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Sugar Beets in South Dakota

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CHEMISTRY DEPARTMENT

Sugar Beets in South Dakota

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SUGAR BEETS IN SOUTH DAKOTA.

Data For Four More Years.

Department of Chemistry.

Jas. H. Shepard, Chemist. R. C. Sherwood, Assistant.

The first experiments with Sugar Beets in South Dakota were made in 1888. Since that time the whole state has been tested out and a summary of results up to 1912 was published in Bulletin 142. The work has continued up to the present time.

The object was to have the work extend over a sufficient length of time in order to determine whether the crop is a dependable one or whether like other crops some failures must be taken into consideration.

The work has covered a variety of factors entering into sugar beet culture as a cash crop and we have also sought to gain experience in seed production. Meanwhile the breeding up of varieties of beets that have a uniformly high sugar content, coupled with a sufficient tonnage to give a high yield of sugar per acre, has been constantly kept in mind. The matter of spacing the beets in a row, as well as the optimum width of rows, has been given attention. Again, the preservation of the mother beets between the time of harvesting in the Fall and the planting out the next Spring has been the subject of much thought and different methods have been tried. It is now evident that if sugar beet culture in this country expects to be firmly established we must make provision to rely upon home grown seed.

Little has been done with methods of harvesting, threshing and cleaning the seed we have produced. It has been found however, that the seed may be threshed with an ordinary grain thresher and the seed may be cleaned with a fanning mill up to the point of removing all leaves, chaff, coarse sticks and dirt. But the short small stems present greater difficulty. We have finished this part with our small quantities of seed by hand. No special mill for this work was available.

In selecting mother beets for seed propagation one rule has been strictly followed. First, the mothers were selected for size, and type. Then each one has been analyzed separately to determine the sugar content. The aim has been to use only those mothers satisfactory in every respect. It is evident that beets yielding around 20% sugar in the beet together with a large tonnage are more valuable than those with a higher sugar percentage and a much diminished tonnage per acre. The crucial test must always be the amount of sugar per acre which any beets can produce. The two factors of high sugar per cent and large tonnage seem to be incompatible. Although we have grown individuals going as high as 25% sugar in the beet, it has seemed best to plant those with the groups of the same varieties carrying from 18% up.

In maintaining the purity of the varieties we have relied upon distance rather than upon sacking the mothers. While there is some risk in cross-fertilization by either method, with the large areas at our disposal we believe that little or no cross-fertilization has occurred.

No attempt at producing hybrids by hand pollination has been made. While selection affords a sure and rapid process in ameliorating sugar beets, hybridization also requires just as much or more selection after the new crosses are obtained. It seems that a long series of selection is necessary to fix the type of any strain of beets. And even then under cultural abuses the very best strain rapidly deteriorates.

The object of this Bulletin may be best achieved by describing each year's work separately. But a few words in regard to the four tables which appear on subsequent pages will be in place here. Most of the headings for these tables are self-explanatory, but other relations are brought out by some explanations.

In taking the samples for the field tests one whole row 100 ft. long was harvested, counted and weighed. Every beet was used. The third column gives the number of beets analyzed and consequently the number of beets to 100 ft. row. It is evident that the average distance between beets can be readily calculated. Also by dividing the whole weight of row by the number of beets the average weight per beet is found. The width of the rows is given in another column. The reason for taking such large samples for analysis was to make positively certain that a strictly representative sample was secured.

It will be noticed that the field spacing used is rather close. While this causes the individual to grow somewhat smaller, it is advantageous in fixing the type of high sugar content beets. There is a tendency in this state for beets to grow very large and this growth is at the expense of the sugar content.

SEASON OF 1913

Spring opened fairly early. The seed was sown the first week in May and germinated well. The cultivation and thinning was completed the last of May and the first week in June. June was a rather cool month.

The rain was well distributed throughout the season. The first signs of frost which did no damage either to the beet tops or to other crops occurred September 11th. But on the 22nd of that month a freeze occurred which extended over the whole region south to the cane belt. The thermometer fell to 16 degrees and the beet tops were killed. This affected the sugar percentage adversely. Usually a light frost occurs about September 10th which tends to check the growth of the leaves. After that period many warm days and cool nights follow during which the sugar per cent increases rapidly and the purity also. An inspection of Table I will show that the yield was affected somewhat as well as the sugar percentage. But the average tonnage came close to 20 tons per acre. This means a most profitable crop for the farmer. The average price per ton of beets is now $6.00 to $7.00 or better.

We continued the growing of stechlinge this year. The seed was planted in rows 12 inches apart and the beets were thinned to two or three inches in the row. By this close planting the size of the beets was held down to a diameter of from one to two inches. These stech linge are used for raising commercial seed in actual practice. The object of these small mothers is to check any tendency toward grossness and low sugar content that may rise from greater spacing and also to furnish mothers for planting that can be handled more economically. They are planted out in the Spring more economically and the ground necessary for their growing is much less than that required for larger mothers.

The stechlinge are siloed in the field in dirt pits. A trench is dug about a foot deep on a high piece of ground where the water will not stand.

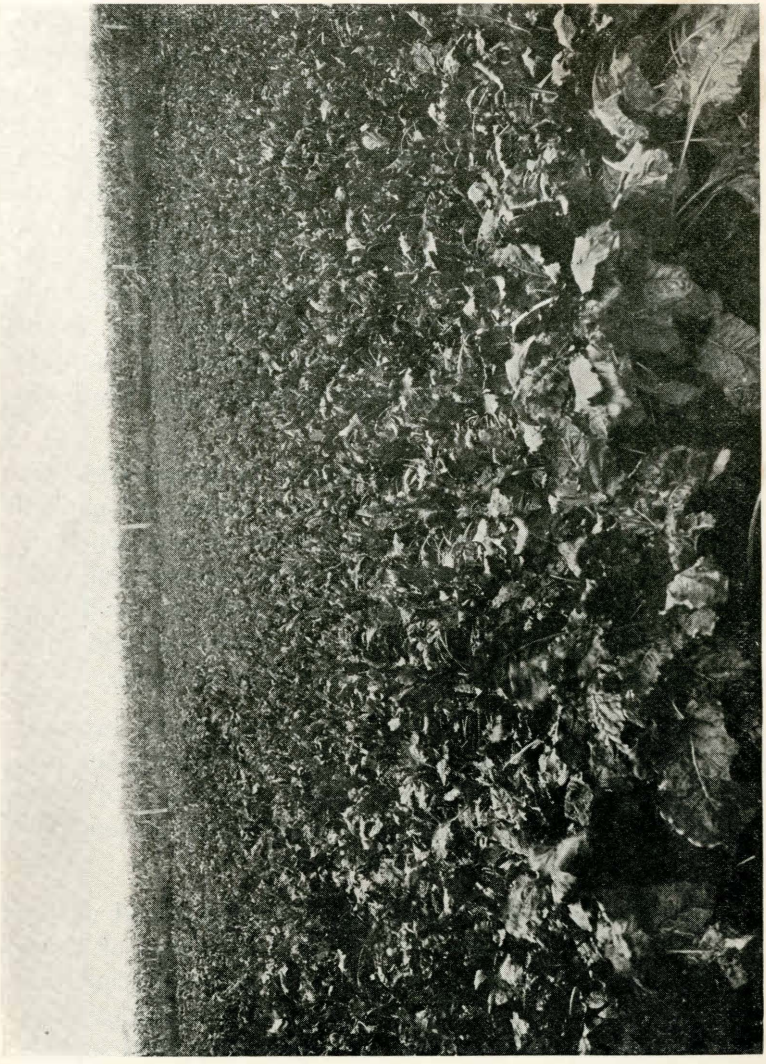

Plate I

It may be made any width or length. The stechlinge may be topped or not as it seems best. One row or layer is first packed in the bottom of the trench and then all spaces are filled with fine dirt. Then a second layer is added until the desired height is reached. Then a layer of dirt is spread evenly over the mound about six or eight inches deep. Next a layer of straw is carefully laid over the mound to a depth of about three feet being careful to place it so it will shed water. No further attention is necessary until the pit is opened in the Spring. We have repeatedly had stechlinge keep without spoiling or loss from the last week in October until the middle of June. No ventilators are necessary. No doubt the temperature goes much below freezing in the pits but with winter weather 40 degrees below zero the beets were not damaged.

Much trouble has been experienced in keeping the analyzed mothers over when stored in a cellar and packed in sand. The crowns are attacked with an enzymic trouble which destroys the upper part of the crowns and consequently the seed stalk buds. This year we tried dipping the mothers in a solution of formaldehyde, one pound of 40% formaldehyde to 25 gallons of water.

The mothers kept well until they were later brought to the laboratory for analysis. The next Spring the loss was not materially checked; nearly one-third of them were spoiled. It seems as if the high sugar content was most favorable to enzymic action.

The seed yield of both analyzed mothers and of the stechlinge was very good this year. The seed of those varieties yielding considerable quantities was threshed with a small thresher and cleaned with the exception of the small sticks with a fanning mill. The final separation of the sticks was accomplished by hand, a troublesome process.

Each year a number of photographs of the plats have been taken. These furnish an unmistakable record. A

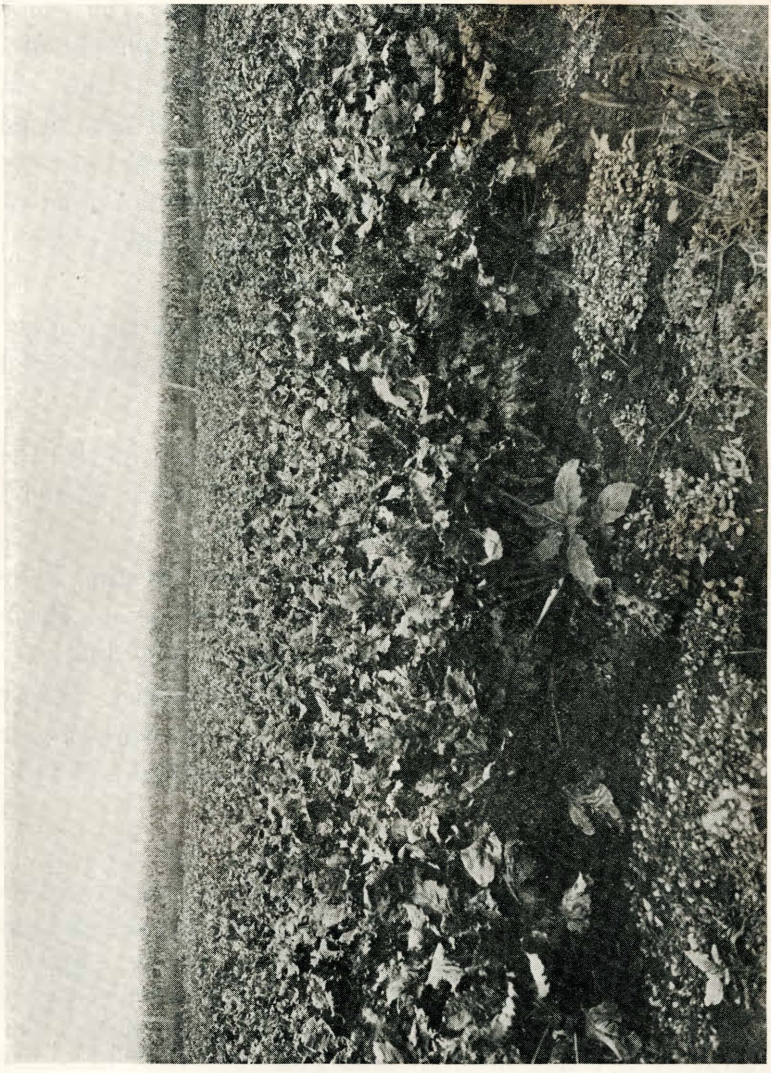

Plate II

few photos from each year are given in this Bulletin to illustrate some important phases of the work.

Plate I was taken August 6th and shows the beets growing in 18 inch rows. The ground is completely covered. By consulting Table I it will be seen that the plats in 18 inch rows give the largest yield of both beets and sugar per acre. But in commercial work the rows can not be made so narrow in this state. The large horses used for farm work can not walk in such narrow rows. That is why spacing tests have been made.

Plate II shows stechlinge growing in 12 inch rows. This crowding gives very small beets used in commercial seed production.

Plate III shows stechlinge bearing seed. Note the luxuriant growth and the heavy crop of seed. Table I which follows gives the results for 1913.

This year the beets grown at Newell on the Belle Fourche irrigation project on the Experimental Farm were analyzed. In all nineteen samples were analyzed. They gave an average of 19.6% sugar in the beet. These beets were grown under irrigation. All the work on our home fields has been done without irrigation or fertilization.

There is one interesting feature of the Belle Fourche work and that is, sugar beets are made a part of a systematic rotation. It is a remarkable fact and shows the status of sugar beet culture in this country, and that is, little or no systematic work has been done to show the effects of preceding crops on sugar beets. The only anxiety has been to ascertain the effect of sugar beets on the next crop following. It fixes the status of sugar beets as a new and interloping crop that has to fight its way against the ordinary crops grown in the sections where sugar beet culture is being introduced.

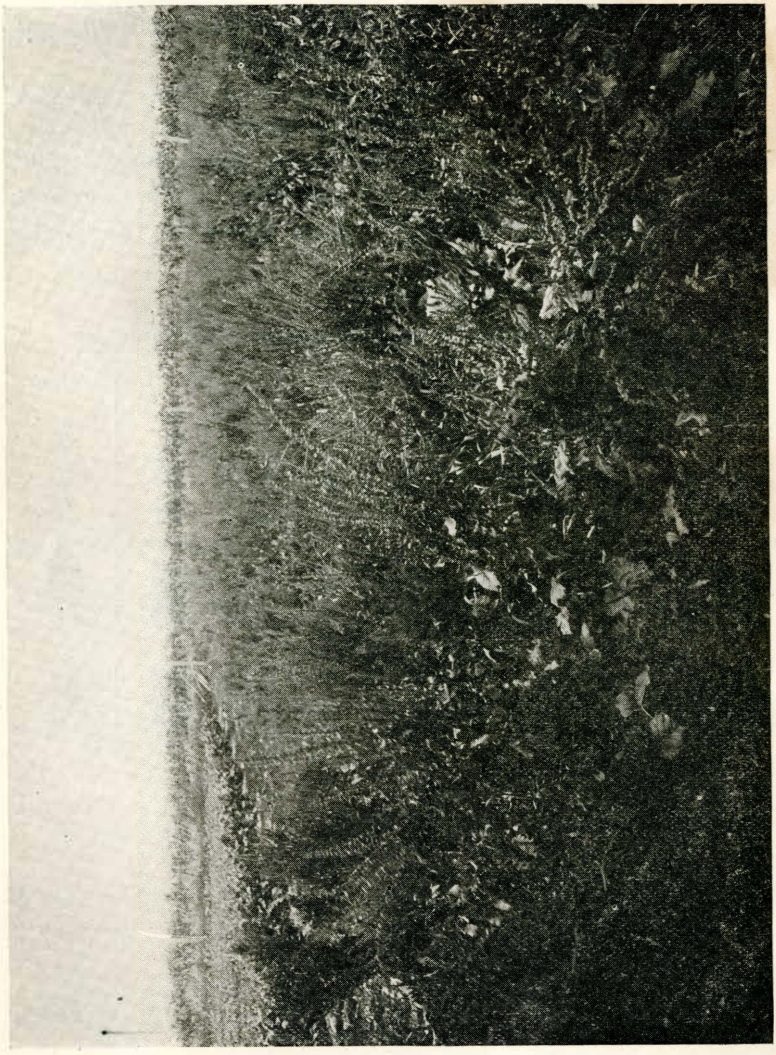

Plate III

This is wrong and here is an opportunity for our experiment stations to do some really valuable work. When it appears that sugar beets in a system of mixed farming is one of the most valuable crops grown and one of the surest, all this will be changed.

Small quantities of home grown seed were sent out to various parts of the state. The beets sent in for analysis, where any care was taken of them gave sugar percentages of from 16 to 18 per cent. This merely confirms the exhaustive work done all over the state many years ago.

TABLE I

VARIETY TESTS OF SUGAR BEETS FOR 1913

Variety Number	Width Rows	Number Beets Analyzed	Weight Beets Analyzed	Degree Brix	% Sugar in Juice	Purity	% Sugar in Beets	Pounds Beets Per Acre	Pounds Sugar Per Acre
8N	18	154	96	20	17.6	88	16.7	42905	6680
28	18	157	91	19.2	16.4	85	15 6	39912	5915
43	18	179	95	20	17.4	87	16.5	41667	6531
23	18	180	89	20	17.4	87	16.5	39035	6118
SPACING TESTS 1913									
23	18	180	89	20	17.4	87	16.5	39035	6118
23	22	179	123	20.6	17.8	86	16.9	32841	5273
23	26	169	108	19.8	17.0	86	16.2	24516	3773
23	30	179	119	19.6	17.0	87	16.2	23205	3311

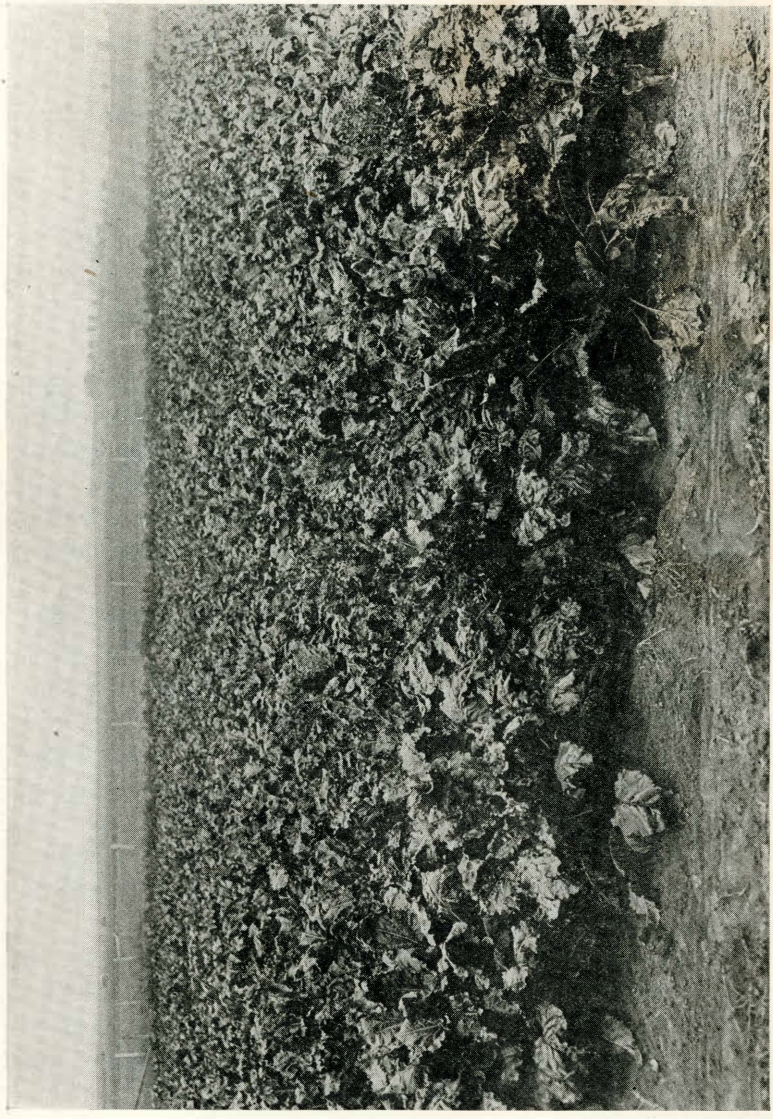

Plate IV.

SEASON OF 1914

Spring opened rather early with cold, rainy weather. The ground was fitted the first of May but owing to weather conditions the seed was not planted until the third week in May. The first cultivation was made the last week in May.

Early in June flea beetles attacked the young plants but these were completely destroyed by a single application of Paris green. During all these years the beets have been singularly free from attacks of predatory insects.

As usual the rain was well distributed throughout the growing season but no checking frost occurred in September nor until the latter part of October. The leaves were green and growing up to the time of harvest. As a consequence the ripening of the beets did not proceed as usual, and while the tonnage was all that could be desired, the sugar percentage was reduced.

An attempt was made this season to leave the beet seed in the field until all the seed was harvested. The seed ripens unevenly here as elsewhere. When the seed was finally hauled to cover it was found that much had been shattered and had fallen to the ground. It was impossible to recover this seed. A few days elapsed between the housing of the seed and the threshing which was done with flails. It was found that field mice had ruined a large quantity of seed. Mice are especially found of beet seed and will go great lengths to get it.

The mother beets were stored in a cellar packed in sand. Owing to the losses that had previously occurred by disturbing the beets in the winter and taking them to the laboratory for analysis, the expedient was tried of not analyzing them until just before planting the mothers out in the Spring.

As soon as analyzed the beets were again treated with formaldehyde. Some were left in the laboratory a few days before planting and many of these failed to send

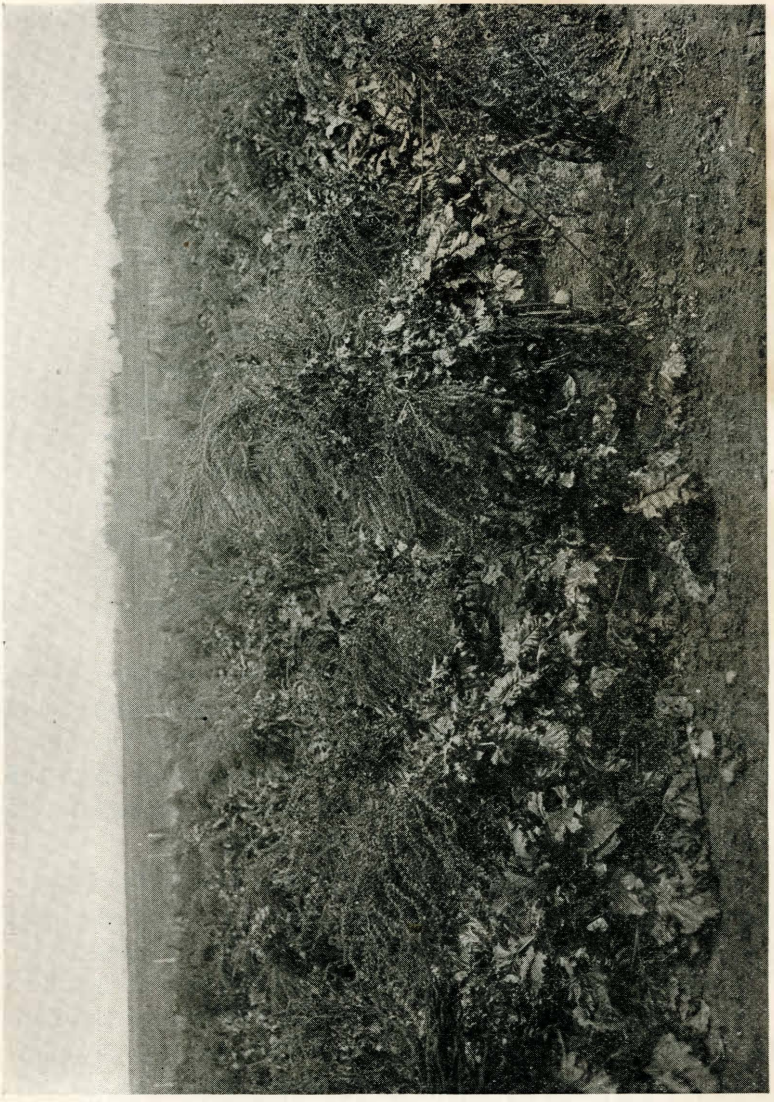

Plate V.

up seed stalks. But those that were planted immediately after treating gave the best germination of any mothers we ever planted. It was noticed that the small per cent that failed to produce seed had lost a portion of the crowns that had been carelessly removed by the harvesters when topping the beets. It seems that the seed stalk buds had been cut away with the leaves. Here is an important lesson. In topping mother beets two or three inches of the leaf stalks must be left on the beets. While leaves may form from adventitious buds, if the seed stalk buds are removed no seed will be produced.

When beets are stored some cell action continues. All life does not cease. This life action consumes fuel, i. e., sugar. So in analyzing for mothers in the Spring it is necessary to learn approximately how much the sugar content has been depleted in each variety. We have the average sugar content in our field tests that are determined in the Fall. Now by determing the average of the beets analyzed in the Spring it is possible to approximate closely the loss by storage. The different varieties lost from 0.7% to 2.5% sugar during storage.

This year we made field tests for three samples of seed sent in for that purpose. The Schreiber seed came from Garden City, Kansas, the Wohanka from the Dominion Sugar company, Canada, and the Russian seed from the Holt Tractor Company. The results are given in table II with the usual data from our own work.

We analyzed twenty samples of beets from the Experimental Farm at Newell, South Dakota. These were very good beets averaging 22.5% sugar in the beet.

Chas. Pope, Chicago, reports on seed grown at this Station that the tonnage was 15.9 while the rest of the field with commercial seed gave 13.4. The per cent of sugar in beets from our seed was for large beets 14.5, medium beets 17.1, while for the rest of the field it was 13.5.

Reports from widely scattered localities give results favoring our home grown seed. This is important. We must grow our own seed.

Plate VI.

Plate VII.

The spacing tests this year gave about the same results as last. It is likely that about a 24 inch row will be found right for our conditions notwithstanding the fact that the 18 inch rows gave larger returns. We have plenty of good sugar beet land in the state.

As will appear from Table II the tonnage for all varieties and all spacings runs from 14 to 20 tons per acre with an average of about 16 tons. This makes one of the most profitable crops the farmer can grow.

The photos were taken this year August 19th. Plate IV shows the beets growing in 24 inch rows. As can be seen the ground is well covered, an important item. The leaves help hold moisture by shading the ground and they also prevent caking.

Plate V gives a view of the field bearing seed for this year. There is no doubt that the state is well adapted to seed production.

Plate VI shows 30 inch rows. Here the ground is not fully covered. In very dry years this would be a disadvantage.

TABLE II

VARIETY TESTS OF SUGAR BEETS FOR 1914

Variety Number	Width Rows	Number Beets Analyzed	Weight Beets Analyzed	Degree Brix	% Sugar in Juice	Purity	% Sugar in Beets	Pounds Beets Per Acre	Pounds Sugar Per Acre
21S	18	185	134	21	18.6	88	17.7	37299	6802
18S	18	168	141	20.5	18.8	91	17.9	39248	7025
42	18	213	94	21.5	19.4	90	18.4	26169	4815
40	18	184	114	19.5	18.0	92	17.1	31732	5426
43	18	208	117	20	16.4	82	15.6	32567	4090
35	18	173	136	21	18.2	86	17.3	37856	6548
44	18	171	101	20	18.8	94	17.9	29112	5030
S. D. 1	18	153	140	20.5	18.2	88	17.3	39920	6906
SPACING TESTS 1914									
S. D. 1	18	153	140	20.5	18.2	88	17.3	39920	6906
S. D. 1	22	167	107	19.5	17.4	90	16.5	24396	4015
S. D. 1	24	139	118	20	16.6	83	15.6	24662	3896
S. D. 1	30	140	187	19	16.6	87	15.8	31267	4940
MISCELLANEOUS TESTS 1914									
Schreiber	18	183	104	19	17.6	92	16.7	29950	5000
Wohanka	18	190	138	18	16.2	86	15.4	28818	4138
Russian	18	200	122	20.5	18.6	90	17.7	33998	6017

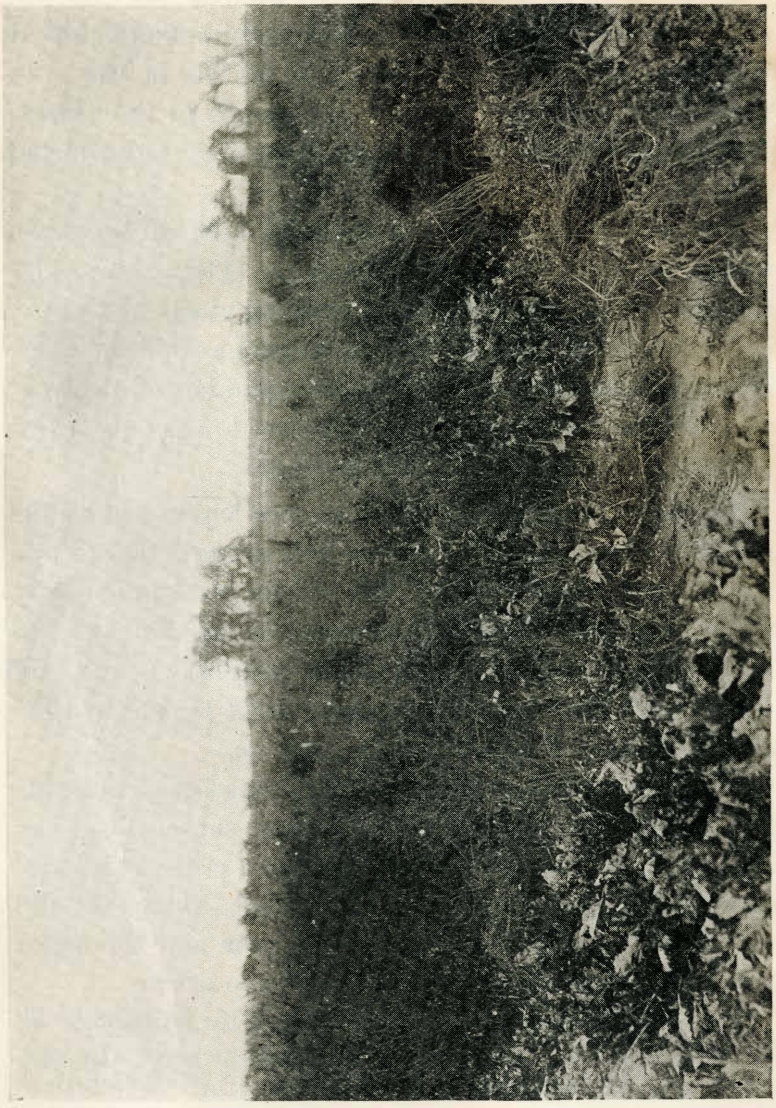

Plate VIII.

SEASON OF 1915

This season is the coldest South Dakota has ever yet experienced. The Spring opened early enough, but it was rainy and cold with light frosts till late in May. In fact, there were light frosts every month in the season. But strange to relate the sugar beets were not affected even up to harvest time.

The seed was not planted until the 19th of May, two weeks too late. The beets were up the 30th of May. By the first of July the beets were growing nicely and promised a fine crop. On the 10th of August a sudden, sharp, sporadic hail storm struck the beet plants and destroyed practically all the leaves. The storm was only a few rods wide and less than a mile in length.

The beets immediately threw up new leaves and by the middle of September the leaves had covered the ground again when the photos for this season were taken. By consulting Table III it will be seen that the tonnage was materially reduced and the sugar percentage fell off somewhat. The tonnage averaged about 11 tons and the question arises whether this is a failure.

When it is remembered that this figure is practically the average for this country, in that sense it is not. And when compared with our ordinary crops it is most emphatically not a failure. The whole Northwest did not mature a sound corn crop this year and the sugar beets gave a return better than any crop grown.

The miscellaneous sample was tested by request of M. B. Austin & Co., Chicago. This Russian seed was certainly a good seed, one of the best tested at this Station. The beets came very true to type and as shown in Table III stood up well under our adverse conditions. It may be necessary for us to look to Russia for a large part of our seed supply.

Plate IX.

In the spacing tests 18 inch rows gave the best results again as they always will. But the 24 inch rows seem to be the next best.

In order to avoid the wasteful shattering of seed this year, squares of heavy unbleached factory nine feet on a side were procured. These were spread on the ground and as the seed ripened progressively it was placed on these canvases. No seed was lost. A heavy duck canvas of the same size was used for threshing the seed in the field. This was done by simply pounding the seed loose with a light stick. It is astonishing how much seed a couple of men can thresh out in this way. Probably no better way is available where small quantities of pedigreed seed are grown.

Since such good success has attended the siloing of stechlinge in the field it was decided to silo the mother beets in the same way, to analyze them in the Spring and to plant out immediately without the use of formaldehyde.

We have secured a higher percentage of seed bearing mothers in this way than by any other method. The average sugar loss by storage was about 2%.

The photos reproduced were taken Sept. 17th after the new growth of leaves had appeared. At harvest time there were but slight traces of the damage by hail.

Plate VII shows beets growing in 24 inch rows. The ground is not quite covered, but this mattered little this year. Rain was plentiful and well distributed.

Plate VIII shows stechlinge bearing seed. These views are given since there have been doubts raised in some quarters concerning the adaptability of the state to produce seed. The seed stalks were little damaged by hail.

Plate IX shows a single analyzed mother bearing seed. Note the luxuriant growth. The splendid soils of this state are capable of giving heavy yields not only of sugar beets but also of seed.

The field data are given in Table III.

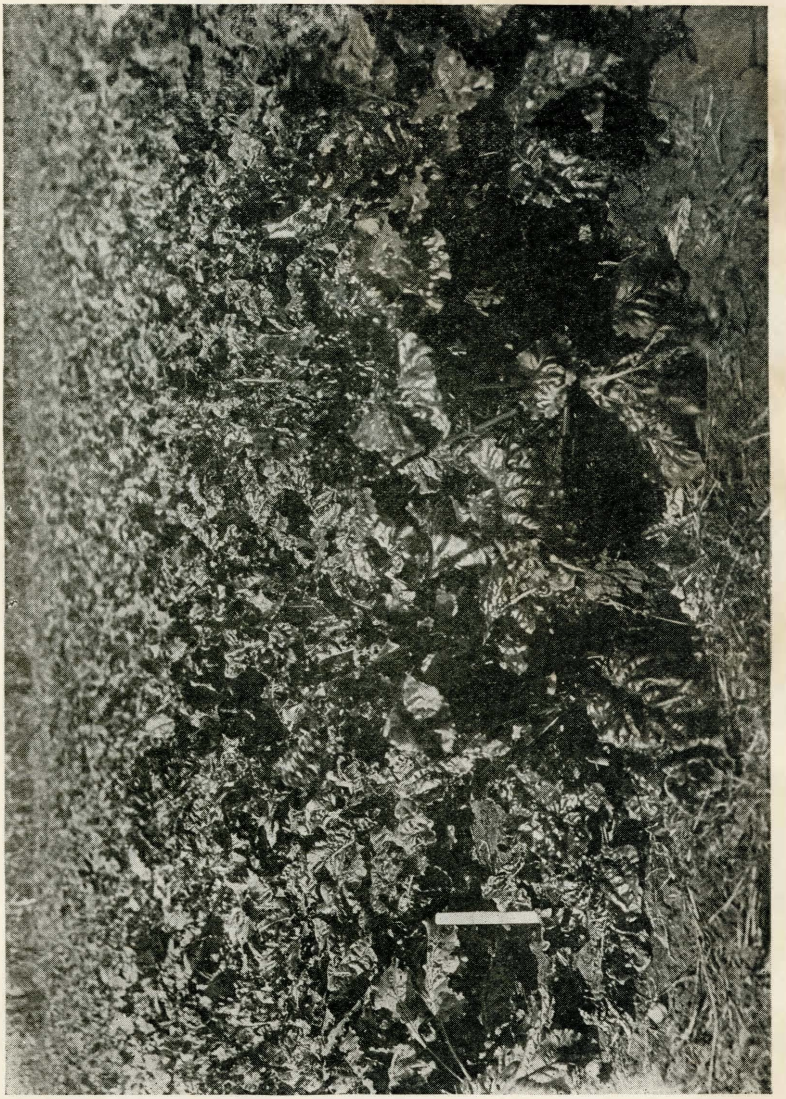

Plate X.

TABLE III

VARIETY TESTS OF SUGAR BEETS FOR 1915

Variety Number	Width Rows	Number Beets Analyzed	Weight Beets Analyzed	Degree Brix	% Sugar in Juice	Purity	% Sugar in Beets	Pounds Beets Per Acre	Pounds Sugar Per Acre
42	18	158	96	20.5	19.0	92	18.0	27878	4767
44	18	167	72	21.5	19.8	92	18.8	20908	3734
218	18	175	62	20.0	18.6	93	17.7	18004	2427
35	18	145	69	21.0	19.4	92	18.4	20037	3502
SPACING TESTS 1915									
35	18	145	69	21.0	19.4	92	18.4	29037	3502
35	22	144	73	20.0	19.2	91	18.2	18704	3234
35	24	153	87	20.5	19.0	92	18.0	18949	3240
35	30	151	99	20.5	18.8	92	17.9	17150	2991
MISCELLANEOUS TESTS 1915									
Russian...	18	171	76	21.0	20.0	95	19.0	22070	4173

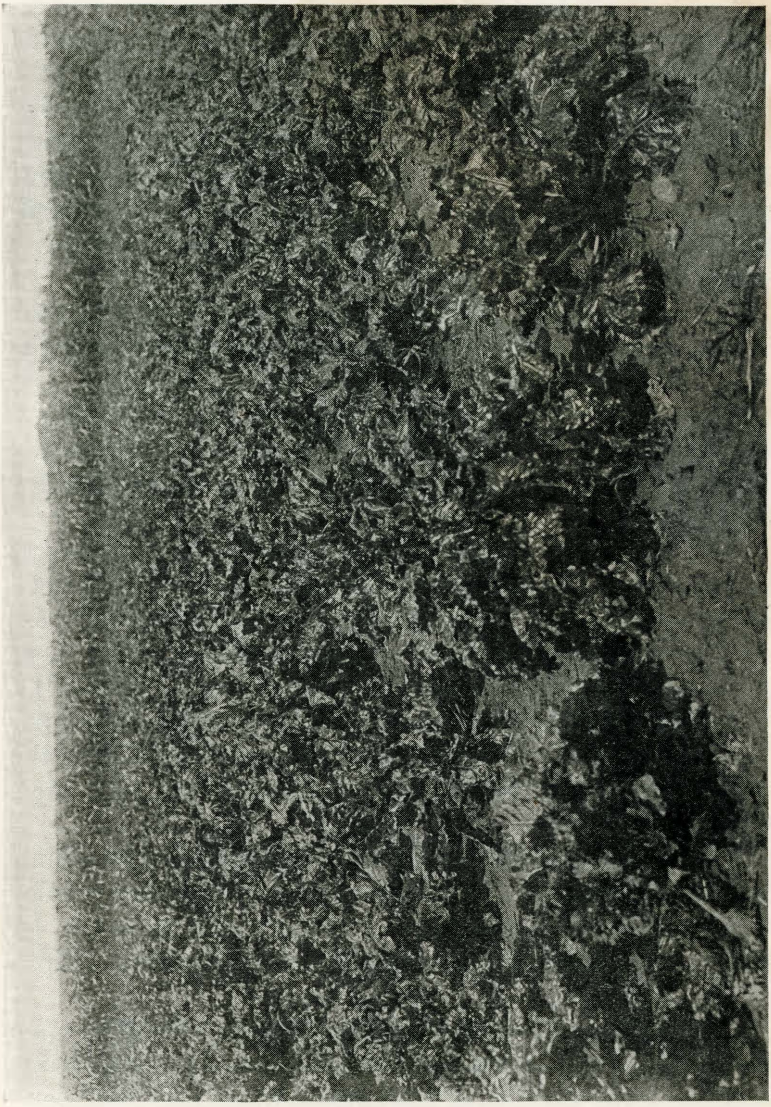

Plate XI.

THE SEASON OF 1916

The season opened early enough. The ground was fitted the first week in May but heavy cold rains delayed planting until the 13th. More cold rains followed so that the seed germinated unevenly leaving gaps in the rows. About four inches of rain fell during the month. June also had plenty of rain, about four inches. But from this time on till harvest the rains were inconsequential. This was the worst year for sugar beets for many years.

There were no frosts to injure the sugar beets this year before harvest time. The cold snap that spread over the sugar beet belt October twentieth did no damage. It was preceded by a light fall of snow which protected even the leaves. The thermometer however fell to 12 degrees F. The weather came off fine with ample time for harvest.

It is a matter of such recent record that the greatly reduced yields of all small grain and corn for 1916 need no rehearsal here. Even potatoes failed completely except in favored localities. Sugar beets as usual were the most certain crop grown in the state. Table IV shows that the yields were diminished and the sugar per cent lost a couple of points. But in comparison with the staple crops sugar beets certainly show a very nice profit.

This year a transplanting machine was used in planting the stechlinge. This was an adapted planter similar to those used in transplanting tobacco and is in use by the Horticultural Department for transplanting alfalfa roots.

This is a two wheeled machine with one shovel to open the furrow, two boxes to hold the beets and with three seats, one for the driver and two for the beet droppers. Wings draw the dirt around the beets as they are dropped. A pair of rollers to firm the dirt around the beets would make a great improvement. About two or two and a half acres a day was the rate achieved in our trials.

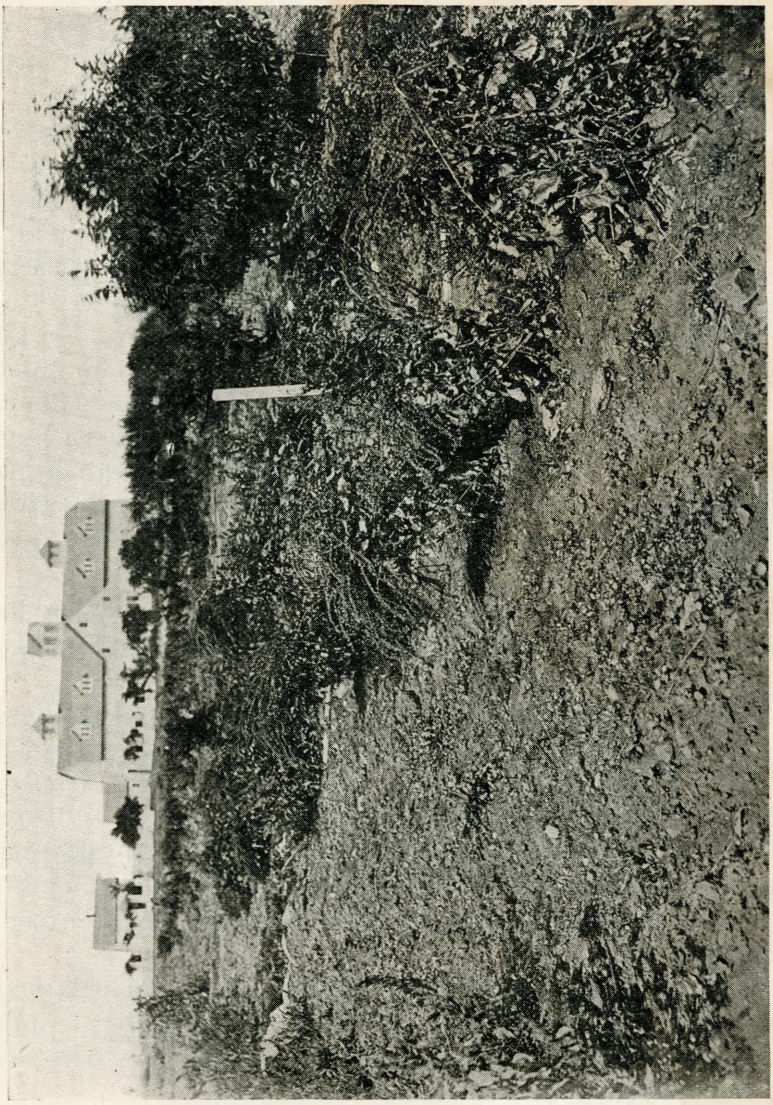

Plate XII.

Here is certainly an opportunity for inventive genius to save the costly and laborious hand work in planting mother beets. The photos were taken the middle of August this year. Plate X shows the beets in 18 inch rows while Plate XI shows 24 inch rows. It will be noticed that the stand is not good. Both the surface mulch and the leaf covering did not suffice to keep the ground from baking during the fierce Summer drouth. This caused the beets to grow smaller, and reduced the yield.

It will be noticed in Table IV that the number of beets in the row analyzed is low. Not that the rows were thinned wider but on account of the gaps in the row. In all widths of rows the thinning has been from six to eight inches. This was done purposely to keep the beets down to a weight of about one pound each. In eighteen inch rows thinned to six inches and with beets weighing one pound each, the tonnage would be 29 tons per acre. This is simply an ideal towards which our experiments have been aiming.

This year 22 samples of beets grown on the Belle Fourche irrigation project averaged 19.6% sugar in the beet.

Plate XII shows a group of isolated, analyzed mothers bearing seed. During the years passed we have been aiming to produce a 20% beet with a high tonnage While it is not necessary to give details here, it will suffice to say that the mothers selected from the different varieties, have carried from 18% to 22% sugar in the beet. A little wider variation in a few varieties has been permitted.

Table V is a reprint from Bulletin 142 of this Station. It gives the data for 1911 and 1912. The lengths of rows analyzed in 1911 were not 100 feet so previous remarks do not apply.

In conclusion, it is scarcely necessary to state that South Dakota is well adapted to sugar beet culture and to seed production. The land used for our experiments here is not of the best the state affords. There are hun-

dreds of square miles of black, loamy soils, easy of cultivation and of immense fertility where good careful culture coupled with good seed will produce better paying crops than the state has ever grown. The average tonnage for 6 years has been about 18 tons per acre for the 18 inch rows. This means over $100.00 per acre. The wider rows give a trifle less. No other crop gives such an income.

The raising of seed for commercial use is also a profitable undertaking. Results at this station demonstrate that sugar beet seed can be raised successfully in South Dakota. But for the average farmer, the many difficulties which arise make this industry impracticable. Yields as high as 1,400 pounds per acre have been attained at this station. At 15c per pound this means a return of $210 per acre. It is probable that with the increase in the price of beets the price of seed will rise also.

There is considerable expense in the raising of the seed. The cost of the mother seed and the stechlinge and the extra care necessary in cutting, threshing, and cleaning the seed make the outlay greater than for our small grain crops. But taking this into consideration, the net return is greater per acre than for most of our crops.

It is of utmost importance that seed be selected from a strain of beets which is high both in sugar content and in tonnage. It has not been found possible to establish a variety of sugar beets which will continually produce beets with a high sugar percentage. High standards have been attained by a long process of selection according to type and sugar percentage, and only by continued selection can deterioration be prevented. This selection requires experienced workers who understand the meth-

ods of breeding, and also a chemist with a laboratory equipped for the analysis of the beets.

Thus it is evident that the raising of commercial seed is not feasible for the individual farmer. It is better that sugar beet seed companies finance and superintend the raising of seed and furnish it to the farmers at reasonable cost. It is to their interest that the best seed be used and their capital, equipment, and experienced men make it possible to carry on this highly technical work.

TABLE IV

VARIETY TESTS OF SUGAR BEETS FOR 1916

Variety Number	Width Rows	Number Beets Analyzed	Weight Beets Analyzed	Degree Brix	% Sugar in Juice	Purity	% Sugar in Beets	Pounds Beets Per Acre	Pounds Sugar Per Acre
218	18	92	72	21.0	17.4	83	16.5	20909	3450
S. D. 1	18	92	72	21.0	17.6	84	16.7	24684	4124
35	18	107	75	22.5	19.8	88	18.8	21730	4094
43	18	113	74	20.0	17.0	85	16.1	21490	3545
SPACING TESTS 1916									
43	18	113	74	20.0	17.0	85	16.1	21490	3545
43	22	115	82	21.5	17.8	83	16.9	19483	3293
43	24	97	82	22.5	18.8	84	17.8	17840	3122
43	30	93	109	21.5	17.8	83	16.9	18992	3210

TABLE V

VARIETY TESTS OF SUGAR BEETS FOR 1911

Variety No.	No. Rows Analyzed	No. Beets Analyzed	Wt. Beets Analyzed—lbs.	Degree Brix	Per Cent Sugar In Juice	Purity	Per Cent Sugar In Beet	Pounds Beets Per Acre	Pounds Sugar Per Acre
35	5	248	267	19.6	17.1	88	16.3	31015	4550
40	7	368	354	19.6	17.0	87	16.2	28515	3865
42	6	288	297	19.8	17.6	89	16.7	32016	4812
43	6	326	307	20.4	17.9	89	17.0	32894	5031
44	6	317	303	20.3	17.9	88	17.0	32665	4797
	Width of Row			VARIETY TESTS FOR 1912					
35	18	142	115	24.0	21.0	88	20.0	46379	8532
42	18	158	112	24.4	22.0	90	20.9	45173	8497
43	18	146	118	24 5	22.0	88	20.9	47593	8952
44	18	138	101	25.4	22.6	89	21.5	40737	7782
288	18	120	106	25.6	23.2	91	22.0	42753	8653
218	18	132	106	24.6	22.0	89	20.9	42753	8025
SD1	18	143	111	24.2	21.4	88	20.3	44766	8268
				SPACING TESTS 1912					
40	18	138	96	25.2	22.4	89	21.3	38962	7469
40	22	143	147	21.0	18.0	86	17.1	48510	7605
40	26	123	142	22.2	20.0	90	19.0	39700	7011
40	30	122	169	21.0	18.8	90	17.9	40898	6762

AVAILABLE BULLETINS.

105. Stock Food for Pigs.
106. Sugar Beets in South Dakota.
107. Sheep Scab.
109. Rusts of Cereals and other Plants.
111. A study of South Dakota Butter with suggestions for Improvement.
114. Digestion Coefficients of Grains and Fodders for South Dakota.
123. Milk Powder Starters in Creameries.
127. Breeding and Feeding Sheep.
129. Growing Pedigreed Sugar Beet Seed in South Dakota.
130. Some New Fruits.
131. Scabies (Mange) in Cattle.
134. More Winter Dairying in South Dakota.
136. Fattening Pigs.
137. Wintering Steers.
138. Hog Cholera.
142. Sugar Beets in South Dakota—Results to Date.
143. Roughage for Fattening Lambs.
144. Preliminary Report on the Milking Machine.
145. A Report of Progress in Soil Fertility Investigations.
146. Some Varieties and Strains of Wheat and their Yields in South Dakota.
147. Effect of Alkali Water on Dairy Cows.
148. Corn Silage and Mill Products for Steers.
149. Some Varieties and Strains of Oats and their Yields in South Dakota.
150. Weeds.
151. Trials with Sweet Clover as a Field Crop in South Dakota.
152. Testing and Handling Dairy Products.
153. Selecting and Breeding Corn for Protein and Oil in South Dakota.
154. The Pit Silo.
155. Selection and Preparation of Seed Potatoes, Size of Seed Pieces, and Bud-Variation.
156. Kaoliang, A New Dry Land Crop.
157. Rape Pasture for Pigs in Corn Field. Kaoliang for Pigs.
158. Proso and Kaoliang for Table Foods.
159. Progress in Plant Breeding.
160. Silage and Grains for Steers.
161. Winter Grain in South Dakota.
162. First Annual Report of Vivian Experiment and Demonstration Farm.
163. Comparative Yields of Hay, From Several Varieties and Strains.
164. Making Butter and Cheese on the Farm.
165. Corn Silage for Lambs.
166. Important Factors Affecting Machine Milking.
167. Transplanting Alfafa.
168. Breakfast Foods and Their Relative Value.
169. Flax Culture in South Dakota.