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## Sugar Beet Culture in South Dakota

J.H. Shepard

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# **AGRICULTURAL EXPERIMENT STATION**

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

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**DEPARTMENT OF CHEMISTRY**

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## **SUGAR BEET CULTURE IN SOUTH DAKOTA RESULTS TO DATE**

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# SUGAR BEET CULTURE IN SOUTH DAKOTA

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## RESULTS TO DATE

### DEPARTMENT OF CHEMISTRY

Jas. H. Shepard, Chemist

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Of late much interest is manifested in Sugar Beets for this state. This is caused by the probably early erection of Sugar Beet factories in the state. Many inquiries are received at this station in regard to the whole subject. It is in answer to these inquiries that this Bulletin is issued.

While long and tedious tables of the different data now at hand is purposely omitted, the statements herein are backed by data secured during the long and painstaking investigations that have been made. Many people are not aware of the work that has been done with Sugar Beets at this station and one of the most insistent questions asked, relates exactly to that point. This question will be fully answered.

The first work done was in 1888 and it continued until the close of 1892. It was resumed in 1897 and continued through 1898. The work was then discontinued until 1907 when it was resumed in cooperation with the United States Department of Agriculture, Dr. C. O. Townsend acting for the department. This cooperative work was carried on until the spring of 1912, when this station again took full charge.

In relating the results obtained it will be of assistance to the reader to state some of the prime requisites for successful sugar beet culture. This will make it easy to understand why certain results are obtained. In every instance where these requisites were observed, good results followed and where they were not observed, less favorable ones. The few main essentials are as follows:



1. Good seed. It is evident that poor seed would give bad results.

2. Well prepared seed beds. Discing alone or shallow plowing will give poor results. The beet is a deep rooted plant. The land must be plowed at least eight inches and then sub-soiled eight inches more. Also rather high land gives the best results.

3. Proper spacing between rows and in the row. If these are made too wide the beets grow too large and the percent sugar is too low. If too close the beets do not grow large enough. Experiment has shown that 22 to 24 inches between the rows and about 6 inches in the row give the best results in this state.

4. The observance of the proper time for sowing and harvesting. If the seed is sown too late the beets do not have time to ripen, and if harvested too early the same bad result follows. Green beets are low in sugar and in purity. Experiment has shown that right close around the first of May is the best time to sow and the beets ripen about the middle of October.

If these facts are borne in mind a clear understanding of what follows can easily be had. It will also help to know that sugar beets carrying 12 per cent sugar in the beet are bought by factories and that while exact information is not available the probable average in sugar growing countries is around 14 to 15 per cent.

When the work was first begun, way back in 1888, there was little information to be had in regard to the essentials of sugar beet culture in this country. Also genuine sugar beet seed was hard to obtain. No one knew whether sugar beets would grow at all in the state or whether they would have sugar content high enough to make them marketable, even if they would grow. Nevertheless a start was made. The seed, four so-called varieties, were purchased from a Chicago seedsman and four more varieties came from a Sioux City dealer. We now know that none of this seed was sugar beet seed at all. All





PLATE IV. STECHLINGE BEARING SEED, 1400 LBS PER ACRE: VALUE \$210.00



were simply varieties of mangels slightly resembling sugar beets.

The seeds were not sown until the 8th of June and owing to the dry weather of that month they did not germinate till about the first of July. Also the rows were 30 inches apart. Thus were three requisites violated. The sugar went from 6.5 per cent to 10.5 per cent sugar in the beet. The tonnage of beets per acre varied from 6 to 15 tons. We were encouraged with even this poor showing. Beets would grow and they had sugar in them.

*In 1889* we made a desperate effort to get better seed. We secured eight varieties from seedsmen in Philadelphia, Chicago and LaCrosse. Although we paid from 20 to 60 cents per pound we made no improvement on the seed of 1888. The tonnage went from 7 to 16 tons per acre and the per cent of sugar in the beet from 9.9 per cent to 12.3 per cent. The beets were planted on May 10th.

We learned that we could reduce the sugar per cent one-half by planting in wide rows with wide spacing in the row. We were making progress.

*In 1890* we obtained five varieties of genuine sugar beet seed. The United States Department of Agriculture furnished four of these and the Oxnard Co. furnished one. This year the Station plats were sown early in May in rows 30 inches wide with beets eight inches in the row. The per cent sugar in the beet for the poorest variety was 13.2 per cent and for the best 17.9 per cent. Tests were made showing the date of ripening to be about the middle of October.

This year saw the beginning of cooperative work over the two Dakotas. We had about 100 plats grown by farmers. In every case where directions were followed equally good results were obtained as were secured at the home Station. One sample from Huron gave 19.9 per cent sugar in the beet. The tonnage run from 7 to 10 tons per acre actual stand. At this time the reports gave the German average per cent sugar in the beet at 14 per cent. Here



we were approaching the true conditions to be expected when good seed is used.

*In 1891* we decided to grow plats of sugar beets all over the state. Notwithstanding the fact that among the 100 farmers who grew beets for us last year many failed to follow directions we had no better way to make a preliminary trial. It was a serious undertaking. There were distributed more than 1000 different packages of seed sufficient to sow large plats. Many of the people who received the seed did not have even a garden drill for sowing the seed. None had subsoil plows, but all had a great willingness.

This year we made efforts to learn if any section of the state was better than the others for sugar beet growing. The Eastern region, the James River Valley, the Missouri Valley and the Black Hills comprised the regions as mapped out.

It required a Bulletin of 68 pages to give the results. We found it impossible to say that either this or that region was better or worse. But we did secure the most convincing testimony that sugar beets would do very well indeed, in any part of the state when the fundamental requisites, in their simplicity were observed.

The seed used was imported, some furnished by the United States Department of Agriculture, some by the Oxnards and some obtained from Germany by citizens of the state. This was "Cut Worm" year. These worms were a veritable pest. They even ate the leaves off the berry bushes. Notwithstanding all vicissitudes the growers who reported obtained from 6 to 30 tons per acre. A few claimed higher results, 40 to 50 tons. Of course we had no way of verifying these high results. At the Station we grew from 14 to 17 tons per acre. It is likely that the thick seeding of the beets gave the cut worms all the forage they needed, and more too, so that a good portion of the beets survived. But as a matter of course some plats were damaged and some destroyed.

It may serve a good purpose to tell some of the awful

mistakes cultivators made this year. Nearly all plowed shallow. Rows sometimes went 8 feet apart. Some cultivated with a common drag. Many sent in monstrous beets. Good sugar beets weigh from three-fourths to two pounds each. Some sent in weighed fifteen pounds. Some used heavy applications of manure. Many sent in green beets for analysis. And a great many sent the largest beets they raised. It is well nigh impossible to convince the ordinary farmer that the biggest sugar beet is not the best. Does not the biggest beet take the premium at the county fair? One man sent two beets weighing 15 pounds each. He wrote, "I bet you they will have a barrel of sugar in them." They had 6 per cent sugar, so we threw the results away. All these things happened despite the fact that explicit instructions were given to each grower. But the faithful few saved the day.

We made 263 composite analyses this year, each analysis using from 3 to 8 beets. About 55 low records were made, under 10 per cent sugar in the beet by greivous mistakes in cultivation as enumerated above. About 50 others had beets just under 12 per cent. And it speaks well for the state that these two classes were not larger. The remainder had fine marketable beets running from 12 per cent up to 18 per cent sugar in the beet. These good ones came from every section of the state impartially.

This year the Station learned something too. Our beets were planted on low, creek bottom land where the black, mucky soil was six feet deep. The sugar in the beet ran from 10.2 per cent to 13.6 per cent. Upland soil anywhere in the state will increase these results nearly one-half. It does not pay to violate essentials.

This year also saw the beginning of raising sugar beet seed from analyzed mother beets. A small quantity of seed from several varieties was grown. When planted the next year the beets grown gave a promising increase over the mothers planted for seed. In some instances 3 per cent more sugar was found. Thus by selection a 15 per cent beet was raised to 18 per cent. This is mentioned





PLATE III. GROWING STECHLINGE, ROWS 12 IN. AUG. 6th, 1912



here, since this small beginning has borne fruit in the splendid achievements of the present time.

*In 1892* we were thoroughly convinced that there was no use of trying to work with farmers who would not follow directions. Accordingly no seed was sent to any one unless he gave promise to follow the directions which were sent out with each sample.

The Station imported two types of seed, the Vilmorin and the Kleinwanzlebener, grown by the German grower, Aug. Knoche. Again the state was divided into the same four regions as they were last year. Once more the results were tabulated and once more none of the regions showed any marked superiority over the others.

All honor is due to the cooperators of this year. They did their work well in most instances. Some lost their entire plots. Stock ate up their beets. There were few fences in the country. The usual per cent did not report. Taking it all in all it was not a markedly good season. While a few gave their plats poor care most did very well indeed. But there was one thing that many of the experimenters could not get away from, and that was the belief that the biggest beets were the best. Some reduced their sugar per cent from 14 per cent or 15 per cent down to 9 per cent or 10 per cent by selecting the large ones.

Out of the 160 analyses only 27 samples fell below 12 per cent. The others ranged all the way up to 20 per cent, with the majority around 14 to 17 per cent. The tonnage run all the way from 10 to 40 tons per acre, and some reported even higher results. At the station we grew 19 tons per acre. In all probability these figures are more exact than some reported, but even 19 tons makes for the most profitable crop the farmer can grow.

Owing to the splendid showing of this year the work was discontinued. The Bulletin for this year closes thus—"The fact may be accepted that most portions of the state can raise sugar beets of a high grade for sugar manufacture." It seems that fears of adverse legislation and financial reasons prevented the advent of factories at this

time. It would have been much better for many investors had they come to South Dakota.

Interest was aroused in Sugar Beet circles and pressure was brought to bear on the Station to the extent that work was resumed in 1897. The United States Department of Agriculture furnished the seed which was of the original Kleinwanzlebener variety. The seed was sent to 954 farmers residing in 59 different counties. With our improved knowledge of the different portions of the state the four previous divisions were subdivided until ten different areas or regions were established. It is of no import so far as this work is concerned to enumerate these regions, because we did not find that any one of them possessed superior merits over the rest.

As well may be imagined, we met with the same trouble on the part of some experimenters who would not follow directions which were sent with each sample. Some things like these happened in a few cases. One man simply disced his ground, one planted his beets in rows eight feet apart; one planted them all in one row, some did not cultivate at all. Some did not firm the seed bed and sowed the seed in the dry dirt so they did not germinate. But we did make one gain. No one sowed the seed broadcast nor cultivated the beets with a drag. This year I personally inspected many of the plats. I found bad conditions prevailing in some places, but many did good work. Then again we had few samples sent in green. They held the samples until notified to harvest them. Some plats again were destroyed by stock, and some used trashy ground and had a little trouble with cut worms.

The usual percentage did not report. These were followed up and it was found to be due mostly to carelessness, altho some had failures for reasons above stated.

But we did get 380 samples for analysis, coming from 51 counties. We made it a rule to reject samples where the beets had been grossly mistreated. In following this rule we threw out the one-row man's beets, notwithstand-



ing the fact that they gave over 13 per cent sugar in the beet. Thirty-seven samples in all were rejected.

Taking into account what has been said, it speaks most highly for the fitness of this state for growing sugar beets of most excellent quality for factory purposes.

The average tonnage of the whole state was 21.9 tons per acre. The average per cent sugar in the beet was 15.6 per cent. The different regions differed slightly from this average. They usually varied only one or two per cent either way. Owing to the different degrees of carefulness in cultivation these differences are negligible. The highest per cent recorded came from Harding county which reported on four samples, 20 per cent. These beets had extra care. Any county could have materially increased its percentage. It must not be overlooked also that we had a frost on the 24th of May which did some damage.

After we had the results of the year before us, we decided to continue the work another year. But we decided not to send samples promiscuously over the state. Any state that could make such a showing as we had made and under such circumstances, needed no further experiments along the same line.

*In 1898* the work took up other features of the Sugar beet industry, since the quality of the beets had been demonstrated beyond perad-venture. We next sought to determine the cost of production and yield per acre, using an acre of beets or some large fraction for each plat. It was decided to do this work in those localities where the most interest had been shown and where Sugar factories were liable to be erected soon.

Accordingly committees were chosen at Aberdeen, Huron, Yankton and Sioux Falls who arranged for the growing of the plats and superintended the cultivation. We obtained successful reports from all of these localities. While the reported cost per acre for production was not satisfactory in some cases, it must be remembered that these people had no special machinery, for planting, cul-



tivating or digging. The work was mostly done by hand, even the seeding was done with a garden drill.

It is estimated that the average cost of production where the industry is now established is somewhere around \$24.00 per acre. Our co-operators gave the cost at from \$25.00 up to twice that amount. The chief expense seemed to be in the digging. It was all done by hand and expensive labor was employed. Had these people had a modern beet lifter and had they suitable arrangements for topping, this item would have been cut more than half in most cases.

In making up the total cost all legitimate charges were made against the acre. The fitting of the land, the thinning, cultivating, harvesting, topping, hauling to the factory or railroad six miles, cost of seed and interest on price of land. Then again the impression was unavoidable that some estimates were not carefully made. One man estimated the hauling six miles at \$20.00 per acre which yielded 22 tons. On our smooth, hard roads one team can easily haul six tons and by longer hours work as in threshing time it could easily be made nine tons. Again one man estimated the cost of thinning and cultivating at \$23.00. It would take very foul land and extremely high priced labor to make it cost that much. The contract price for thinning is around \$8.00 per acre in the fields. Again one man estimated that he could haul his beets to the factory for about thirty cents per ton. He could not haul them six miles at that rate. But not all growers live so far away from factory or station. Some would live less than a mile away.

But on the analytical data we may rely once more, and I believe the tonnage per acre is reliable since the whole plat was weighed. The tonnage run from 6.5 to 28.5 tons per acre. The average for the whole state was 16.3 tons. The cause of the lowest figures on tonnage was caused by what was described as small "false chinch bugs." I am inclined to think it must have been the gray blister

beetles. These come once in a great while but usually not in sufficient numbers to be injurious.

If they do come in numbers one spraying with Paris green will drive them away. Also it will destroy all kinds of leaf eating insects.

The per cent sugar in the beets varied from 16.40, the lowest up to 21.2, with an average of 18.4 per cent for the whole state. And this is what we may expect when the industry is established, providing the prime essentials are observed. In view of the facts gleaned during this two years work, it was decided that the work should be discontinued until such time when the State should need the further services of this Station.

In the spring of 1907 there was renewed interest in sugar beet culture. Factories were doing well and the Secretary of Agriculture had special attention given to the various phases of the industry. Owing to the fact so much work had been done at this Station a co-operative work was commenced here. But it was along entirely different lines than those followed previously. It will be remembered that sugar beet seed had been grown here successfully in a small way as mentioned in these pages.

The object of the new work was to breed up strains of sugar beets in which the individuals should give uniformly high sugar percentages, while the beets should be large enough to make a profitable tonnage for the farmer.

The first year of this work in co-operation with the Bureau of Plant Industry, Dr. Townsend secured 26 different varieties of sugar beet and stock beet seeds. The sugar beet seed was from best American and foreign growers who were furnishing our factories with commercial seed.

Each variety was planted and when ripe the variety was harvested and the beets, after a thorough sorting for shape, type and size, were siloed in a cool cellar. Later they were all brought to the laboratory and each beet was analyzed separately. Any sugar beet that failed to have 15 per cent sugar in the beet this year was rejected. This



severe culling process left good beets of proper form and size with at least a good commercial per cent of sugar. Some varieties were thrown out entirely. And of the beets saved in the field in some varieties the number of rejected beets were small, in others it amounted to as much as 20 per cent.

We were unable at this time to cull closer than this. But some varieties gave one or two beets out of the whole number analyzed that went up to 20 per cent sugar in the beet, and one gave 24.8 per cent sugar. These few best ones were planted separately and sacked so they self-fertilized, thus giving us the beginnings of new strains.

But one thing became immediately apparent, and that was, **THAT THERE WERE NO PURE STRAINS OF SUGAR BEET SEED IN THE COUNTRY THAT WOULD GIVE UNIFORM PERCENTAGES** among the individuals of any variety. In even the best varieties individuals were found that differed from one another by 10 per cent sugar in the beet. The enormous waste that would ensue from using such seed may be readily imagined. The poor beets cost just as much to grow as the good ones and they reduced the profits of both farmer and manufacturer.

So we found ourselves confronted squarely with the problem of growing varieties of beets that would give not only a high per cent of sugar but also one that was uniformly high. It was our problem to reduce the variation among individuals to the minimum.

In 1908, 21 more varieties of seed were secured and treated as the first 26. This year there was plenty of moisture and the beets grew larger. This gave us a good opportunity to make a more rigid rejection. The number rejected on a 15 per cent basis ranged all the way from 50 per cent to 100 per cent. This shows the value of the chemical analysis in cutting out individuals with a tendency towards low sugar production. It is gratifying to say that some of the varieties thus ruthlessly treated are today our best and most dependable ones.

This year it was possible to try the amelioration of



the sugar beet by the process of cross-fertilization. This is a most delicate and exacting operation. Just before the flowers opened on a selected beet, the petals were gently raised by a pair of delicate forceps and the anthers were cut away. It can be imagined what a task this would be to go over all the blossoms on a sugar beet! When the flower that had been so treated reached the right stage, pollen from another beet which was to serve as the male parent of the new hybrid, was dusted on the pistil, thus fertilizing it. The flowers so treated were then sacked to prevent stray pollen from reaching the pistil.

Any new blossoms that might come forth were cut off. In this way hybrids were produced. We have some valuable strains produced in that way.

*In 1909* we were busy propagating and testing out not only the main lots of beets and seed grown during the past two years, but owing to an early freeze in October we were able to give the first 26 varieties grown as severe a culling as we had given the seeds planted the previous year. We had fine beets but the freeze prevented the complete ripening, thereby costing us as estimated about 4 per cent sugar. So we fixed the minimum for rejection at 14 per cent, which would be a distinct advance over previous years or 18 per cent. The culling was most severe, the rejects often constituted over half the beets analyzed. But this has proven a blessing in disguise. But we commenced to see for the first time that we had made substantial gains in reducing the variation between individuals of the same strain. The variation of 10 per cent had been reduced in most cases to 5 per cent or 6 per cent. In only a very few cases did it rise to 8 per cent, while in some cases it had dropped to 3 per cent or 4 per cent. The mother beets averaged about 15 per cent sugar in the beet.

*In 1910* we continued the work, analyzing, selecting, and testing out the new strains of mothers and seed we had grown. During this year an attempt was made to discover if possible some relation between the morphological structure of the sugar beet and its sugar content. Upwards of





PLATE II. THE GROUND COVERED, ROWS 26 IN. AUG. 6th, 1912



4,000 beets were analyzed and classified. Up to this time that work has borne no fruit.

But when we came to select our mother beets after analysis we made the satisfactory discovery that the individual variation between beets of the same variety was rapidly disappearing. On a basis of 15 per cent the rejects had dwindled down to an average of only 3.4 per cent for all varieties. The lowest per cent rejected on account of low sugar content was 0.9 per cent and the highest was 7.0 per cent. When we consider that when these same strains at their last selection required the rejection of around 50 per cent and over, it needs no erudition to discover the remarkable progress made. Also we made the largest number of individual analyses this year that has been made in this work.

This year the mother beets averaged over 17 per cent sugar in the beet. This fact marked another distinct advance in our quest for a high and uniform percentage of sugar.

In the spring of this year Dr. W. A. Orton of the Bureau of Plant Industry succeeded Dr. Townsend who had resigned. Dr. Orton detailed Mr. F. A. Pritchard to look after the cultural work.

1911 will go down into history as the great drouth year. It is a most instructive lesson to note the performance of sugar beets as compared with other crops. While corn and potatoes made fair crops nearly all small grains were practically failures. Only in certain low lying farms were they harvested. Tame grasses were nearly a failure, and only lowland prairie native grasses gave any hay.

But sugar beets gave a really good crop. All the varieties grown averaged nearly 16 tons to the acre of over 16 per cent beets. Had more of our land been in sugar beets, instead of failure, each acre would have yielded an income of from \$80.00 to \$95.00. Such an income does not mean failure.

*For 1911*, owing to the fact that we now had some very good strains well on their way toward our ideals,





PLATE I. BLOCKING AND THINNING



other phases of the work are undertaken. These had to do principally with some commercial aspects of the industry again. The one most largely emphasized was the commercial production of sugar beet seed. We had on hand a large number of analyzed mother beets. Enough of these were used to plant about one-half acre. These the drouth affected most severely. Only from 5 per cent to 10 per cent set seed. But the seed grown was of prime quality. From a commercial standpoint this was not a success. But even at that it was no such complete failure as the one that overtook our ordinary crops.

Of course we grew our strain-perpetuating mothers as in other years and while no extra large amounts of seed were grown we had more than we could use the next year. We did not lose a single variety owing to failure to set seed.

But commercial sugar beet seed is not grown from analyzed mothers. These are set for seed, and then their seed is sown thickly in very narrow rows about a foot apart. This causes the beets to grow very small, whence their name "Stechlinge." A good English equivalent for this German word would be "Fingerlings." The beets are from the size of a finger up to one inch in diameter.

A large number of Stechlinge were grown this year. Of course there was no failure with these. But the next problem was, could we handle these Stechlinge profitably in this state. It is customary to silo Stechlinge right in the field where they are grown. They are simply piled in long or round conical piles without removing the leaves and a small quantity of dirt is sprinkled on to fill all spaces. Then the piles are covered with suitable covering, such as dirt and straw.

We made ten silos. Some were covered with about three feet of dirt and four feet of straw. These kept very well notwithstanding the fact that we had the severest winter for years. For weeks the thermometer was below zero every day and at one time reached 42 below. Some that were covered with only three feet of dirt were nearly

all spoiled, but we had some good stechlinge from these. One or two silos were not covered at all, the beets were just piled up. As was to be expected, these did not keep.

In the spring of 1912 it was decided that the cooperative work should cease and this station took up the work alone. It gave a better opportunity to grant some aid that the people of the state were asking.

It was decided that the work of breeding up mother beets to uniform excellence should be continued, but we determined to reduce the number of strains, concentrating on only the best ones. We had seed of our best strains, also some mother beets and enough stechlinge to set one-tenth acre for seed production. We were not discouraged by the small yield of seed for last season. And our perseverance has already proved well justified. Not only was seed set in abundance but it proved itself a very good commercial crop. The stechlinge yielded and at the rate of 1400 pounds per acre. At 15 cents this would give an income of \$210.00 per acre. We believe we can increase the yield of seed by planting closer. The rows were three feet apart with beets two feet in the row.

We also made experiments with spacing to determine the effect on the sugar yield per acre. We found that 22 inches gave the largest yield. At thirty inches the beets grew larger, but not large enough to offset the fewer number of rows and the slightly diminished sugar in the beets. Probably 24 inches would give as good results as 22 with the beets six inches in the row.

In analyzing beets for mothers we were able to reject all under 18 per cent sugar in the beet this year. Here is a mighty advance. With this high standard the reject per cent was low, running around 10 per cent or under. In no variety did the per cent sugar in the beet as determined by a composite analysis in which every beet in the row was analyzed fall below 20 per cent. The highest average was 21.5 per cent. Even the rejects averaged well over 15 per cent. Analyzing mother beets is like going fishing in the interest which it excites. As beet after beet is



put through the process interest runs high. Maybe the next one will be a big one! We have been looking all these years for a sugar beet that will give 25 per cent sugar in the beet. And this year we not only found several that were that high but we surely caught a big one, 25.4 per cent. Perhaps they grow richer. We do not know.

As for tonnage, the different varieties gave from 20 to 24 tons per acre. Owing to the great interest at this time there is appended a table giving a summary of the results secured along commercial lines during 1911 and 1912. The table is self-explanatory. The pounds sugar per acre were calculated by weighing the topped beets. Then this weight was multiplied by the per cent sugar in the beet. In factory practice around 4 per cent of the sugar in the beet is not recovered as sugar. Some of it goes to molasses. The molasses is worked up into alcohol and other valuable products.

**TABLE 1**  
**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	26515	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	849
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
18S	18	120	106	25.6	23.2	91	22.0	42753	8653
21S	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

To the casual reader perhaps the figures in the table do not have much significance. But let us see. There is no ordinary crop raised on the farm that gives any such tonnage as sugar beets. Even corn cut green for silage does not amount to any such figure as 24 tons per acre.

Again no ordinary crop grown on the farm has any such cash value as sugar beets. Factories buy sugar beets according to their sugar contents. The lowest price paid is \$5.00 per ton. Beets like those grown at this Station would certainly bring a much higher rate, perhaps \$7 or \$8 per ton. A few figures will show that our land can be made to bring an income of from \$100.00 to \$125.00 per acre under careful culture in sugar beets.

Then look again at the sugar per acre column. Take variety No. 42 as an average. It gave in round numbers 8500 pounds of sugar per acre. To grow as many pounds of wheat per acre it would require 140 bushels. To grow the same number of pounds of oats per acre would make it necessary to grow 260 bushels per acre. The utter hopelessness of any such undertaking is so striking that it needs no comment. In fact it would require ten acres in either oats or wheat to yield as much grain pound for pound as the sugar yield. Then again let us take the cash value of the recoverable sugar per acre neglecting the by-products of manufacture, pulp, alcohol, etc. Sugar at wholesale is now \$5.40 per hundred. Consequently the manufactured products from the sugar grown on one acre would be around \$400.00. To raise that value in wheat even at \$1.00 per bushel would require 400 bushels and to grow that much at the average yield of 15 bushels per acre would require 26 acres of land, while to grow the same value in oats at 25 cents per bushel would take, at 30 bushels per acre, 52 acres of land. Moreover, sugar comes from the air. It does not deplete the soil as grain raising does.

We have now given a review of the work done with sugar beets in this state during the many years of its continuation. We have followed the beets through good years and through bad years. We have had drouths and other



un-toward features to contend with the same as other states. There is no paradise on earth. But through all these conditions we have no failures to record. The sugar beet furnishes one of our most reliable crops. In order that the reader may know how the sugar beet yields in other states the averages for the United States are taken from the 1911 Year Book of the Department of Agriculture. The average tons per acre is 10.82 and the average sugar in the beet is 15.81 per cent. Our rejects from the mother beet analyses will give higher per cent than the average of all the commercial beets grown in the country. California has the highest per cent sugar in the beet of any state where they are grown commercially, 18.54 per cent while her tonnage is 10.72. The reader can make his own comparisons with South Dakota.

In conclusion, the work will be carried on at this Station, in order to learn the best conditions for growing both the beets themselves and for growing the seed.

It is evident that both industries, under proper management, will prove most profitable. We now have on hand a limited amount of home grown seed. But it will be useless for individuals to ask for samples. In the light of our past experience, it is evident that this would bring us nowhere. In certain communities where organized bodies are striving for factories would be a better place to send this high grade seed. What we need now is concentrated, intelligent effort.