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SUGAR BEETS IN COLORADO IN 1898.

Approved by the Station Council.

ALSTON ELLIS, President.

FORT COLLINS, COLORADO.

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SUGAR BEETS IN COLORADO IN 1898.

By W. W. COOKE.

For several years the Station has been carrying on experiments in Colorado on the adaptation of the sugar beet to the conditions of soil and climate found here. During 1898 these tests were conducted on a larger scale than ever before. It can be said in general that the results of the season of 1898 are so conclusive, that we may feel justified in saying that Colorado can raise as good sugar beets and as large crops of beets as any place in the world. We purpose now to consider this point as settled, and future experimental work with sugar beets will be directed toward some of the minor points of methods of irrigation, times and distances of planting, etc.

The work of 1898 was distinguished from that of previous years in that it was done largely in connection with the Denver Chamber of Commerce, and cash prizes were offered for the best crops of sugar beets, thus affording an incentive to better care of the crop. It is believed that the inducement thus offered was a powerful factor in the good results obtained, yet the value of the prizes was as nothing compared with the value of the crop if raised for a factory. So that it is a fair presumption that what was done under the stimulation of the Denver Chamber of Commerce, prizes would be the common result under factory conditions.

The work of the season of 1898 may be grouped under four headings:

1. The experiments conducted on the College Farm at Fort Collins and on the sub-station at Rocky Ford, with reference to methods of growing sugar beets.

2. Experiments conducted at these two places and at about twenty other places in the State, with reference to the quantity and quality of sugar beets grown from seed raised in the United States as compared with seed grown in Europe.

3. Competitive tests for the prizes offered by the Denver Chamber of Commerce in connection with the County Commissioners of various counties.

4. General tests in the parts of the State above irrigation or in those irrigated sections that did not take interest enough in the matter to co operate in the matter of prizes.

The beet seed was obtained principally from the United States Department of Agriculture, but some, also, from the Oxnard Sugar Co., of Grand Island, Nebraska, through the efforts of the officials of the Union Pacific, Denver & Gulf Railroad ; some from the sugar factory at Rome, N. Y., through the efforts of Mr. M. B. Colt, of Alamosa, and when all these sources of supply failed, the Denver Chamber of Commerce bought, in open market, enough seed to supply the remainder of the requests. In all, about four thousand pounds of seed were distributed to two thousand three hundred persons. In each case the seed was delivered free of charge to the person making the tests.

All the analyses on which this bulletin is founded were made by the Chemical Section of the College at Fort Collins. There were eight hundred and twelve samples analyzed at Fort Collins.

Through the courtesy of the U. S. Department of Agriculture the franking privilege was given to the Station for the sugar beet work, and all the seed and several thousand pounds of the beets for analysis were sent through the mail postage free. In addition the railroads of the State, particularly the Union Pacific, Denver & Gulf, Denver & Rio Grande, and Atchison, Topeka & Santa Fe, took a lively interest in the experiments and furnished transportation that materially facilitated the work.

EXPERIMENTS AT FORT COLLINS AND ROCKY FORD ON METHODS OF RAISING SUGAR BEETS.

These tests can be grouped under the following headings:

1. Different dates of planting.
2. Planting on freshly plowed ground as compared with ground plowed a few days before planting.
3. Seed irrigated at planting as compared with that not irrigated.
4. Soaking seed before planting.
5. Sowing at the bottom of a three-inch furrow.
6. Different depths of planting.
7. Transplanting.
8. Different distances of thinning.
9. Different dates of thinning.
10. Variety tests.
11. Number of irrigations.

Each of these tests will be considered by itself, but at the outset it is necessary to make some explanations.

The following general statements apply to all the experiments at Fort Collins. The piece selected was a rather heavy clay loam, sloping slightly to the south. The ground had been heavily manured the spring of 1896 at the rate of nearly sixty tons per acre of well-rotted stable manure. It was cropped during 1896 and 1897 with corn. The spring of 1898 it was plowed in sections. A part of the section was planted the day it was plowed, the rest was allowed to lie from two to four days before it was planted. The seed was sown with an ordinary wheat drill in rows twenty-four inches apart. A few rows that will be specially mentioned were sown with a hand garden drill in rows eighteen inches apart. As soon as the beets broke through the ground so as to define the rows, they were wheel-hoed by hand. Later they were thinned, hand-hoed, cultivated three times with a horse cultivator, and twice irrigated, on June 27 and July 19.

The first set of samples was taken the last of September, after a period of long continued and severe drought. The last samples were taken October 22. Between these two dates there had been several rains, giving a total precipitation of three-fourths of an inch and dampening the beets to the bottom of the furrow. The beets were dug during the following week, with no further rain. Each of the 176 rows was dug in two parts and each part weighed separately. Every beet on the field was counted, to get the stand under the various conditions, and about half of them were counted the second time. This work involved about a thousand weighings and the counting of over sixty thousand beets.

The plantings at Fort Collins were made May 10, May 27 and June 15, with supplementary plantings May 13 and May 31. It had been expected to make four plantings, but a very heavy snow storm set in the last of April, with a total precipitation of three inches. None of this ran off and the ground was thoroughly soaked to a depth of eight inches. It was not until the second week in May that the soil dried out enough so that it could be worked.

This storm had a far reaching effect on the sugar beet work of the season. It saturated the ground without packing it, and to this is largely due the almost perfect germination obtained and the small influence observed from soaking the seed or irrigating at time of planting. The influence of this storm was still felt at the time of the second planting, the last of May, and the ground was hardly dried out by the last planting, the middle of June. The same storm will be referred to later with reference to its effect on the beets at Rocky Ford.

Before giving the detailed record of the various tests, it may be well enough to notice the analyses of the two sets of samples. Both

sets were taken in the same way. Every tenth beet was taken from two contiguous rows until about a dozen beets had been dug. These were at once topped, cleaned by brushing or scraping, or in a few cases by washing, and weighed on scales accurate to the quarter of an ounce. If they were analyzed the same or the next day no account was taken of the small amount (about two per cent.) that they had dried out between digging and analyzing. If they stood longer than two days before they were analyzed, a correction was made in both total solids and sugar for the water that had dried from the beets after the second day. All of the analyses given in this section on methods of raising beets and in the section of this bulletin on tests of different sources of seed are the corrected analyses after making allowance for the drying out after the second day. In actual factory practice the beets seldom reach the factory until the third day after digging, and often not until much longer periods. So that it is probable that had these beets been raised and delivered to a factory they would have dried out a little more and tested a little higher than the figures given in this bulletin.

About fifty samples were taken the last of September, and an equal number October 22. The average of the first set is 15.43 per cent of sugar in the beet and 78.6 purity. The second set averaged 16.38 sugar and 78.1 purity, thus indicating a small gain in sugar and slight loss in purity between the first and second samplings. If these fifty tests are divided into five sets, according to the dates of planting, as will be given later, the last four sets give 14.97 sugar and 77.2 purity for the first samples, and 16.24 sugar with 77.6 purity for the samples three weeks later. Thus, they show an increase in sugar with but little change in purity. The samples from the first planting average 17.28 sugar and 84.2 purity for the first set, and 16.96 sugar with 79.7 purity for the last samples. A study of the ground gives some explanation of the cause of these differences. The ground first planted was so damp at the time it was worked, that it was somewhat packed by the working, and consequently suffered more from the late drought. At the time the samples were taken, the last of September, the leaves of the beets on this part of the field were so badly wilted as to touch the ground. The beets were really dried out in the ground. When the rain came they absorbed water and showed a lower test, with a change in purity, from a slight second growth.

It can be said, then, that, on the whole, the beets gain one per cent. of sugar during the three weeks between the two times of sampling. but there are so many apparent exceptions to this general statement, due to differences in sampling and analyzing, that it is deemed best to use the analyses of both sets of samples.

1. Different Dates of Planting.

A section of the ground was plowed May 10, part planted at once and the remainder planted May 13. A second section was plowed May 27, and planted on that day and on May 31. The third section was both plowed and planted June 15. The rows were two feet apart and 177 feet long; the intention was to thin to six inches, so as to have one beet for each square foot of surface. In the following table, a "perfect stand" would have been one beet for each six inches of row:

Row.	Date planted.	Per ct. of perfect stand.	Average distance apart in row. Inches.	Average weight of beets. Lbs.	Test.	Sugar in beet.	Purity.	Weight of crop in tons per acre.	Pure sugar per acre. Lbs.
21-92.....	May 10	....	....	....	First	17.28	84.2	....	.....
"	"	....	....	....	Second	16.96	79.7	....	.....
"	"	88	6.8	0.92	Average	17.12	82.0	17.8	6095
103-120.....	May 13	....	....	....	First	15.24	74.3	....	.....
"	"	....	....	....	Second	17 26	78.8	....	.....
"	"	83	7.2	0.90	Average	16.25	76.6	16.3	5296
141-155.....	May 27	....	....	....	First	16.18	79.9	....	.....
"	"	....	....	....	Second	16.54	77.4	....	.....
"	"	72	8.3	1.09	Average	16.36	78.7	17.4	5693
156-161.....	May 31	....	....	....	First	15.37	77.3	....	.....
"	"	....	....	....	Second	17.05	78.9	....	.....
"	"	71	8.4	0.91	Average	16.21	78.1	14.2	4604
165-176.....	June 15	....	....	....	First	13.01	77.5	....	.....
"	"	....	....	....	Second	14.11	75.5	....	.....
"	"	34	18.0	1.27	Average	13.56	76.5	9.3	2522

For the purpose of studying the effect of the main three different dates of planting, the preceding table may be summarized as follows:

Row.	Date planted.	Per cent of perfect stand.	Average distance apart in row. Inches.	Average weight beets. Lbs.	Per cent of sugar in beet.	Per cent purity.	Weight of crop in tons per acre.	Pure sugar per acre. Lbs.
21-120.....	May 10-13	87	6 9	0.91	16.85	79.3	17.5	5897
141-162.....	May 27-31	72	8.3	1.00	16.31	78.3	16.6	5415
165-176.....	June 15	34	18.0	1.27	13 56	76.5	9.3	2522

The showing against the late planting is very decided. It produced less than half as much sugar as either of the others. It is evident that the small weight of crop is due, primarily, to the poor stand, since, even planting the middle of June, the beets average larger than those planted earlier. But, with only a third of a stand and the beets eighteen inches apart, the extra size did not compensate for the smaller number of beets. The poor stand is due to hot, dry weather, and, as will be noticed more at length in another place, even irrigating at the time of planting did not much increase the germination.

The difference between the crops of the May 10 planting and that of May 27, is not large, indicating that profitable crops may be raised, even though the seed is not planted until the last week in May. The difference in the stand in this case is, undoubtedly, due to the drying out of the ground, rather than to the greater heat. Though differences in sugar and purity are not large, yet these differences are in favor of the earlier planting. The analyses of the beets from the June 15 planting, show that the crop did not reach nearly to the degree of ripeness attained by the earlier plantings.

There is nothing in these experiments to show whether still better returns would be obtained by planting in April, and, unfortunately, the test of this point, made at the Rocky Ford sub-station, was so injured by a severe hailstorm as to offer little light on this point.

The beets at Rocky Ford were planted at four different dates, April 18, May 2, May 16 and June 1. As the season there is about two weeks earlier than at Fort Collins, these dates are about the same, so far as the season is concerned, as those used at Fort Collins, with the addition of one earlier date. The beets were planted in good mellow garden soil, in rows eighteen inches apart and thinned to nine inches apart in the row.

As noted above, a severe hailstorm, on June 6, interfered seriously with the experiment. The plantings of April 18, May 2 and May 16, were well up at the time and were cut even with the ground, allowing the later planting to approach them in growth. When the present writer visited the field, the middle of July, the eye could scarcely tell any difference between the first three plantings.

Two sets of samples were taken of each of these plantings, the first October 8 and the second October 29. The crop was harvested during the next week and the beets counted from several rows of each planting, so as to get the stand and the average size:

Date of planting.	Per cent of full stand.	Average distance apart in row. Inches.	Average weight of beets. Pounds.	Weight of crop in tons per acre.	Pure sugar per acre. Pounds.
April 18	63	9.5	0.96	18.4	6097
May 2	57	10.5	0.89	15.1	5138
May 16	85	7.0	0.64	15.6	5338
June 1	90	6.7	0.50	13 8	4857

Date of Planting.	Test of October 8.		Test of October 29		Average.	
	Sugar in beet.	Purity.	Sugar in beet.	Purity.	Sugar in beet.	Purity.
April 18	16.98	84.6	16.07	86.9	16 57	85.7
May 2	16.79	83.7	17.32	85.2	17.05	84.4
May 16	16.75	86 2	17.47	86.7	17.11	86.4
June 1	18.02	87.0	17.17	85.5	17.59	86.2

The beets at Rocky Ford ripened better than those on the College Farm. They show for the first three plantings about half a per cent more sugar and more than six per cent. better purity than the first two plantings at Fort Collins. The crops from the earlier plantings at the two places are about equal. But while the last planting at Fort Collins never ripened and produced less than two-thirds the crop of the earlier plantings and not half as much sugar per acre, the last planting at Rocky Ford gives the best beets of all in quality and not much below the others in quantity. At both places the last of May seems to be as late as it is advisable to sow, although a crop can be obtained from beets sown considerable later. The averages of the two sets of samples at Rocky Ford are identical, showing that the beets had fully ripened before the first samples were taken. The intention was to take some earlier samples, but the letter of instructions was lost in the mail.

2. Planting on Freshly Plowed Ground.

One of the greatest troubles in raising sugar beets is getting a good stand. If the seed is planted deep and the planting is followed by a rain, the ground packs and the seed cannot get through; if planted shallow and dry weather follows, the seed cannot get enough moisture to grow well. In the present case, there was a large amount of moisture in the ground at the time of plowing and the question was, will the amount that dries out in the first few days after plowing be enough to influence germination and growth. The table already given contains the figures of the test and the re-

sults are strikingly in favor of planting on freshly plowed ground. In the first case three days elapsed between plowing and planting; in the second case four days intervened. The four items of germination, sugar, purity and weight of crop are in each case in favor of the beets planted as soon as possible after the ground is plowed. These differences are not always large, though in the case of the weight of the crop they amount to one-seventh, but in the aggregate the difference would have a decided influence on the sugar value of the crop. The average of the two plantings on freshly plowed ground is 16.74 per cent sugar, 80.3 purity and 17.6 tons per acre. The beets planted three or four days after plowing give 16.23 per cent sugar, 77.3 purity and 15.3 tons per acre. Combining these figures, the first gives 4731 pounds of available sugar per acre, while the latter yields but 3839 pounds, a difference of nearly a thousand pounds of sugar, or something over ten dollars per acre in favor of immediate planting. In the light of these figures, it can be seen how important it is that if large areas are to be planted, they should be plowed in sections and each section planted the day of plowing.

3. Irrigating at the Time of Planting.

Three tests were made of irrigating the ground as soon as the seed was planted, as compared with allowing the seed to germinate from the moisture in the soil. In each case a small furrow was made some six inches from the seed, and water run in this furrow until it soaked sideways and wet the seed.

Irrigated at Planting.					Not Irrigated at Planting.				
Rows.	Number beets per row.	Tons per acre of crop.	Sugar in beet.	Purity.	Rows.	Number beets per row.	Tons per acre of crop.	Sugar in beet.	Purity.
27-32.....	232	15.8	17.48	84.7	21-26.....	243	16 0	17.84	85 7
45-56.....	338	18.4	17.77	86.4	33-44.....	271	17.8	16.97	84.6
165 170.....	112	9.9	12.12	76.5	171-176.....	128	8.1	13 08	76.2
Average.....	227	14.7	15.79	82.5	Average.....	214	14.0	15.96	82.2

The results are closer than would be expected had the treatment been exactly alike, showing that so far as these tests are concerned there was no advantage from irrigating up the seed. It should be remembered, however, that this was on a soil very retentive of moisture, and which at the time the first two of these tests were made, was already well supplied with water. This soil also bakes easily and of course the bad effects of the hardening of the soil would go far toward counteracting the good effect of the extra moisture. It was expected that if irrigating up the seed was an ad-

vantage it would show most clearly in the last case, which was sown June 15 after the ground was quite dry. Here, however, the irrigation seemed to be a detriment, due probably to the baking of the soil.

While the above results are not favorable to the practice of irrigating up the seed when sown in ground as heavy as that of the College Farm, it does not follow that this may not be advantageous under other conditions and in other parts of the State. The present writer visited the farm of Mr. B. F. Wyckoff, at Rocky Ford, the past season, and saw there a large field of sugar beets with a perfect stand, that had been secured by irrigating up the seed. This field produced over 23 tons of beets to the acre. At Lamar he saw another perfect field of beets produced in the same way, on the farm of Mr. M. D. Parmenter. On remarking to Mr. Parmenter that at the College our greatest trouble was to get a stand, Mr. Parmenter replied that he always felt perfectly sure of that part of the business. His land was sandy enough so that it would not bake and had plenty of slope. He planted whenever he got ready, and then turned on the water. His perfect stand in 1898 was obtained with about four pounds of seed per acre.

On the lighter soils of the Arkansas valley, irrigating up the seed is a necessity, as the ground will not hold enough moisture to make a complete germination.

4. Soaking Beet Seed.

Two rows were sown with dry seed; two with half each of dry and soaked seed, and two with soaked seed, *i. e.*, seed that had been soaked in water for twenty-four hours before it was planted. Unfortunately, these tests being made on a small scale, were sown with a hand drill that did not do good work. Good results were obtained with the soaked seed, but no better than were obtained on neighboring rows with unsoaked seed. The test shows, therefore, neither advantage nor disadvantage from soaking the seed.

5. Sowing at the Bottom of a Three-Inch Furrow.

It was thought that, adopting the idea of the trench method of raising potatoes, there might be some advantage from getting the beet seed deep in the ground. A small furrow was made with a hand plow, and then the beet seed sown with a hand drill at the bottom of this furrow. This put the beet seed nearly four inches below the surface of the ground, but left it only lightly covered. Three tests were made, including both early and late sowing. The stand was not so good as in the rows on each side sown at ordinary depths. The yield was once as good and twice poorer than from similar rows of ordinary planting. The sugar and purity were not perceptibly different from other plantings.

In connection with this and some other tests, there is a chance to compare the results of planting with a hand planter and a horse planter. Though we have a good hand planter, yet on the whole the horse planter, which with us is an ordinary wheat drill, has given the better stand and the larger weight of crop.

6. Different Depths of Planting.

The following tests were made with the grain drill, set to plant as nearly as possible at the desired depths.

Row.	Depth of planting.	Number beets per row.	Weight of crop per row.	Sugar in beet.	Purity.
57–68	½ inch	360	313	15.51	76.1
147–149	" "	233	237	16.10	79.0
69–80	1 inch	358	281	17.00	78.7
150–152	" "	239	284	15.78	79.6
81–92	1½ inches	315	279	17.31	80.0
153–155	" "	270	313	16 76	85.0

With the first lot, rows 57–92, sown May 11, there is not much difference, but this slight difference both in stand and yield is in favor of the shallow planting. But it should be remembered that this seed was put into thoroughly damp, freshly plowed ground that was over a damp, almost wet, subsoil. The analysis is enough in favor of the deeper plowing to make the available sugar per acre the same for all three depths of planting.

At the later planting, May 27, rows 147–155, the ground was freshly plowed but had dried out considerably since May 11. In this test the stand, yield and quality are all in favor of the deepest planting, amounting in the comparison of the half inch with the one and a half inch to more than a third of the crop.

7. Transplanting Beets.

Some beet seed was sown in the greenhouse April 20 and the young beets transplanted to freshly plowed ground May 10. The rows were 18 inches apart and the beets 9 inches apart in the row. In the first part of the rows about three fourths of the beets lived, but less than half of them in the rest of the rows, making an average of about one beet to each two square feet. The growth of the beets was satisfactory so far as weight was concerned. They averaged a little over one and a half pounds each, or 16.3 tons per acre. Not a single tap root grew in the whole four hundred beets; they were a mass of fibrous roots that lost at least a fifth in trimming. Their quality was the lowest of all the beets planted early in May, being 14.44 sugar and 74.3 purity.

The above beets were planted in damp ground without irrigation. The next day some more from the same lot were transplanted and irrigated as soon as set. The stand was even poorer than before, though it was supposed that the work had been done with greater care. The size of the beets and the quality were the same as in the first lot. The fibrous roots were not quite so numerous, but there was not a good beet in the whole lot. Seed was sown in the ground at this date, May 10, and on June 8 some of the small beets were transplanted to some neighboring rows. They grew poorly and not one-fourth of them lived. They were not so bad in shape as those from the greenhouse and the quality was better, but as a method of raising beets it proved a financial failure.

Transplanting from the greenhouse, both with and without irrigation, was tried on another lot of plants May 26. It was a hot day, and in spite of the immediate irrigation only a few of the beets lived.

On June 15 transplanting was again tried with some larger beets that had been sown in the ground May 13. These beets were set in running water, and though in the middle of the summer at least nine-tenths of them grew. They were far from good shaped, but they made a crop of 19.3 tons per acre, testing 15.91 sugar, with 79.7 purity.

On June 27 some more transplanting was done from the beets sown May 27. These beets were quite small. They were planted in running water and nearly all grew. They made a crop of 18.9 tons per acre, testing 17.00 sugar with 80.1 purity. Judged by yield and test, these beets show quite well, but they were not good shaped. They were transplanted with the greatest of care into running water and afterwards irrigated several times, so as to give the best possible chance. Better results could hardly be expected, but the method would not be a financial success.

8. Different Distances of Thinning.

The attempt was made to thin beets to 4 inches, 6 inches and 8 inches, but the thinning was so poorly done that the 4-inch and the 6-inch each averaged 8 inches apart, and the 8-inch rows averaged 10 inches apart. Three trials were made. The first two tests on beets planted May 10, show no regularity of results and only slight differences. The 4-inch and 6-inch rows are excellent duplicates. By combining these two and comparing with the other rows, there is a slight showing in favor of the first two in yield, sugar and purity, which leads one to judge that 8 inches is a better distance than 10 inches for two-foot rows. The late planting of May 27 is quite decidedly in favor of the thicker stand for yield, sugar and purity. The full figures are given below:

Row.	Intended distance apart. Inches.	Actual distance apart of beets. Inches.	Number of beets in One row.	Weight of crop in tons per acre.	Sugar in beet.	Purity.
21 and 24	4	8	301	16.1	16.97	79.8
27 and 30	4	8	251	15.6	18.31	86.0
103 and 104	4	8	272	16.5	16.52	75.1
22 and 25	6	8	215	16.5	17.63	83.0
28 and 31	6	8	251	15.5	17.55	83.2
105 and 106	6	8	293	14 9	16.54	78.3
Average	....	8	264	15.8	17.26	80.9
23 and 26	8	10	211	15.5	18.38	80.3
20 and 32	8	10	196	16.2	17.03	81.5
107 and 108	8	10	198	13.4	15.12	68.7
Average	....	10	202	15.1	16.69	78.6

Seeing that this form of the test was a failure, another trial of the same point was made by going through the rows that were intended to have the beets 4 inches apart and selecting twelve beets, each of which was just four inches on each side from the next nearest beet. The same was done with the 6 inch rows and the 8-inch rows. The following results were obtained:

Row.	Distance apart of beets Inches.	Average weight of beets. Pounds.	Weight of full stand in tons per acre.	Sugar in beet.	Purity.
21 and 24	4	1.12	36.6	17.58	80.6
22 and 25	6	1.01	22.0	17.67	79.9
23 and 26	8	1.21	19.8	18.34	80.3

The beets at 8 inches apart are a little heavier than the others, and this is about the only noticeable difference. The generally accepted belief is that these beets at 8 inches apart should be poorer in quality than those growing closer together. In this particular case they are a little better. The most noticeable result is the computation on a full stand. If a field had a complete stand of beets four inches apart and of the same size as these, it would yield 36.6 tons of beets. While, at 6 inches apart, the yield would fall to 22.0 tons, and at 8 inches, to 19.8 tons. Judged in this way, the results are favorable to the thicker stand.

Lastly, a third test of the same point was tried with rows 27 and 30, that had been intended to be thinned to four inches apart, by selecting from the two rows twelve beets 4 inches apart on each side, another twelve beets from the same rows 6 inches apart, and a third twelve beets from the same rows 8 inches apart:

Row.	Distance apart of beets. Inches.	Average weight of beets. Pounds.	Weight of full stand. in tons per acre.	Sugar in beet.	Purity.
27 and 30.....	4	0.73	24.0	17.71	76.3
27 and 30.....	6	0.89	19.5	17.10	81.2
27 and 30.....	8	1.08	17.8	18.15	80.7

The differences in weight, owing to the different amount of space occupied by each beet, is quite noticeable, but the beets having the most room do not grow correspondingly larger in size, *i. e.*, the beets eight inches apart are not twice as large as those four inches apart, hence the weight of crop per acre is again in favor of the closer stand. The differences in the analyses are not great, but, here again, the larger beets test slightly better than the smaller beets.

Combining the five sets of tests, it can be said that, as a whole, they show that the distances apart of the beets, from four inches to ten inches, has but slight influence on the quality of the crop as to sugar and purity. It can also be said that it has some effect on the weight of the crop, and, if the stands are equal, more tons per acre will be raised at less that eight inches apart than at over this distance. Even this latter statement can be given as only a general tendency, liable to many exceptions. Rows 57–92 were sown under as nearly as possible like conditions, were all thinned by the same person at nearly the same time, and the thinning was intended to be to six inches. As a fact, the rows vary from an average distance of four inches between the beets to more than eight inches. If, now, there are selected the four rows with the greatest number of beets and the four rows with the least, the following results are obtained: The crop from four rows, 708 feet long, with 1,711 beets, or an average of five inches apart, weighed 1,199 pounds; the other four rows of the same length, with 1,137 beets, or eight inches apart, yielded 1,191 pounds. So that, in this case, the beets grew in size exactly proportional to the space they occupied.

To get still further light on the question of the relation of size and quality, a test was made with row 53. The whole row was dug and the six largest beets selected, also six of medium size and the six smallest.

Size.	Average weight of beets. Pounds.	Total solids in juice.	Sugar in beet.	Purity.
Largest.....	1.73	21.87	16.34	78.6
Medium.....	0.85	23.27	17.33	78.8
Smallest.....	0.30	24.53	19.15	82.5

The above results show that in these extreme cases, the smaller the beets the better the sugar and purity. Even here, however, the difference is not large, being, in both cases, about one per cent of sugar for doubling the size of the beet. The previous tests seem to indicate that, for sizes from three-quarters of a pound to a pound and a half, the size of the beet has but little influence on its quality.

9. Different Dates of Thinning.

Most rules for the culture of sugar beets say that the thinning should be done as early as possible. Four tests were made to note the effects on the quantity and quality of the crop of thinning at different dates. The earliest thinning was done when the plants were quite young, from 18 to 26 days after planting, while the last thinning was 29 to 40 days after planting. These are not very wide extremes, but they cover the time at which most of the thinning would be done in beets raised for a factory.

No. of Test.	Date of thinning.	Days from planting to thinning.	Number of beets per row.	Weight of crop in tons per acre.	Sugar in beet.	Purity.
1	June 6	26	260	16.7	15.90	77.4
2	" 6	26	363	19.0	17.54	83.1
3	" 8	26	385	17.4	17.22	81.0
4	" 14	18	241	17.1	16.59	85.4
Average		24	312	17.5	16.82	81.7
1	June 16	36	297	17.0	16.77	81.8
2	" 16	36	283	17.3	17.08	83.5
3	" 16	34	283	16.4	.....	.....
4	" 17	21	270	20.3	15.76	75.0
Average		32	283	17.7	16.54	80.1
1	June 20	40	268	16.8	17.22	85.3
2	" 20	40	305	17.7	18.43	85.1
3	" 20	38	327	15.5	16.00	78.0
4	" 25	29	288	18.7	17.31	81.6
Average		37	297	17.2	17.24	82.5

The average results are closely alike for the different dates, and the individual records are so irregular as to indicate that these different dates of thinning had little or no effect on either the quantity or the quality of the crop.

As all the results are excellent, the tests would seem to show that the work of thinning can be extended over a period of at least two weeks without injury to the crop. As one person can thin an

acre of beets in about four days, it follows that a given planting can be thinned at the rate of one person to each three or four acres.

10. Variety Tests.

During the spring of 1898, the Station received from the U. S. Department of Agriculture, the seed of six varieties of sugar beets, with the request that they be given special tests. Two rows of each variety were sown, but, although the seed was sown at the rate of more than forty pounds of seed per acre, the stand was not so good as was gotten with the bulk of our beets. The seed of these six varieties was sown May 20, with a hand drill, in rows 18 inches apart, two rows of each kind, 177 feet long. The plants were thinned June 9 to nine inches apart, and the attempt was made to fill in the vacancies by transplanting, but nearly all of the transplanted beets died.

The first samples for testing were taken October 1, and the second samples October 22. The rest of the beets were dug October 26. The figures of analyses in the following table are the actual analytical results obtained on the beets three days after they were dug, with no allowance for drying out. During these three days, the beets had dried out about one-twenty-fifth of their weight. The beets were planted in the following order:

1. Zeringer, grown by Strandes.
2. Vilmorin's Improved, grown in Russia.
3. Kleinwanzlebener, grown by Vilmorin.
4. Pitschke's Elite.
5. Vilmorin's French, very rich.
6. Schreiber's Elite.

In the following table there has been added by way of comparison:

7. Average of eighteen rows of Kleinwanzlebener beets sown May 13 on the west side of the above varieties.

8. Average of fifteen rows of Kleinwanzlebener beets, sown May 27 on their east side. These last two were sown in rows 24 inches apart, and the intention was to thin them to six inches in the row.

Variety.	Per cent of full stand.	Average distance apart in row Inches.	Average weight per beet. Pounds.	Crop in tons per acre.
1	24	38	1.30	11.7
2	60	15	1.16	13.3
3	46	20	1.91	16.8
4	30	30	1.71	9.4
5	32	27	2.09	13.2
6	32	26	2.13	14.7
7	83	7	0.90	16.3
8	72	8	1.09	17.4

Variety.	Test of October 1.		Test of October 22.		Average.	
	Sugar in beet.	Purity.	Sugar in beet.	Purity.	Sugar in beet.	Purity.
1	14.73	73.4	15.44	76.9	15.08	76.6
2	16.48	84.9	16.96	79.0	16.72	81.9
3	14.82	78.9	15.68	77.7	15.25	78.3
4	17.20	87.1	17.20	76.3	17.20	81.7
5	15.49	80.4	14.73	77.6	15.11	79.0
6	16.15	80.3	15.06	76.7	15.60	78.5
7	15.54	74.3	17.80	78.8	16.67	76.5
8	16.50	79.9	16.87	77.4	16.68	78.6
Average	15.85	80.3	16.22	77.5	16.04	78.9

It will be noticed that the principal difference in the analyses of the two sets of samples is in the purity. The sugar in the beet improves about half a per cent, while the purity decreases nearly three per cent. The average analysis of these six varieties is almost exactly the same as of the Kleinwanzlebener beets we raised for our other tests on both sides of them.

Tests of several other varieties were made on the College farm in connection with the general test of European as compared with American grown seed. The results will be reported with the figures obtained on the same test throughout the state.

11. Number of Irrigations.

A plot of beets at the Rocky Ford substation was divided into three sections; the first received no irrigation during the season; the second was irrigated once, while the third was given four irrigations. The results are given in the following table:

Number of Irrigations.	Weight of crop in tons per acre.	Sugar in beet.	Purity.	Pure sugar per acre Pounds.
None	12.0	15.68	79.5	3763
One	12.4	17.58	85.1	4395
Four	11.9	15.53	78.7	3696

The results are somewhat different from those expected when the experiment was planned. They are to be explained by the fact that the unusually heavy rains of the season were almost enough to raise beets in that locality without any irrigation. The one irrigation gave the beets all the water they needed and the other three irrigations were a positive detriment.

In connection with the tests of seed from different sources, Mr. C. K. McHarg, of Pueblo, made for us some tests in regard to late irrigation.

All of the plot, containing three-fourths of an acre, was treated alike until the latter part of the season, then one-half received no further irrigation, while the other half was given two irrigations additional.

The crop was weighed for each variety separately and yielded the following results:

Variety.	Weight of crop from half not irrigated after August 20. Pounds.	Weight of crop from half irrigated twice after August 20. Pounds.
Original Kleinwanzlebener	1018	1133
Utah Kleinwanzlebener	1069	1125
Eddy Kleinwanzlebener	787	927
Elite Kleinwanzlebener	964	1111
Vilmorin	885	931
Mangold	694	1041
Total	5417	6268

In this case there was a gain of one-seventh in the weight of the crop by irrigations late in the season.

An average sample of the Original Kleinwanzlebener from the part receiving the extra irrigations tested 16.42 sugar in beet and 81.0 purity, while a sample from the other half tested 15.79 sugar and 81.7 purity. Here there was an advantage in both quantity and quality from the late irrigation.

AMERICAN-GROWN SUGAR BEET SEED COMPARED WITH THAT GROWN IN EUROPE.

An extensive series of tests was made of beet seed grown in the United States as compared with seed grown in Europe. Six varieties were used; one grown in France, one in Saxony, two in Germany, and two in the United States. The sources of the seed are as follows:

1. *Utah Kleinwanzlebener.*—This seed was grown at Lehi, Utah, by the Utah Sugar Company. The seed first used was the Original Kleinwanzlebener from Germany, and the seed tested this year was the second generation of American seed grown from the German seed.

2. *Original Kleinwanzlebener.*—Imported from Germany and sent to us by the Utah Sugar Company. Of course this is not the identical seed that was used as the ancestor of the Utah Kleinwanzlebener seed above mentioned, but it is from the same seed farm, of a crop a few years later and is presumably of about the same quality.

3. *Vilmorin.*—Sent us by the United States Department of Agriculture and imported by them from the original growers in France.

4. *Mangold.*—Grown by M. Knauer, Grœbers, Saxony, and imported for us by the agent, H. Cordes, LaGrande, Oregon.

5. *Eddy Kleinwanzlebener.*—This seed was grown at Eddy, New Mexico, during the season of 1897 from the beets of 1896 that were grown from seed obtained from Maison Carlier, Orchies, North France. It is, therefore, the first generation of American seed from the original French seed. This is the first crop of seed raised at Eddy.

6. *Elite Kleinwanzlebener.*—Imported from Germany by the United States Department of Agriculture.

Seed of these six varieties was sent to quite a number of persons in the various irrigated portions of Colorado, who had promised to take special pains in the test. Some of the tests were to be on a small scale with the richest of ground and the best of conditions. Another set of tests was to be on a larger scale under general farm conditions.

Great credit is due the experimenters for the large amount of labor and painstaking care that were bestowed on these tests. The first samples were taken the last week in September, being the Utah Kleinwanzlebener and the Original Kleinwanzlebener. Two weeks

later samples were requested of the Vilmorin and Mangold, and the next week the growers were asked to send samples of the other two varieties. About the first of November instructions were sent to harvest the crops and send samples of all six varieties.

Here are therefore two sets of samples, one set in three pairs and the other set from ripe crops in which the samples of the six varieties were taken at the same time and under the same conditions.

The earlier samples are all from the larger plots under field conditions. The later samples are given from the two plots separately.

UTAH KLEINWANZLEBENER.

Name.	Place.	Date of taking sample.	Wdth betwe'n rows. Ins.	Average distance apart of beets in row. Ins.	Average wght of beets. Lbs.	Crop per acre. Tons.	Sugar in beet.	Purity.
S. M. Scott	Fort Morgan	Sept. 14	30	11.3	0.75	6.5	15.55	73.1
S. S. Abbott	Canfield	" 14	18	9.6	1.12	22.5	16.00	80.0
J. A. Davis	Berthoud	" 15	24	9.8	1.62	26.8	14.71	80.4
J. D. Payne	Grand Junction	" 15	18	9.1	3.25	26.6	9.09	64.6
C. K. McHarg	Pueblo	" 17	24	8.9	0.72	10.6	12.80	76.5
M. D. Parmenter	Lamar	" 15	18	6.7	1.10	28.0	14.71	78.3
Adam May	Debeque	" 17	18	8.4	1.12	23.5	15.22	82.3
F. M. Wright	Berthoud	" 19	18	25.7	1.00	7.0	12.80	70.3
E. K. Smith	Fort Lupton	" 22	18	... ..	.....	.....	20.10	91.1
J. W. Dove	Alamosa	" 23	18	10.3	1.06	18.1	12.38	81.1
J. W. Douthitt.	Montrose	Oct. 3	18	6.0	1.06	30 8	15.60	81.9
Average		Sept. 18	20	10.8	1.28	20.1	14.09	78.1

ORIGINAL KLEINWANZLEBENER.

S. M. Scott	Fort Morgan	Sept 14	30	11.1	0.62	5.4	14.82	69.8
S. S. Abbott	Canfield	" 14	18	9.6	1 00	18.2	14.09	78.5
J. A. Davis	Berthoud	" 15	24	10.3	2.00	25.4	13.89	79.5
J. D. Payne	Grand Junction	" 15	18	8.9	2.37	46.3	11 83	71.8
C. K. McHarg	Pueblo	" 17	24	11.1	0.60	7.2	16 74	83.0
M. D. Parmenter	Lamar.	" 15	8	6.9	0.81	17.4	13.20	79.8
Adam May	Debeque	" 17	18	8.5	1.75	35.8	13.02	73.7
F. M. Wright	Be thond	" 19	18	25 7	0 75	5.4	10.72	63.3
E. K. Smith	Fort Lupton	" 22	18	.....	.....	.....	15.04	76.1
J. W. Dove	Alamosa	" 23	18	9.4	0.75	14.3	11.81	77.6
J. W. Douthitt	Montrose	Oct. 3	18	7.2	1.25	30.7	16.13	85.0
Average		Sept 18	20	10.9	1.19	20.6	13.75	75.3

VILMORIN.

Name.	Place.	Date of taking sample.	Wdth between rows. Ins.	Average distance apart of beets in row. Ins.	Average wght of beets. Lbs.	Crop per acre. Tons.	Sugar in beet.	Purity.
S. M. Scott	Fort Morgan	Oct. 25	30	13.6	0.95	7.2	16.44	87.7
S. S. Abbott	Canfield	" 13	18	9.2	1.45	27.2	16.44	.....
J. A. Davis	Berthoud	" 14	24	15.6	1.42	11.4	15.48	81.0
J. D. Payne	Grand Junction	" 17	18	7.6	1.15	28.9	17.05	78.6
C. K. McHarg	Pueblo	" 18	22	13.2	0.84	9.2	17.38	.....
M. D. Parmenter	Lamar	" 13	18	12.4	1.54	21.7	16.67	88.6
Adam May	Debeque	" 18	18	10.0	1.40	24.5	16.87	72.5
F. M. Wright	Berthoud	" 25	18	24.0	1.37	11.5	16 15	81.3
E. K. Smith	Fort Lupton	" 12	18	8.6	0.64	13.1	17 42	.....
J. W. Dove	Alamosa	" 17	18	8.0	0.87	20.0	11.80	78.5
J. W. Douthitt	Montrose	" 24	18	4.8	0.68	21.4	18.22	88.3
Average		Oct. 18	20	11.5	1.12	17.8	16.30	82.1

MANGOLD.

S. M. Scott	Fort Morgan	Oct. 25	30	9.8	1.39	14.6	13.06	73.8
S. S. Abbott	Canfield	" 13	18	9.2	1.52	29.0	16.39	78.0
J. A. Davis	Berthoud	" 14	24	15 2	1.57	13.5	12.58	74.2
J. D. Payne	Grand Junction	" 17	18	8.0	1.50	32.7	13.82	83.5
C. K. McHarg	Pueblo	" 18	22	15.2	1.02	10.0	17.42	.....
M. D. Parmenter	Lamar	" 13	18	13.2	1.75	23.1	16.70	87.4
Adam May	Debeque	" 18	18	8.8	1.44	28.0	13.69	67.2
F. M. Wright	Berthoud	" 25	18	24.0	0.65	5.0	18.05	84.5
E. K. Smith	Fort Lupton	" 12	18	8.8	0.77	14.6	16.06	90.9
J. W Dove	Alamosa	" 17	18	7.2	1.12	27.2	10 86	77.8
J. W. Douthitt	Montrose	" 24	18	5.2	0 69	23.1	16.04	83.7
Average		Oct. 18	20	11 3	1.22	20.1	14.97	80.1

EDDY KLEINWANZLEBENER.

Name.	Place.	Date of taking sample.	Wdth betwe'n rows. Ins.	Average distance apart of beets in row. Ins.	Average wght of beets. Lbs.	Crop per acre Tons.	Sugar in beet.	Purity.
S. S. Abbott	Canfield	Oct. 29	18	7.6	1.00	23.1	14.26	78.1
C. K. McHarg	Pueblo	Nov. 2	24	10.4	0.94	12.0	17.09	81.6
F. M. Wright	Berthoud	Oct. 31	18	.....	1.35	.....	13.03	73.7
J. W. Dove	Alamosa	Nov. 1	18	7.2	0.62	24.5	12.70	83.3
Adam May	Debeque	" 14	18	.....	1.30	.....	16.39	85.8
J. D. Payne	Grand Junction	" 7	18	11.7	1.61	26.7	14.82	77.9
Average		Nov. 4	19	9.2	1.15	21.6	14.71	80.0

ELITE KLEINWANZLEBENER.

S. S. Abbott	Canfield	Oct 29	18	9.3	1.25	23.6	16.35	81.1
C. K. McHarg	Pueblo	Nov. 2	24	8.0	0.88	14.4	18.49	89.1
F. M. Wright	Berthoud	Oct. 31	18	.....	1.25	.....	14.43	73.7
J. W. Dove	Alamosa	Nov. 1	18	8.0	1.12	24.5	9.37	69.7
Adam May	Debeque	" 14	18	.....	1.30	.....	16.39	82.3
J. D. Payne	Grand Junction	" 7	18	11.7	1.61	23.4	14.58	79.0
Average		Nov. 4	19	9.2	1.23	21.5	14.93	79.1

AVERAGES.

Utah Kleinwanzlebener	Sept. 18	20	10.8	1.28	20.1	14.09	78.1
Original Kleinwanzlebener	" 18	20	10.9	1.19	20.6	13.75	75.3
Vilmorin	Oct. 18	20	11 5	1.12	17.8	16.30	82.1
Mangold	" 18	20	11.3	1.22	20.1	14.97	80.1
Eddy Kleinwanzlebener	Nov. 4	19	9.2	1.15	21.6	14.71	80.0
Elite Kleinwanzlebener	" 4	19	9.2	1.23	21 5	14.93	79.1

RIPE CROPS.

UTAH KLEINWANZLEBENER.

Name.	Place.	Date when crop was harvested.	Average distance apart of beets in row. Inches.	Average weight of beets Lbs.	Crop per acre. Tons.	Sugar in beet.	Purity.
Small Plot.							
S. S. Abbott	Canfield	Oct. 29	9.4	1.05	19.4	16.26	83.8
M. D. Parmenter	Lamar	" 28	7.1	1.15	28.3	14.08	82.1
C. M. C. Woolman	Sterling	" 31	9.0	0.80	16.1	18.40	85.4
C. M. Rulison	Parachute	Nov. 12	5.3	1.36	44.6	16.91	81.9
C. K. McHarg	Pueblo	" 9	7.1	1.32	24 5	14.80	80.0
J. D. Payne	Grand Junction	" 12	9.2	5.10	105.5	8.88	64.6
Chas. Milne	La Jara	" 7	8.5	1.00	20 6	15.88	80.1
J. W. Douthitt	Montrose	" 8	6.7	1.18	31.2	12.63	74.5
Average		Nov. 4	7.6	1.12	26.4	15.57	81.0
Large Plot.							
M. D. Parmenter	Lamar	Oct. 28	9.6	1.11	20.1	16.00	87.8
C. M. Rulison	Parachute	Nov. 12	5.0	1.18	41.8	15.27	80.8
Substation	Focky Ford	Oct. 29	7.4	0 67	15.6	17.55	84.6
College Farm	Fort Collins.	" 26	12.4	1.16	16.3	17.87	82.8
Average		Nov. 1	8.6	1.03	23.4	16 67	84.0

ORIGINAL KLEINWANZLEBENER.

Small Plot.							
S. S. Abbott	Canfield	Oct. 29	9.6	0.85	15.5	14 89	78.6
M. D. Parmenter	Lamar	" 28	9.6	2.18	39.9	12.46	76.6
C. M. C. Woolman	Sterling	" 31	9.0	0.87	18.0	16.57	76.9
C. M. Rulison	Parachute	Nov. 12	5.0	1.13	41.8	17.10	86.3
C. K. McHarg	Pueblo	" 9	8.9	1 59	23.4	14.13	79.6
J. D. Payne	Grand Junction	" 12	9.6	6.00	123.4	8.93	66.3
Chas. Milne	La Jara	" 7	8.0	0.97	21.2	15.75	79.8
J. W. Douthitt	Montrose	" 8	6.7	1.62	42.1	13.11	72.4
Average		Nov. 5	8.1	1.32	28.8	14.86	77.7
Large Plot.							
M. D. Parmenter	Lamar	Oct. 28	10.0	1.82	23.2	14.70	86.9
C. M. Rulison	Parachute	Nov. 12	5.3	1.22	39.6	16.39	81.7
Substation	Rocky Ford	Oct. 29	8.2	0.84	17.9	16.45	82.7
College Farm	Fort Collins.	" 26	8.2	0.87	18.5	15 21	74.7
Average		Nov. 1	7.9	1.19	24.8	15.69	81.5

VILMORIN.

Name.	Place.	Date when crop was harvested	Average distance apart of beets in row. Inches.	Average weight of beets Lbs.	Crop per acre. Tons.	Sugar in beet.	Purity.
Small Plot.							
S. S. Abbott	Canfield	Oct. 29	8.8	1.33	26.4	16 79	87.3
M. D. Parmenter	Lamar	" 28	7.0	1.13	28.3	14.38	76.1
C. M. C. Woolman	Sterling	" 31	9.0	0.94	18.0	15.31	78.6
C. M Rulison	Parachute	Nov. 12	5.2	1.10	37.2	15.31	83.6
C. K. McHarg	Pueblo	" 9	8.0	1.27	22.3	14.42	78.3
J. D. Payne	Grand Junction	" 12	9.0	4.46	90.2	9.65	67.9
Chas. Milne	La Jara	" 7	8.0	0.95	20.6	13.48	76.5
J. W. Douthitt	Montrose	" 8	6.7	1.06	27.7	13.80	74.2
Average		Nov. 4	7.5	1.11	25.8	14.78	79.2
Large Plot.							
M. D. Parmenter	Lamar	Oct. 28	16.0	1.82	14.4	14.95	84.8
C. M. Rulison	Parachute	Nov. 12	6.0	1.12	38.5	15.92	80.6
Substation	Rocky Ford	Oct. 29	7.0	0.50	12.5	18.00	89.2
College Farm	Fort Collins	" 26	10.9	0.92	14.7	17.15	78.5
Average		Nov. 1	10.0	1.09	20.0	16.50	83.3

MANGOLD.

Small Plot.							
S. S. Abbott	Canfield	Oct. 29	8.6	1.18	24.0	13.00	68.4
M. D. Parmenter	Lamar	" 28	6.7	1.32	34.5	13.42	80.6
C. M. C. Woolman	Sterling	" 31	9.0	0.78	15.5	14.43	74.9
C. M. Rulison	Parachute	Nov. 12	5.8	1.27	38.2	14.66	78.3
C. K. McHarg	Pueblo	" 9	8.3	1.28	20.0	13.71	78.3
J. D. Payne	Grand Junction	" 12	9.0	4.00	81.1	9.11	65.5
Chas. Milne	La Jara	" 7	8.0	1 06	23.0	14.32	74.8
J. W. Douthitt	Montrose	" 8	6.7	1.60	41.4	13.44	71.0
Average		Nov. 4	7.4	1.21	28.1	14.00	75.2
Large Plot.							
M. D. Parmenter	Lamar	Oct. 28	20.4	1.55	13.5	14.57	87.5
C. M. Rulison	Parachute	Nov. 12	5.0	1.18	42.3	15 88	82.7
Substation	Rocky Ford	Oct. 29	10.4	1.00	16.7	15.84	82.7
College Farm	Fort Collins	" 26	9.4	1.04	19.2	17.15	78.0
Average		Nov. 1	11.3	1.19	22.9	15.86	82.7

EDDY KLEINWANZLEBENER.

Name.	Place.	Date when crop was harvested.	Average distance apart of beets in row. Inches.	Average weight of beets. Lbs.	Crop per acre. Tons.	Sugar in beet.	Purity.
Small Plot.							
S. S. Abbott	Canfield	Oct. 29	8.0	1.04	22.0	.....	.....
M. D. Parmenter	Lamar	" 28	6.7	1.67	43.6	13.56	81.8
C. M. C. Woolman	Sterling	" 31	9.0	0.94	19.1	16.76	82.9
C. M. Rulison	Parachute	Nov. 12	5.6	1.12	34.4	16.04	84.8
C. K. McHarg	Pueblo	" 9	8.0	1.60	26.1	13.39	75.7
J. D. Payne	Grand Junction	" 12	9.2	5.00	98.5	10.36	69.5
Chas. Milne	La Jara	" 7	7.3	1.00	23.0	15.80	81.7
J. W. Douthitt	Montrose	" 8	6.7	1.22	31.0	12.70	70.8
Average		Nov. 4	7.3	1.25	27.0	14.71	79.4
Large Plot.							
M. D. Parmenter	Lamar	Oct. 28	10.8	0.95	15.5	14.22	81.8
C. M. Rulison	Parachute	Nov. 12	5.1	1.18	39.6	16.50	83.3
Substation	Rocky Ford	Oct. 29	8.4	0.70	14.4	16.82	87.5
College Farm	Fort Collins	" 26	11.1	1.06	16.5	15.80	78.1
Average		Nov. 1	8.6	0.97	21.5	15.83	82.7

ELITE KLEINWANZLEBENER.

Small Plot.							
S. S. Abbott	Canfield	Oct. 29	8.0	1.00	21.8	15.90	78.5
M. D. Parmenter	Lamar	" 28	6.7	1.60	40.4	15.75	84.0
C. M. C. Woolman	Sterling	" 31	9.0	0.92	19.2	17.23	83.4
C. M. Rulison	Parachute	Nov. 12	6.0	1.36	40.9	16.84	85.3
C. K. McHarg	Pueblo	" 9	7.7	1.50	25.6	15.38	80.0
J. D. Payne	Grand Junction	" 12	9.0	5.00	102.2	10.45	70 6
Chas. Milne	La Jara	" 7	8.0	1.11	24.2	15.50	85.7
J. W. Douthitt	Montrose	" 8	6.7	1 22	31.9	15.08	77.0
Average		Nov. 4	7.4	1.24	29.1	15.95	82.0
Large Plot.							
M. D. Parmenter	Lamar	Oct. 28	12.8	0.82	10.9	16.61	85.6
C. M. Rulison	Parachute	Nov. 12	4.9	1.14	40.7	15.42	84.2
Substation	Rocky Ford	Oct. 29	6.8	0.67	17.3	17.38	86.1
College Farm	Fort Collins	.....	.....	.....	.....	.....	.....
Average		Nov. 1	8.2	0.88	23.0	16.47	85.3

AVERAGES.

Variety.	Plot.	Crop per acre. Tons.	Sugar in beet.	Purity.
Utah Kleinwanzlebener	Small	26.4	15.57	81.0
	Large	23.4	16.67	84.0
Original Kleinwanzlebener	Small	28.8	14.86	77.7
	Large	24.8	15.69	81.5
Vilmorin	Small	25.8	14.78	79.2
	Large	20.0	16 50	83.3
Mangold	Small	28.1	14.00	75.2
	Large	22.9	15.86	82.7
Eddy Kleinwanzlebener	Small	27.0	14.71	79.4
	Large	21.5	15.83	82.7
Elite Kleinwanzlebener	Small	29.1	15.95	82.0
	Large	23.0	16.47	85.3
Utah Kleinwanzlebener	Both.	24.9	16 12	82.5
Original Kleinwanzlebener	"	26.8	15.27	9.6
Vilmorin	"	22.9	15.64	81.2
Mangold	"	25.5	14.93	78.9
Eddy Kleinwanzlebener	"	24.2	15.27	81.0
Elite Kleinwanzlebener	"	26.0	16.21	83.6
Average		25.1	15.57	81.3

Variety.	Per cent of perfect stand. Weight.	Average weight of beets. Pounds.	Pure sugar per acre. Pounds.	Available sugar per acre. Pounds.
Utah Kleinwanz ebener	86	1.07	8060	6650
Original Kleinwanzlebener	87	1.25	8184	6514
Vilmorin	80	1.10	7163	5816
Mangold	75	1.20	7650	6036
Eddy Kleinwanzlebener	88	1.11	7390	5986
Elite Kleinwanzlebener	89	1.06	8429	7047
Average	84	1.13	7813	6341

A comparison of the results from the different kinds of seed shows, first of all, that they are all good seeds. An average of 25.1 tons of beets per acre testing 15.57 sugar and 81.3 purity is a very high yield. There is, however, considerable difference in the results from the different varieties. The Elite Kleinwanzlebener and the Vilmorin were sent us by the United States Department of Agriculture as the best beet seed that they could get. The Original Kleinwanzlebener was selected by the Utah Sugar company as in their judgment the best brand of seed on the market from which to raise their own seed. If we take the average of these three first-class seeds and compare it with the seed raised in Utah, the comparison is in favor of the Utah-grown seed in per cent of sugar and purity, while the crop per acre is equal. The Utah seed is, therefore, superior in pure sugar per acre and in available sugar per acre. The Utah seed is superior to the seed from which it is descended in sugar and purity, but a little inferior in quantity of crop.

The seed grown at Eddy does not give so good results as the Utah seed, but it equals the Vilmorin and is not far behind the Original Kleinwanzlebener. The germinating quality of the seeds is quite satisfactory. The four Kleinwanzlebener varieties give 87 per cent of stand, while the Vilmorin gives 80 per cent, and the Mangold 75 per cent.

In the light of these experiments there can be no doubt that sugar beet seed can be grown in the United States fully equal to the best of the imported seed.

The tables of the yield of the small plots include the figures from the field of Mr. J. D. Payne, of Grand Junction, but these figures are not used in making the averages, because they are so different from those of the other experimenters and so different from the average of Colorado results.

Mr. Payne planted his beets in a deep sandy loam, where the roots had unlimited room to grow downward. The soil below was full of water that was constantly being brought up to the roots by capillary action. The ground was also full of plant food. These beets, therefore, had the very best possible conditions and they improved their opportunities. The rows were 18 inches apart, and the beets thinned to 9 inches apart in the row. The stand was perfect and the growth enormous. Toward the latter part of the season the tops crowded so that the patch seemed one large beet. It was impossible to see any ground or to distinguish one beet from another. The beets averaged five pounds each and almost touched each other, making practically a solid row of beets.

As would be expected under these conditions, they never ripened and their quality is low. The figures of the crop are as follows:

Variety.	Crop per acre Tons.	Sugar in beet.	Purity.
Utah Kleinwanzlebener	105.5	8.88	64.6
Original Kleinwanzlebener	123.4	8.93	66.3
Vilmorin	90.2	9.65	67.9
Mangold	81.1	9.11	65.5
Eddy Kleinwanzlebener	98.5	10.36	69.5
Elite Kleinwanzlebener	102.2	10.45	70.6
Average	100.1	9.56	67.4

This is over 19,000 pounds of sugar per acre.

A SHIPMENT OF SUGAR BEETS TO GRAND ISLAND, NEBRASKA.

As will be given more in detail later, the Business Men's Association, of Loveland, Colorado, in connection with the Denver Chamber of Commerce, offered prizes for the best crops of sugar beets raised in the vicinity of Loveland. The officials of the Union Pacific, Denver and Gulf Railroad considered that this would be a good opportunity to test the beets of northern Colorado on a commercial scale. They obtained several hundred pounds of beet seed from the Oxnard Sugar Company, of Grand Island, Nebraska, and distributed this to the farmers of Loveland and vicinity, free of charge, on condition that the growers ship their beets to Grand Island. Instructions in regard to the methods of growing beets were sent to each one, by the College; the present writer visited a good many of the farms during the growing season and took notes on the crop and the care it had received, and as the season advanced he took samples for analysis at various times until it was evident that the crops were ripe enough to ship.

The changes of the crop in the process of ripening and the date when the crop was ready for harvesting, can be gathered from the following samples that were among those taken at Loveland:

Name.	Dated when sample was taken.	Sugar in beet.	Purity.
R. S. Cox	Sept. 22	12.45	73.4
" " "	Oct. 4	12.73	78.5
" " "	" 20	13.40	75.7
John Hahn	Sept. 22	14.21	76.6
" "	Oct. 4	14.54	83.7
" "	" 20	17.39	83.7
C. C. Smith	" 4	13.87	79.4
" " "	" 27	14.73	79.0
N. R. Faulkner	" 4	10.93	72.1
" " "	" 22	12.07	74.0
Alvin Shields	" 3	13.30	81.2
" "	" 29	15.96	86.8
J. S. Steele	" 4	13.06	76.6
" " "	" 29	15 68	82.9
Harvey Skinner	" 3	16.53	84 5
" "	" 27	17.38	85.3
I. W. Clapper	" 4	16 15	83.9
" " "	Nov. 1	18.53	80.4
D. Hershman	Oct. 18	12.11	77.5
" "	" 31	14.06	74.9
P. C. Benson	" 3	17.96	83.6
" " "	" 20	17.77	84.0
" " "	" 31	19.05	86.0

According to these figures, a factory could have found beets in proper condition for working the last week in September, and ten days later nearly half the crops were of excellent quality. All of the fields improved in quality during October, and some of the more backward were hardly ripe before the end of the month.

Harvesting for shipment to Grand Island began on October 28 and was completed November 2. Six carloads were shipped from Loveland, two from Fort Collins and one from Greeley. Each wagonload of beets was weighed when brought to the cars and samples of the beets taken for analysis. When the cars reached Grand Island they were weighed, the beets again analyzed, and also a sample was cleaned to ascertain how much dirt was attached to the beets.

Name.	Date of harvesting.	Sugar in beet.	Purity.
E. E. Bassett, No. 1	Oct. 28	17.48	85.3
Harvey Skinner, No. 1	" 28	15.06	79.4
" " No. 2	" 28	17.32	83.1
" " No. 3	" 28	18.15	87.4
H. L. Boyd, No 1	" 28	17.10	85.0
John Hokanson	" 28	17.39	84 2
J. M. Naylor	" 28	16.15	84.7
G. O. Whelchel, No. 1	" 28	15.63	86.8
John Derby	" 28	18.77	84.5
Pugh and Merry, No. 1	" 29	13.73	75.4
" " " No. 2	" 29	14.73	81.8
R. S. Cox, No. 1	" 29	13.82	78.2
" " No. 2	" 29	12.83	75.4
J. S. Steele	" 29	15.68	82.9
E. E. Bassett, No. 2	" 29	17.77	84.8
J. W. Flinn	" 29	16.63	83.4
H. L. Boyd, No. 2	" 29	16.91	84 5
J. R. Samuels	" 29	14.96	83.0
I. O. Hollowell, No. 1	" 29	16.58	78.1
" " No. 2	" 29	16.63	82.6
P. C. Benson, No. 1	" 29	19.33	87.9
" " No. 2	" 29	19.14	87.5
C. H. Brown	" 29	16.34	84.7
H. C. Caldwell, No. 1	" 29	12.97	73.7
W. H. Fairbrother	" 29	15.87	80.9
W. M. Pugh	" 29	14.20	78.1
J. J. Youtsey	" 29	18 00	87.2
G O. Whelchel, No. 2	" 29	18.53	86 6
W. S. Warner, No 1	" 29	17.53	80.1
Alfred Wild	" 31	15.25	80.7
F. G. Barthelf, No. 1	" 31	13.83	78.0
D. Hershman	" 31	14.06	74 9
E. F. Abernathy	" 31	15.34	78.2
W. S. Warner, No. 2	" 31	18.24	84.0
Alvin Shields, No. 1	" 31	14.39	77.8
" " No. 2	" 31	15.96	86.8
H. C. Caldwell, No. 2	" 31	16.15	82 0
John Hahn	" 31	15.01	75 5
P. C. Benson, No. 3	Nov. 2	19.05	86.0
F. G. Barthelf, No. 2	" 2	15.68	85.3
C. A. Anderson, No. 1	" 2	15.96	86.0
" " No. 2	" 2	15.44	87.7

The six cars of beets from Loveland were several days on the road, and of course dried out considerably. This would tend to lower the weight and raise the analysis, as is seen in the table below

Car.	Loveland weight.	Grand Island weight.	Loveland Analysis.		Grand Island Analysis.	
			Sugar in beet.	Purity.	Sugar in beet.	Purity.
U. P. 27599	31070	29600	16.00	84.8	17.1	84.8
O. R. & N. 6147	30850	30000	15.24	81.5	16.8	83.7
U. P. 40847	31870	30800	15.60	82.3	16.9	80.8
U. P. D. & G. 26964	19000	17700	14.50	80.7	16.0	82.8
U. P. 66800	29460	25800	15.19	81.0	15.8	80.2
U. P. 41001	17590	16700	15.62	85.7	15.8	79.8
Average	26640	25100	15.36	82.7	16.4	82.0

The above shows a shrinkage, during the time of shipping, of 1,540 pounds per carload, or 6 per cent. In addition to this shrinkage, there was a still further deduction made for the "tare," or the dirt on the beets, and improper trimming. After making both these allowances, the record stands as follows :

Car.	Grand Island weight.	Per cent of tare.	Net weight.	Sugar in beet.	Purity.	Price for beets per ton.	Pure sugar per car.
U. P. 27599	29600	11.0	26344	17.1	84.8	$4.75	4505
O. R. & N. 6147	30000	7.0	27900	16.8	83.7	4.75	4687
U. P. 40847	30800	9.0	28028	16.9	80.8	4.75	4737
U. P. D. & G. 26964	17700	5.0	15930	16.0	82.8	4.50	2549
U P. 66800	25800	13.0	22446	15.8	80.2	4.50	3547
U. P. 41001	16700	10.0	15030	15.8	79.8	4.50	2375
Average		10.0		16.4	82.0	$4.62	
Total	150600		135678				22400

No complete records were kept of yield per acre. There was some trouble about getting the cars for shipment, and owing to a shortage of cars there were so many beets that had been raised that were not shipped that it was impossible in several cases to tell the amount of land on which the part of the crop grew that was shipped. We have the records of about three-fourths of the beets, and the average of these is a trifle less than nineteen tons to the acre, gross weight, or, after taking out the tare, a little over seventeen tons net per acre. This gives about 5,300 pounds of pure sugar per acre, or about 300 pounds more sugar per acre for these

crops at Loveland raised under field conditions, than is found as the average of the whole state for the crops grown in competition for the sugar beet prizes.

This shipment of beets is one of the best ever made where the crop came from so many different farms, and shows conclusively that Colorado soil and climate are wonderfully adapted to the sugar beet.

In this connection, it seems proper to add the records of some shipments of sugar beets made in 1893 and 1894 from Grand Junction and vicinity to the sugar factory at Lehi, Utah:

Date of shipment.	*No. of cars.*	*Sugar in beet.*	*Purity.*
Nov. 15, 1893	1	15.7	84.0
" 20, "	1	16.2	84.0
" 20, "	1	15.0	84.0
1894	1	14.7	88.4
"	2	14.2	84.2
"	1	12.6	78.5
Average of seven cars		14.7	83.7

SUGAR BEETS AT GRAND JUNCTION.

The bulletins of the Agricultural College contain nearly all of the analyses that have ever been made of Colorado sugar beets. In order to make the record complete, it is deemed best to insert here two sets of analyses made in the years 1893 and 1894 of beets raised in the valleys of the Grand and the Gunnison.

The seed was furnished by the Utah Sugar company of Lehi, Utah, the samples of the beets were taken with the greatest care by men sent out for that special purpose, and the analyses were all made at the sugar factory at Lehi. The first table gives the results of the season of 1893:

Name.	Date planted.	First Sampling.			Second Sampling.		
		Date.	Sugar in beet.	Purity.	Date.	Sugar in beet.	Purity.
P. A. Rice	Apr. 20	Sept. 27	13.0	73.5	Oct. 25	13.6	73.6
Mr. Currie	" 20	" 27	12.2	73.5	" 25	12.7	76.1
A. A. Miller	" 20	" 19	10.2	72.3	" 25	14.1	81.3
Indian School	" 26	.....	.....	.....	" 19	16.0	84.0
A. J. McCune	" 22	" 27	10.0	67.1	" 25	11.7	70.9
Ed. Bravier	" 22	" 27	13.4	76.1	" 19	15.7	85.0
Eugene Allison	" 28	.....	.....	.....	" 25	16.5	81.3
Ovid Turnill	" 29	.....	.....	.....	" 25	13.3	78.2
W. H. Benkitt	May 3	" 27	12.0	74.1	Nov. 4	14.0	78.3
W. D. Spencer	" 4	" 27	11.5	71.4	Oct. 31	13.8	78.5
N. Poffenberger	" 8	" 19	11.6	73.5	" 16	14.7	81.0
L. Johnson	" 8	" 19	9.5	67.5	" 25	12.6	84.0
W. F. Shewel	" 9	" 27	9.0	67.7	" 25	10.4	76.5
Joseph Smith	" 9	.....	.....	.....	" 25	14.8	83.9
John Vaughn	" 10	" 27	12.4	72.1	.....	.....	.....
M. S. Hildreth	" 11	.....	.....	.....	" 31	12.8	77.2
J. C. Sullivan	" 12	.....	.....	.....	" 31	12.3	72.2
Frank Leach	" 15	" 19	12.7	76.4	" 25	15.0	82.0
Geo. Davis	" 17	.....	.....	.....	" 31	17.2	76.3
C. N. Cox	" 23	" 27	10.4	68.3	" 25	15.1	81.5
Smith Bros	" 15	.....	.....	.....	" 25	16.1	83 7
Mr. Almes	" 15	.....	.....	.....	" 31	12.5	78.8
Frank Rich	" 23	" 27	11.6	70.0	" 25	17.0	84.5
W. E. Renick	" 25	" 19	12.3	77.7	" 16	11.6	68.9
John Peugh	" 26	" 19	11.0	75.3	.....	.....	.....
J. O'Keefe	" 30	" 27	11.0	78.8	.....	.....	.....
J. A. Lawton	" 30	" 27	10.9	69 4	.....	.....	.....

During the month from the latter part of September to the last of October the beets improved about two per cent in sugar and nearly ten per cent in purity. The shipments of carload lots were not made until late in November, and the beets of those that shipped had made by that time a still farther gain of one per cent in sugar.

The above crops represent all kinds of soil from one end of Grand valley to the other.

This was the first season that these farmers had raised sugar beets, and the general tendency was to give too much water and too little cultivation. Some of the fields had one cultivation, a smaller number were cultivated twice, and most of them had no cultivation

at all. In only a few cases was the thinning done with any degree of care.

In every case where the last analysis has shown a purity less than 80, the crop was irrigated from two to four times.

The work was repeated in 1894, and as many of the growers had had the benefit of the previous year's experience, the tests as a whole show an improvement. Only one set of samples was taken, and the results show that several of these were taken before the beets were ripe.

Sample Number.	Number of beets in sample.	Sugar in beet.	Purity.	Sample Number.	Number of beets in sample.	Sugar in beet.	Purity.
1	6	16.0	84.4	21	6	16.1	85.0
2	9	13.0	78.2	22	6	12.8	79.4
3	9	15.8	78.0	23	4	12.2	73.1
4	6	12.5	72.0	24	9	14.4	81.3
5	5	16.8	86.2	25	4	11.9	75.3
6	4	15.0	74.5	26	4	12.8	76.7
7	4	14.2	78.8	27	7	12.5	69.6
8	6	15.8	86.3	28	9	15.1	84.6
9	7	12.0	78.8	29	4	13.3	81.4
10	4	17.5	87.4	30	18	17.6	85.6
11	3	16.0	83.3	31	7	13.9	81.6
12	4	18.0	87.0	32	8	15.0	84.0
13	4	17.5	86.1	33	5	14.3	77.3
14	8	17.0	86.2	34	2	12.8	79.0
15	4	14.7	82.9	35	9	15.2	82.0
16	5	12.1	74.2	36	4	12.6	74.3
17	5	16.9	85.6	37	8	15.0	83.7
18	6	13.5	79.3	38	1	15.7	84.6
19	5	14.6	81.5	39	11	14.5	83.1
20	7	15.0	82.9				

Several of these samples deserve special attention. Numbers 2, 18 and 34 grew very large beets, from four to six pounds weight each, and had an enormous weight per acre, and yet, although these beets are not so rich as some of the others they are above the standard required by factories and would have brought a large return per acre. Numbers 27 and 28 came from the same field, the first from sandy soil and the other from heavy adobe soil. Number 39 is also from sandy soil, while number 30 is from new land and heavy adobe. In both cases the sandy soil gives poorer beets than

the heavy soil. The same has been noted in northeastern Colorado, where the heavy soil, though harder to work, gives a better quality of beet.

Numbers 1, 5, 10, and 17 had had previous experience in raising beets, and their crops averaged 16.8 sugar and 85.9 purity, showing that care and experience are all that are needed to raise the best of beets in the valley of the Grand.

SUGAR BEET PRIZES.

It was recognized in the spring of 1898, that the time had come when there should be a well organized effort to get the most exact information possible on the adaptation of the sugar beet to Colorado soil and climate. Nearly all the estimates of previous beet crops in Colorado have been based on the yield from a hundred square feet of ground. It was recognized by all that this was too small a plot for commercial estimates. It had been adopted because the beet growers disliked to spend the large amount of time and trouble necessary to make exact experiments on a large scale. It was seen that some substantial inducement must be offered before it could be expected that better results could be obtained than those of former years.

Acting on this idea, the Denver Chamber of Commerce offered $1,000 in cash prizes to those who grew the best crops of beets, these to be grown on a commercial scale, and each to cover 2,700 square feet of ground. The offer was conditioned on the appropriation of certain sums for the same purpose by the County Commissioners of each county. This was done by the County Commissioners of the following counties: Conejos, Costilla, Delta, Logan, Mesa, Otero and Weld. In Larimer county the money was subscribed by the business men of Loveland; in Fremont county by the Canon City Chamber of Commerce; while in Garfield county prizes were offered by the Denver and Rio Grande and by the Colorado Midland railroads.

The following instructions were sent to those who desired to compete for these prizes:

COLORADO AGRICULTURAL COLLEGE.

Directions for Harvesting the Crop.

The plot of beets selected to compete for the prizes must contain, as nearly as possible, one-sixteenth of an acre, and must be all in one continuous piece. Call in a neighbor to witness harvesting and certify to the weights and measures.

Begin on one side and harvest every other row, *but no row harvested should be an outside row, i. e.*, if the plat selected is on the outside of the field, begin with the second row and harvest every other row.

Cut off the tops of the beets just at the base of the leaves, Shake the beets free from any loose dirt, and weigh the crop in this condition. This is the one referred to later as the "gross weight."

Throw the beets into a pile and roughly divide the pile in the middle, and again divide one of the halves in the middle, giving one-fourth of the original crop. Throw this fourth into a pile and treat it the same way, so that you have a fourth of a fourth, or about one-sixteenth of the crop. Weigh this lot and record it as the "gross weight of one-sixteenth of crop." Scrape these beets with a dull knife until they are free from dirt, fibrous roots and any stubs of leaves that may have been left on the crown. Weigh again and call this the "net weight of one-sixteenth of crop."

Count the number of beets in this last lot, and then select from it four to eight beets that together will weigh about eight pounds, and will be representative of the crop, *i. e.*, select big, medium and little, good shaped and bad, so as to get a fair sample of the lot. Weigh these beets together *very carefully*, and record this as "weight of sample for analysis."

Wrap each of the beets separately in paper and then do them up in two packages, not to exceed four pounds in each package, sew each package up securely in cloth and attach the mailing tag, which will enable the package to be sent postage free.

The harvesting, weighing and preparing the sample for analysis should all be done on the same day, and as quickly as possible to prevent drying out.

Three blanks are sent you; one to be filled out and enclosed in each package, and the other to be kept by you for your own information.

Mail the sample for analysis as soon as possible after it is ready. The receipt of the sample for analysis will be acknowledged by return mail.

Do not harvest the rest of the plot until you receive word that your sample and records are satisfactory. By this means it may be possible to correct mistakes, if any have accidently been made.

It will be seen from the instructions, that it was desired that the crops be harvested and sampled between October 15 and November 1. In the case of Logan county, the crops were harvested the last week in September, so that they could be exhibited at the county fair. The crops were not then ripe and the results are much poorer, both in quantity and quality, than would have been obtained had the beets remained in the ground a month longer. At the request of the present writer, two of these fields were but partly harvested, and the rest of the beets were pulled the latter part of October, when the beets in the other counties were being harvested. In each case the beets tested in sugar more than three per cent higher than during September.

It was desired that the contest be put as nearly as possible on a commercial basis, *i. e.*, the prizes be awarded to the crops in the order of their real value for sugar making purposes. It was necessary then, to take into account three things: The weight of the

crop, the amount of sugar in the crop, and the amount of sugar that could be gotten out in the factory. These items are given in the accompanying tables. The column headed "Gross weight of trimmed beets per acre," gives the weight of the beets in the same condition as they would ordinarily be brought to a factory, *i. e.*, with the tops cut off, but no attempt made to remove the dirt that naturally sticks to the beet. At a factory, a sample of the beets, usually about half a bushel, is taken and cleaned and the calculation made as to how much dirt there is in the whole load.

The column headed "Sugar in the beet," represents the character of the beet at the time it was analyzed. On the average, this was about three days after harvesting. During this time, of course, the beets had been drying out, which would tend to raise the per cent of sugar in the sample. The first two columns, therefore, represent the gross weight of beets and dirt together and the analysis of a partly dried sample, in both cases making the crops apparently better than they were. To offset this, the column headed, "Pure sugar per acre," is obtained by multiplying the other two together and deducting one-fifth for tare and drying out. It is probable that this is a larger shrinkage than would have been made had these crops been sent to a sugar factory, but it is deemed best to make sufficient reduction so there could be no possible appearance of an attempt to exaggerate Colorado's sugar beet crops. The figures, even after the 20 per cent reduction, show magnificent crops, and still more so that we can look at them as a slight underestimate.

The column headed "Purity," is the measure of the factory value of the sugar that is in the beet. If a lot of beets test 80 purity, it means that for every 80 pounds of pure sugar they contain, they also have 20 pounds of impurities that are not sugar. These impurities prevent the factory from saving all the pure sugar, and the greater the amount of impurity the greater the amount of pure sugar that will be lost in the process of manufacture. The "pure sugar per acre," multiplied by the "purity" will give the "available sugar per acre," or the approximate amount of sugar that would have been produced from the crops in an ordinary factory. It is considered that this measures the true sugar value of the crop, and it is on the figures of this column that the order of excellence of the various crops is based.

In the table of averages by counties, another column is introduced headed "Factory value per acre." It is obtained by deducting ten per cent tare from the gross weight of the crop and multiplying the remainder by the price paid during 1898 by factories where the price is varied according to the quality of the beets. The prices used are :

$3.75 per ton for beets testing less than 14.4 sugar and less than 78 purity.

$4.00 per ton for the same sugar and more than 78 purity.
$4.25 per ton for tests from 14.5 to 15.4 sugar.
$4.50 " " " " " 15.5 to 16.4 "
$4.75 " " " " of 16.5 sugar or higher.

CONEJOS COUNTY.

Name and Place.	Date of harvesting the crop.	Gross weight of trim'ed beets per acre. Tons.	Sugar in beet.	Purity.	Pure sugar per acre. Lbs.	Available sugar per acre. Lbs.
Chas. Milne, La Jara	Nov. 7	28.16	17.65	79.8	7952	6436
W. M. Martin, Alamosa	Oct. 29	24.57	16.96	86.8	6684	5802
W. A. Braiden, La Jara	" 10	20.05	11.45	72.2	3673	2803
D. E. Newcomb, La Jara	" 12	12.80	15.65	80.1	3205	2563
S. J. Parish, Alamosa	" 16	12.06	16.64	80.5	3174	2554
J. L. Rutledge, La Jara	" 15	.....	18.91	84.4	.....	.....
J. W. Dove, Alamosa	.....	.....	13.19	78.0	.....	.....
Mrs. N. A. Broyles, Antonito	" 15	.....	11.97	70.9	.....	.....
Average	Oct. 21	19.53	15.67	80.0	4689	3741

COSTILLA COUNTY.

G. W. Shaw, Alamosa	Oct. 22	12.29	15.30	86.6	3008	2605
A. McKinnon, Alamosa	" 18	7.26	12.54	83.8	1457	1213
Peter Legard, Alamosa	" 20	.....	15.58	.....	.....	.....
N. E. Morgan, Hooper	Nov. 7	.....	20.43	83.2	.....	.....
R. W. Maddux, Mosca	Oct. 15	.....	12.40	83.8	.....	.....
Wm. Douglas, Mosca	" 18	22.60	.....	.....	.....	.....
Average	Oct. 22	14.05	15.42	84.3	3093	2607

DELTA COUNTY.

G. H. Hammond, Hotchkiss	Oct. 22	38.51	17.34	77.4	10962	8485
Martin Cade, Delta	" 17	20.57	15.91	89.5	5236	4686
G. W. Umbrell, Delta	" 31	21.78	14.68	80.9	5116	4139
I. S. Hewitt, Delta	" 19	19.96	12.87	71.0	4118	2924
J. M. Trew, Delta	" 19	10.87	13.40	76.5	2331	1783
Charles A. Barnes, Delta	" 28	.....	15.44	83.9	.....	.....
Average	Oct. 23	22.54	14.74	80.0	5301	4241

FREMONT COUNTY.

Name and Place.	Date of harvesting the crop.	Gross weight of trim'ed beets per acre. Tons.	Sugar in beet.	Purity.	Pure Sugar per acre. Lbs.	Available sugar per acre. Lbs.
B. F. Rockafellow, Canon City	Oct. 21	30.05	18.05	86.8	8678	7533
William Curtis, Canon City	" 29	29.18	16.63	86.9	7766	6748
L. K. Mortimer, Canon City	Nov. 2	26.35	17.96	83.5	7589	6337
Charles Kaess, Cotopaxi	Oct. 24	29.40	16.63	79.6	7822	6226
G. E. Murray, Howard	" 15	29.80	15.33	84.3	7310	6162
W. A. Dumm, Canon City	" 28	21.33	18.05	82.0	6160	5051
J. M. Murray, Howard	" 15	29.52	13.63	79.4	6444	5117
John Ripley, Canon City	" 27	21.90	16.96	80.3	5942	4772
H. T. Gravestock, Canon City	" 20	14.50	16.48	90.7	3831	3475
E. S. Armstrong, Hillside	" 12	16.13	15.68	77.7	4046	3116
C. H. Gravestock, Canon City	" 28	8.45	19.00	84.8	2569	2178
E. V. Kimmel, Canon City	" 20	.....	18.05	93.5	.....	.....
Phil Sheriden, Canon City	" 18	.....	19.10	81.3	.....	.....
B. F. Rockafellow, Canon City	" 29	.....	18.24	81.8	.....	.....
J. E. Brown, Canon City	.....	.....	14·42	81.3	.....	.....
A. C. Haggart, Canon City	" 20	.....	12.06	67.7	.....	.....
Average	Oct. 23	23.36	16.87	84.1	6226	5236

GARFIELD COUNTY.

C. H. Harris, Catherin	Oct. 29	37.98	17.20	80.1	10458	8397
D. G. Edgerton, Carbondale	" 18	14.91	17.34	91.8	4113	3776
Jesse Kerlee, Parachute	" 19	10.77	15.68	88.0	2702	2378
Charles H. Miller, Antlers	" 17	12.17	14.25	79.4	2774	2203
W. C. Parker, New Castle	.....	.....	17.39	82.9	.....	.....
C. M. Rulison, Parachute	.....	.....	15.89	82.2	.....	.....
Harry Brenton, Rifle	.....	.....	15.91	83 6	.....	.....
F. W. Mallory, New Castle	" 21	.....	15.96	76.1	.....	.....
E. E. Westhafer, Satank	" 18	.....	15.01	86.7	.....	.....
F. M. Peebles, Satank	.....	.....	16.29	78.8	.....	.....
Average	Oct. 21	18.96	16 12	84.8	4901	4153

LARIMER COUNTY.

Name and Place.	Date of harvesting the crop.	Gross weight of trim'ed beets per acre. Tons.	Sugar in beet.	Purity.	Pure sugar per acre. Lbs.	Available sugar per acre. Lbs.
J. M. Naylor, Loveland	Oct. 23	36.26	16.53	79.3	9590	7589
I. W. Clapper, "	Nov. 1	31.60	18.53	80.4	9369	7533
C. C. Smith, "	Oct. 27	33.01	14.73	79.0	7781	6147
F. G. Bartholf, "	" 31	28.72	15.68	85.3	7205	6142
Alfred Wild, "	" 27	31.50	15.25	80.7	7606	6138
Alvin Shields, "	" 29	27.47	17.43	79.7	7490	5970
Harvey Skinner, "	" 27	24.80	17.38	85.3	6896	5882
R. O. Joslyn, "	" 27	14.10	18.05	84.8	4072	3453
R. S. Cox, "	" 27	21.05	13.40	75.7	4513	3416
P. C. Benson, "	" 31	10.72	19.05	86.0	3267	2810
N. R. Faulkner, "	" 22	19.35	12.07	74.0	3456	2765
Average	Oct. 28	25.32	15.69	80.9	6356	5091

LOGAN COUNTY.

Fred Bernhard, Sterling	Sept. 26	34.15	13.40	72.7	7322	5323
W. C. Propst, Merino	" 25	24.50	14.72	76.2	5771	4397
A. F. Krause, Sterling	" 27	21.50	14.50	83.7	4988	4175
J. H. King, Sterling	" 27	18.10	13.30	79.1	3852	3047
C. D. Brownell, Iliff	" 26	14.60	14.72	80.0	3438	2750
C. M. C. Woolman, Sterling	" 27	12.50	14.30	72.4	2860	2071
C. E. Harter, "	" 27	9.50	15.33	78.8	2331	1837
T. A. Whiteley, "	" 26	7.65	14.15	71.5	1730	1239
James Weir, "	" 26	.....	14.49	78.2	.....	.....
M. V. Propst, "	" 26	.....	14.25	78.8	.....	.....
John Landrum, "	Oct. 1	.....	14.10	79.2	.....	.....
R. C. Perkins, "	Sept. 27	.....	13.30	79.1	.....	.....
H. C. Hatch, "	" 26	.....	12.63	73.3	.....	.....
Average	Sept. 27	17.8	14.09	77.3	4013	3102

MESA COUNTY.

Name and Place.	Date of harvesting the crop.	Gross weight of trim'ed beets per acre. Tons.	Sugar in beet.	Purity.	Pure sugar per acre. Lbs.	Available sugar per acre. Lbs.
Fred Burmeister, Grand Junction	Oct. 1	36.0	17.10	86.3	9850	8491
J. D. Payne, Grand Jnnction	Nov. 23	29.3	16.57	76.0	7768	5904
Adam May, Debeque	" 14	22.0	16.41	77.3	5776	4465
W. K. Sterling, Collbran	Oct. 26	21.0	14.30	88.2	4805	4234
Joseph Dietz, Fruita	" 29	27.0	13.54	71 6	5850	4183
J. P. Veach, Fruita	" 29	11.2	19.81	85.4	3878	3313
E. B. Bonnel, Grand Junction	" 25	23.2	11.40	68 2	4241	2932
C. V. Wasson, Grand Junction	Nov. 5	11.6	16.15	75.8	3019	2289
G. N. Patterick, Grand Junction	" 2	16.5	11.88	72.7	3142	2284
S. M. Cox, Fruita	Oct. 29	.....	15.16	77.0	.....	.....
H. S. Groves, Fruita	" 29	.....	14.16	78.4	.....	.....
Lee D. Wilson, Grand Junction	Nov. 21	11.7	.....	.....	.....	.....
Average	Nov. 2	20.9	15.22	77.9	5114	3984

OTERO COUNTY.

J. W. Ruble, Rocky Ford	Oct. 25	31.40	18.19	86.2	9138	7877
J. P. Pollock, La Junta	Nov. 7	33.52	18.01	77.7	9652	7500
B. F. Wyckoff, Rocky Ford	Oct. 25	23.21	14.16	78.3	5259	4108
Albert Conner, Rocky Ford	" 27	27.70	10.83	72.8	4800	3494
C. S. McKinley, Fowler	" 20	13.27	16.06	84.7	3411	2889
Fred Janrow, Fowler	" 29	18.17	13.30	73.6	3906	2875
Richard Mason, Higbee	" 20	10.70	15.20	78.3	2603	2048
C. S. Heath, La Junta	" 26	.....	15.39	76.8	.....	.....
C. W. Ruckman, La Junta	" 20	.....	14.96	83.3	.....	.....
M. A. Gordon, La Junta	" 29	.....	15.34	76.8	.....	.....
Marten Sorensen, Fowler	" 17	.....	15.39	73.4	.....	.....
Average	Oct. 26	22.59	15.14	79.8	5474	4379

WELD COUNTY.

Leonard Burch, New Windsor	Oct. 25	17.17	17.10	83.5	4699	3924
Newton Clegg, Greeley	" 25	12.20	16.25	78.1	3172	2477
Martin Nelson, Greeley	" 18	12.58	15.68	74 2	3154	2340
Fritz Niemeyer, Evans	" 26	.....	14 54	82.4	.....	.....
C. F. Mason, Greeley	" 13	.....	14.44	81.2	.....	.....
Average	Oct. 23	13.98	15.89	79.8	3562	2850

AVERAGE RESULTS BY COUNTIES.

County.	Date of harvesting of crop.	Gross weight of trim'ed beets per acre. Tons.	Sugar in beet.	Purity.	Pure sugar per acre. Lbs.	Available sugar per acre. Lbs.	Factory value per acre.
Conejos	Oct. 21	19.53	15.67	80.0	46.89	3741	$ 79.11
Costilla	" 20	14.05	15.42	84.3	30.93	2607	56.92
Delta	" 23	22.54	14.74	80.0	53.01	4241	86 23
Fremont	" 23	23.36	16.87	84.1	6226	5236	99.75
Garfield	" 21	18.96	16.12	84.8	4901	4155	76.98
Larimer	" 28	25.32	15.52	80.2	6278	5023	102.56
Logan	Sept. 27	17.80	14.09	77.3	4013	3102	64.00
Mesa	Nov. 2	20.90	15.22	77.9	5114	3984	79.90
Otero	Oct. 26	22.59	15.14	79.8	5474	4374	86.40
Weld	Oct. 23	13.98	15.89	79.8	3562	2850	56.70
Average	Oct. 22	19.90	15.47	80.8	4950	4000	$ 76.07

In considering the foregoing tables, one is struck at once with the high average excellence of the sugar beets of Colorado as regards both quantity and quality. In the districts of the United States, where beets are raised for factories, 12 per cent of sugar and 78 purity are considered standards, and one who has raised ten to thirteen tons of beets to the acre is thought to have done well. A fair estimate of the cost of raising sugar beets is $30 per acre, while the above table gives $76.07 as the average factory value for the whole state. The difference of $46.07 profit per acre will compare well with any other kind of farming practiced in Colorado, not even excepting the famed cantaloupes of the Arkansas valley, the orchards of the western slope, or the lambs of the northern feeding districts.

In concluding this portion of the subject, it is fitting that grateful appreciation should be expressed of the aid that the Denver Chamber of Commerce has given in this work. The above tables present the largest amount of the most reliable reports that have ever been collected concerning Colorado sugar beets, and their collection was made possible, only through the generosity and public spirit shown in offering the sugar beet prizes.

Cooke, Wells W. 1899. "Sugar beets in Colorado in 1898." *Bulletin* 51, 1–43.

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