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# Sugar Beets in South Dakota

J.H. Shepard

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**BULLETIN NO. 121**

**MAY 1910**

# **AGRICULTURAL EXPERIMENT STATION**

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**SOUTH DAKOTA STATE COLLEGE OF AGRICULTURE  
AND MECHANIC ARTS**

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**CHEMISTRY DEPARTMENT**

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## **SUGAR BEETS IN SOUTH DAKOTA**

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**BROOKINGS, SOUTH DAKOTA**

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# **Growing Sugar Beet Seed in South Dakota**

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A CONTINUATION OF BULLETIN 117

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DEPARTMENT OF CHEMISTRY

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JAMES H. SHEPARD, CHEMIST

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This Bulletin records a continuation of the co-operative work between this Station and the Bureau of Plant Industry, United States Department of Agriculture.

The work has been carried out under the same terms and supervision as that recorded in Bulletins 106 and 117. The work in hybridizing was done under the personal supervision of Dr. C. O. Townsend of the Bureau of Plant Industry. The field work continued under Mr. Middleton, and the sugar determinations were made by Messrs. Koch and Youngberg of the Station.

## **CLIMATIC AND CULTURAL NOTES FOR 1909**

The spring opened cold and wet. The ground occupied by the sugar beets was medium high prairie soil, and we were able to plow and subsoil to a depth of 24 inches in a first class manner. Owing to the lateness of the season, planting

was deferred until May 4th, when the ground, which had been repeatedly cultivated, was in fine condition. The sowing was completed May 9th.

The weather remained dry until about the middle of May, when heavy rains fell until the end of the month. The seed commenced germinating by the 15th of May, but cultivation was deferred owing to wet weather until the end of the month. Weeds had made a good start. Up to the 10th of June the beets were cultivated three times, but they were small and the rows were weedy. After that time the weather turned fine and the beets advanced rapidly.

The mother beets were planted during the middle of May and commenced to grow almost immediately. By the middle of June they had made good advancement.

June 15th blocking was started, with a very fair stand of beets in the rows. Thinning was started June 18th and completed June 24th. A few days of warm, showery weather caused the beets to grow by leaps and bounds. The mother beets also were sending up strong, vigorous seed stalks. July 1st the first flower buds appeared. The weather was hot and damp, and the flowers developed so rapidly that it was necessary to begin sacking on July 2d. The work of hybridizing was started July 12th, and by the 23d that work and the sacking was practically completed. Hot weather prevailed during this period and the seed stalks were so heavily loaded with seed that it was necessary to stake and tie the stalks to prevent whipping and breaking.

July 28th the seedling beets were cultivated for the last time, with a good stand of beets, and in a few days the ground was fairly covered by the leaves. On the 30th of July a heavy rain and wind storm with some hail occurred, but practically no damage was done to the plats, as only a few scattering stones fell. August was a wet, growing month and the plats were in fine shape.

Seed commenced to ripen by the 23d of August, and al-

though a white frost occurred on the 28th, no damage was done to either sugar beets or to other crops. September was a fine growing month for sugar beets and all the seeds were safely ripe and harvested before the first frost, which was a light one, occurred on the 23d of the month. During the middle of September many caterpillars appeared and commenced feeding on the beet leaves. These were promptly destroyed by a light application of Paris green. The seedling beets went into October in very fine condition and with a promise of a high sugar content which develops during the warm sunshiny days and cool nights of that month.





A Plat of Sugar Beets During Growing Season

October 4th the seedlings were sampled and analyzed. The analysis showed they were not ripe. This was to be expected. Just a few more days of fine weather and the sugar percentage would have been most satisfactory, indeed.

But October 11th the weather turned cold and threatening, a warning or forerunner of the continental storm that swept the central valley region from the northern boundary to the Gulf of Mexico. A couple of inches of snow fell, and on the night of the 12th the thermometer fell to 11 degrees F. Being fearful of the threatening outlook, on the morning of the 12th straw was spread over some of the choicer varieties. On the day preceding, the hybrids were hastily harvested and placed in the cellar. This storm froze the tops of the beets to such an extent that their sugar producing functions were destroyed. Although the weather turned warm and ideal for producing sugar, trials showed that the beets had been so injured in their leaves that no further increase of sugar was to be expected. Consequently harvesting was resumed and finished on the 22d of October. This was the same unusual storm that left destruction in its wake over the central region, even freezing the sugar cane in Louisiana. It is undoubtedly true that this storm reduced the sugar content of all the beets on our plats by at least four per cent. This matter is mentioned here, as it was a deciding factor in selecting the mother beets for the next season's work.

#### MOTHER BEETS GROWN IN 1909

In Bulletin 106 is given a list and description of seed sown in 1908 from which mother beets were grown for 1909. These varieties are numbered from 1 up to 26. In Bulletin 117 is given the Station numbers assigned to the seed sown for the mother beets grown in 1909 and which are to be used for seed growing in 1910.

These beets, main lots, singles and hybrids, were analyzed and the following table gives the data for the whole output



of the year. As noted in notes on culture, etc., the unusual storm of October 12th cut down the sugar percentages so that it was necessary to save beets with a percentage as low as would correspondingly bring the rejection point up to the high grade of previous years. Therefore 14% was selected as a minimum, since it is certain that had we only a few days longer the beets would have gone four per cent higher in sugar. This would have made the minimum 18%, or a little higher than that of former years.

It will be noticed that all these mother beets were grown from home grown and selected seed from carefully chosen mother beets of the previous year. There are several facts that the table does not bring out clearly. While the number of rejected beets is apparently large, the raising of the minimum as previously explained will account for that. Again the wild fluctuation shown in the beets grown from the original seed is disappearing. While in some instances there is still a spread of several per cent as shown from the lowest per cent of sugar found and the highest in some varieties, the number of beets carrying those low percentages are decreasing. In fact there is often only one such low found in nearly a hundred individuals. Then again, the number of highs is increasing, so that the difference between the highs and the average is represented by very small figures. In many instances this difference is represented by a small fraction of one per cent, while in no case does the difference exceed about three per cent.

These facts bear only one interpretation, viz: our selected seed is bringing a more uniform progeny. A further inspection of the table will show that the average percentages are very acceptable ones to both grower and manufacturer, while the average weight of the beets is also satisfactory. This means that our plans and methods of seed propagation are rightly conceived, and if faithfully carried out will bring into existence strains of seeds well adapted to central sugar beet areas of the United States.

In examining the table, so far as the hybrids are concerned, it must always be borne in mind that cross bred progeny are prone to exhibit numerous and unaccountable freaks. Some may be better than either progenitor. Some may be equal to the best, and some may be worse than the poorest parent. But one thing is certain. Hybridization is sure to set some new forces working, and it is to be hoped that some of the progeny thus created will prove worthy of propagation in that it possesses qualities far superior to either parent. But it takes time to demonstrate whether a single offspring from a cross which may apparently possess these desirable qualities also possesses the ability to transmit those qualities to its own offspring, thereby becoming the foundation stock of practically a new strain.

TABLE I

## MOTHER BEETS GROWN IN 1909

Station No.	No. Beets Analyzed	No. Mother Beets	Av. % Sugar in Beet	Av. Weight Grams	Lowest % Sugar in Beet	Highest % Sugar in Beet
18 .....	114	28	14.4	378	9.2	16.4
28 .....	103	63	14.9	388	10.8	17.0
48 .....	120	69	14.7	406	10.0	16.4
88 .....	119	78	15.0	390	10.0	17.4
238 .....	105	43	14.7	399	9.6	16.4
268 .....	39	23	15.1	318	11.2	17.0
1S .....	101	10	14.3	350	5.4	14.6
2S .....	40	25	15.3	357	11.0	17.9
3S .....	14	6	14.7	376	10.6	16.0
4S .....	40	19	14.9	372	11.6	16.8
5S .....	40	15	14.5	301	10.6	15.4
6S .....	24	8	14.3	308	11.0	15.0
7S .....	12	4	14.5	342	10.0	15.6
8S .....	50	3	14.6	438	10.0	15.0
9S .....	9	4	13.4	456	10.8	13.6
10S .....	17	4	14.3	320	10.2	14.8
11S .....	25	9	14.7	370	10.2	16.4
12S .....	36	31	14.9	382	12.2	17.4
13S .....	30	19	14.6	401	12.4	16.0
14S .....	20	12	14.7	376	12.6	15.6
15S .....	20	11	14.7	405	10.8	16.0
16S .....	45	12	14.7	408	9.8	17.8
17S .....	21	15	15.4	331	10.6	16.4
18S .....	45	38	15.4	254	11.8	17.8
19S .....	16	11	15.3	299	12.8	17.6
20S .....	17	9	14.6	359	12.0	15.8
21S .....	60	34	14.2	344	10.2	16.4
22S .....	9	1	14.0	375	10.6	14.0
23S .....	34	19	15.0	365	10.8	16.2
24S .....	13	2	14.6	417	11.0	14.8
8A .....	21	8	14.7	402	11.6	15.6
8B .....	14	6	14.9	425	12.4	16.2
8C .....	18	15	15.1	406	13.2	16.6
8D .....	18	7	14.5	327	12.0	15.6
8E .....	21	12	14.7	302	12.6	16.6
8F .....	14	9	15.1	446	12.6	17.0
8G .....	19	14	15.0	424	12.4	17.0
8H .....	10	10	16.1	288	14.0	17.6
8I .....	4	3	13.4	398	12.6	13.6
8J .....	3	1	14.0	365	14.0	14.0
8K .....	11	6	14.5	306	12.8	16.0
8L .....	11	2	15.5	440	10.8	16.0
8M .....	21	17	15.2	360	10.6	16.0
8N .....	28	24	15.1	413	13.0	16.2

## SUGAR BEET SEED GROWN IN 1909

In Bulletin 117 a list of mother beets is given, numbered from 27 to 47. During the season these beets were carefully tended, and as in the previous year, three lots of seed were secured. First come the main lots, which were grown in the open at safe distances from all other beets. These were free to self pollinate or cross pollinate within the variety. Considerable quantities of this seed were secured. A portion of this seed is for use on the home plats and the remainder is for use by the Bureau of Plant Industry. In fact all seeds are thus divided. The sugar percentages of the main lots range from 15% up to 17% in the beets. The yield of seed was very satisfactory. The stalks were loaded, and in spite of the lateness of the season all seed was safely harvested before killing frosts came. Sugar beet seed is a sure crop here so far as climatic conditions are concerned.

The same plan of assigning Station numbers to the main lots was followed as in the previous year. The original Station numbers run from 27 up to 49. To each one of these the number 9 was affixed, thus indicating the original number and the year grown, while still keeping the figures few enough to engrave on the mother beets. To illustrate, the original Station number 27 becomes 279, thus indicating the original stock and the year of growth.

The following table gives a view of the main lots of seed:

TABLE II

## MAIN LOTS 1909

Station Nos.	Variety Nos.	Range of Sugar Percentages	Station Nos.	Variety Nos.	Range of Sugar Percentages
279.....	27.....	15.0—16.8	389.....	38.....	15.0—16.8
289.....	28.....	15.0—16.8	399.....	39.....	15.0—16.4
299.....	29.....	15.0—16.8	409.....	40.....	15.0—17.4
309.....	30.....	15.0—16.8	419.....	41.....	15.0—16.4
319.....	31.....	15.0—16.6	429.....	42.....	15.0—16.8
329.....	32.....	15.0—16.6	439.....	43.....	15.0—16.8
339.....	33.....	15.0—16.8	449.....	44.....	15.0—16.8
349.....	34.....	15.0—16.6	459.....	45.....	15.0—16.6
359.....	35.....	15.0—16.4	469.....	46.....	15.0—16.6
369.....	36.....	15.0—16.4	479.....	47.....	15.0—16.8
379.....	37.....	15.0—16.6			



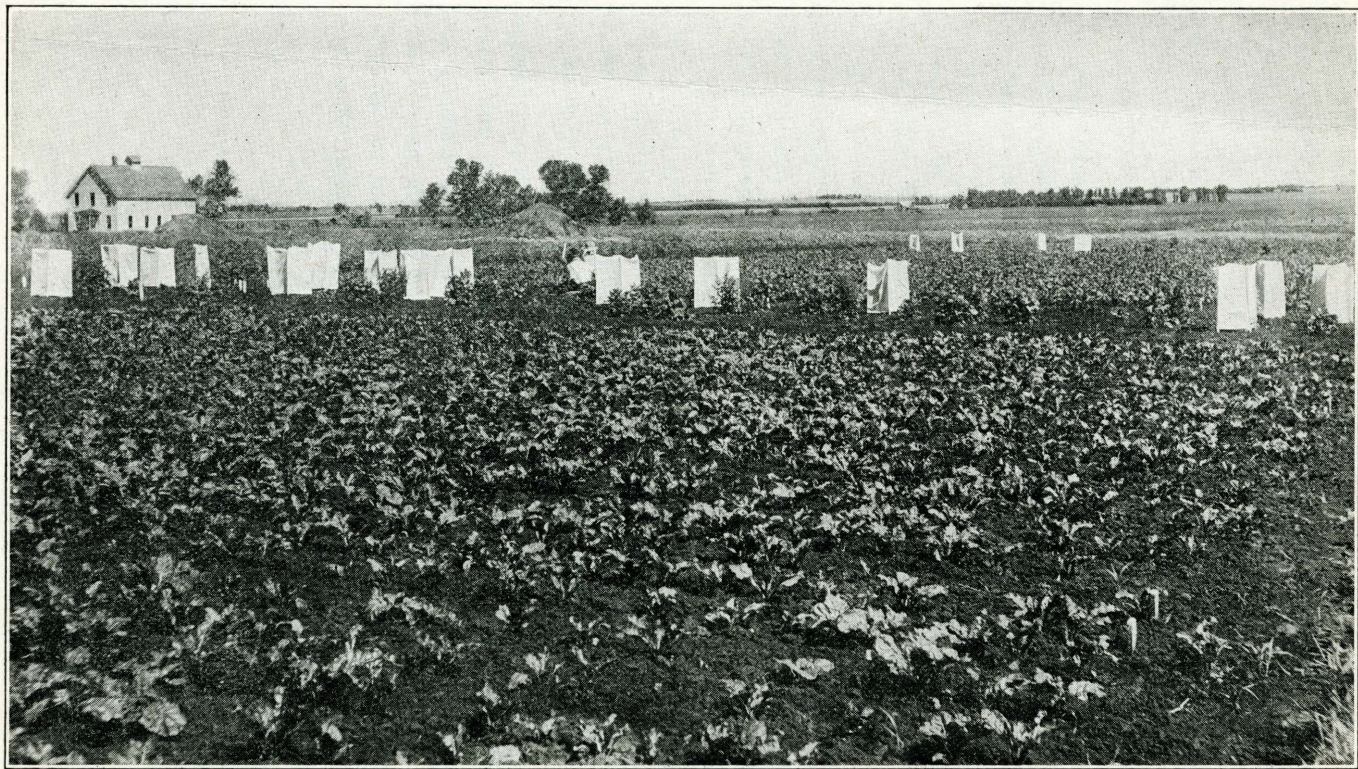
## SINGLES FOR 1909

In all fifty-five singles were saved for 1909. These were the very best beets grown in each variety. These were used for two purposes. First, they were employed in hybridization. This consumed a large number of them, that is, it took them out of their original variety to reappear among the hybrids. The second use was to employ them in strictly propagation work in order to seek improvement by selection. Unfortunately mice gained access to some of the seed thus grown.

In propagating singles they were carefully sacked so that no cross fertilization could possibly take place. Two singles were saved for planting in 1910. The singles were numbered consecutively with those grown the previous year. The same system was followed. The table gives the data:

TABLE III  
SINGLES GROWN IN 1909

Station No.	Variety and Beet No.	Per cent Sugar
25S.....	40—107. ....	18.0
26S.....	44— .....	over 17.0



Artificial Crossing. White sacks are put on plants to prevent pollen from blowing from one plant to the other



## HYBRIDS GROWN IN 1909

A large number of crosses were made during the season. Of these, 22 matured seed for planting in 1910. In making these crosses several different kinds of selections were made. For instance, a whole mother beet was chosen as the female parent and all the blossoms were fertilized from some other selected beet chosen as a male parent.

In order to test the relative influence of the male and female plants on the progeny obtained, another form of crossing was employed. Let us take for example two beets, A and B. One-half of the stalks of A were fertilized with pollen from B. Then one-half of B was fertilized by pollen from A. Thus each beet is actually acting in a double role, *i. e.*, as a male and also as a female parent. This, of course, is perfectly feasible, since the blossoms of sugar beets are perfect flowers.

The same arbitrary system was employed in numbering the hybrids as that employed the previous year and described in Bulletin 117. First the year number was used, which in this case is the figure 9. To this is affixed some letter of the alphabet. Then a complete key is made, giving both the origin and sugar percentages of both parents.

The following table gives the key to all the hybrids produced. An inspection of this table will also show just which method of crossing was employed. It will be noticed that some beets with low percentages of sugar was used. But by consulting Bulletins 106 and 117 it will appear that these are beets containing strains of stock beet blood which is on its way to the production of new varieties:

TABLE IV

## CROSSES OR HYBRIDS FOR 1909

Station No.	Male No.	Per cent Sugar	Female No.	Per cent Sugar
9A .....	27— 42	18.0	28— 17	17.6
9B .....	30— 29	18.0	33—111	17.0
9C .....	33—111	17.0	30— 29	18.0
9D .....	35— 19	17.4	43—145	17.0
9E .....	38— 38	17.0	20— 1	9.8
9F .....	40— 33	17.4	33— 14	17.4
9G .....	42—124	17.0	43— 34	17.4
9H .....	43— 34	17.8	42—124	17.0
9I .....	43—118	19.6	44—189	21.0
9J .....	43—117	17.4	44— 78	17.4
9K .....	44— 78	17.4	43—117	17.4
9L .....	44— 81	17.4	20— 6	10.8
9M .....	44— 11	18.2	46—125	17.0
9N .....	44—123	17.0	46—137	17.4
9O .....	44—189	21.0	43—118	19.6
9P .....	46—137	17.4	44—123	17.0
9Q .....	47— 19	17.4	42— 18	17.2
9R .....	47— 46	17.2	37— 78	17.0
9S .....	47— 66	17.2	20— 1	9.8
9T .....	20— 1	9.8	47— 66	17.2
9U .....	20— 2	12.2	47— 61	17.2
9V .....	20— 3	7.8	38— 38	17.0

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GENERAL REMARKS

In considering any section of the country as a possible site for factories, the first consideration should be the soil. Some soils bake, some are too sandy, some are such stiff clays that working is difficult. The soil of South Dakota has none of these drawbacks. It is a clay loam with sufficient sand to insure easy cultivation and to prevent caking. It is very absorptive towards moisture, and the subsoil is a yellow boulder clay very retentive of moisture. It seems strange that no factories have been built in the state. The land is easily worked, is highly productive, and the saccharine contents of the beets is confessedly high.

Moisture is also an essential factor. There has never been a year since the state was settled that sufficient rain has not



fallen. The length of the season is also a prime factor. The seasons in South Dakota are always long enough to insure good crops which may be harvested safely before freezing weather. The future may still hold a brilliant record for the state in sugar beet culture.