

Bulletin No. 18.

1899.

UNIVERSITY OF IDAHO AGRICULTURAL EXPERIMENT STATION.

Moscow, Idaho.

DEPARTMENT OF CHEMISTRY.

SUGAR BEET

INVESTIGATION

IN

1898.

By

CHAS. W. McCURDY.

THORN SMITH.

MOSCOW
MIRROR JOB ROOMS
1899

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Bulletins.

The regular bulletins of the Station are sent free to all who request them.
Bulletins issued since the close of the fiscal year, June 30th, 1898:

16. The San Jose Scale in Idaho.
17. Construction and Management of Hotbeds.
18. Sugar Beet Investigation in 1898.

SUGAR BEET INVESTIGATION IN 1898.

CHAS. W. McCURDY, Ph. D.,
Chemist.

THORN SMITH, B. Sc.,
Assistant.

Five years have passed since sugar beet growing in Idaho became a leading line of investigation by this Station. Bulletin No. 12 summarizes the results of such work in the state to the close of 1897. It is our purpose in this publication to present the results of the sugar beet experimentation in 1898.

At the close of 1897, it became evident to those in charge that the plans of conducting the experiment over the state should be radically changed if trustworthy results were to be obtained and of sufficient scope to be of value to the capitalist who might be contemplating the erection of a beet sugar plant within our borders.

In former years, the general trend of sugar beet experiments, in vogue at this Station, had been to distribute seed gratuitously and promiscuously to any and all who might apply. The results were unsatisfactory as not having furnished data at all comprehensive and reliable. While seeming to awaken interest in the experiment, the method lacked unity and purpose among the growers in the preparation of the soil and the cultivation and harvesting of the crop; the failure to return to the laboratory with the sample any data from which the cost of production, yield, climatic and other conditions affecting the crop, could be determined, necessarily gave results so varied as to be practically worthless.

For the season of 1898, the Chemical Department was given full charge of the work and a more intensive as well as compre-

hensive procedure was adopted. This plan was approved by the United States Department of Agriculture with which this Station co-operated, at the same time, Dr. H. W. Wiley, chief chemist of the department in charge of beet seed distribution, offered to furnish us, gratis, the necessary seed and such franked stationery as we could use. Under these conditions the Station carried forward the work as indicated in the following pages.

It was determined to distribute seed to those farmers only who would enter into an agreement with the Station and early in March the following blank was mailed to those interested:

UNIVERSITY OF IDAHO

AGRICULTURAL EXPERIMENT STATION.

Department of Chemistry.

AGREEMENT.

..... IDAHO, 1898

To the Idaho Agricultural Experiment Station,
Moscow, Idaho:

I agree to plant..... acre of land to Sugar Beets with seed to be furnished free of cost by the Idaho Experiment Station and cultivate the same during the season of 1898, following carefully the directions of said Station as published in Bulletin No. 10, on Sugar Beet Culture, and to send to the Station, Department of Chemistry, when the beets are mature, from twenty-five to fifty sample beets, said samples to be delivered by me at my nearest railway station or postoffice, as may hereafter be directed by said Station, and transported to the Station without further cost to me; Station agreeing to determine the percentage of sugar in the beets and their purity and report the same to me. It is further understood that the entire crop, save the samples as above, is reserved by me for my sole use and disposition.

SIGNED.....

Directions for Sugar Beet Culture.

BULLETIN NO. 10, 1898

We present herewith brief directions for the guidance of sugar beet growers, especially in the interest of those farmers co-operating this season with the Idaho Experiment Station.

Soil Conditions.

A black, sandy, or clay loam, or any other soil that will raise a good crop of corn or potatoes, that possesses good depth and is well drained, is typical for sugar beets. The roots require plenty of moisture, so the soil must be of a porous nature, to absorb the water.

Preparation of Soil.

After the removal of the preceding crop, wheat, corn, barley or oats, but not beans, peas or potatoes unless the soil be rich in the elements of plant food—nitrogen, potassium, and phosphoric acid—a liberal supply of fresh barnyard manure should have been applied and the ground plowed to a depth of 12 to 14 inches; subsoiling would improve it and may be necessary. Plow again in the spring to kill weeds, harrow and level. Rotate the beet with other crops; the beet should not be grown on same soil oftener than every three or four years.

Sowing the Seed.

Having the ground thus well prepared, and when the temperature of the soil is about 50 degrees, sow the seed in straight rows, 16, 18 or 20 inches apart, if the crop is to be cared for by hand; if horse hoe is to be used, 22, 24 or 28 inches. Drop 3 or 4 seeds every 3 inches. Do not plant over three-fourths inch deep; the seed may rot. If sown by hand use from 10 to 15 pounds per acre; if planted by drill use from 15 to 25 pounds. Easier to thin out the small plants than to replant in case of poor stand. After sowing, press the ground firmly about the seed, either by a roller, or by press wheels attached to seed drill. The young plants should show in 15 days.

Cultivating.

Begin by hoeing as soon as plants break through the ground, to destroy weeds and loosen the soil; THIN CAREFULLY AND PROMPTLY as soon as plants show four leaves, or beets will be stunted and roots become entangled;

leave one plant every 8 to 10 inches apart. Hoe the crop 3 or 4 times during the season to kill weeds, bringing fresh soil up around the beets, keeping them well covered to stem. Cease cultivating after beets have become full grown—about 3 months after planting. Irrigate if in the arid belt, as often as necessary to keep the beets growing. Remember that irregular, scraggy, prongy beets, and beets that project above ground are worthless for sugar; that the beets should not attain a weight greater than two pounds each, and must be smooth and tapering in shape. IN THE CULTIVATION LIES THE SECRET OF SUCCESS IN SUGAR BEET CULTURE; for "the sugar is hoed into the beet," and any neglect of this thorough bred root will show in lower sugar content and purity.

Harvesting.

As soon as the outer leaves begin to turn yellow and die down, the beet is ripe and harvesting should begin. Do not start too early, however, as the beets increase in weight during the last six weeks of the growth; but remove them from the ground before a second growth and frosts set in; repeated freezing and thawing affects the sugar content. If a quantity of beets be grown, plow them loose, then remove by hand or by spade. Remove soil adhering to roots; cut tops off down to base of leaves, one straight, deep cut, not whittled. Place beets in silos or trenches until ready for shipment; if left exposed they will lose in sugar and juice; results of analysis will be inaccurate. Directions for shipment to laboratory will follow later.

Acres and Experiments.

During April, 400 pounds of sugar beet seed were distributed to 63 farmers who grew the beets under contract and directions sent out from this department. Of this quantity, August Rolker & Sons, New York, donated 50 pounds, and the Wernick Seed Co, Milwaukee, 25 pounds; the remainder was furnished by the government. The counties represented, with the number of acres sown and experimenters, is as follows: Bannock, 1, 1; Bingham, 5½, 12; Blaine, ½, 1; Canyon, 1¼, 3; Fremont, 1, 2; Idaho, ½, 2; Kootenai, 1¼, 6; Latah, 6½, 16; Lincoln, 1, 1; Lemhi, ¼, 1; Nez Perce, 3¾, 9; Oneida, 3, 4; Washington, 1½, 5; Total 27.25 acres. This was exclusive of two acres grown upon the

University farm, under the immediate supervision of the agriculturist.

About the first of June, Professor J. M. Aldrich, entomologist of the Station, at our request, prepared the following statement which was promptly mailed to the co-operative growers:

Insects Affecting Sugar Beets.

"While most crops are less damaged by insects in Idaho than in older states, there will doubtless be some injury to the sugar beet here; the following suggestions are intended to anticipate the more probable attacks of insects upon this plant:

Cut-Worms.

Most of these burrow in the ground and remain concealed by day. At night they cut off small plants at or below the surface, and climb large vegetables and eat the foliage. Their work ends in nearly every case before the last of June, on account of their reaching full size. They then pass through a transformation and emerge from the ground as plain brown moths,—the so-called "miller" so common in the summer evenings,—which afterward deposit eggs for the next season's brood. The remedy which has proved most satisfactory is to tie up little bunches of juicy foliage—clover, alfalfa, young grass, etc.,—dip them in a Paris green solution, say 1 ounce to 8 gallons, and scatter them at evening wherever the worms are troublesome.

Flea-Beetles.

Several kinds of these occur here. All are small, shining, entirely black or with two light stripes, and may be recognized by the flea-like manner in which they jump when disturbed. They eat small holes in the leaves of various garden vegetables. Beets may be sprayed with 1 pound Paris green in 100 gallons of water, if the injury seems serious. Usually these insects do but little damage.

Blister-Beetles.

These are rather large, elongated, soft-shelled beetles of several kinds, either brown, black, grey or green in color according to the species, occurring

usually in quite large numbers together, and rapidly devouring the plants they feed upon. Immediate spraying as for flea-beetles is necessary.

Garden Web-Worm.

This has been quite troublesome where beets are raised on a large scale for factories. It may not occur in Idaho this season. It is a yellowish or greenish caterpillar, reaches a length of about an inch, and spins a web wherever it is working. It grows rapidly and matures quickly, so there are several broods in a season. It keeps principally on the under side of the leaves. Spraying with Paris green, 1 pound to 150 gallons of water is an effective remedy.

Wire Worms.

These are elongated yellow, worm-like larvæ, destitute of legs except close to the head. The mature form is an elongated brown beetle, that has the power of throwing itself into the air with a snapping sound when placed on its back. No satisfactory remedy is known, though the subject has received a great deal of study.

While the spray-pump is very desirable for Paris green applications, and necessary for high plants, a fair degree of success may be attained by sprinkling the solution on with a common garden sprinkler, or even with a whisk broom dipped into the solution. Success will be in proportion to thoroughness.

Any serious insect attack on sugar beets or other plants should be brought to the attention of the Experiment Station."

Manufacturing Centers.

It will be observed that the greatest interest in the experiment, as shown by the acreage was in and about those points where factory facilities are available, viz; South-eastern Idaho, comprising the counties of Bingham, Bannock and Oneida; western Idaho, comprising Washington and Canyon counties, and the Clearwater valley, on which border Latah and Nez Perce counties. At each of these centers there are good factory facilities. The necessary fuel, limestone, pure water, acreage, stock for consumption of refuse, and transportation may be easily

secured. It was the intention of the chemist to visit these different centers during the growing season. He was able to inspect a few plats in Latah County only, but was in correspondence with about fifty growers, a few men not having been heard from after signing the agreement. Early in September the following circulars were sent to the growers, being modifications of direction furnished by Dr. Wiley:

Directions for Securing Samples of Sugar Beets for Analysis.

Enclosed please find circular "A" which you will kindly fill out and return to us in the penalty envelope enclosed. Please follow closely the directions herewith enclosed for taking samples of sugar beets for analysis, making accurate calculation. Fill blank with care, otherwise the information it conveys may have no scientific value. You have given of your land, time and best thought to the experiment; please carry it to completion. We promise you early returns of the analyses and shall promptly give to the state and government the results of your skill and hearty co-operation.

When the beets appear to be mature and before any second growth can take place, select an average row (or rows), and gather every plant along a distance which would vary as follows, according to the width between the rows:

From rows	16 inches apart,	length	75 feet.
" "	18 " "	" "	66 "
" "	20 " "	" "	59 "
" "	22 " "	" "	54 and four-fifths feet.
" "	24 " "	" "	50 " " "
" "	28 " "	" "	42 " " "

The beets grown in a row, of the length above mentioned, are counted. The tops are removed, leaving about an inch of the stems, the beets carefully washed free of all dirt and wiped. Where the row is not long enough to meet the conditions, take enough from the adjacent row or rows to make up the required length. Rows of average excellence must be selected; avoid the best or poorest. Throw the beets promiscuously into a pile and then select the required samples of medium size. Be careful not to select the largest or smallest. The beets are then weighed.

The number of beets harvested multiplied by 435.6 gives the total num-

ber per acre. The total weight of beets harvested multiplied by 435.6 gives the yield per acre.

From our experimenters growing one acre of beets, we desire fifty samples to be shipped by freight; if you are growing two varieties, send twenty-five samples of each variety. Those growing one-half an acre will please ship twenty-five samples; if growing two varieties, fifteen samples of each variety should be forwarded. Those having a less area, namely: one-quarter of an acre, will ship ten samples either by mail or freight as may seem best. The railroads will carry free to this point sugar beets and samples of soil on which beets are grown, or representative samples taken from any part of your farm.

Enclosed find penalty shipping tags for use in mailing packages which must not exceed four pounds in weight each. When shipping by freight, mark tags: "Sugar beets for analysis, forward promptly," addressing same to this Station. Wrap the beets in soft paper, pack closely in a box, giving name of variety and nail tightly. If, for any reason, you have no samples to return, please make necessary explanation upon blank "A" returning same in the franked envelope together with the mailing tag. This is necessary to complete our records in this office and to keep faith with the government. Below is a copy of blank "A" properly filled out.

CHAS. W. MCCURDY,

Chemist and Acting Director of Exp. Station.

"A"

UNIVERSITY OF IDAHO.

AGRICULTURAL EXPERIMENT STATION.

Description of Sample of Sugar Beets.

Prepared by Chas. W. McCurdy, Chemist.

1. Variety, — *Vilmorin's Improved*.
2. Date planted, — *May 9th 1898*.
3. Date thinned, — *June 15, and 16*.
4. Date harvested, — *October 24, and 25*.
5. Date shipped to laboratory, — *October 26*.
6. Character of soil, — *dark sand*.
7. Value of land per acre, market rates, — *from \$15 to \$25*.

8. Last crop grown on beet plat, —*general garden.*
9. Method of preparing plat for crop, —*well manured a year ago with stable manure; plowed last fall ten inches; twice before planting.*
10. Cost of preparation of plat, —*\$3.*
11. Cost of planting, —*\$1.50.*
12. Cost of thinning and cultivation, —*about \$3.50.*
13. How, and when cultivated? —*First pulled weeds by hand; cultivated with horse June 17; every ten days thereafter; hoed after cultivating with horse.*
14. Exact area under cultivation, —*about one-half acre.*
15. Length of row harvested, (feet) —*444 feet.*
16. Width between rows, (inches) —*23.*
17. Number of beets harvested, —*5728.*
18. Weight of beets harvested, (pounds) —*three pounds per beet.*
19. Weight of beets after cleaning and removal of necks and tops, (pounds) —
20. Yield per acre in tons, —*17.*
21. Character of weather during growing season, by months, —
June wet; July dry and hot; August hot and dry; September some rain; October cool with showers.
22. If the crop was a failure, give cause—
23. Can this crop be grown for commercial purposes with success in your locality? —*Not at present prices paid for beets.*
24. Extent of interest shown in the sugar beet industry in your section? —*Forty acres of beets grown in Fairview township for Ogden factory.*
25. Suggestions. —*Counted beets in one row, averaged the rest by it; sent you medium size.*

Postoffice, —*Fairview, Oneida County.*

Date, —*October 25, 1898.*

Name, —*Charles Fifield.*

(NOTE.—Beets arrived at laboratory Nov. 6, in good order.)

As before stated, sixty-three farmers entered into an agreement with the Station to grow from one-third to one acre of sugar beets under instructions from this office. Seed was mailed to that number at the rate of sixteen pounds per acre. The varieties sent were:

1. Dipps' Elite Klein Wanzlebener, donated by Rolker & Sons.
2. Dipps' Elite Vilmorin, donated by Rolker & Sons.
3. Flota's Elite Klein Wanzlebener, donated by Wernich Seed Co.
4. Improved Vilmorin, donated by United States Government.
5. Elite Klein Wanzlebener, donated by United States Government.

In most cases two varieties of seed were given each grower. Its receipt was acknowledged, the seed was planted, and the instructions for seeding, thinning, cultivating, and harvesting were supposedly carried out. Only twenty-nine farmers, however, or 46 per cent. of those receiving seed forwarded beets with accompanying data to the laboratory. There were a number of factors entering into the problem which could not be foreseen or controlled by the growers and which materially influenced the final results. It is unnecessary to enumerate them here.

Reports by Counties.

Bingham.

This department is under obligation to the intelligent enthusiasm of Hon. W. W. Wheeler, of Idaho Falls, and Hon. W. A. Sample, of Blackfoot, for the very excellent results reached in this county.

GROWER.	POST OFFICE.	ACREAGE.	NO. OF BEETS.	ANALYSES.
W. A. Sample, Blackfoot.....		1	33	17
J. A. Porter, ".....		1	40	35
B. A. Trego, ".....		$\frac{1}{3}$	15	9
J. A. Anderson, ".....		$\frac{1}{3}$	16	16
J. H. Robertson, Idaho Falls.....		$\frac{1}{4}$	2	2
W. S. Jackson, ".....		1	1	1
E. R. Ricks, Victor.....		$\frac{1}{2}$	6	3
Total.....		4.4	113	83

Fremont.

J. F. Dorchens, Lodi.....	1	18	9
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Mr. Dorchens reports a large crop though the season was dry. He pronounces sugar beets a choice root for stock, especially milch cows.

Lemhi.

D. P. Eldridge, Gibbonsville.....	$\frac{1}{4}$	2	1
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Oneida.

Chas. Fifield, Fairview.....	$\frac{1}{2}$	26	26
John Martin, Preston.....		2	1

NOTE.—Forty acres of beets were grown in Fairview township in 1898 for the Ogden factory.

Blaine.

C. W. Castle, Leduc.....	$\frac{1}{4}$	16	15
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Canyon.

Riley Cox, Caldwell,.....	$\frac{1}{2}$	30	14
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Nez Perce.

Alfred White, Russell,.....	$\frac{1}{2}$	31	15
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Kootenai.

A. K. White, Clarkia,.....	$\frac{1}{2}$	4	2
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F. W. Shaw, Priest River,.....	$\frac{1}{4}$	2	2
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Jerry Collings, Athol,.....	$\frac{1}{4}$	6	1
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Latah.

G. P. Mix, Moscow,.....	$\frac{1}{2}$	72	41
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J. C. Muerman, Cornwall,.....	$\frac{1}{2}$	57	19
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Wm. Bartroff, Kendrick,.....	$\frac{1}{2}$	46	41
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Thos. Weaver, Kendrick,.....	$\frac{1}{2}$	32	32
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J. E. Muterback,.....	$\frac{1}{4}$	10	10
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E. P. Smith, Juliaetta,.....	$\frac{1}{4}$	19	11
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C. M. Wilson, Princeton,.....	$\frac{1}{4}$	9	1
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J. A. Nelson, Anderson,.....	$\frac{1}{4}$	10	5
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E. W. Hill, Kendrick,.....	$\frac{1}{4}$	10	8
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Wm. Tetley, Blaine,.....	$\frac{1}{4}$	12	12
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Total - - -	3.5	277	180
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University of Idaho.

Experiment Station.....	2	718	67
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Total for the State.

(1) Number of acres grown.....			13.8
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(2) Number of beets forwarded.....	1245		
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(a) Special from Station.....	264		1509
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(3) Number of analyses made.....	405		
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(a) Special for Station.....	67		472
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TABLE I.
SUMMARY BY COUNTIES OF SUGAR BEET EXPERIMENTS, 1898.

DATA.	Bingham.	Fremont.	Lemhi.	Oneida.	Blaine.	Canyon.	Nez Perce.	Latah.	Kootenal.	State.
Samples handled.....	113	18	2	28	16	30	31	1259	12	1509
Analyses made.....	83	9	1	27	15	14	15	303	5	472
Growers reporting....	8	1	1	2	1	1	1	11	3	29
Acreage.....	4.4	1	0.5	0.25	0.5	0.5	0.5	5.5	.62	13.77
Yield per acre (tons)..	11.2	16	19.5	17.	17.	18.	13.	10.5	10.20	14.00
Gross weight (oz).....	25.5	10.7	12.5	23.	23.	13.2	9.	10.1		15.00
Net weight (oz).....	20.7	9.2	11.9	23.25	20.	10.7	6.8	9.2	13.30	13.86
Total solids.....	20.20	19.70	21.73	19.16	19.81	19.37	17.42	18.70	17.93	19.39
Sugar in juice.....	17.23	17.55	20.10	16.85	17.80	16.55	15.10	16.95	15.60	17.08
Sugar in beet.....	16.36	16.69	19.10	16.01	16.91	15.72	14.34	16.10	14.83	16.23
Degrees of purity....	86.54	87.96	92.40	85.86	89.88	84.72	86.53	90.64	87.02	89.07
Land values per acre..	18.00		10.00	20.00	5.00	15.00	5.00	27.75	7.50	
Preparation for crop..	4.75	3.00	20.44	4.00	4.00	2.00	4.00	7.50	5.35	
Cultivation.....	7.80	12.00	44.00	11.00	6.00	10.00	19.00	25.00	15.35	

Summary of Investigation 1898.

The results of the sugar beet investigation of the past year were highly satisfactory to this department. While less than one-half of the farmers receiving the seed returned samples for analysis, others wrote in their reasons for failure to do so, so that seventy-five per cent of those undertaking the work reported—a splendid showing over any former year. The interest in the experiment narrowed itself to those sections where factory facilities are available. The drouth seriously affected the yield in Latah county. The following table shows the status of the work during the years 1897 and 1898, being the only two years during the period of investigations (1893-1898) that are comparable.

As an independent experiment there were grown at Sonna,

Canyon county in 1898, four acres of beets under the supervision of R. E. Green, manager of the Nampa Irrigation and Power Co. The sugar test was made by the Lehi factory chemist

Number of acres grown.....	4
Yield per acre, tons	15
Per cent of sugar in beets.....	15.6
Degree of purity.....	87.8

The company is doing nothing further this year.

Below is a comparative statement of the campaigns of 1897 and 1898.

TABLE II.

DATA.	1898.	1897.	Increase.
1. No. of growers under contract.....	63.	None.	63.
2. No. of farmers reporting.....	29.	22.	7.
3. No. of beets received from growers.	1245.	105.	1140.
4. No. of beets received from Station..	264	100.	164.
5. Total samples handled.....	1509	205.	1304.
6. No. of analyses of Station beets....	67	20	47.
7. No. of analyses of State beets.....	416	21.	395.
8. Total analyses.....	472	41.	431.
9. Highest percentage sugar in beet....	20.61	18.05	2.56
10. Lowest percentage sugar in beet....	12.07	9.69	2.38
11. Average sugar content.....	16.23	15.17	1.06
12. Highest co-efficient purity.....	96.96	98.39	
13. Lowest co-efficient purity.....	74.31	73.80	0.51
14. Average purity.....	89.07	87.55	1.52
15. Yield per acre (tons).....	14.3	Not deter.	14.30
Grand total of analyses to date (1893-98).....			1107.
General average sugar in beet, percent.....			15.53
General average co-efficient of purity.....			82.76

Experimental Plats Grown on the University Farm.

The two acre tract selected was of average soil, rather cold, draining to the east and north, sheltered from cold winds and consisting of black loam with clayey subsoil. Straw piles had enriched the land in the past; it was subsoiled in the fall of 1897 to fourteen inches, was thoroughly worked the following spring, being a typical seed bed at the date of planting. The season was late, cold winds and rain prevailing. The seed was planted May 24, with a drill, in rows 18 inches apart. The stand was fine, the plants coming to the thinning period June 15, thinning continuing until July 15. The cultivation was thorough and regular, and tended entirely by hand labor. The cost of producing and harvesting the beets was about \$32.00 per acre. Not having recourse to irrigation the drouth and heat which prevailed from July 15 until into September ruined the experiment as to tonnage; in all other respects it was a success. The purpose of the experiment was to test the adaptibility of the different varieties of seed to our soil and climate, and on subsoiled land. On the whole, the results were gratifying though the season was unfavorable, there being a shortage in the yield of all farm crops.

The succeeding tables give in detail the results of the analyses. Eight separate samplings were made commencing while the tops were yet green and continuing until the beets were ripe. Credit is due the agriculturist, Professor F. A. Huntley, who had in charge the field work covering the entire experiment.

TABLE III.

VARIETY AND DATA.	DATES OF SAMPLING.							Harv ested Nov. 12	Totals or Aver- ages.
	Sept. 9	Sept. 19	Sept. 29	Oct. 8	Oct. 18	Oct. 28	Nov. 7		
Plat I.									
Klein Wanzleben.—Neb.									
Samples.....	8	4	3	4	4	4	4	61	92
Analyses.....	7	1	1	1	1	1	1	13	20
Total solids.....	20.12	20.26	19.68	20.67	16.99	17.67	21.68	21.37	19.81
Sugar in beets.....	16.60	17.29	16.44	17.20	13.68	14.92	16.53	17.86	16.32
Purity.....	86.98	89.83	87.90	87.56	84.70	80.70	88.26	87.50	86.68
Plat II.									
Dipp's Elite.									
Klien Wanzleben.									
Samples.....	6	6	4	4	5	4	4	76	111
Analyses.....	1	1	1	1	1	1	1	6	13
Total solids.....	21.17	21.25	19.23	20.32	16.94	18.75	21.48	20.33	19.93
Sugar in beets.....	17.30	17.77	16.34	16.34	16.92	16.91	17.77	17.48	17.08
Purity.....	85.97	87.59	89.48	84.64	82.39	93.94	87.06	90.42	87.62
Plat III.									
Vilmorin's Improved.									
Samples.....	6	4	3	4	4	4	4	92	121
Analyses.....	1	1	1	1	1	1	1	6	13
Total solids.....	20.27	21.36	16.43	19.37	20.19	18.91	21.22	19.58	19.67
Sugar in beets.....	16.70	18.24	13.69	14.82	17.29	17.10	17.77	16.62	16.53
Purity.....	86.82	89.89	85.66	80.54	90.14	95.02	88.12	91.12	88.41
Plat IV.									
Dipp's Elite.									
Vilmorin—Le plus rich.									
Samples.....	4	6	7	5	4	4	4	90	124
Analyses.....	1	1	1	1	1	1	1	6	13
Total solids.....	19.67	21.81	18.93	18.92	18.77	21.40	20.58	19.17	19.91
Sugar in beets.....	16.00	18.72	15.96	14.07	16.43	17.50	17.39	16.62	16.59
Purity.....	80.32	90.32	88.96	77.20	92.17	81.77	88.92	91.12	86.36
Plat V.									
Orig. Klein Wanzleben-Utah									
Samples.....	5	5	5	4	5	4	4	91	123
Analyses.....	1	1	1	1	1	1	1	6	13
Total solids.....	22.12	20.01	18.43	18.94	14.99	14.80	19.08	19.42	18.47
Sugar in beets.....	17.90	17.39	15.87	15.11	12.63	12.35	16.72	16.53	15.56
Purity.....	84.99	98.49	90.61	83.95	88.65	87.80	92.24	88.94	89.46
Plat VI.									
Hota's Elite, Klein Wanzleben.									
Samples.....	4	4	5	5	6	4	4	121	153
Analyses.....	1	1	1	1	1	1	1	12	19
Total solids.....	17.17	16.48	19.43	19.87	19.08	17.76	20.48	19.75	18.75
Sugar in beets.....	14.25	13.30	16.91	16.11	17.19	15.01	18.24	17.77	16.20
Purity.....	87.36	84.80	91.61	90.08	94.86	88.80	93.75	90.80	90.80
Plat VII.									
Vilmorin's Imp—U. S. Gov.									
Samples.....	7	5	4	5	5	4	4	95	129
Analyses.....	1	1	1	1	1	1	1	10	17
Total solids.....	22.17	21.43	19.18	18.97	19.02	19.36	20.94	20.61	20.21
Sugar in beets.....	17.90	17.77	15.68	14.35	16.34	17.10	17.86	17.91	16.86
Purity.....	84.79	87.26	85.40	79.50	90.18	92.97	89.78	90.65	87.57
Plat VIII.									
Klein Wanzleben, U.S. Gov.									
Samples.....	5	5	5	5	5	6	6	92	129
Analyses.....	1	1	1	1	1	1	1	8	15
Total solids.....	17.90	19.61	19.43	21.45	19.02	20.32	20.94	20.90	19.84
Sugar in beets.....	14.00	16.53	16.44	16.72	17.19	17.10	19.19	18.14	16.91
Purity.....	86.01	88.73	89.04	82.05	95.16	88.58	96.46	91.38	89.68

COMPARATIVE STATEMENT OF THE EIGHT EXPERIMENTAL PLATS,
SEPT. 9—NOV. 12.

TABLE IV.

DATA.									Gen. Aver. or total of 8 Varieties.	Harvest data (Nov. 12) aver. independently
	I—Klein Wan- zlebener, Neb.	II—Dipp's Elite—Klein Wanzlebener	III—Vilmor- in's Imp.	IV—Dipp's Elite—VII- morin.	V—Original Klein Wanz- lebener—Utah	VI—Plot's Elite—Klein Wanzlebener	VII—Vilmor- in's Imp. U. S.	VIII—Klein Wanzlebener U. S.		
Beets sampled	92	111	121	124	123	153	129	129	982	718
Analyses made	20	13	13	13	13	19	17	15	123	67
Gross weight oz.	7.6	4.	4.1	3.9	3.5	4.3	5.	5.1	4.8	3.1
Net weight oz.	6.3	3.3	4.2	3.3	2.9	3.6	4.1	4.4	4.1	2.6
Total solids	19.81	19.93	19.67	19.91	18.47	18.75	20.21	19.84	19.57	20.14
Sugar in juice	17.20	18.00	17.38	17.43	16.38	17.18	17.73	17.89	17.38	18.28
Sugar in beets	16.32	17.08	16.53	16.59	15.56	16.20	16.86	16.91	16.51	17.37
Degree of purity	86.68	87.62	88.41	86.36	89.46	90.80	87.57	89.68	88.44	90.50
Yield, tons	6.0	2.5	2.5	3.0	2.75	4.5	4.5	3.	3.60	3.60

NOTE.—Percent of loss in trimming, based on 982 separate beets, was 14.62; excluding the harvesting data the loss on 264 beets was 14.4 percent.

Sugar Beets in Rotation.

As stated in a former publication of this office (Bulletin No. 12), sugar beets are excellent to rotate with other crops. Beets may do well, year after year, on the same land; but it is the exception, and deterioration will surely follow. This is shown by the analysis of the ash of pulp of sample No. 1584, grown by this Station, submitted below:

CONSTITUENTS.	PERCENT.
Alumina	3.14
Iron oxid.	Trace.
Lime	2.40
Magnesia	2.17
Soda	14.96
Potash	8.33
Phosphoric acid	4.86
Sulfuric acid	2.02
Silica	10.20
Carbon, moisture, CO ₂ , Cl.	51.92
Total	100.00

This indicates quick exhaustion of the soil, but if the pulp is fed and the droppings of the animals applied as manure, beets will exhaust the land less than any other crop we grow. The sugar itself takes nothing from the soil that is of any value in fertility. More frequently, however, the pulp is allowed to rot about the factory, hence crop rotation becomes necessary to restore the fertility of the soil. Both tonnage and quality are best subserved by four year rotation. In Nebraska where beets have been long grown the rotation most followed is (1) beets, (2) wheat, or oats, (3) corn, (4) wheat or oats or barley, (5) beets. A short rotative practice is (1) beets, (2) small grain, (3) corn, (4) beets. A favorite rotation in California consists of (1) beets, (2) wheat, (3) barley, (4) beets. For the inter-mountain region a four year rotation, at least, should prevail.

CAMPAIGN OF 1898.

Compiled from data received from the managers of the companies named below:

TABLE V.

NAME.	Acres of beets grown.	Av. yield per acre, tons.	Total beets consumed, tons.	Percent sugar in beets.	Total weight of sugar made, pounds.	Av. price paid growers per ton beets.	AVERAGE RETURNS PER ACRE.
Lehi Sugar Co.,—Utah.....	3 200	13.543	111	14.5	9 900 000	\$4 52	\$61 00
Ogden Sugar Co.,—Utah.....	1 600	11.015	525	14.0	3 600 000	4 25	40 00— 60 00
Pecos Valley Beet Sugar Co., New Mexico.....	1 500	5.4	8 000	15.5	1 600 000	4 25	5 60— 25 00
Oxnard Beet Sugar Co.,—Neb.	1 970	10.019	000	13.5	3 595 000	4 00 5 00	40 00— 50 00
Oregon Sugar Co.,—Oregon....	3 500	2.3	8 150	1 833 600
Minn. Sugar Co.,—Minn.....	1 200	10.510	000	15.1	2 000 000	4 35	45 00
Michigan Sugar Co.,—Mich....	3 000	11.0	3 200	13.3	5 800 000	4 44	49 00
Los Alamitos Sugar Co.,—Cal.	1 500	10.0	3 000	15.8	692 400	4 44	44 40
Western Beet Sugar Co.,—Cal.	7 627	7.40	56 761	4 00	29 76
First New York Beet Sugar Co., —New York.....	1 000	8.50	8 500	12.6	1 303 085	5 00	42 50

The preceding figures do not represent more than fifty percent of the actual capacities or possibilities of the factories and the territory named and should not be used as a basis of comparison; but are given to show the difficulties met with from drouth, from new soil and insufficient help by inexperienced growers in establishing the industry. The long drouth in California reduced the output of 1898 one-half over that of 1897; thousands of acres of new land were broken in California, Utah and Oregon; scarcity of help during the thinning period, climatic influence, insects and other causes contributed to reduce the total output in the United States to 33,960 tons, whereas the estimated yield for 1898 was placed at 90,000 tons of sugar. These are factors that must be carefully considered by capitalist and grower when about to inaugurate the new industry in any state.

Production for 1898-9.

The estimated total beet sugar production, the past year, for the world is stated thus by Willitt & Gray, (May 11, 1899):

United States,	33,960 tons.
Canada,	300 "
Europe,	4,910,740 "
Total for the world	<u>4,880,000 "</u>

Of the total sugar supply of the world, from all sources,—8,857,260 tons, sixty-two percent was manufactured from the sugar beet.

The United States consume about 2,000,000 tons of sugar annually. The two factories owned by Claus Spreckels in California can produce 100,000 tons a year. Hence to supply this nation twenty such factories would be necessary. The rapid increase in number of beet sugar plants, as indicated in the following table, should not cause alarm as likely to overstock the market in the near future:

U. S. Factories Operated During 1898-99.—(Willett & Gray.)

Alameda Sugar Company, Alvarado, Cal.	800	tons.
Sprekels Sugar Company, Watsonville, Cal., ...	1000	"
American Beet Sugar Co., Chino Cal.,	750	"
Los Alamitos Sugar Co., Los Alamitos, Cal., ...	700	"
California Beet Sugar & Refining Co., Crocket, Cal.	500	"
Oregon Sugar Company, La Grande, Ore.,.....	350	"
Utah Sugar Company, Lehi, Utah,.....	450	"
Ogden Sugar Company, Ogden, Utah,.....	350	"
Pecos Valley Beet Sugar Co., Eddy, New Mexico,	200	"
American Beet Sugar Co., Grand Island, Neb.,...	350	"
American Beet Sugar Co., Norfolk, Neb.,	350	"
Minnesota Sugar Co., St. Louis Park, Minn.	350	"
Michigan Sugar Co., Bay City, Mich.,	350	"
First New York Beet Sugar Co., Rome N. Y.,	150	"
Binghamton Beet Sugar Co., Binghamton, N. Y.,	200	"

Total capacity Old Factories,..... 6,850 "

U. S. Factories Building for 1899-1900.

Spreckels Sugar Co., Spreckels, Cal.....	3,000	tons.
American Beet Sugar Co., Oxnard, Cal,	2,000	"
Union Sugar Company, Santa Maria, Cal.	500	"
D. C. Corbin, Fairfield, Wash.,	350	"
Utah Sugar Company, Springville, Utah,.....	350	"
Colorado Sugar M'fg Co., Grand Junction, Col.	350	"
Standard Beet Sugar Co., Ames, Neb.....	500	"
Illinois Sugar Co., Pekin, Ill.....	700	"
Bay City Sugar Company, Bay City, Mich ...	600	"
West Bay City Sugar Co, West Bay City, Mich.	400	"
Peninsular Sugar Co., Caro, Mich.	600	"
Detroit Sugar Company, Rochester, Mich.....	500	"
Alma Sugar Company, Alma, Mich.....	500	"
Kalamazoo Beet Sugar Co., Kalamazoo, Mich .	500	"
Wolverine Sugar Co., Benton Harbor, Mich...	400	"
Holland Sugar Company, Holland, Mich,.....	350	"

Total capacity New Factories. 11,600 "

Beets vs. Wheat.

Those sections of the state specially adapted to the growing of the sugar beet are also large wheat growing areas; indeed the latter crop predominates in Latah, Nez Perce, Idaho and Bingham counties over any other cereal. In South Idaho wherever the land can be brought under water wheat is a staple crop. Below is a comparative statement based upon the experience of a leading farmer in Latah county in growing wheat the past ten years, and of that of a prominent sugar beet grower in Oneida county:

Cost of 10 acres of wheat.....	\$ 96.00
Value of straw.....	2 50
Sale of wheat, 300 bu. @ 50 cents....	150.00
	<hr/>
Profit.....	\$ 56.50
Average per acre.....	\$5.60

Cost of 10 acres of beets.....	\$ 376.00
Sale of 150 tons @ \$4.25.....	637.00
	<hr/>
Profit.....	\$ 261.50
Average per acre.....	\$26.15

These figures are applicable to North Idaho.

In the above estimate are included the preparation of the soil, seeding, cultivating, harvesting, hauling to market, interest and taxes.

In Oneida county the cost for growing 10 acres of wheat was \$38.00; yield 400 bushels at 38 cents per bushel, \$152.00; profit per acre, \$10.40. To raise 10 acres of beets the cost is placed at \$227.50; yield 170 tons at \$3.50 per ton, \$595.00; profit per acre, \$36.80.

Here is the actual experience in Minnesota the past season: The "Register" of Glencoe, Minn., makes the following comparison of the profits in raising wheat and beets:

Cost of 10 acres of wheat..	\$ 124 85	Cost of 10 acres of beets..	\$277 50
Sale of straw.....	31 00	Sale of 150 tons at \$4 50..	675 00
Sale wheat, 250 bu. at 65 cts	162 50		<hr/>
	<hr/>	Profit.....	\$397 50
Profit.....	\$68 65		

Campaign of 1899.

The sugar beet investigation by this Station for 1899 is confined to Bingham county where unusual interest in the experiment prevails. Seventeen farmers are growing beets aggregating fifteen acres. The experiment is directed to the securing of reliable data bearing on cost of production and tonnage. Already capital is directed to that center of industry and energy and the outcome of this years' effort is awaited with interest.

Below we give an estimate made by Willett & Gray as late as June 1st, showing the acreage of sowings, tonnage of beets, and output of sugar, of the new crop. Due allowance has been made for partial failures of inexperienced growers, operating new factories, and for drouth in California.

	Sowings—Acres.	Beets—Tons.	Sugar—Tons.
New York.....	3 200	32 000	3 200
Illinois.....	4 000	34 000	3 400
Michigan.....	43 400	320 000	32 000
Minnesota.....	4 000	36 000	3 600
Nebraska.....	10 500	92 000	9 200
New Mexico.....	2 500	20 000	2 000
Colorado.....	3 800	30 000	3 000
Utah.....	7 800	78 000	7 800
Oregon.....	2 000	18 000	1 800
Washington.....	2 200	20 000	2 000
California.....	60 000	540 000	54 000
Total.....	144 100	1 220 000	122 000

These figures may be somewhat reduced by factors not yet apparent, but they serve to show that the American beet sugar industry is assuming and rapidly becoming a factor in the world's supply. Shall Idaho be in the list next year and shall the state enter the twentieth century with a factory or two to her credit?