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Sugar Beets in South Dakota

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Agricultural Experiment Station

South Dakota State College of Agriculture
and Mechanic Arts

BROOKINGS, SOUTH DAKOTA



Mother Beets in Blossom

Sugar Beets in South Dakota

Department of Chemistry

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Growing Sugar Beet Seed in South Dakota

A CONTINUATION OF BULLETIN 106

DEPARTMENT OF CHEMISTRY

Jas. H. Shepard, Chemist

The work recorded in this Bulletin is a continuation of the co-operative work undertaken by this Station and the Bureau of Plant Industry, U. S. Department of Agriculture. The work has been carried on under the same terms and the same supervision reported in Bulletin 106.

It will be readily understood, that since the sugar beet is a biennial, it was necessary to sow additional seed to that reported on in 1908. The sugar beet seed planted in 1907 furnished mother beets for 1908, which ripening that year, furnished us with seed for the 1909 planting. Consequently this Bulletin concerns itself with the home grown seed produced in 1908 and with the new varieties of seed sown during that year.

WORK WITH MOTHER BEETS IN 1908

In the final selection of mother beets all were rejected which fell below 15% sugar in the beet. In some instances noted further on, all below 18% were rejected.

The selected beets were planted early in the spring as soon as danger from heavy frosts was over. As far as possible each variety was planted by itself, so there was no opportunity for cross pollenization. In each variety a few single beets were

selected owing to their superior form and sugar producing qualities. These singles were sacked with light muslin sacks so that the seed was self fertilized. In each variety the main lot of beets were not sacked, but were allowed to fertilize either by self pollination or by cross pollination within the variety.

In other instances crosses were made by hand, after which the artificially fertilized flowers were sacked so that no stray pollen might reach the treated flowers.

ARTIFICIAL CROSSING

The making of definite crosses between different varieties of beets involved much hand labor requiring very delicate and skillful manipulation. In the first place it is necessary to select the blossoms to be pollinated at the proper time. This is just before the petals open. The operation goes on in two stages. First, the petals are carefully opened and the unripe anthers are cut away by delicate scissors. Either a whole plant may be treated thus, or one branch of a plant may be taken only. In either case the flowers so treated are carefully sacked to prevent stray pollen from coming in contact with the pistils of the emasculated flowers. These flowers are examined from time to time in order to note when the petals open, which usually occurs in a day or so. Then ripe pollen is secured from the male plant chosen for the cross and this is carefully dusted over the now exposed pistils of the female progenitor of the cross. After the flowers have been pollinated the sacks are again placed around the flowers until danger from stray pollen is past. When that time arrives the sacks are removed, since the seeds do not develop so well in the sacks as in the open air. After the sacks are removed it is necessary to go over the treated plants every few days and cut off any new flowers that may start to grow.

In all fourteen crosses were made in this way and thousands of seeds were treated. In every case cross bred seed was secured. An idea of how this work was done may be secured

from Plate I, which shows two young men working. This same plate also shows the cotton sacks stretched over slender sticks which were used to isolate both the singles and the cross breeds where the whole plant was treated.

The three different kinds of seed obtained this year was divided into two parts. One part was retained at this Station for the 1909 planting, while the remainder was turned over to Dr. Townsend, who had it planted at different suitable government stations. In this way two objects were served. First, insurance against total loss of any of the new seeds was secured. If all had been planted at any one place, a crop disaster at that point would have meant a total loss. This would have been a serious matter. This cross fertilization is expensive work. In the next place, sowing this new seed in different places will early demonstrate whether seed so produced will be adapted to the different cultural regions scattered over the United States.

NON-UNIFORMITY OF TYPES

In Bulletin 106 attention was called to the fact that individual beets in the same variety when grown under identical conditions, gave widely different sugar percentages. The beets themselves seemed uniform enough on inspection. But when the mother beets threw up their seed stalks a striking dissimilarity was plainly evident between the individuals. One of the most pronouncedly marked characteristics was the way in which the seed stalks arranged themselves in their branching. At one extreme stands the markedly deliquescent stem in which there is no strong central stem. Emerging almost from the crown are numerous small, finely divided stems bearing an abundance of seeds arranged along finely divided side branches. This type is well shown in Plate II. At the time the photograph was taken the seeds were so heavy that it was necessary to support the stems by tying them together with twine. In passing it may be of interest to note that beet No. 5 in variety 23, which gave the phenomenal percentage of 24.8%



PLATE I—Artificial Crossing

sugar in the beet, was of this deliquescent type. Also it is a matter of gratulation that this same beet survived all the vicissitudes and gave us a goodly quantity of self pollinated seed, as well as a large amount of pollen for use on other varieties.

The second type is distinctly arboreal. In this type there is a strong central stem throwing off strong lateral branches, which again subdivide. This type is pronouncedly tree-like in appearance, as shown in Plate III. Between these two extremes there are numerous modifications, some favoring one type to a greater or less degree, while others vary in the opposite direction. Surely the sugar beet, in spite of its years of domesticity, is still a wild and erratic creation, always tending to lapse back into numerous wild and primitive forms and conditions.

ASSIGNING NUMBERS TO HOME GROWN SEEDS

In assigning station numbers to the seed from mother beets grown in 1908, it was necessary to adopt some system whereby small numbers might be employed, in order that it would be possible to engrave those numbers on the beets grown from the seed.

The seed grown in 1908 readily divides itself into three classes. First, the main lots of each variety where the mother beets were grown in the open, each variety by itself, and where both self and cross pollination between the different individuals of any one variety was free to take place. Second, where chosen individuals or singles were selected from the different varieties and sacked so that only self pollination was possible. Third, crosses made by hand between individuals of different varieties and where self pollination or promiscuous pollination were both absolutely prevented.

In naming the main lots the station numbers as given in Bulletin 106 were taken as a basis. To each of these the figure 8, as indicating the year of planting, was added. Thus to station No. 1, by adding or affixing the figure 8, we have 18,

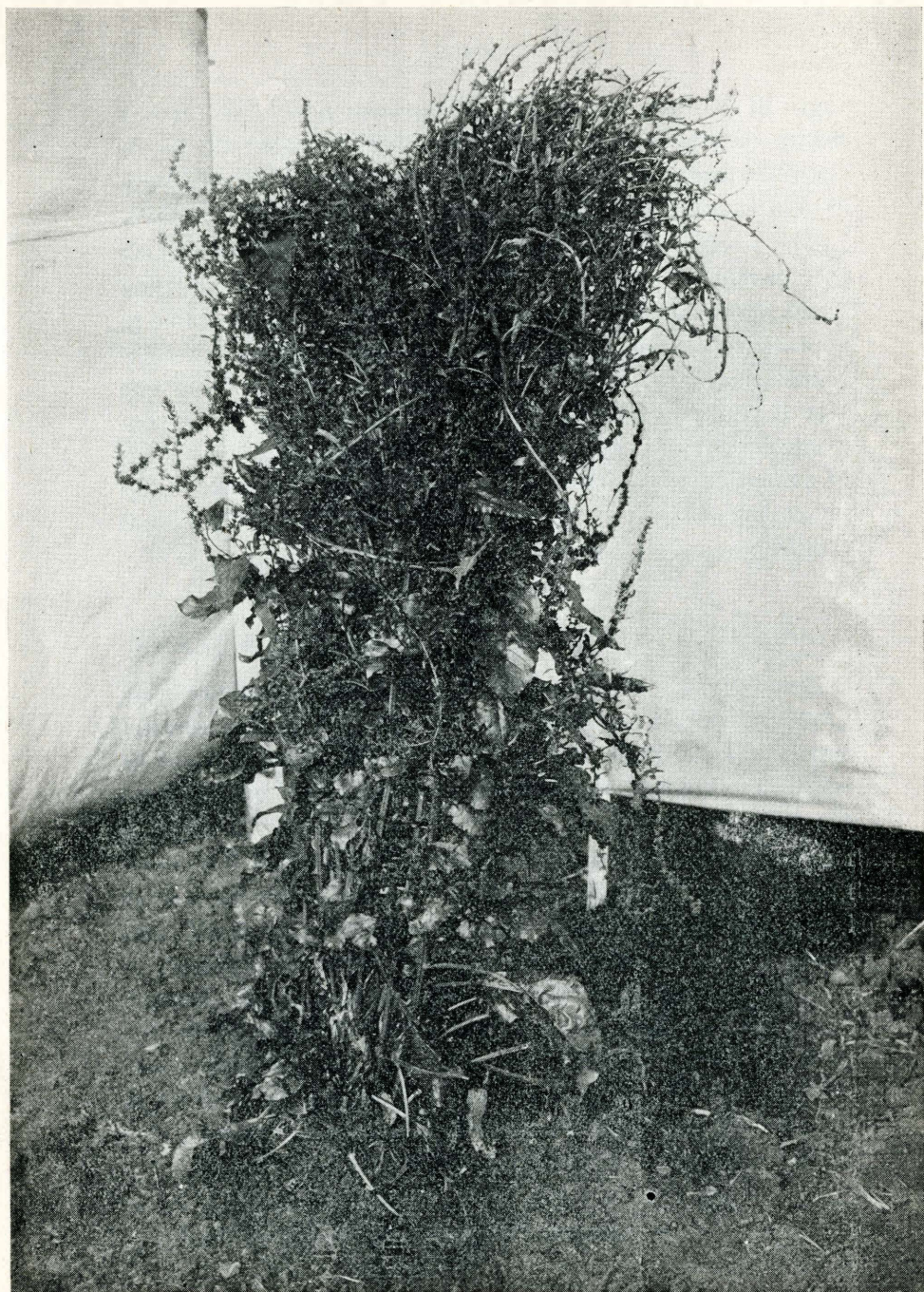


PLATE II—Mother Beet, Deliquescent Type

a small number suitable for engraving on the mother beets grown from the seed of variety 1. The following scheme will indicate the main lots and also give the range of sugar percentages, thus rendering it easy to trace the pedigree of each lot of seed:

MAIN LOTS

Station Nos.	Variety Nos.	Range of Sugar Percentages
18	1	15.2—19.8
28	2	15.0—19.8
48	4	18.0—19.8
88	8	15.0—19.6
238	23	18.0—19.8
268	26	17.0—18.8

It will be noted that main lots were not grown for the whole twenty-six varieties planted in 1908. Only the hardiest and best promising ones were propagated.

In assigning station numbers to the singles it was necessary to adopt an arbitrary system. They were numbered consecutively, beginning with 1, and so on up to 24, the whole number of singles saved separate. To each number the letter S is affixed in order to indicate that the seed is from a self pollinated single. Since singles were saved from several different varieties, it is necessary to publish a key whereby the pedigree of each single can be traced. The following scheme will be understood by a simple explanation. Thus, 1S comes from variety No. 1, beet No. 348 in that variety. The per cent sugar is also given to keep the record complete.

KEY TO SINGLES

Station No.	Variety and Beet No.	Per Cent Sugar
1S	1—348	21
2S	2—9	20.4
3S	2—58	20.2
4S	2—61	20.8
5S	2—89	21.2
6S	2—92	20.6
7S	3—16	20.4
8S	5—16	20.4
9S	5—20	19.8
10S	6—97	19.4
11S	7—98	18.2

12S	11—5	16.
13S	12—2	19.
14S	13—18	18.
15S	13—50	18.
16S	14—25	19.
17S	22—28	20.6
18S	23—5	24.8
19S	23—8	19.4
20S	23—20	19.6
21S	23—23	19.5
22S	23—27	19.8
23S	23—30	19.0
24S	24—15	18.0

In numbering the crosses it was also necessary to use short arbitrary symbols. Since there were fourteen crosses it was possible to use letters; and to indicate the year the figure 8 was prefixed. The following scheme will give all necessary data concerning the crosses:

CROSSES

Station No.	Male No.	Per Cent Sugar	Female No.	Per Cent Sugar
8A	1—348	21.0	26—126	17.4
8B	11—2	19.4	1—359	16.6
8C	11—6	17.4	23—9	19.2
8D	11—6	17.4	25—6	19.0
8E	11—6	17.4	26—126	17.4
8F	11—2	19.4	25—6	19.0
8G	11—2	19.4	1—360	18.4
8H	23—5	24.8	11—6	17.4
8I	23—5	24.8	23—9	19.2
8J	26—126	17.4	23—9	19.2
8K	26—150	20.0	1—360	18.4
8L	26—150	20.0	1—359	16.6
8M	26—150	20.0	23—9	19.2
8N	23—5	24.8	26—126	17.4

NEW LOTS OF SEEDS PLANTED IN 1908

In order that the work might be continuous, new lots of seeds were planted in 1908. As before, these seeds were drawn from the best American and European growers. It will be noticed that these new lots are frequently named the same as those given in Bulletin 106. It seems to be the custom of foreign growers to put out seed from year to year under the

same name. But as these seeds are different from those named and numbered in Bulletin 106, new station numbers have been assigned to them. While station numbers 17, 18 and 19 were planted again, this year's test has shown conclusively that they are of no value in this work. Consequently they have been discarded.

In the list as published below, the first number is the station number and the second is the government number. The name of the variety and the name and address of the grower is given. If this list be taken together with the table of results that follows it, no further comment is necessary.

By comparing the latter table with the similar one published in Bulletin 106, it will appear that the weights of the mother beets are much greater. Also the per cent of sugar is lower on an average. The number of rejects is larger. The reasons for these differences are threefold. In the first place, the seed is not strictly comparable with those bearing the same name in Bulletin 106. These seeds come from a different year's crop, and we have no data at hand to show how or under what circumstances they were produced. Second, the season of 1908 differed markedly from that of 1907. It was earlier and wetter, and the growing season was materially prolonged. In the third place the ground selected was lower, and this accounts to some extent for the differences noted.

The two tables follow:

TABLE I

SUGAR BEET SEED FOR 1908

- No. 27—21839, Kleinwanzleben, Utah Sugar Co., Lehi, Utah
- No. 28—21840, Kleinwanzleben, Otto Breunstedt, Schladen-am Haertz, Germany
- No. 29—21841, Kleinwanzleben, Henry Mette, Queuedlinburg, Germany
- No. 30—21842, Zuckerreichst, Wohanka & Co., Prague, Bohemia
- No. 31—21843, Aderstedts, peeled and disinfected, Zuckerschwerdt & Beuchel, Magdeburg
- No. 32—21844, Kleinwanzleben, C. Braune & Co., Biendorf, Germany
- No. 33—21845, Kleinwanzleben, F. Heine & Co., Hadmersleben, Germany
- No. 34—21846, Kleinwanzleben, E. E. Morrison, Fairfield, Washington
- No. 35—21847, Kleinwanzleben, Grandmother No. 229, Fairfield, Washington



PLATE III—Mother Beets, Arborescent Type

- No. 36—21848, Old Type, Kleinwanleben Sugar Co., Kleinwanleben, Germany
 No. 37—21849, Kleinwanleben, Adolph Strandes, Anhalt, Germany
 No. 38—21850, Kleinwanleben, Kuhn & Co., Naarden, Holland
 No. 39—21851, Behren Kleinwanleben, Zuckerschwerdt & Beuchel, Magdeberg, Germany
 No. 40—21852, Kleinwanleben, Otto Hoerning, Eisleben, Germany
 No. 41—21853, Jaensch Victrix, Gustave Jaensch, Ascherleben, Germany
 No. 42—21854, Original Kleinwanleben, K. Sugar Co., Kleinwanleben, Germany
 No. 43—21855, Schreiber's Specialitate, Schreiber & Sons, Nordhausen, Germany
 No. 44—21856, Pioneer, K. Sugar Co., Kleinwanleben, Germany
 No. 45—21857, Kleinwanleben, Wohanka & Co., Prague, Germany
 No. 46—21858, Dippe's Elite, Kleinwanleben, Dippe Bros., Quedlinberg, Germany
 No. 47—21859, Kleinwanleben, Idaho Sugar Co., Sugar City, Idaho
 No. 18—2811, Stock Beets, Royal Giant
 No. 20—2813, Stock Beets, French White Sugar Red Top
 No. 17—2810, Stock Beets, Giant Feeding

TABLE II

Station No.	Government No.	No. Beets Analyzed	No. Beets Rejected	No. Mother Beets	Average Per Cent Sugar in Beet	Average Weight Grams	Sugar in Beets Lowest Per Cent	Sugar in Beets Highest Per Cent
27	21839	98	64	34	16.1	487	11.0	18.4
28	21840	99	65	34	16.0	519	11.8	17.6
29	21841	109	67	42	15.8	481	11.2	16.8
30	21842	149	120	29	15.7	483	10.0	18.4
31	21843	87	60	27	15.6	473	11.0	17.0
32	21844	96	78	18	15.5	520	10.0	17.0
33	21845	127	96	31	15.8	483	10.4	17.4
34	21846	122	101	21	15.7	513	10.8	18.2
35	21847	143	85	58	15.7	530	11.0	17.4
36	21848	126	86	40	15.6	520	10.8	17.4
37	21849	162	142	20	15.7	509	10.0	17.0
38	21850	101	74	27	15.9	446	10.2	19.0
39	21851	124	112	12	15.4	435	9.8	16.4
40	21852	156	106	50	16.2	407	9.8	20.4
41	21853	134	107	27	15.9	469	10.8	21.0
42	21854	152	91	61	15.8	492	11.2	18.2
43	21855	158	79	79	16.3	463	10.8	21.2
44	21856	191	103	88	16.1	484	10.2	21.0
45	21857	126	97	29	15.6	464	9.6	17.0
46	21858	136	107	29	15.9	530	10.8	17.4
47	21859	140	85	55	16.2	549	11.2	19.0
18	2811	6	6	.....	.....	.....	4.0	8.2
20	2813	6	6	.....	.....	.....	8.4	12.2
17	2810	6	6	.....	.....	.....	2.0	6.0

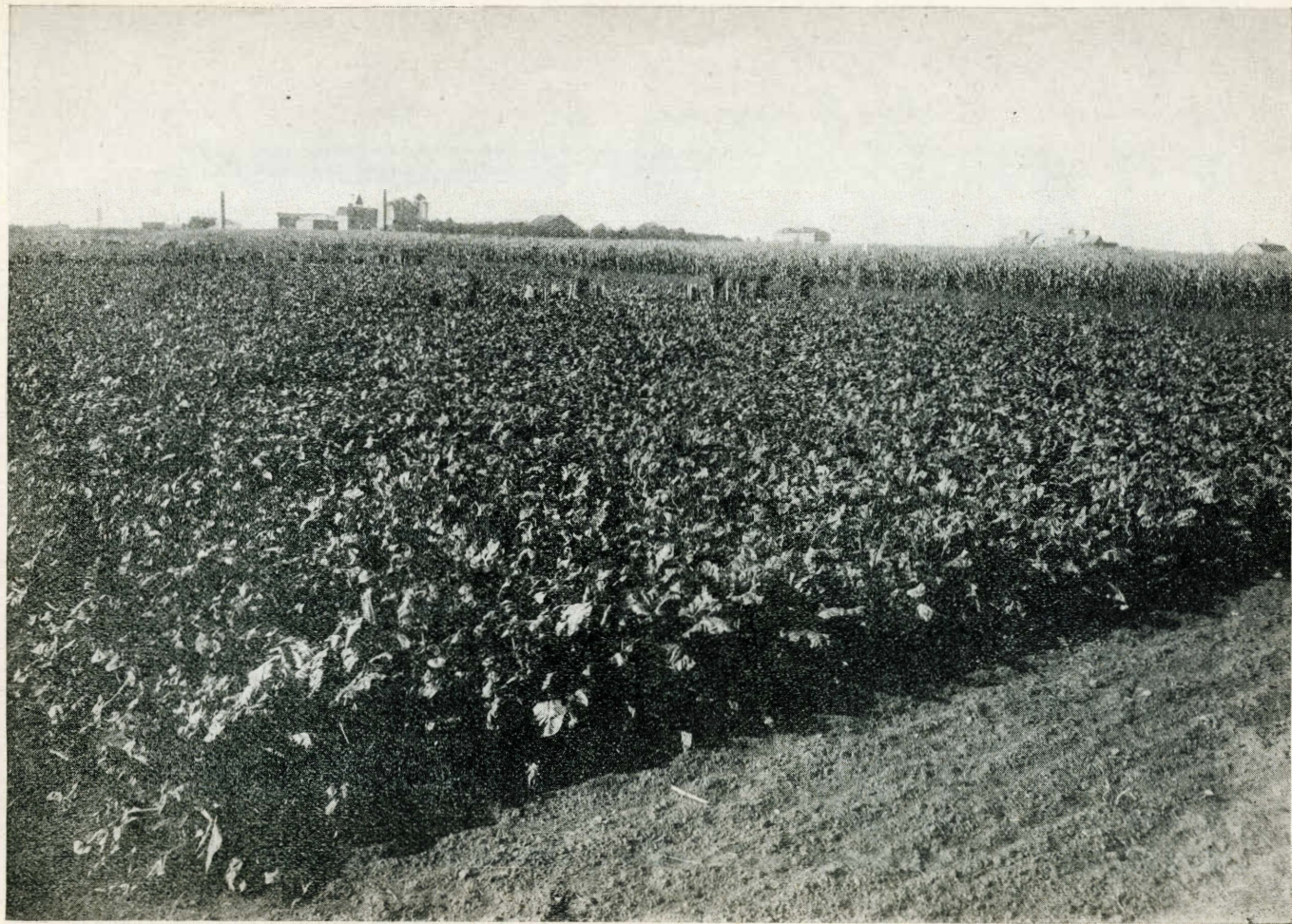


PLATE IV—Plats 1908, Mother Beets in Background

CULTURAL NOTES

The season of 1908 was a very wet one. The spring opened cold and rainy. The seed for the new varieties was sown from April 30th to May 2d. The mother beets were planted May 12th. The seedling beets made a vigorous growth and the different varieties averaged about sixteen tons per acre. A view of the plats is shown in Plate IV. The stand was nearly perfect and when the ground was covered the plats were a handsome sight. The seedlings grew to a greater size than those of the previous year, although the same cultural practices were observed in both years. The per cent sugar in the beets was lower than in the previous year.

The mother beets came on unevenly. It seems that some of them had been frozen slightly on the crown, thus necessitating the development of adventitious buds. Owing to this fact some of the seed ripened later than usual, but it was all out of the way of frost. The germinating power of the seed was very good indeed. It could not have been better. The seed was all harvested by September 15th. A slight rime or frost occurred August 21st, but it damaged neither sugar beets nor other crops. The first killing frost occurred September 28th.

The wet weather in the fall was not conducive to the greatest development of the sugar content of the seedling beets. Otherwise the season was a fairly favorable one so far as the sugar beet industry is concerned.

The cultural work during the year continued under the charge of Mr. Middleton, and the sugar determinations were made by Messrs. Koch and Dutcher.