83
Cross of Orange and Amber.....	Sept. 22	90	1.089	17.58	.....	83
Cross of Orange and Amber.....	Sept. 22	90	1.088	17.21	.....	82
Cross of Orange and Amber.....	Sept. 25	90	1.091	17.93	.87	83
Cross of Orange and Amber.....	Sept. 25	90	1.090	17.80	.92	83
Cross of Orange and Amber.....	Sept. 25	90	1.090	17.80	.83	83
Cross of Orange and Amber.....	Sept. 26	50	1.091	17.65	1.00	81
Cross of Orange and Amber.....	Sept. 26	50	1.090	17.80	.....	83
Cross of Orange and Amber.....	Sept. 26	50	1.090	17.50	1.09	81
Cross of Link's and Orange.....	Oct. 7	80	1.090	16.73	.80	78
Cross of Link's and Orange.....	Oct. 7	80	1.090	16.83	.64	79
Cross of Link's and Orange.....	Oct. 7	80	1.089	16.51	.83	78
Cross of Link's and Orange.....	Oct. 7	80	1.088	16.28	.57	77
Early Amber.....	Sept. 17	41	1.078	14.96	1.02	79
Early Amber.....	Sept. 18	60	1.080	15.43	.99	80
Early Amber.....	Sept. 18	30	1.083	16.48	1.09	83
Early Amber.....	Sept. 18	30	1.081	16.12	1.44	83
Early Amber.....	Sept. 19	84	1.082	16.12	1.22	82
Early Amber.....	Sept. 19	84	1.082	16.14	1.57	82
Kansas Orange.....	Sept. 28	90	1.096	18.59	.84	81
Kansas Orange.....	Sept. 28	90	1.094	19.26	1.52	82
Kansas Orange.....	Sept. 28	90	1.093	17.88	1.14	80
Kansas Orange.....	Sept. 28	90	1.093	17.92	1.02	81
Link's Hybrid.....	Oct. 5	90	1.092	17.38	.42	79
Link's Hybrid.....	Oct. 5	90	1.092	17.41	.40	80
Link's Hybrid.....	Oct. 5	90	1.091	17.21	.38	79
Link's Hybrid.....	Oct. 5	90	1.091	17.25	.41	80
Link's Hybrid.....	Oct. 5	90	1.091	17.16	.40	79
Link's Hybrid.....	Oct. 5	90	1.090	17.02	.....	79
Link's Hybrid.....	Oct. 5	90	1.090	17.05	.....	79
Link's Hybrid.....	Oct. 5	90	1.090	17.16	.....	80
Medium Orange.....	Sept. 23	92	1.091	17.84	.76	82
Medium Orange.....	Sept. 23	92	1.090	17.83	.67	83
Medium Orange.....	Sept. 23	92	1.089	17.13	.....	81
Medium Orange.....	Sept. 23	92	1.089	17.37	.66	82
Medium Orange.....	Sept. 23	92	1.090	17.72	.54	82
Red Liberland.....	Oct. 6	90	1.086	14.90	2.19	72
Red Liberland.....	Oct. 6	90	1.087	15.34	1.92	74
Red Liberland.....	Oct. 6	90	1.086	14.55	2.56	70
Red Liberland.....	Oct. 6	90	1.085	14.52	2.88	71
Undebule.....	Oct. 2	92	1.098	18.95	.72	81
Undebule.....	Oct. 2	92	1.098	18.83	.67	81
Undebule.....	Oct. 2	92	1.097	18.24	.70	79
Undebule.....	Oct. 2	92	1.096*	18.11	.91	79
Undebule.....	Oct. 2	92	1.095†	18.39	.79	81
Undebule.....	Oct. 3	90	1.099	18.27	.43	78
Undebule.....	Oct. 3	90	1.099	18.67	.35	80
Undebule.....	Oct. 3	90	1.098	18.43	.46	80
Undebule.....	Oct. 3	90	1.098	18.03	.36	77
Undebule.....	Oct. 3	90	1.098	18.48	.....	80
Unkunjana.....	Oct. 8	40	1.088	16.83	.59	80
Unkunjana.....	Oct. 8	40	1.088	16.94	.54	80
Unkunjana.....	Oct. 8	40	1.086	16.33	.....	79
Unkunjana.....	Oct. 8	40	1.086	16.47	.....	80
Unkunjana.....	Oct. 8	40	1.090	16.97	.38	79
White Amber.....	Sept. 24	56	1.087	14.85	.92	71
White Amber.....	Sept. 24	56	1.086	14.69	1.10	71

*Juice of two stalks of equal specific gravity.
†Juice of six stalks of equal specific gravity.

Whether we examine the table of single stalks or that of general samples, we find evidence of remarkable richness in cane sugar and comparative freedom from the undesirable glucose sugars. Among the newer varieties are many that do not deserve further trial; but in Undendebule, the one that is the richest in cane sugar and the lowest in reducing sugar, we have a sorghum of rare merit. Among the single-stalk analyses it shows to especially good advantage. Our cane-growers should secure seed of this variety.

Many of the kinds in the general table have been subjected in past years to more or less selection of seed, and this may affect the composition even where no indication of selection appears in the table. But undoubtedly the excellence of the season must be regarded as the chief factor in the production of the uniformly high sugar content shown by nearly all varieties.

Our selections have, however, been in the line of high cane sugar and low glucose sugar. If these qualities, which characterized this year's sorghum to such an extent, are due to the selection and cultivation that the plant has received in the past, we may hope to eliminate the glucose factor from the sorghum sugar problem, and to greatly increase the true sugar factor. A sugar plant that has no more than one-half of one per cent. of uncrystallizable sugar is very nearly free from it. If this much has been accomplished, the end is not yet reached.

We can, however, only look to the future to determine the real facts as to the causes that have operated to produce our results, and whether the change is permanent or only an accident of the season.

IMPROVEMENT BY SEED SELECTION.

We have made more numerous analyses of single stalks of sorghum this year than heretofore. The work has been conducted on the same general plan as that of previous years. The plats grown from the seed of the best stalks of last year have been examined by individual stalks. Only fair-sized canes are examined. The juice expressed is first tested with the hydrometer, and unless the specific gravity is found to be high it is mixed with that of others of the same variety to make a general sample. Those samples of juice showing the highest specific gravities are analyzed, and only the results upon these appear in the table.

In making the selections, the juice is collected in a wide-mouthed bottle, and the seed-top belonging with it is put into the bottle also, the stalk being cut off rather short for that purpose. The seed then remains with the juice until it is finally disposed of, making it unnecessary to label any samples of juice or any seed-tops, excepting the best ones finally selected. In this way, we have examined nearly 1,300 single stalks, and have analyzed 66. We have not deemed it worth while to examine over a hundred from any one plat, or to work upon inferior varieties in this connection.

A careful examination of Table II will show that juices having the greatest specific gravity were not necessarily those containing the highest

percentage of sugar, and the juices of greatest purity have frequently a slightly lower percentage of cane sugar than some juices of less purity. For example, the highest specific gravity observed was 1.099 with juice from two different stalks of Undendebule, but the highest percentages of cane sugar were found in juices of specific gravity 1.098 from other stalks of the same variety. So, too, while these stalks yielded juice of the highest percentage of cane sugar, its purity was but 81 per cent., while the crosses of Orange and Amber furnished juice of 85 and even 86 per cent. purity, but somewhat less cane sugar.

The highest per cents. of cane sugar observed in several varieties were, 18.95, in Undendebule; 18.25, in a cross of Orange and Amber; 18.59, in Kansas Orange; 17.84, in Medium Orange; 17.41, in Link's Hybrid; 16.94, in Unkunjana; 16.83, in cross of Orange and Link's, and 16.48 in Early Amber. The lowest per cents. of reducing sugars were found in Undendebule, Link's Hybrid, and Unkunjana.

The highest percentage of cane sugar which we have observed in any previous year has been 17.47, in a cross of Orange and Amber.

THE TRIAL WITH FERTILIZERS.

The plan of the experiment with fertilizers, as given in Bulletin 16, is as follows: "An experiment was begun to see whether better sorghum may be produced by the use of fertilizers and good cultivation. To this end plats were staked off permanently, so that the same treatment may be given these plats for a series of years. The treated plats alternate with "nothing" plats. The following substances were selected for trial: Lime, superphosphate, nitrate of soda, sulphate of potash, plaster (gypsum), and a complete fertilizer composed of superphosphate, sulphate of potash, nitrate of soda, and plaster. The lime was applied at the rate of 20 bushels per acre; the superphosphate at the rate of 600 pounds per acre; nitrate of soda, 400 pounds; sulphate of potash, 400 pounds; and plaster, 200 pounds. To the plat receiving the complete fertilizer the following amounts per acre were applied: Sodium nitrate, 200 pounds; potassium sulphate, 200 pounds; superphosphate, 300 pounds; plaster, 100 pounds. The fertilizer was sown broadcast along the rows soon after planting." Salt was applied at the rate of 150 pounds per acre. The plats were treated the same this year as last, and were all planted on May 8, with the same kind of seed, which was a good strain of Kansas Orange. They received uniform and thorough cultivation and produced an excellent crop, as the following table shows. The analyses were made September 29 and 30, the sorghum being fully ripe.

TABLE III.—ANALYSES OF SORGHUM GROWN ON FERTILIZED PLATS.

FERTILIZER APPLIED, AND AMOUNT PER ACRE.	Number of plat.....	Average weight of dressed canes in pounds.....	Per cent. of juice extracted.....	Specific gravity of juice.....	Per cent. of cane sugar in juice.....	Per cent. of reducing sugar in juice.....	Coefficient of purity.....	Cane sugar above or below the mean of the "nothing" plots each side.....
Nothing.....	1	1.05	50.0	1.087	17.29	.53	83	
Complete manure, 800 pounds.....	2	.95	52.3	1.087	17.02	.77	82	-.17
Nothing.....	3	.98	50.5	1.089	17.10	.82	81	
Sulphate of potash, 400 pounds.....	4	1.19	54.4	1.083	16.53	1.03	83	-.11
Nothing.....	5	1.09	55.2	1.084	16.18	1.36	81	
Nitrate of soda (Chili saltpeter), 400 pounds..	6	.96	51.9	1.088	17.21	.82	82	+.88
Nothing.....	7	.91	53.8	1.086	16.47	1.32	80	
Superphosphate, 600 pounds.....	8	.98	56.0	1.085	16.42	1.24	81	-.11
Nothing.....	9	1.15	54.1	1.083	16.59	.98	84	
Gypsum (plaster), 200 pounds.....	10	.99	53.0	1.083	16.31	1.18	82	-.02
Nothing.....	11	1.03	54.8	1.082	16.08	1.22	82	
Lime, 20 bushels.....	12	1.13	55.4	1.084	16.61	.94	82	+.46
Nothing.....	13	1.07	52.7	1.082	16.21	1.05	82	
Salt, 150 pounds.....	14	.91	51.4	1.082	16.27	1.32	83	-.21
Nothing.....	15	.81	53.6	1.086	16.74	1.15	81	

The plats are one-fiftieth of an acre in area, containing four rows 62.2 feet long and 3½ feet apart. The samples for analysis were taken from one of the middle rows of each plat. All of the sorghum growing in 10 consecutive hills was taken as the sample. The aggregate weight of the 15 samples was nearly 500 pounds of dressed cane. The significance of the very high cane sugar content shown is much greater on this account than it would be if the results were obtained from only a few canes. With such sorghum as was furnished by these plats, sorghum sugar would soon be an important factor in commerce. It will be seen by examining the figures in the last column of the table that the fertilizers had little, if any, influence. The differences may easily be the expression of errors inevitably involved in plat experimentation. The greatest difference is shown in the plat receiving sodium nitrate, where there is an apparent increase of .88 per cent. The same plat showed an increase last year, but the early freeze had injured the cane so much that we do not think it worth while to make any detailed comparisons of this year's results with last year's. The experiment will be continued as planned, and if the sodium nitrate plat shows an increased percentage of cane sugar next year, a plat will be started in which the attempt will be made to combine stalk selection and fertilization in the production of an improved strain of the best variety of sorghum.

SUMMARY.

The season of 1891 was the most favorable for sorghum that we have had at this place for at least eight years, the growing season being amply supplied with rain, followed by the rather dry fall, so favorable to maturation of a sorghum rich in cane sugar. A killing frost did not occur until October 7th.

Only about thirty varieties were grown this year, the poorer ones having been rejected after two years' trial.

The highest percentages of cane sugar found in general samples of certain varieties is as follows: Undendebule, 17.68; Cross of Orange and Amber, 17.07; Kansas Orange, 16.82; Medium Orange, 16.58; Link's Hybrid, 16.37; Cross of Orange and Link's, 15.81; Unkunjana, 15.52; White Amber, 15.40.

The selection of individual stalks of high sugar content and purity has been continued. Nearly 1,300 canes, from 10 varieties, were examined, and 66 analyses made. The highest percentages found in a few of the varieties were: Undendebule, 18.95; Kansas Orange, 18.59; Cross of Orange and Amber, 18.25; Medium Orange, 17.84; Link's Hybrid, 17.41; Unkunjana, 16.94; Cross of Orange and Link's, 16.83; Early Amber, 16.48.

The quality of the sorghum grown at this Station in previous years has never approached the excellence shown by the percentages quoted above. This year's samples of standard sorts show 1 to 3 per cent. more cane sugar than previous years. Part of this improvement may be, and probably is, due to seed selection; but the propitious season is credited with most of the increase in sugar content.

The continuation of the trial of fertilizers on sorghum has not yet yielded conclusive results, although there is an indication that Chili saltpeter increases the cane sugar in the juice.

NOTE-The Chemical Department has preserved a limited extra amount of seed of some of the best varieties named in this Bulletin, and will be glad to supply farmers with small amounts as long as the supply holds out. Address Prof. G. H. Failyer, Manhattan, Kas., inclosing a two-cent stamp for postage and packing.