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The Sugar Beet

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SOUTH DAKOTA

AGRICULTURAL COLLEGE

AND

EXPERIMENT STATION

BROOKINGS, SOUTH DAKOTA.

Bulletin No. 19.

DECEMBER, 1890.

DEPARTMENTS OF AGRICULTURE AND CHEMISTRY

THE SUGAR BEET.

PRESS PRINT, BROOKINGS.

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Departments of Agriculture and Chemistry.

LUTHER FOSTER, AGRICULTURIST.

JAS. H. SHEPARD, CHEMIST.

THE SUGAR BEET.

The Station began its work in the cultivation of the sugar beet three years ago, the single object of the experiment being to determine if the sugar beet, containing a per cent of sugar large enough for profitable manufacture, could be grown here in South Dakota. Methods of planting, fertilizing and cultivating came in as secondary matters only, those already established in France and Germany being followed as nearly as seemed practical for our new soil and higher priced hand labor. The high sugar per cent. being now satisfactorily settled, the attention of the Station may, in the future, be directed to the economic production of the crop.

SOIL.—In the matter of soil and climate our State meets fully the requirements laid down by those who have experimented on the subject. While it is claimed that there is no definite rule for the chemical composition of a soil suitable for the cultivation of the sugar beet and that the character for the purpose must be determined by actual trial, yet, a sandy loam with a subsoil of clay is universally recommended. This sandy loam, with few exceptions, is the soil found all over the State of South Dakota. Our soil also combines, to a remarkable degree, other characteristics essential to successful beet culture, viz.: a tillable depth of from twelve to fifteen inches, well drained, mellow in texture, not becoming hard or compact after rains and lending itself easily to tillage. In addition to this we have what may

be classed, in general, as an early soil, a point of much value in the full growth and maturity of the beet.

TEMPERATURE.—Temperature and rainfall exercise the most pronounced influence not only on the yield in tons per acre but also on the saccharine qualities. Authorities agree that a mean temperature near 70 degrees during the three summer months is that best adapted to sugar beet culture. Dr. Wiley, Chemist of the United States Department of Agriculture, in his bulletin on the Sugar Beet Industry, gives a map showing the sugar beet belt of the United States. This includes a zone 200 miles wide, extending 100 miles north and south of the mean isotherm of 70 degrees Fahr. for the three summer months of June, July and August for a period of ten years from '79 to '90. Of this zone he says, "By the kindness of the Signal office I have obtained a record of mean temperatures and precipitation for each month in the year for a period of ten years of those portions of the country in which the culture of the sugar beet is most likely to succeed. Also from the same source a tracing of the mean isotherm of 70 degrees Fahr. for ten years for the three months of June, July and August. Extending for 100 miles on either side of this line, the map shows a belt extending from the Atlantic to the Pacific, within whose limits the most favorable conditions for growing beets, as far as temperature alone is concerned, will be found.

The mistake must not be made of supposing that all the region included within the boundaries of this zone is suitable for beet culture. Rivers, hills and mountains occupy a large portion of it and much of the rest would be excluded for various reasons. On the other hand, there are many localities lying outside of the indicated belt, both North and South, where doubtless the sugar beet will be found to thrive. The map, therefore, must be taken to indicate only in a general way those localities at or near which we should expect success to attend the growth of sugar beets in the most favorable conditions other than temperature alone.

In respect to the rainfall it is necessary to call attention to the fact that a wet September and October are more likely to in-

jure a crop of sugar beets than a moderately dry July and August. A wet autumn succeeding a dry summer is almost certain to materially injure the saccharine qualities of the beet before it can be properly harvested. In this regard it will be seen from the tables of precipitation that the two Dakotas are more favorably situated than Oregon and Washington."

The map shows this line of 70 degrees mean temperature referred to, enters South Dakota on the East slightly South of 44 degrees Long., then tending northward it crosses the Missouri river just north of 45 degrees Long., thence directly South through the western part of the State. This map puts almost the whole State within the sugar beet belt.

RAINFALL.—The amount of rainfall necessary to the full development of the sugar beet, depends to a large degree on the character of the soil and temperature. Moisture sufficient to make the desired growth should come during the summer months, giving the last six or eight weeks of the season for sugar storing. The beet is less liable to be affected by dry seasons than most any other crop on account of its long root reaching far down into the soil, and in seasons of drouth the percentage of sugar is so much greater that it will largely make up for the shortage in yield.

Dr. McMurtrie in summing up climatic conditions says: "The conditions are in general, comparatively dry and warm spring months during the time for the preparation of the soil, planting and cultivating the crop; moderate temperature, abundant and frequent rains during the summer months, the time for the ultimate development of the crop and its valuable constituents; a cool, dry fall, the time for ripening, harvesting and storing the crop. If these conditions prevail, the results will be good, otherwise but medium or even bad."

It thus seems that so far as soil, temperature and rainfall are concerned, our conditions here in South Dakota are exactly right for the cultivation of the sugar beet and we may anticipate its adoption in the near future as one of our principal crops.

SOIL PREPARATION.—The soil used by the Station is the

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ordinary upland sandy loam of the Big Sioux valley and has been for twelve years under cultivation. A mechanical analysis made by the Station Chemist gave the following results:

Top Soil—Eight and one-half inches.

COMPOSITION.

- 31.5 per cent of pure sand.
- 11.5 per cent. of organic matter.
- 53.7 per cent. fine earth.
- 5.3 per cent. of pure clay.

Mixed soil, next under surface, six inches.

COMPOSITION.

- 33 per cent. of pure sand.
- 5.8 per cent. of organic matter.
- 56.4 per cent. of fine earth.
- 4.8 per cent. of pure clay.

Sub-soil, four inches.

COMPOSITION.

- 36.3 per cent. of pure sand.
- 4 per cent. of organic matter.
- 55 per cent. of fine earth.
- 4.7 per cent. pure clay.

The ground was plowed to the depth of eleven inches in the spring just before planting. Deep plowing is necessary to provide room for root growth entirely beneath the surface since any part that projects is of little value for sugar. If the plowing be done in the fall, the final preparation should be made at planting time, carefully avoiding any plowing or deep stirring that would cause a loss of the winter's accumulated moisture. Thorough preparation before planting is of prime importance. It is one of the chief factors of a good crop. Any neglect here will be a source of frequent annoyance and extra labor throughout the season.

FERTILIZING.—The land used for the experiment received an evenly distributed coating of well rotted barnyard manure the previous fall, put on at the rate of twenty-four cubic yards

per acre. An excessive quantity is not recommended, neither is fresh or partially decomposed manure desirable as the tendency would be to grow a large beet deficient in sugar content, the natural resultant of a period of growth too rank and too much prolonged for complete maturity. Foreign growers advise the application of manure to the crop preceding the beet, the latter coming in as a second crop after the application. Stable manure if applied directly should be plowed under in the fall and not more than fifteen to twenty tons per acre used.

PLANTING.—Experience teaches that the planting must be exceptionally well done to secure a desirable stand. The seed should go into the ground as early in May as the temperature will insure germination. It may be considered safe when the average daily temperature of the air reaches 50 degrees.

The French and German seed growers have increased the per cent. of sugar by the continued careful selection of "mother beets" for producing the seed, none being used that did not test a high per cent. of sugar. At present no seed should be used but that coming from foreign growers through responsible importers. Those who wish to grow trial plats the coming season will likely be able to secure the seed from the Agricultural Department at Washington. Mr. C. Kennedy Hamilton, Jr., Secretary of the Oxnard Beet Sugar Co., of Grand Island, Neb., writes that while it is not possible for him to engage to furnish any seed, if he has a surplus at the time of planting he will be pleased to do all in his power to serve the interest of the industry.

It matters not so much what method is followed in planting whether by hand, garden seeder or otherwise so the seed is put down into moist earth and covered at least one inch in depth. If this covering be well firmed it will assist in holding the moisture. Some have done this latter work satisfactorily with a loaded wheel-barrow. The porous shell encasing the seed makes an extra amount of moisture necessary to reach the real seed within and cause it to grow. Germination may be hastened by soaking the seed in water at a temperature of 120 to 135 degrees for twenty-four hours just before planting. They can easily be

made dry enough to plant with a machine by mixing them with plaster or dry soil.

It is claimed that the largest yield per acre both in per cent. of sugar and quantity of beets is obtained from thick planting where the rows are from fourteen to eighteen inches apart and the plants six to eight inches in the row. Here in South Dakota the high price of hand labor and cheapness of land would place the limit of planting at that width of row easily cultivated with horse implements. This is usually estimated at eighteen to twenty inches, but even twenty-four inches seems quite narrow for most of our cultivators. The Station rows were thirty inches apart with plants thinned to eight inches in the row.

Mr. E. L. Spurling, of this county, secured an excellent stand by using the Havanna Press Drill. He fastened small hoppers in the seed box over every fourth runner, thus making the rows, twenty-eight inches apart. The gauge was opened full width and the runners put down about two inches which left the firm bed covering about one inch thick. In this instance the planting was done in the latter part of May and the beets were up in seven days while in the Station planting done some days earlier and covered by hand, the beets were five days longer in coming.

The method adopted by Mr. Spurling makes the job of planting short and easy.

VARIETIES.—The seeds for all varieties tested this season, with one exception, came from French and German seedsmen. The Agricultural Department at Washington furnished the following varieties: Bulteau Desprez' Richest, Dippe's Vilmorin, Florimond Desprez' Richest, Dippe's Klein Wanzleben and Simon Legrand's White Improved. One variety came from the Oxnard Beet Sugar Company, and one from the Western Beet Sugar Company, of San Francisco.

CULTIVATION.—The early and often system of cultivation applies with emphasis to successful beet growing. This not only kills the weeds at starting but also forms a layer of fine mellow earth which constitutes an obstacle to dryness. The loosened layer acts as a mulch and tends to keep the soil below cooler.

while it prevents the water from reaching the surface to be evaporated.

One careful hoeing at the time of thinning will, under ordinary circumstances, be all the hand work required, the after cultivation being most economically done with the horse cultivator. The crop of the past season was twice hoed and four times cultivated. The implement used for the latter was an adjustable harrow toothed cultivator and its work was very effective. Cultivation was all completed by the 20th of July, the surface of the soil being left loose and free from weeds.

THINNING.—The time recommended for this work is soon after the appearance of the fourth leaf. It can best be done, with least injury to the plants left standing, just after a rain. A sharp hoe of proper width will greatly assist in this work by cutting across the row leaving a small bunch standing every six or eight inches. The cutting must be deep enough to prevent any aftergrowth from the roots cut off. The bunches left standing by the hoe must be reduced to single plants. This work should be carefully done so that the growth of the plant left standing will not be checked.

HARVESTING.—Just when the crop has reached its maximum in per cent. of sugar is a question not easily settled by any outward appearance of the beet. The test of the chemist is the only sure method. It is to the interest of both grower and manufacturer, where grown as a crop, that they stand in the field as long as a profitable increase of sugar continues. The test made for determining the maturity, detailed in another part of this Bulletin, showed a marked increase of sugar during the last few days of maturing.

The crop should be harvested and stored convenient for protection before there is danger of injury through freezing. In this respect they require greater care than other root crops. A temperature low enough to freeze the surface of the ground will destroy their keeping qualities. Where small quantities are grown a spade may be used in harvesting, care being taken not

to puncture or bruise them that the keeping qualities may be unimpaired.

STORING.—Sugar beets and mangels require the same treatment in storage. They should be placed in cool, moist cellars, making the piles not to exceed four or five feet in depth. In the dry cellars of Dakota it is best to cover with damp earth to prevent wilting. This will also help to protect from freezing. The dirt must be put directly on the beets, no straw or litter of any kind intervening. By the above method beets have been kept on the College farm in the best condition into June. For perfect storage the cellar should be kept at a temperature varying but little from 40 degrees Fah.

The following is the official advice of the Oxnard Beet Sugar Company, to its patrons on the subject of beet culture:

THE SUGAR BEET CULTURE.—In raising this vegetable the soil has to be carefully selected. The best is a deep rich soil with a subsoil, that allows the surface water to pass through. Although it requires a considerable quantity of moisture for its growth, it cannot bear standing water. It is advisable to select the best piece of land available, not too wet of course, but neither too dry. A sandy hill for instance might dry out too quickly. Land on which 35 bu. of corn to the acre can be raised will do.

WORKING THE SOIL.—To obtain growth it is best to plow deep, to allow the beet to extract as much as possible from the soil. But this can be done only gradually i. e. by plowing 1 to 2 inches deeper every year so to reach a depth of 12 to 14 inches. This method refers only to a deep soil. Where the soil is only 6 to 7 inches deep a subsoil plow must be used; thereby preventing the turning up of a dead subsoil. Land which has been plowed 12 inches deep in the fall, does not require to be plowed in the spring. When the plowing is finished, the land must be thoroughly worked with a heavy sharp harrow in order to get rid of all roots and trash. It should then be rolled as thoroughly as possible. when it will be ready for the sowing of seed.

For this purpose the implement dealers of Grand Island have in stock, hand sowing machines as well as larger ones for horses.

The seed should be planted in rows 16 to 18 inches apart, and not deeper than one inch. The machine to be set in such a way as to drop 18 to 20 pounds to the acre. The right time for sowing depends mainly on the climatic conditions of the locality, whether there is danger of heavy night frost or not. The sowing should not be too late, else the culture of the beets might interfere with the harvesting of small grain, and moreover the beet needs its time to get a hardy growth. The land to be planted should be divided into three parts, the first of which should be sowed down about the 20th of April, the second May 1st, and the last May 10th. Every sowing machine has a small roller to cover the seed, but it is much better to use the large roller.

The seed will take from ten to fourteen day to sprout. Two or three days after the young shoots appear, the soil between the rows should be loosened with a horse hoe about one inch deep, in order to keep out the weeds. After one or two days the land should be rolled again with the large roller, to prevent the air and sun from drying it out. This does not hurt the beets at all, except in the early morning, when there is dew on them. After a week's rest the beet will have its fourth leaf and then is the time to begin thinning them out. The quicker this is done the better for the growth of the beets and the yield of the crop. It must be done in the following manner: Hoe right across the row with a hoe four inches wide, in such a manner as to leave a bunch of four or five plants every six or seven inches. After one day's rest reduce the bunches by hand to one good plant. Children do very well for this work. When this is done the most important and disagreeable work is over, all that remains is to keep the land free from weeds. About a week after thinning out go through the field with horse hoe, working it two inches deep. Two weeks later repeat this, going possibly somewhat deeper. About the beginning of July the beets will have reached such a growth, that the leaves will entirely shade the ground and no more work is necessary until harvest."

NOTES ON TERMS AND METHODS USED IN ANALYSIS.

SAMPLING THE BEETS.—It is a well understood fact that individual beets belonging to the same variety and cultivated under the same conditions frequently vary very widely in their sugar content. This difference often amounts to three or four per cent. Large, over grown beets usually contain a low percentage of sugar. Likewise small, undeveloped beets are low in sugar content. Other circumstances being equal, medium sized beets are more likely to give a true average of the value of the crop than either the largest or the smallest specimens grown. As a rule the smaller beets when fully developed are high and, as previously stated, the largest are apt to be low in their per cent. of sugar. Of course exceptions may occur to any rule.

In this year's work all sending samples were requested to send six average beets of each variety. These beets were arranged in order when they reached the laboratory and four average sized beets from every lot were taken for analysis. This was done in order to avoid giving out results that were either to high or too low. An average result was sought for that would be as near the truth as it is possible to arrive by means of such a limited number of analyses. In case four beets or less were sent by any one person they were all used for analysis. Perhaps it would be permissible to note here that to those sending less than six beets, other motives than a desire to secure either high or low results, must be attributed, since we certainly have no experts among us who could approximate with any degree of accuracy the sugar content of any of the samples sent.

PER CENT. OF SUGAR IN THE WHOLE BEET.—This was determined as follows: From each individual of the variety under analysis, the crown was cut off and rejected. Then a longitudinal prism was reserved from the center of each beet by slicing off the sides of the beet. These prisms were then grated on an ordinary tin grater and the gratings were thoroughly mixed. A sample of the pulp thus obtained was accurately weighed out into a tared dish and used for analysis. The actual amount used was in each case 36.048 grams or the normal weight for the fine Schmidt & Haensch double wedge compensation, half-shadow saccha. imeter subsequently used in the polarization of the sample. This pulp was now transferred to a filtering tube and by means of 35 per cent alcohol was completely extracted in a Soxhlet's apparatus. Basic lead acetate was next added to clarify the solution which was then diluted up to exactly 100cc. filtered into a narrow necked flask to avoid evaporation and then polarized with the usual precautions. This method gives results that are accurate.

MARC.—By this term is meant the dried chips remaining after the sugar and juice have been extracted. This determination was made by drying to a constant weight the contents of the filter tubes and returning the results in per cent. of the whole beet. The results are accurate.

SUGAR IN THE JUICE.—This was calculated from the data already obtained and the results are accurate.

DEGREE BRIX.—As soon as the sample for extraction was weighed out, the remainder of the pulp was placed in a strong canvas bag and the juice forced out by pressure. The juice was now placed in a tall jar and the temperature reduced exactly to 69 degrees F when the reading of the Brix spindle was taken. This determination is but a crude one at best, and especially was this the case in the overheated basement rooms in which the Experiment Station laboratory is situated. The uncontrollable heat from the steam feed pipes passing through the room must of necessity cause some evaporation from the finely divided pulp. This would tend to condense the juice and give too high a reading. It is apparent that too high a degree Brix will give a purity co-efficient too low. But it was thought that in the present stage of the sugar beet problem in South Dakota, especially when the meagre data obtainable from those sending samples, were taken into considera-

tion, more emphasis should be placed upon an accurate determination of other data.

PURITY CO-EFFICIENT.—The Brix spindle is so graduated that it shows approximately the per cent. of sugar in a solution of pure cane sugar in water. But this instrument has come into quite extended use in sugar factories, where it has been used for solutions, such as cane juice and beet juice, which are manifestly sugar. Hence its readings in such cases are still more at fault. But it has become not pure somewhat customary to determine the so-called purity co-efficient by dividing the sugar in the juice by the degree Brix. It is evident from what has been said that the results so obtained in the present case are too low.

RESULT OF THE SEASON'S WORK.—Owing to the great interest which now is awakening throughout the sugar beet belt, it was decided to investigate all available data tending to throw light upon this economic problem. At the beginning of the season nearly one hundred samples of seed were distributed throughout the state. Farmers were requested to note characteristic features of soil, cultivation and such other matters as would go to prove or disprove the adaptability of various sections of the state for sugar beet culture. In the results obtained from those to whom seed was sent much disappointment is felt. But an insignificant number of those receiving seed have responded at all. Some of those who have responded have sent no samples, giving as reasons that they planted the seed too shallow and it failed to grow; that the beets did not grow so large as they expected; that they wanted the beets to try for eating purposes; for stock feeding, etc., etc.

Many have received seed from the Department of Agriculture at Washington and some of these have sent in samples until with what was raised at this Station and with what came from those that received seed from this Station and from other sources, quite a respectable number of samples have been received. While the information is valuable that has been thus collected it might have been much more valuable had the farmers co-operated with the Station in a more careful manner. In most every case, as will appear from an inspection of the results given, the data were not complete.

MATURITY OF THE BEET AND THE SUGAR CONTENT.—It is not an easy matter for inexperienced cultivators to decide just when the sugar beet has completely ripened. It is important to

determine this fact since immature beets are manifestly poor in every desirable respect.

It is generally conceded that the last few days before ripening add materially to the sugar content of the beet. In localities where fall rains are copious and warm weather prevalent, there is danger of second growth setting in and this results in the injury of the beet. But with our dry fall weather, our warm days and cool nights, it seems there should be found the ideal conditions for the safe and complete ripening of the sugar beet.

In order to throw as much light as possible upon this question, it was decided to analyze at different intervals one of the seven varieties grown by the Station. But before beginning the work the difficulties in the way of depending upon a chemical analysis alone were taken into consideration. First there is the fact of the variation between individuals to be considered, and secondly there remains the great difficulty of securing an average sample of the variety under consideration. So in addition to the work in the laboratory I made it a point to examine the samples as they were growing in the Station plat.

The variety chosen was Dippe's Vilmorin and the first analysis was made on October 9th when all the samples were still growing. All the varieties raised at the Station were planted May 16th, and the samples were analyzed within a few hours after harvesting. The samples were not taken consecutively from those beets growing side by side but were taken from different points in the row. In the case of the variety used in this investigation every precaution was taken to have the samples selected for analysis as uniform among themselves as possible thus endeavoring to make the results indicate the same average. The results of this analysis, Station Number 18, were as follows, the numbers expressing per cents:

Sugar in whole beet	13.70
Sugar in juice.....	14.40
Marc	4.75
Degree Brix.....	19.00
Purity co-efficient.....	76.26

Four days later, October 13th, this same variety, Sta. No. 19, analyzed as follows:

Sugar in whole beet.....	14.50
Sugar in juice.....	15.21
Marc.....	4.67
Degree Brix.....	19.40
Purity co-efficient.....	78.40

This shows a slight rise in the sugar content, but the difference lies plainly within the varietal limit. Oct. 17th, the analysis, Sta. No. 26, of the same variety gave:

Sugar in whole beet.....	15.50
Sugar in juice.....	16.28
Marc.....	4.87
Degree Brix.....	21.20
Purity co-efficient.....	76.79

This analysis shows an increase over the preceding by one per cent. and the beets still growing began to give evidence that they were approaching maturity. But as the weather still continued fine it was thought best to wait a few days longer. October 21st the same variety, Sta. No. 23, gave the following results:

Sugar in whole beet.....	16.60
Sugar in juice.....	17.39
Degree Brix.....	21.50
Marc.....	4.52
Purity co-efficient.....	80.88

The last four days gave an increase over the preceding analysis of over one per cent of sugar and this analysis shows an increase over that of October 9th by nearly three per cent. Moreover the purity coefficient had risen by over four per cent since the 9th. Now as the beets were showing more decided signs of maturity it was thought expedient to analyze the remaining six varieties, grown on the Station plats. The following results were obtained October 22nd:

Sta No.	NAME OF VARIETY.	Per Cent. Sugar in whole beet	Per Cent. Sugar in Juice.	Per Cent. Marc.	Degree Brix.	Purity Coefficient
30	Oxnard*	17.85	18.77	4.93	22.60	83.08
31	Pajaro Valley.....	14.65	15.36	4.64	20.40	75.29
32	Simon Legrand's white improved.....	15.55	16.34	4.85	20.80	78.56
33	Florimond Desprez' Richest.....	13.15	13.67	3.83	17.80	76.80
34	Dippes Klein Wanzleben.....	16.15	16.93	4.58	20.80	81.39
35	Bulteau Desprez' Richest.....	14.75	15.42	4.36	19.70	78.27

*NOTE.—The name of this variety is unknown to me. The seed was received from the Oxnard Co., Grand, Island, Neb. J. H. S.

Three days later, October 25th, Dippe's Vilmorin, Sta. No. 36, was again analyzed. This was a fine sample and averaged rather better than any of the previous samples. It gave:

Sugar in whole beet.....	17.00
Sugar in juice.....	17.93
Marc.....	5.20
Degree Brix.....	22.40
Purity co-efficient.....	80.06

On October 29th Station No. 37, the same variety was analyzed. This sample was as much below the average as the preceding one was above. Nos. 2 and 3 were decidedly off type. Nos. 1 and 6 were rejected from the regular sample on account of their size. While the regular sample was extracting, 1 and 6 were prepared, grated, and the juice expressed and tested. Thus was obtained sugar in juice 20.00; Degree Brix 24.80. The regular sample gave:

Sugar in whole beet.....	15.55
Sugar in juice.....	16.40
Marc.....	4.93
Degree Brix.....	20.80
Purity co-efficient.....	78.84

It now became apparent that so far as might be determined by chemical analysis the beets raised on the college farm had passed maturity some days since, probably between the 15th and 20th of October. Moreover the appearance of the beets left in the field confirmed the same result.

As the weather continued fine the remaining beets were left standing until October 30th, when a heavy frost occurred. The other six samples were brought to the laboratory for analysis on that date and a sample of all seven varieties were forwarded to the Department of Agriculture at Washington. In this connection it may be stated that all samples, for analysis from the college farm were selected by Mr. Copeland, the Farm Foreman.

The samples sent to this laboratory analyzed:

Sta No.	NAME OF VARIETY.	Per Cent. Sugar in Beet.	Per Cent. Sugar in Juice.	Per Cent. Marc.	Degree Brix.	Purity Co-efficient
38	Oxnard.....	16.80	17.64	4.76	21.80	80.92
39	Pajaro Valley.....	14.69	15.35	4.85	19.80	77.53
40	Simond Legrand..	17.25	18.19	5.17	22.40	81.21
41	Florimond Desprez	12.90	13.45	4.12	17.40	77.30
42	Dippes Klein Wanzleben.....	17.30	18.22	5.04	21.00	86.76
43	Bulteau Desprez..	14.99	15.62	4.60	19.70	79.29

These samples were all good except No. 38, in which two beets, Nos. 2 and 3 were forked and off type. The samples sent to Washington gave the following analyses as returned by Dr. Wiley, the Department Chemist:

Dept Ser. No.	VARIETY.	Average weight of Beets—Grams	Cane Sugar—Per Cent. of Beets	Cane Sugar—Per Cent of Juice.	Ash—Per Cent of Juice.	Co-efficient of Purity.	Saline Co-efficient.
8116	Bulteau Desprez						
	Richest.....	570	14.92	15.70	1.68	84.00	14.54
8117	Dippes' Vilmorin..	390	15.11	15.90	.86	84.10	18.49
8118	Oxnard Factory...	328	16.91	17.80	.85	91.28	20.70
8119	Pajaro Valley.....	418	13.68	14.40	1.00	76.60	13.33
8120	Florimond Desprez						
	Richest.....	585	12.35	13.00	1.67	85.00	7.28
8121	Klein Wanzleben..	556	14.44	15.29	.....	89.40	.....
8122	Simond Legrand...	451	13.49	14.29	.....	87.10	.....

It will be noticed that Dr. Wiley's analyses give an average of about one per cent. less of sugar in the beet than the analyses made by this Station. It will also be noticed that the purity co-efficients are higher. These differences are partly due to varietal variations and partly to different methods of analysis.

SUGAR AND PURITY.—Can these factors be favorably affected by any inexpensive treatment in the field? It is stated that in certain climates this may be done as follows: The beets are harvested and the tops are left on. The beets are then arranged in long shallow piles with the tops outward. On these piles a shallow covering of dry earth is then placed, leaving the tops exposed. The theory is that the tops continue to increase the sugar content under such circumstances.

On October 22nd while the weather was most favorable' samples of all seven varieties grown on the farm were pulled and thus treated. These samples were left until the 31st of October when they were brought to the laboratory for analysis. They resulted as follows:

Sta. No.	VARIETY.	Per Cent. Sugar in	Per Cent. Sugar in	Per Cent. Marc.	Degree Brix.	Purity Co-efficient.
		Beet.	Juice.			
44	Oxnard.....	18.90	19.98	5.39	24.60	81.82
45	Pajaro Valley.....	16.00	16.78	5.26	22.00	76.27
46	Simon Legrand.....	15.50	16.32	5.01	19.70	82.82
47	Florimond Desprez.....	15.90	16.80	5.34	20.50	81.95
48	Dippe's Klein Wanzleben.....	18.85	19.39	5.71	24.70	80.93
49	Bulteau Desprez.....	19.50	20.94	6.87	27.20	76.99
50	Dippe's Vilmorin.....	18.00	19.00	5.24	24.00	79.17

At first glance it would seem that the apparent gain of two per cent shown by the average of these analyses over the averages of October 22nd and 30th, indicated that some such results as those claimed had ensued. But the purity co-efficient has not risen and the samples had wilted somewhat. Therefore, a simple loss of water would account for any difference here noticed. Hence it is fair to conclude that nothing is gained and nothing is lost by piling the beets as described.

The following table shows the weights of the individual beets from the college farm used in the preceding analyses :

Sta No.	VARIETY.	No. 1.		No. 2.		No. 3.		No. 4.	
		lbs	oz.	lbs	oz.	lbs	oz.	lbs	oz.
		18	Dippes' Vilmorin.....	1	$\frac{3}{4}$	1	$3\frac{1}{2}$	1	$8\frac{3}{4}$
19	do do.....	1	$2\frac{1}{2}$	1	$2\frac{1}{2}$	1	$3\frac{3}{4}$	1	$14\frac{3}{4}$
26	do do.....	1	$2\frac{1}{2}$	1	$5\frac{1}{2}$	1	$4\frac{1}{2}$	1	$12\frac{1}{2}$
28	do do.....	..	12	1	$1\frac{3}{4}$	1	$2\frac{3}{4}$	1	$5\frac{1}{2}$
30	Oxnard.....	1	4	1	$5\frac{1}{2}$	1	9	1	$14\frac{1}{2}$
31	Pajaro Valley.....	1	3	1	3	1	$11\frac{1}{2}$	2	5
32	Simon Legrand.....	1	$2\frac{1}{2}$	1	8	1	12	1	$10\frac{1}{2}$
33	Florimond Desprez.....	1	$5\frac{3}{4}$	1	$7\frac{1}{4}$	1	$11\frac{1}{4}$	1	$1\frac{1}{4}$
34	Dippe's Klein Wanzleben.....	1	$1\frac{3}{4}$	1	3	1	$8\frac{1}{2}$	1	$6\frac{1}{2}$
35	Bulteau Desprez.....	1	$1\frac{3}{4}$	1	$7\frac{3}{4}$	1	9	1	$14\frac{1}{4}$
36	Dippe's Vilmorin.....	1	$1\frac{1}{2}$	1	$4\frac{1}{4}$	1	$3\frac{1}{2}$	1	$8\frac{1}{2}$
37	do do.....	..	$12\frac{1}{2}$	1	$1\frac{1}{4}$	1	1	1	$1\frac{1}{4}$
38	Oxnard.....	..	12	1	$2\frac{1}{2}$	1	$14\frac{1}{4}$	2	$2\frac{1}{2}$
39	Pajaro Valley.....	..	12	1	$2\frac{3}{4}$	1	$5\frac{1}{2}$	2	$3\frac{1}{4}$
40	Simon Legrand.....	..	$13\frac{3}{4}$	1	$1\frac{1}{2}$	1	1	1	$5\frac{3}{4}$
41	Florimond Desprez.....	..	10	..	13	1	$11\frac{1}{2}$	2	$5\frac{1}{2}$
42	Dippes' Klein Wanzleben.....	..	$14\frac{3}{4}$	1	1	1	$5\frac{1}{2}$	1	$3\frac{3}{4}$
43	Bulteau Desprez.....	..	$12\frac{1}{2}$	1	$1\frac{1}{4}$	1	$2\frac{3}{4}$	1	$10\frac{3}{4}$
44	Oxnard.....	1	$6\frac{1}{2}$	1	$3\frac{3}{4}$	1	$8\frac{3}{4}$	2	$2\frac{3}{4}$
45	Pajaro Valley.....	1	1	1	9	1	14	1	15
46	Simon Legrand.....	..	$14\frac{1}{2}$	..	14	2	$2\frac{1}{2}$	2	$3\frac{1}{2}$
47	Florimond Desprez.....	..	13	..	9	1	8	1	13
48	Dippes' Klein Wanzleben.....	..	$11\frac{1}{2}$	..	13	1	$2\frac{1}{2}$	1	$5\frac{3}{4}$
49	Bulteau Desprez.....	..	$11\frac{3}{4}$	..	$14\frac{3}{4}$	..	$13\frac{1}{2}$	1	3
50	Dippes' Vilmorin.....	..	12	1	$4\frac{1}{4}$	1	7	1	13

WEIGHT OF SUGAR BEETS.—An inspection of the foregoing table will show that medium sized sugar beets vary from about one to two pounds in weight. From the method of selecting these beets for analysis it will be readily understood that some beets are smaller and some are larger in each variety.

FROM THE STATE AT LARGE.—The value of the results obtained from the state at large is materially lessened by the scarcity of details as to methods of cultivation, yield per acre, names of varieties, and other facts tending toward exact experimentation. But it seemed best to analyze all samples sent since the analyses would show at least with what result sugar beets in general, so far as the sugar content is concerned, could be grown. Together with the analysis of each sample is given all the information obtained. No fertilizers were used on any of the samples.

Station Nos. 20 and 29 were sent by Mr. I. C. Wade of Jamestown, N. D. The samples were of the same variety, but the first reached the station in bad condition. The seed was obtained from the Secretary of Agriculture, Washington. Mr. Wade had forgotten the name of the variety. The beets were planted May 20th, and were harvested September 30th. In all probability the beets were unripe. They were grown on bottom land a few rods from the James river, and five miles south of Jamestown. They were hoed and weeded three times, and no fertilizers were used. The beets were planted in rows eighteen inches apart and the beets stood from two to eight inches apart in the row. They yielded at the rate of 36,000 pounds per acre, with a fair stand of crop. The beets analyzed weighed in No. 20 respectively 15, $16\frac{3}{4}$, $28\frac{3}{4}$ and $21\frac{3}{4}$ ounces; No. 29, 12, $15\frac{1}{2}$, 19 and $18\frac{3}{4}$ ounces. The analyses were:

	Sta. No. 20. Per Cent.	Sta. No. 29. Per Cent.
Sugar in beet.....	19.10	10.45
Sugar in juice.....	10.52	10.96
Mare.....	4.65	4.64
Degree Brix.....	15.00	15.20
Purity Co-efficient.....	70.13	72.10

Station No. 21 came from J. J. Nierling, Jamestown, N. D. He obtained the seed, Dippe's Klein Wanzleben, from Secretary Rusk. The seed was planted May 10th and the beets harvested

October 7th. It is doubtful if these beets were ripe. The seed was planted between rows of small trees, 8 feet apart and were thoroughly cultivated. The analysis gave: Weight of beets, $14\frac{1}{2}$, $16\frac{1}{4}$, $21\frac{3}{4}$, and 24 ounces.

Sugar in beet.....	11.70
Sugar in juice.....	11.15
Marc.....	4.15
Degree Brix.....	16.40
Purity Co-efficient.....	68.00

Station Nos. 22 and 23 were from G. W. Garrett, Boz, S. D.

Both were planted May 1st and harvested October 13th. They grew in a black loamy soil, and had shallow cultivation, being kept perfectly clean from weeds. Rows three feet apart, and beets five inches apart in row, good stand of crop. The samples reached the station in good condition and analyzed as follows:

Sta No.	Variety	Seed obtained from.	Weight of Beets—oz.	
			No. 22.	No. 23.
22	Oxnard	S. D. Ex. Sta.	$11\frac{1}{2}$, 13.	18, 22.
23	Vilmorin's White Imp.	Crete, Neb., Seedsman.	$9\frac{3}{4}$, $18\frac{3}{4}$, 16.	$25\frac{3}{4}$
			Per Cent.	
			No. 22.	No. 23.
Sugar in beet.....			15.20	7.70
Sugar in juice.....			16.90	7.93
Marc.....			5.98	2.91
Degree Brix.....			20.60	13.20
Purity Co-efficient.....			77.67	69.07

NOTE.—The beets of No. 23 were covered with warty excrescences.

Station No. 24 came from Dr. S. S. Wentworth, Cresbard, Faulk Co., S. D. The seed was planted May 24th, on bottom land between trees one year old, in rows $3\frac{3}{4}$ feet apart, and the beets stood 16 inches apart in the row. The beets were cultivated when the trees were cultivated, and were harvested Oct. 9th. No other data given. The analysis is: Weight, $22\frac{1}{2}$, 30, $34\frac{1}{2}$, and $44\frac{1}{2}$ ounces.

Sugar in beet.....	13.20
Sugar in juice.....	13.85
Marc.....	4.73
Degree Brix.....	18.85
Purity Co-efficient.....	74.86

NOTE.—These beets were probably not mature, and are a large variety of great promise. It is a pity nothing further is known of them.

Station No. 25 was sent by R. C. McKenney of Watertown, S. D. The beets, a large reddish variety, were grown on Uria

Skinner's farm, and the seed was obtained from Mr. Lucas, proprietor of the Kiote seed store, Watertown. They yielded 24,000 pounds per acre. No farther information was obtainable. The analysis is: Weight, 27, 50, 49 $\frac{3}{4}$, and 58 ounces.

Sugar in beet.....	10.95
Sugar in juice.....	11.27
Marc.....	3.80
Degree Brix.....	15.60
Purity Co-efficient.....	72.24

Station No. 27 was sent by A. Harkins of Gary. These beets were planted June 10th and harvested October 17th. The ground had been worked six years without manuring. The beets were cultivated twice and hoed twice. The rows were three feet apart and the beets six inches apart in the row. The season was dry and the stand thin, yielding 6,000 pounds per acre. The weight of the beets analyzed were: 22 $\frac{1}{4}$, 20 $\frac{1}{2}$, 26 $\frac{1}{2}$, 30 $\frac{3}{4}$ oz.

Sugar in beet.....	9.80
Sugar in juice.....	10.17
Marc.....	3.63
Degree Brix.....	14.80
Purity Co-efficient.....	68.72

Station No. 51 was supposed to have been sent by S. F. Corwin of Jamestown, N. D. The beets are of a large pinkish variety. Nothing further is known of this sample. Weight of beets analyzed: 30 $\frac{1}{2}$, 34, 49, 45 $\frac{1}{2}$ ozs.

Sugar in beet.....	8.40
Sugar in juice.....	8.69
Marc.....	3.34
Degree Brix.....	14.50
Purity Co-efficient.....	59.95

Station No. 52 came from J. S. Vandenberg, Huron, S. D. He obtained the seed from the Western Sugar Co., San Francisco, Cal. The beets were a white variety, slightly wilted, and only three were sent. No other information was to be had. Weights of beets: 29, 41, 43 $\frac{1}{4}$ ozs.

Sugar in whole beet.....	12.40
Sugar in juice.....	12.91
Marc.....	3.94
Degree Brix.....	18.60
Purity co-efficient.....	71.72

Station No. 53 came from E. T. Sheldon, St. Lawrence, S. D. The seed came from Secretary Rusk and was of the variety

Dippe's Klein Wanzleben. Planted May 20th, harvested Oct. 8th. Soil a sandy loam, rather black in color. The rows were three feet eight inches apart and beets two to six inches apart in the row. The ground was plowed and harrowed and marked with a corn marker; seed dropped by hand and covered from 1 to $1\frac{1}{2}$ in. deep. Cultivated same as corn. So dry seed did not come up till late. When rain came had to weed by hand. No rain after July 8th. The beets were stored in root cellar with tops on till Nov. 3, when they were sent to the Station. Yield 12,000 lbs. with thin stand of crop. Undoubtedly the beets were not mature. Weights of samples; $14\frac{1}{2}$, 14, $18\frac{3}{4}$, $25\frac{3}{4}$ oz.

Sugar in whole beet.....	12.00
Sugar in juice.....	12.54
Marc.....	4.28
Degree Brix.....	17.60
Purity co-efficient.....	71.25

Station No. 54 came from A. O. Johnson of Montrose, S. D. The seed was obtained from this Station and was of the Oxnard variety. Planted May 20th, and harvested October 14th. The soil was dark bottom land of the east Vermillion valley. The beets were preceded by one crop of corn and two of flax. Land plowed eight inches deep. Beets hoed once and cultivated twice. Rows thirty inches, beets eight inches. Beets were dug and kept in dirt until Nov. 6th. Mr. Johnson says: "Seed excellent but injured by dry hot winds. Hard frost September 2d. The soil of this valley appears to differ from that of other valleys in the state. More muck and less sand than in the Sioux valley. I should like to have the soil analyzed." [NOTE: It is possible that the soil contains too much muck to raise good sugar beets. I shall be pleased to analyze the soil next spring.— J. H. S.] The stand of the crop was good and the yield 15,000 pounds per acre. Beets weighed $13\frac{1}{4}$, $18\frac{1}{2}$, $17\frac{1}{2}$, 28 ozs.

Sugar in whole beet.....	10.10
Sugar in juice.....	10.50
Marc.....	4.65
Degree Brix.....	15.40
Purity co-efficient.....	68.77

The next fourteen samples were sent by N. T. Smith, Huron, S. D. Of these samples Mr. Smith raised ten in the immediate vicinity of Huron. They were planted June 5th, (too late a

(late for planting,) and harvested October 24th. They were kept in a cellar until Nov. 11th, when they were sent to this Station. They were cultivated with a garden hoe only and the rows were eighteen inches apart and the beets six inches in the row. In most cases only one beet was sent for analysis. The data given are very meagre. Sta. No. 59 yielded twelve tons per acre with only two-thirds stand of crop. The seed is marked from Secretary Rusk; but this is evidently a mistake as will appear from the analysis. It is probable that Nos. 59 and 60 are confused.

Nos. 62 and 65 were raised by H. G. Wolf, Huron. Rows eighteen inches, beets ten inches apart. No. 64 was raised by Mr. Graves, seven miles north of Huron, and No. 73 by Dr. Collins, nine miles east of Huron. No. 66 was raised by Mr. Rowland of Tracy, Minn.

The following table will give the remaining data :

Sta No.	VARIETY.	Character of Land.	Condition of Sample.	Weight of Samples—oz	Per Cent Sugar in Beet	Per Cent sugar in Juice	Per Cent. Mure.	Degree Brix.	Purity Co-efficient.
55	White improved.....	Sandy loam, new.	Good.	35	13.20	13.82	4.52	19.00	73.
56	Quedlin berg.....	do	Wilted.	14½	11.20	11.78	4.93	19.50	61.
57	Vilmorin's improved	Old land.	Good.	22½	9.50	9.94	4.44	15.90	63.
58	Quedlin berg.....	Old land.	Wilted.	22¾	12.45	13.11	5.06	19.40	68.
59	Florimond Desprez?	Sandy loam, new.	Wilted.	32	4.50	4.62	2.74	11.00	42.
60	Lanes' improved?....	Old land.	Wilted.	16½	8.55	8.74	4.45	11.50	60.
61	Vilmorin's.....	New land.	Wilted.	21½	14.10	14.84	4.39	19.50	76.
62	Quedlin berg.....	Old land.	wilted and blackened	24	13.35	14.06	5.06	21.05	67.
63	Dippes' Klein Wanzleben.....	Sandy loam, new.	Wilted.	13¾	14.00	14.84	5.68	21.00	77.
64	Quedlin berg.....	Black loam, new.	Good.	21½	11.35	11.92	4.83	17.50	68.
65	Vilmorin.....	Sandy loam, old.	Off type.	13¾	6.35	6.59	3.76	12.50	53.
66	Le Maires.....	.....	Good.	11¾, 17	13.95	14.87	6.18	22.00	68.
67	Le Maires.....	.....	wilted and wounded.	11¾	19.90	21.52	7.54	28.00	77.
73	Quedlin berg.....	Old land.	Wilted.	11½, 16½, 17, 16	16.75	17.91	6.46	23.80	75.

Station Nos. 68 and 69 were sent by S. W. Narregang of Aberdeen, S. D. No data were obtainable for these. No. 68 was a white variety and the samples weighed: 15, 17½, 23¾ ozs. No. 69 was a reddish variety and the samples weighed: 16, 17½, 20¾, 19 ozs.

	No. 68. Per Cent.	No. 69. Per Cent.
Sugar in beet.....	15.55	8.55
Sugar in juice.....	16.48	8.84
Marc.....	5.66	3.26
Degree Brix.....	23.00	15.20
Purity Co-efficient.....	72.00	58.00

Station Nos. 70 and 71 came from James Holes, Fargo, N. D. The seed was obtained from Secretary Rusk and was planted May 31st in black vegetable mold that was heavily manured three years ago. The seed was sown with a garden drill in rows sixteen inches apart and cultivated with a garden hoe. The beets were grown on the North Dakota Experiment Farm, and were harvested October 16th and stored till November 10th. The samples were good. No. 70, weights: 13¾, 15¾, 15½, 18½ oz; No. 71: 15, 24, 25½, 30 ounces.

Sta No.	VARIETY.	Per Cent. Sugar in Beet.	Per Cent. Sugar in Juice.	Marc	Degree Brix.	Purity Co-efficient
70	Dippes Klein Wanzleben	12.40	12.98	4.54	17.50	74
71	Lemaire's Richest.....	12.45	13.06	4.23	17.80	73

Station No. 72 was from A. D. Coleman, Stirling township, Brookings county. He obtained the seed from Secretary Rusk, and the variety is Dippe's Klein Wanzleben. The seed was planted May 15th, and the beets were harvested October 15th. The soil was fairly good garden soil; the rows were eighteen inches apart and the seed was sown with a hand drill and cultivated by means of the attachments belonging to the same. The yield was 15,000 pounds per acre with a good stand of crop. Samples weighed 11, 15, 16 and 18 ounces.

Sugar in whole beet.....	16.13
Sugar in juice.....	17.15
Marc.....	5.85
Degree Brix.....	20.00
Purity co-efficient.....	78.00

Station No. 74 was put into the express office at Faulkton. Nothing further is known of it. The samples were wilted. Weights, 13½, 15¼, 17½ and 19¼ ounces.

Sugar in whole beet.....	18.50
Sugar in juice.....	19.61
Marc.....	6.02
Degree Brix.....	25.20
Purity co-efficient.....	77.81

Station No. 75 came from H. C. Preston, Mitchell, S. D.

The seed came from Secretary Rusk and was planted May 1st, on sandy loam, with a hand drill in rows three feet apart, with beets 10 inches apart in the row. The beets were cultivated four times and hoed once by hand, and were kept clean from weeds. The samples were received at the laboratory Nov. 5th, and were wilted and blackened. Yield, ten to twelve tons per acre with a good stand of crop. Weights of samples, 19¾, 23½, 22¾, and 26 ounces. Name of variety unknown.

Sugar in whole beet.....	18.40
Sugar in juice.....	19.64
Marc.....	6.31
Degree Brix.....	27.50
Purity co-efficient.....	71.65

VALUE OF VARIETIES.—Where everything is yet to be determined it will be necessary to ascertain what variety or varieties of beets are best adapted to our soil or climate. The following table, compiled from the results of the season's work, will show what the different varieties have done this year under all the different conditions to which they have been subjected. The results given are averages and may be fairly taken to represent what may be expected should the sugar beet industry become an established industry in this state. It is to be regretted that so many samples were entirely thrown out of this computation, thus causing some of the best results to go for naught, owing to the neglect of those raising samples.

From an inspection of the following table it will appear that the variety obtained from the Oxnard Co. and the Bulteau Desprez give the highest per cent of sugar, while the Pajaro Valley leads all others in the yield of sugar per acre. But it is safe to say that any of the varieties enumerated in the foregoing table would do well on soil similar to that of the Experiment Station plat where the sugar beets were planted this year. We have a right to expect that beets of the Klein Wanzenleben type would do

well in South Dakota. In fact if the average yield as obtained at this Station, had not been reduced by less careful cultivation in different hands, better reports would follow for this variety.

Little can be said in favor of the ordinary American grown seed called by courtesy sugar beet seed. In fact all tests at this Station have shown that they are little better than ordinary mangel wurtzels. We must procure our seed from eminent breeders at first, but our greatest need at present is for reliable American grown seeds, propagated from pedigreed beets.

Before leaving the subject of varieties it might be well to say that according to the evidence of this year, any of the varieties enumerated contain a per cent of sugar sufficiently high to make the beet sugar industry a paying one. The tests of this year show an average somewhat higher than the German average, according to the latest reports received at this Station. The results of another year may be looked for with great hopes.

VARIETY.	Actual Results for 1890.						Computed on 100 per cent stand	
	No. of Analysis.	No. of Beets Analyzed	Average weight of Beets—oz.	Per Cent. Sugar in Beets.	Yield of Beets per acre—pounds.	Total Sugar per acre—pounds.	Yield of Beets per acre—pounds	Yield per acre of Sugar—pounds.
Lemaire's Richest.....	3	7	10	15.42				
Oxnard.....	4	16	22	16.41	13000	2131	4275	5808
Pajaro Valley.....	3	12	25	15.08	20550	3114	4830	7320
Simon Legrand's white improved.....	3	12	21	16.10	14712	2359	3770	4433
Florimond Desprez's Richest.....	3	12	24	13.98	16498	2306	36371	5080
Quedlin berg.....	5	24	12	13.05				
Dippe's Klein Wanzleben.....	2	23	17	14.70	16400	2411	38800	5704
Dippe's Vilmorin.....	2	23	20	15.84	14420	2234	32711	5060
Bulteau Desprez's Richest.....	3	12	19	16.38	16311	2672	4207	6880

SUMMARY OF THE ANALYSES.—The following table will show the most important data obtained by this year's work. In case any other information is desired concerning any one sample it may be found in the body of the report, by means of the station number.

Sta. No.	VARIETY.	LOCALITY.	No. Beets Analyzed.	Per Cent Sugar in Beets	Percent sugar in Juice	Per Cent. Marc.	Degree Brix.	Purity Co-efficient.
18	Dippe's Vilmorin	Brookings.	4	13.70	14.49	4.75	13.00	76.25
19	do	do	4	14.50	15.21	4.67	19.40	77.40
20	do	Jamestown, N. D.	4	19.19	10.52	4.05	15.00	71.13
21	Dippe's Klein Wanzleben	do	4	10.70	11.15	4.15	16.40	68.00
22	Oxnard	Boz.	4	15.20	16.03	5.08	20.60	77.62
23	Vilmorin's Improved White	do	4	7.70	7.93	2.94	13.2	60.07
24	do	Cresbard.	4	13.23	13.85	4.73	18.53	71.86
25	do	Watertown.	4	10.95	11.27	3.80	15.60	72.24
26	Dippe's Vilmorin	Brookings.	4	15.50	15.28	4.87	21.2	75.78
27	do	Gary.	4	9.80	10.14	3.65	14.80	68.72
28	Dippe's Vilmorin	Brookings.	4	16.60	17.34	4.52	21.53	81.78
29	do	Jamestown, N. D.	4	10.45	10.96	4.64	15.29	72.10
30	Oxnard	Brookings.	4	17.85	18.77	4.93	22.60	83.98
31	Pajaro Valley	do	4	14.05	15.36	4.61	23.49	75.29
32	Simon Legrand	do	4	15.55	16.34	4.15	23.80	78.56
33	Florimond Desprez	do	4	13.15	13.67	3.83	17.80	70.80
34	Dippe's Klein Wanzleben	do	4	16.15	16.34	4.58	23.80	81.37
35	Bulteau Desprez	do	4	14.75	15.42	4.36	19.70	79.27
36	Dippe's Vilmorin	do	4	17.90	17.93	5.23	22.40	83.96
37	do	do	4	15.55	16.40	4.93	23.80	78.84
38	Oxnard	do	4	16.80	17.64	4.73	21.89	81.92
39	Pajaro Valley	do	4	14.63	15.33	4.85	19.80	77.53
40	Simon Legrand	do	4	17.25	18.19	5.17	22.4	81.21
41	Florimond Desprez	do	4	12.99	13.45	4.12	17.40	77.39
42	Dippe's Klein Wanzleben	do	4	12.70	18.22	5.94	21.00	86.76
43	Bulteau Desprez	do	4	14.90	15.62	4.60	19.70	79.29
44	Oxnard	do	4	18.99	19.98	5.30	24.60	84.22
45	Pajaro Valley	do	4	16.09	16.78	5.29	22.00	76.27
46	Simon Legrand	do	4	15.59	16.32	5.01	19.70	82.82
47	Florimond Desprez	do	4	15.99	15.81	5.34	23.59	81.35
48	Dippe's Klein Wanzleben	do	4	18.85	19.93	5.71	24.00	89.33
49	Bulteau Desprez	do	4	19.59	21.34	6.87	27.21	76.99
50	Dippe's Vilmorin	do	4	18.09	19.09	5.28	24.60	79.17
51	do	do	4	8.49	8.69	3.34	14.59	59.35
52	do	Huron.	3	12.49	12.91	3.94	18.99	71.72
53	Dippe's Klein Wanzleben	St. Lawrence.	4	12.00	12.54	4.28	17.60	71.25
54	Oxnard	Montrose.	4	10.19	10.59	4.65	15.49	68.77
55	White Improved	Huron.	1	13.29	13.82	4.52	19.40	72.68
56	Quedlin berg	do	1	11.29	11.78	4.93	19.50	69.41
57	Vilmorin's improved	do	1	9.50	9.94	4.44	15.90	62.51
58	Quedlin berg	do	1	12.45	13.11	5.05	19.49	68.03
59	do	do	1	4.59	4.62	2.74	11.00	42.03
60	do	do	1	8.35	8.74	4.45	14.50	69.00
61	Vilmorin's	do	1	14.19	14.81	4.99	19.59	76.00
62	Quedlin berg	do	1	13.35	14.06	5.05	21.00	67.00
63	Dippe's Klein Wanzleben	do	1	14.19	14.88	5.68	21.00	77.00
64	Quedlin berg	do	1	11.35	11.42	4.13	17.50	68.99
65	Vilmorin	do	1	6.35	6.59	3.73	12.50	53.00
66	Lemaire's	Tray. Minn.	2	13.95	14.87	6.18	22.00	68.09
67	Lemaire's	Huron.	1	14.99	15.52	7.54	28.00	77.03
68	do	Aberdeen.	4	15.55	16.48	5.66	23.00	72.00
69	do	do	4	8.55	8.87	3.25	15.20	58.09
70	Dippe's Klein Wanzleben	Fargo, N. D.	4	12.45	13.01	4.23	17.8	73.99
71	Lemaire's Richest	do	4	12.19	12.88	4.54	17.59	74.00
72	Dippe's Klein Wanzleben	Brookings.	4	13.15	17.15	5.87	22.00	78.00
73	Lemaire's	Huron.	4	13.75	17.91	6.43	23.80	75.03
74	do	do	4	18.59	19.61	5.02	25.29	77.81
75	do	Mitchell.	4	18.49	19.64	6.31	27.50	71.05

CONCLUSION.—The sugar beet industry as now carried on is one requiring the utmost care in all its details. From the raising of the beets to the manufacture of the sugar well established principles must be followed, and skilled labor as well as expensive machinery are necessary. This industry at present offers no inducements to small concerns with no capital and no experience. On the other hand, when the industry is once established on a paying basis it will be of untold benefit to the locality in which the factory is placed. Another crop will be added to those now under cultivation, scientific farming must of necessity ensue, stock raising will receive an impetus, and diversified farming will be the order of the day.

Again the farmers of the state of South Dakota are invited to co-operate with this Station to give the sugar beet a fairer trial during the coming year. A limited quantity of seed will be distributed by this Station, and all samples accompanied by sufficient data to make the analysis of value will be analyzed free of charge. The fact is already established that a high per cent of sugar is to be had by ordinary care; consequently beets with no name, no yield per acre, no data concerning soil and cultivation would be valueless in establishing the facts with which we next have to deal