

T H E S I S

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A COMPARISON OF PASTURED AND  
ENSILED BEET TOPS AS A FATTENING  
FEED FOR YEARLING STEERS

Submitted by  
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I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY  
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## INTRODUCTION

The growing of sugar beets has become one of the leading industries of Northern Colorado, and with it has come the problem of utilizing the various by-products of the beets.

The beet tops, which include not only the tops, but also a part of the crown of the beet, are the first of the by-products to be utilized. They are usually left in the field in windrows on either side of the furrow in which the topped beets are piled, and if utilized during the fall or early winter of the year in which they are grown will yield considerable feed. If, however, they are left in the field until spring very little good is to be had from them.

In this section of the state it is customary to feed the tops to cattle or lambs, because many of the beet growers feed either cattle or lambs, or both, during the fall and winter.

There are three methods which have been practiced in utilizing the beet tops. The most general of these is pasturing them in the field where they were grown. Perhaps 85 percent of the tops are made use of in this manner. A few, possibly 5 to 10 percent are dried in the field and then hauled to the feed lots to be fed. The remainder, which is a very small percentage, are made

into beet top silage.

In making beet top silage, a trench silo is most commonly used. This is simply a trench dug in the ground, preferably in some well drained spot, and in soil which will not easily cave in or crumble, so as to mix with the beet tops after they are placed in the silo.

The trench may be of any dimensions desired, but one from six to eight feet wide and four to eight feet deep, with length enough to give it the necessary capacity for holding what tops are to be ensiled is preferable. It is customary to make the ends sloping so that a wagon loaded with the tops can be driven into the trench for unloading, and also so the tops may be better packed by driving over them.

An analysis of the beet tops, taken at the Colorado Experiment Station in the fall of 1922, after the tops had remained in the field for sometime, showed the following composition:

Moisture	71.2%
Ash	7.32%
Ether Extract	.673%
Protein	4.360%
Nitrogen Free Extract	18.44%

While the ensiling of beet tops is still comparatively new in this country, it is a common practice in Germany and other European countries. Of the ensiling of beet tops in Germany, Mr. Hans Mendelson, Chief Agriculturist for the Great Western Sugar Company, has

the following to say:

"In Germany, where pressed wet pulp was returned during the campaign - a load for each load of beets delivered - the pulp was placed in a silo with alternating layers of beet tops. These silos were merely longitudinal excavations - carefully lined with concrete, brick or cobble stones in permanent places near the stables.

As the factories turned out more and more dried pulp, the beet tops are still siloed during the beet harvest and coincident with it. In the moist climate of middle Europe, the keeping of beet tops in the fields is impossible, as they rot very quickly. Pasturing there is also impossible, as the soil is generally too moist and the weather is not good enough to raise cattle or young animals in the open air. This refers only to the beet districts in middle Europe. There are many places in the South and West of Germany and along the ocean, where conditions are more favorable.

Personally, I think the siloing of beet tops in our western beet districts is ill-advised. Beet tops can be cured in small piles perfectly. The best method is to haul the cured tops to the feed yard, so that by liberal use of bedding the optimum amount of manure may be obtained for the maintenance of humus in the soil. Even if time should be lacking for hauling the beet tops, the little piles are better for the animals to pasture from

with the least waste and in case of a little snow are still sticking out of the snow easily accessible to the animals.

All these feeding methods have to be adapted to local conditions, just like methods of tilling the soil. Widely different methods are possible and necessary in middle Europe from what we can do here."

In connection with this test the author in his capacity as a Fellow in the Animal Husbandry Department was an assistant in actually conducting the test.

PREVIOUS WORK WITH BEET TOPS

In the fall of 1918 the Colorado Agricultural Experiment Station started a feeding experiment with tops which was continued on the same basis for three consecutive years, and in 1921 only pastured beet tops and beet top silage were used.

Five lots of ten yearling steers each were fed on the following rations during 1918, 1919, and 1920:

- Lot I Wet Beet Pulp and Alfalfa Hay
- Lot II Pastured Beet Tops and Alfalfa Hay
- Lot III Dried Beet Tops fed in the lot and Alfalfa Hay
- Lot IV Beet Top Silage and Alfalfa Hay
- Lot V Corn Silage and Alfalfa Hay

In 1921 Lot I Pastured Beet Tops and Alfalfa Hay  
 Lot II Beet Top Silage and Alfalfa Hay

Table No. I gives the average daily gain per steer for the five lots fed on the different rations during the four years.

Table No. I Year of Test	Average Daily Gain Per Steer				
	1918	1919*	1920*	1921	Average
Lot I Wet Beet Pulp and Alfalfa Hay	1.98	2.42	2.19		2.19
Lot II Pastured Beet Tops and Alfalfa Hay	1.30	.61	1.86	1.49	1.31
Lot III Dried Beet Tops and Alfalfa Hay	1.12	1.29	1.79		1.40
Lot IV Beet Top Silage and Alfalfa Hay	1.13	1.56	1.61	1.46	1.44
Lot V Corn Silage and Alfalfa Hay	1.45	1.79	1.95		1.73

\*Colorado Experiment Station Bulletins 335A and 422.



It will be noted from Table No. I that the wet beet pulp and alfalfa hay lot leads all others in average daily gain per steer with an average of 2.19 pounds for the three years. In the lots where beet tops were fed there was considerable variation, however, from year to year. This might be largely attributed to the differences in weather conditions, the quality and condition of the tops, the amount of tops fed where they were hand fed, and the quality of the hay fed in different years.

In 1918 weather conditions were fairly good with no great amount of wet and stormy days. This made it possible to get quite a complete utilization of the pastured beet tops and they gave a fair rate of gain. The next year, however, was one with very bad weather, there being five distinct snowstorms and the temperature at one time dropped to as low as 34 degrees below zero. Consequently it was not possible for the steers to use as many of the tops, more hay was consumed, and a lower rate of gain resulted. In 1920 ideal weather conditions were had, the tops were practically all eaten by the steers, and a good gain was made by this lot. The following year was again only moderately favorable, but good gains were made and the tops well utilized.

The dried beet tops fed in the lots did not produce as good gains in 1918 as in the two following years. This might have been caused by some of the tops spoiling after

they had been hauled to the lots in too large quantities, also by a larger daily feed per steer, and by a rather poor quality of hay which was fed that year. There might also have been a difference in the quality of the steers as compared with those fed in other years. During 1919 and 1920 this method of feeding the tops made gains which compared very favorably with the other methods, for some of the difficulties encountered in the first year had been overcome.

Beet top silage and alfalfa hay also produced its lowest gain in 1918, probably for much the same reasons as the dried beet tops and alfalfa. During the next three years this ration produced gains which were comparatively high. For the four years it ranked above pastured beet tops and dried beet tops and was outranked only by the rations in Lots I and V.

Corn silage and alfalfa hay in the three years gave gains which were second only to wet beet pulp and alfalfa hay.

The average gains for the several tests placed corn silage and alfalfa hay second only to wet beet pulp and alfalfa hay, thereby, demonstrating the values of these two rations. In the lots fed on beet tops, beet top silage ranks highest, producing an average daily gain of 1.44 pounds for four years. Dried beet tops and alfalfa hay was a close second with 1.40 pounds while pastured

beet tops and alfalfa hay show the lowest gain 1.31 pounds for four years. For the three good years, eliminating 1919, this ration shows a gain of 1.55 pounds; higher than the other two lots. From these results it is quite evident that good weather conditions are necessary to produce favorable gains from pastured beet tops and alfalfa hay.

Table No. II

Feed Required for 100 Pounds Gain (Feed Lot Weights)

Year	1918				
	1	2	3	4	5
Lot Number	10	10	10	10	10
No. Steers in Lot	10	10	10	10	10
Ration Fed to Steers	Wet Beet Pulp Alfalfa Hay	Pastured Beet Tops Alfalfa Hay	Dried Beet Tops Fed in Lot Alfalfa Hay	Beet Top Silage Alfalfa Hay	Corn Silage Alfalfa Hay
Feed Required for 100 Pounds Gain	3911.4	12705 or .77 Acre	3024.6	3849.6	2310.3
Wet Beet Pulp	441.1	534.7	1663.0	1752.7	757.4
Pastured Beet Tops					
Dried Beet Tops					
Beet Top Silage					
Corn Silage					
Alfalfa Hay					
Year	1919				
Wet Beet Pulp	2578.9	2.06 Acres			
Pastured Beet Tops			1434.6	1497.7	1956.2
Dried Beet Tops					
Beet Top Silage					
Corn Silage					
Alfalfa Hay	639.8	2137.3	1207.9	1163.2	698.2
Year	1920				
Wet Beet Pulp	2490.9	.539 Acre			
Pastured Beet Tops			1000.7	1239.7	1458.4
Dried Beet Tops					
Beet Top Silage					
Corn Silage					
Alfalfa Hay	750.9	316.5	972.8	1075.3	546.5

Table No. II - Continued

		1921			
Year	Lot Number	1	2	3	4
No. Steers in Lot	No. Steers in Lot	31	31	31	31
Ration Fed to Steers	Wet Beet Pulp Alfalfa Hay	Pastured Beet Tops Alfalfa Hay	Dried Beet Tops Fed in Lot Alfalfa Hay	Beet Top Silage Alfalfa Hay	Corn Silage Alfalfa Hay
Pastured Beet Tops		.866 Acre			
Beet Top Silage Alfalfa Hay		156.7		1373.00 1297.48	
Four Years for Pastured Beet Tops and Beet Top Silage					
Lot Number	1	2	3	4	5
No. Steers in Lot	10	10	10	10	10
Feed Required for 100 Pounds Gain					
Wet Beet Pulp Pastured Beet Tops	2992.73				
Dried Beet Tops Beet Top Silage Corn Silage Alfalfa Hay		1.0587 Acres	1819.96	1990	1908.3 667.4
	610.6	785.8	1281.2	1322.17	

From Table No. II it is evident that in 1918, which was the first year in which the work was carried, more feed was necessary to secure 100 pounds of gain than in the succeeding years. This was caused in part by a poorer grade of hay and probably also in part by the method of preparing and handling the beet tops, indicating that experience is a factor to be considered in feeding beet by-products in any form.

From the average for the different years, it may be seen that the wet pulp, corn silage, and pastured beet top lots consumed the smallest amounts of hay, which would tend to indicate that the needs of the cattle were being supplied in greater proportion by their other feeds since alfalfa was consumed at will. However, the steers on dried tops and beet top silage were fed all of these feeds they would clean up. The dried beet top and beet top silage lots were about on a par, requiring considerably more alfalfa. The amounts of dried beet tops, beet top silage, and corn silage consumed were quite near the same in these lots, but much more wet beet pulp and pastured beet tops were needed to produce the same amount of gain.

In comparing wet beet pulp and beet tops it is evident that over 1000 pounds more wet pulp was required to make 100 pounds of gain than of either dried beet tops or beet top silage. It is difficult to draw any compari-

son between the wet pulp and pastured beet tops for the amounts charged to the steers is not only what was eaten by the steers, but also what was wasted by tramping, spoiling, and other causes.

Table III sets forth the relative values of the different rations in cost of 100 pounds of gain.

Table III. Cost of 100 Pounds of Gain on Steers.

Year of Test	1918	1919	1920	1921	Average
<u>Lot and Ration</u>					
I. Wet Beet Pulp and Alfalfa	4.97	6.09	6.88		5.98
II. Pastured Beet Tops and Alfalfa Hay	8.69	28.39	5.60	6.37	12.25
III. Dried Beet Tops and Alfalfa Hay	20.03	12.55	9.80		14.16
IV. Beet Top Silage and Alfalfa Hay	20.18	11.46	10.32	12.24	13.55
V. Corn Silage and Alfalfa Hay	12.16	11.11	8.48		10.58

Prices charged for feeds:-

Wet Pulp, \$1.00 per ton  
 Beet Tops in Field, \$6.00 per acre  
 Dried Beet Tops, \$5.00 per ton  
 Beet Top Silage, \$3.64 per ton  
 Corn Silage, \$6.00 per ton  
 Alfalfa Hay, \$15.00 per ton

From Table No. III it may be seen that wet beet pulp and alfalfa hay gave the lowest cost of 100 pounds gain for two years as well as the largest daily gain.

For the year of 1918 under fair conditions pastured beet tops gave a cheaper gain than any of the other

methods of feeding tops. The next year, however, caused this method of feeding to show the highest cost, but in 1920 the pastured tops cost was again lowered by good weather conditions, making it even lower than the wet pulp lot. This would tend to indicate that weather conditions must be favorable in order to get cheap gains on pastured beet tops. This makes for a lower consumption of hay and a higher utilization of the beet tops.

The cost for 100 pounds of gain in feeding dried beet tops was quite high in 1918, possibly due to the poor quality of the tops and also to the high cost of hauling them to the lots. In 1919 the cost was reduced to nearly half and during 1920 it was made even lower. This might have been caused by using more care in bringing the dried beet tops to the lots, there being a lower loss of tops during these two years than during the first one. This method of feeding the tops gave cheaper gains for all three years than did the pasturing in 1919, the bad year, which would tend to show that, in a year when weather conditions are bad, it is cheaper to feed the tops at the lots than to pasture them.

Beet top silage produced gains which were very expensive during the year of 1918, as a result of heavy spoilage of tops which had been handled in too large piles. During the following years as with the dried beet tops fed in the lot, the cost was much reduced. In spite of



the reduction, it was much higher than pasturing the tops in a good year. This was perhaps due to the added expense of hauling the tops from the field to the silo.

Corn silage and alfalfa hay produced gains at a cost which were slightly lower than those from dried beet tops and alfalfa, and beet top silage and alfalfa, but not as low as pastured beet tops and alfalfa hay in a good year.

The high cost of gains for Lot II in 1919 was caused by the consumption of 2137.3 pounds of alfalfa hay as compared with 534.7 pounds in 1918, and 316.5 pounds in 1920, and also by the low gains made during that year. In 1918, 1919, and 1920 the high cost of gains in Lots III and IV was very largely the result of eating large amounts of alfalfa hay purchased at wartime prices.

COMPARISON OF PASTURED AND ENSILED

BEET TOPS

The 1922 Test

The objects of this test are to compare pastured and ensiled beet tops as a fattening feed for yearling steers, preliminary to finishing with grain rations; and to study the latent effect of these two methods of feeding beet tops on the subsequent gains made by fattening steers.

The experiment was begun October 26, 1922 and was continued until all of the beet tops pastured in the field were consumed. This was on November 25, 1922, which made a total of thirty days. The steers were then divided into six lots of ten head each and started on the regular feeding test which was for 180 days.

Methods of Experimentation

The animals used were 60 head of yearling grade Hereford steers that were bred on Southern Colorado range. They ranged in weight from 550 to 850 pounds with an average of about 675 at the beginning of the experiment. Four lots of 15 steers each were used in the test. They were very good steers for experimental purposes, being of uniform type with no poor individuals among them, although there was some variation in weights. In condi-

tion they ranged from fair to good with an average of about medium. They were all good thrifty animals.

Before starting them on this experiment all of the steers had been on the Range Management experiment which is carried on on the foothill range owned by the College. For seven days after being brought off the pasture they were all kept in corrals and fed on alfalfa hay. All steers had been inoculated for black leg and all were branded on the left hip with successive numbers. They had all received the same treatment and started the test under exactly the same conditions.

In making the allotments for the preliminary feeding test the following factors were taken into consideration:

1. Breeding
2. Weight
3. Condition
4. Uniformity

#### General Management

The groups with rations are as follows:

- Lot I Pastured Beet Tops and Alfalfa Hay
- Lot II Pastured Beet Tops and Wheat Straw
- Lot III Beet Top Silage and Alfalfa Hay
- Lot IV Beet Top Silage and Wheat Straw



Some of the steers used in the experiment;  
pictured at the close of the grazing period.

Lot I and II each had five acres of beet tops. All feeds to these lots were self fed. In Lots III and IV the beet top silage was hand fed twice daily at about 7 A. M. and 5:30 P. M. The alfalfa hay and wheat straw were self fed to these lots. Lots III and IV had water from the College hydrant before them at all times. There being no water supply at the beet field it was necessary to haul it to Lots I and II.



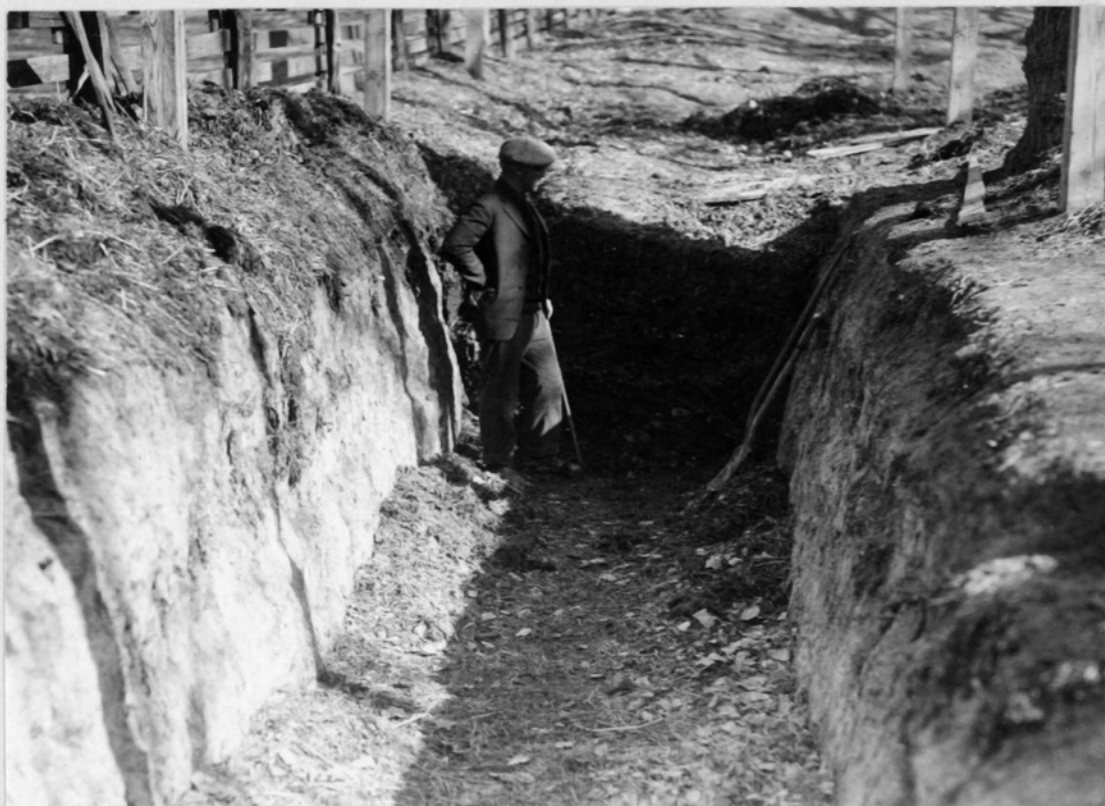
Beet tops piled for pasturing.

The beet tops which were pastured were put in small piles about two and a half feet in diameter to preserve the tops in good condition, and to keep the steers from tramping so many of them into the ground. The beet top silage was placed in the trench silo, the first on September 30, 1922 and the last on October 11, 1922. This gave the beet tops fifteen days to go through the curing process and by October 26th, they were in good shape to feed.

The wheat straw was baled but the alfalfa hay was not. Salt was provided for all lots.

Since there was no way of regulating the amount of beet tops consumed by Lots I and II, they were on a full

feed long before Lots III and IV. The beet top silage lots, however, were started on feed slowly to prevent excessive scouring and were not taking a full feed until ten days after the test began.



The trench silo.

#### Equipment

Lots I and II each had five acres of ground on which to range. These areas were measured and enclosed in a four barbed wire fence. Racks for feeding the alfalfa hay and wheat straw were built at the south side of the field and a water tank was placed under the cross fence so that both lots were watered from the one tank. No shelter was provided for these lots.

Lots III and IV were kept in the regular experimental feed lots which are 24' by 100' in size with a 14 foot open shed at the north end of each lot. The beet top silage was fed in regular grain feed bunks such as are in common use in most feed lots. The hay and straw was fed in pole racks which permitted the steers to have free access to it and at the same time waste very little.

#### Feeds Used

The tops from ten acres of beets were put in the silo. They weighed 82,370 pounds or 41.185 tons when put into the silo. When all of the tops were in the silo they were covered with a layer of six or eight inches of clean straw and then a layer of several inches of loose dirt, sealing the trench and keeping the silage in good condition.

Moisture tests were made of the silage at intervals during the feeding period. They showed the following moisture contents:

71.55%  
70.75%  
63.87%  
68.27%  
70.00%  
68.22%

A chemical analysis at the end of the feeding period showed the following contents:

Moisture	71.25%
Protein	3.81%
Fiber	3.32%
Ash	9.56%
Crude Ether Extract	.54%
Carbohydrate	11.52%

Kellner gives the following figures for the dry substance of fresh and fermented beet tops.

Dry Substance per 100 Pounds

	<u>Fresh Tops</u>	<u>Silage</u>
Digestible crude protein	9.5	6.5
Digestible Albumen	8.64	0.9
Starch Value	44.00	41.0

The proportion between real albumen and starch value is about 1:5 in the fresh tops and 1:40 in the ensiled tops. To judge by that fresh or dry tops are not a supplement to, but a substitute for alfalfa, while silage is a carbohydrate supplement for alfalfa.

(H. Mendelson, Great Western Sugar Company).

The great problem in making a good palatable grade of beet top silage is to get as little dirt as possible mixed with the tops when they are put into the silo. Experience has shown that there is a loss of about one-third of the beet top silage in dirt, spoiled silage, and evaporation. If too much dirt is present, the animals will not consume the silage as readily and bad results may be had.

In pasturing the beet tops, the problem of dirt is



a minor point for it has been observed that a steer will pick up the top by the crown and whirl it around enough to shake off most of the dirt so that very little will be consumed.

The pastured beet tops were grown on the other ten acres of the twenty acre field from which the beet top silage was taken. They were placed in small piles and the steers allowed to eat them as they chose. The moisture content of the fresh top as it was cut from the beet was 79.25%.

The hay fed was good quality, first cutting alfalfa, well cured, and had a good percentage of leaves left on. Good bright, clean wheat straw, free from chaff and dust was used in the straw fed lots. Pressed sulphur block salt was kept before all lots during the entire period. Fresh water was always available.

#### Weights of Animals

Individual weights of all animals were taken on three consecutive days at the beginning of the test. The average of these three weights was taken as the initial weight. At the end of the feeding period individual weights were again taken for each animal on three consecutive days and the average of these weights taken as the final weight.

No attempt was made to limit the gains of the animals in any of the lots. In Lots I and II the steers had no limit placed on any of their feed, and in lots III and IV the beet top silage only was limited to the extent that the animals did not scour.

A close watch was kept on the animals and developments were noted daily concerning condition of weather, general condition of animals, appetite, and condition of feces.

#### Results of Experimental Feeding

During the first three days of the feeding period the weather was fair and warm, but on October 29th a heavy snow fell which remained for two days. This caused a lighter consumption of pastured tops and an increase in the amount of hay and straw for Lots I and II. The tops being in piles minimized the trouble to a marked extent, however.

Following this brief spell of winter the weather was again fair until November 11th, when the temperature dropped below freezing and more snow fell, remaining this time for three days. Again more hay and straw was consumed and the soft condition of the soil found the steers tramping a good many of the pastured tops into the ground.

Fair weather again prevailed until November 17th, when an all night's rain was followed by a very wet snow.

This snow stayed for only one day, but a sudden drop in temperature was next in order, freezing the water in the tanks and making it necessary to break the ice before the steers could drink.

With so much wet weather the beet tops in the field were becoming more and more tramped into the ground and by November 20th they were quite badly mixed with the soil. There was, however, quite a quantity of them still available and when the steers wanted the tops they would pick them out quite well. More hay and straw was being consumed but, because as great utilization of the pastured tops as possible was desired, it was decided to leave the steers on pasture until November 25th, when the tops were well used up. The weather was fair at the end of the period.

The weather conditions had little effect on Lots III and IV because they had access to shelter during the storms and their feed was always in the same condition.

At the end of the feeding period the lots might have been ranked in the order of I, II, III, IV in regard to condition and general appearance. While the coats of Lots I and II were not as smooth as those of Lots III and IV because they were not protected during bad weather, the first two lots had a smoother appearance with a slightly thicker covering than did the latter.

There was very little difference in uniformity within the different lots for the feeding period was

hardly long enough to show any appreciable difference in the individuals.

No very marked difference in the appetites of the various lots was noticeable during the first few days. All lots seemed to be chiefly concerned with getting their fill of beet tops, especially the two lots on pasture. A little later, however, when they seemed to have a desire for a supplement it was apparent that Lots I and III ate much more hay in proportion to the straw eaten by Lots II and IV. This was especially true of Lot II and as long as beet tops could be had with a reasonable amount of effort they ate very little straw. Lot IV, however, seemed to grow accustomed to the straw and consumed more and more of it. This increased consumption of straw made it possible for them to handle slightly more beet top silage than could Lot III; due perhaps to the constipating effect of wheat straw as against the rather laxative effect of alfalfa hay.

On an average about 25 minutes were required by Lots III and IV to eat their ration of beet top silage. Lot III would spend an average of about 45 minutes per steer per day at the hay rack and Lot IV about 30 minutes at the straw rack.

Lots I and II spent no definite amount of time eating the pastured beet tops, simply getting their fill and then lying down to ruminate. Lot I ordinarily

spent an average of about 12 minutes per steer per day at the hay rack, while Lot II spent less than 5 minutes at the straw rack.

The feces of all lots appeared as normal until the third day when Lots I and II began to show the effects of the laxative properties of the beet tops. The feces was very loose and dark green in color. In Lots III and IV, however, it was not until November 2nd, seven days after the test began, that any change in the condition of the feces was noted. Again on November 5th the feces of all lots were very thin for four days. By November 9th the feces of Lots I and II were quite firm, especially Lot II and the same was true of Lots III and IV, with the exception of three steers in each lot.

Lot IV was consuming  $2 \frac{2}{3}$  pounds more beet top silage per head per day than was lot III, but they showed no ill effects from it. This might have been attributed to the wheat straw in their ration which was of a more constipating nature than the alfalfa hay in the ration of Lot IV.

From the above mentioned facts it seems to be apparent that the beet tops fed to all lots caused a disturbance of the digestive tract during the first few days of the feeding period, believed to be caused by certain toxins contained in them which no doubt set up an irritation in the intestines. This condition of

auto-intoxication would cause an enteritis and the irritation set up would cause increased bowel peristalsis, the steers consequently being unable to retain all of the elements contained in the beet tops for a sufficient length of time to fully absorb the nutrients they contained.

It was, however, but a temporary condition and is usually associated with the feeding of a succulent feed; especially during the early part of the feeding period before the digestive tract of the animal has become adjusted to the handling of such feeds. Consequently no serious ill effects were noted.

Such a condition can be partially and in some cases almost wholly overcome by the feeding of some feed not containing the same toxins but having a constipating effect. It was with this in mind that the wheat straw was added to the rations of Lots II and IV.

After the first few days all of the steers appeared to be perfectly healthy and no bad effects were observed. There were no cases of bloat nor any other form of illness. The steers apparently did not consume enough dirt with the beet tops to make them sick.

Gains

Table IV shows a record of total gain, average daily gains and final weights for the period.

Table No.IV.

Total Gains, Average Daily Gains and Final Weight per Steer, October 26, 1922 - November 25, 1922  
30 Days

<u>Lot No.</u>	<u>Total Gain</u>	<u>Average Daily Gain</u>	<u>Final Weights</u>
I	45.84	1.53	722.5
II	44.44	1.48	716.9
III	44.13	1.47	719.0
IV	19.53	.65	693.1

From the above table it may be seen that Lot I fed on pastured beet tops and alfalfa hay made the largest gains, with Lot II fed on pastured beet tops and wheat straw a good second, Lot III fed on beet top silage and alfalfa hay a very close third, while Lot IV fed on beet top silage and wheat straw was a poor last.

From these figures it is seen that there is no great difference in the gains of the first three lots. This would lead us to believe that there is no advantage in feeding high priced alfalfa hay over wheat straw for the rate of gains are so close. According to farm experience the beet tops when pastured seem to make a good ration in themselves, but the addition of some dry carbohydrate feed, such as straw, is of some advantage.

In Lot III where the beet top silage was limited

a good deal more hay was consumed than in Lot I and so the rate of gain was kept close to that of Lot II.

Because the steers in Lot IV were somewhat limited in their ration of beet top silage and did not have alfalfa hay to make up for its deficiencies, their gain was low even though they did consume a good amount of wheat straw.

Table No. IV sets forth the relative values of the different methods of feeding beet tops with regard to producing rapid gains.

In Table V will be found a record of the amounts of feed consumed daily by the steers in the various lots.

Table No. V

Average Daily Ration Fed Per Steer				
Lot No.	1	2	3	4
No. Steers in Lot	15	15	15	15
Ration Fed to Steers	Pastured Beet Tops Alfalfa Hay	Pastured Beet Tops Wheat Straw	Beet Top Silage Alfalfa Hay	Beet Top Silage Wheat Straw
Average Daily Ration Fed Per Steer				
Pasture Beet Tops	90.607	90.607		
Beet Top Silage			18.5	20.01
Alfalfa Hay	5.98		13.23	
Wheat Straw		1.31		5.68

From this table it will be noted that lots I and II consumed considerably larger rations of beet tops in the field than Lots III and IV did of beet top silage. This might have been because it was not possible to limit the



tops for Lots I and II, while Lots III and IV were started on feed slowly and did not receive a full feed for several days and because of the difference in dry matter content and in palatability of the rations.

The hay consumption of Lots I and III also presents quite a contrast. In Lot I where the beet tops were unlimited the steers would eat their fill of them and so cared for very little hay. It was only during or immediately following a snow storm that much hay was used. With Lot III it was different; they were allowed only so much beet top silage and so would complete their meal on alfalfa hay.

With the wheat straw in Lots II and IV it was much the same.

That Lot IV was able to consume slightly more beet top silage than was Lot III and without bad effects, was probably made possible by the wheat straw in their ration instead of alfalfa hay because it tends to offset the scouring effects of the beet top silage.

It will be seen that Lot II required more pastured tops than did Lot I, but there is a great difference in the amount of wheat straw and alfalfa hay consumed by the two lots. Lot II consumed only 1.31 pounds of wheat straw per head per day, while Lot I consumed 5.98 pounds of alfalfa hay. With the very slight difference in gains made by the two lots this would lead us to be-

lieve that it does not pay to add alfalfa hay to pastured beet tops when very nearly as good a gain and a much cheaper gain can be had with wheat straw.

In Lots III and IV it will be seen that nearly two and a half times as much beet top silage was required for Lot IV as for Lot III, while almost as much wheat straw as alfalfa hay was required. From these figures it appears that wheat straw can be substituted for alfalfa hay when fed with pastured tops and money will be saved, but when fed with beet top silage the reverse is true.

The amount of pastured beet tops charged to the steers includes not only the actual amounts consumed, but also those wasted by tramping, spoiling from weather conditions, etc.

Henry and Morrison give the following analysis for the feeds used in the experiment:

First Cutting Alfalfa Hay			Carbohydrates			
Water	Ash	Crude Protein	Fiber	N. Free Ex-tract	Fat	
8.5%	8.8%	13.9%	30.9%	36.2%	1.7%	
Wheat Straw						
8.4%	5.2%	3.1%	37.4%	44.4%	1.5%	
Total Dry Matter		Digestible Nutrients				
100 Lbs.		Per 100 Lbs				
		Crude Prot	Carbo.	Fat	Total	Nut. Ratio
Beet Tops	11.4	1.7	5.4	0.1	7.3	1:3.3
Beet Top Silage	28.8	1.4	7.3	0.3	9.4	1:5.7
Alfalfa Hay	91.5	9.3	39.0	0.6	49.7	1:4.3
Wheat Straw	91.6	0.7	33.1	0.5	36.9	1:51.7

Table No. VI.

Feed Required for 100 Pounds Gain

Feeding Period - October 26, 1922 to November 25, 1922.

30 Days

Lot Number	1	2	3	4
No. Steers in Lot	15			
Ration Fed to Steers	Pastured Beet Tops Alfalfa Hay	Pastured Beet Tops Wheat Straw	Beet Top Silage Alfalfa Hay	Beet Top Silage Wheat Straw
Feed Required for 100 Pounds Gain				
Pastured Beet Tops	.727 Acre 5988.3	.748 Acre 6163.3		
Beet Top Silage			1263.61	3085.32
Alfalfa Hay	391.59		899.54	872.35
Wheat Straw		88.49		.614
Salt	.029	.039	.158	

Table No. VII.

Feed Costs for 100 Pounds Gain

Feeding Period - October 26, 1922 to November 25, 1922.

30 Days

Lot Number	1	2	3	4
No. Steers in Lot	- 15			
Rations Fed to Steers	Pastured Beet Tops Alfalfa Hay	Pastured Beet Tops Wheat Straw	Beet Top Silage Alfalfa Hay	Beet Top Silage Wheat Straw
Av. Daily Gain	1.53	1.48	1.47	.65
Feed Cost Per 100 Lbs. Gain	5.23	5.39	3.17 6.75	7.74
Pastured Beet Tops	2.94	.13		1.31
Beet Top Silage				
Alfalfa Hay				
Wheat Straw				
Total	8.17	5.52	9.92	9.05

Prices charged for feeds:

- Beet Top Silage, \$5.02 per ton
- Pastured Beet Tops, \$7.20 per acre
- Alfalfa Hay, \$15.00 per ton
- Wheat Straw, \$3.00 per ton
- Block Salt, \$.015 per pound

Estimated Cost of Ensiling Beet Tops

The beet tops which were ensiled were taken from the north half of a twenty acre field about a mile and a half from the college farm. The purchase price per acre was \$6.00. 194 man hours and 182 horse hours were required in putting the tops in the trench silo. Below is a statement of the expense:

10 acres of beet tops @ \$6.00 .....	\$60.00
194 man hours @ 30¢ .....	58.20
182 horse hours @ 10¢ .....	<u>18.20</u>
Total .....	\$136.40

41.19 tons of fresh beet tops were put in the silo, but previous work at the Colorado Experiment Station has shown that 66 percent or 27.19 tons of beet top silage is all that can be expected from this amount of tops.

This ratio was used in computing cost per ton of the beet top silage:

$$\text{\$136.40} \div 27.19 = \text{\$5.02 cost per ton of beet top silage.}$$

Because it was necessary to haul these tops quite a distance before they were put in the silo, the cost is relatively higher than it would be for the average farmer where his beet field often lies adjacent to the feed lots.

Estimated Cost of Pastured Beet Tops

The beet tops from the remaining ten acres were piled in small piles preparatory to pasturing. This required 40 man hours at 30¢ per hour. A statement of expense follows:

10 acres of beet tops @ \$6.00 .....	\$60.00
40 man hours @ 30¢ .....	<u>12.00</u>
Total .....	\$72.00

\$72.00 ÷ 10.00 = \$7.20 total average cost per acre

Table VII gives the feed cost for 100 pounds gain in the different lots.

From the preceding table on feed costs for 100 pounds of gain it may be seen that Lot II fed on pastured beet tops and wheat straw made the cheapest gains. This was probably brought about by the small amount of wheat straw consumed, most of the gain being made on beet tops. Lot I on pastured beet tops and alfalfa hay produced the next cheapest gains. In these two lots the animals were not limited in the amount of beet tops they consumed, and so consumed large quantities of them. The latter lot, however, consumed much more alfalfa hay in proportion to the amount of wheat straw consumed by Lot II. The probable reason for this might be the greater palatability of the alfalfa hay over the

straw.

The cost of gains in the beet top silage fed lots were materially higher, especially when compared with those of Lot II. Where straw was used in the combination the cost was slightly lower than where hay was used. Here again much more hay was used than straw, due perhaps to the same reason as in Lots I and II.

The added cost in the beet top silage lots may be attributed in Lot III to the large amount of high priced hay consumed and in Lot IV to very low gains as well as to the greater expense necessary in preparing it for feed, over that of the pastured tops. These figures again remind us that with favorable or at least semi-favorable weather conditions cheaper gains can be made by pasturing the beet tops than by feeding as beet top silage.

LATENT EFFECT ON THE SUBSEQUENT GAINS  
OF THE STEERS

Tables VIII, IX, X, XI, XII, and XIII give a record of the subsequent daily gains of the animals from each lot of the test reported above during the time they were on fattening rations. Tables XIV, XV, XVI, and XVII give these gains according to grouping in the beet top test. From these tables it may be seen that there was very little variation in the different lots. During one period one lot might have a slightly higher rate of gain, while at the end of the next period the various lots might have reversed positions. At the end of 180 days Lot IV led the others with an average of 2.32 pounds per head per day, with Lots I and II tied for second at 2.24 pounds per head per day and Lot III last with 2.18 pounds per head per day.

Results from the 1922 test show that wheat straw fed with pastured beet tops returns almost as large a gain as alfalfa hay fed with pastured beet tops, and at a much lower cost.



Table No. VIII

LOT I. Steer Number	Previous Treatment	Average Gain Per Head Per Day By Lots					Average for 180 Days	Dressing Per- centage Warm
		Average for 60 Days	Average for 90 Days	Average for 120 Days	Average for 150 Days	Average for 180 Days		
1	P.A.	1.90	2.32	2.53	2.56	2.52	64.01	
18	S.A.	2.67	2.22	2.29	2.27	2.38	65.40	
27	S.S.	2.53	2.63	2.60	2.81	2.62	60.00	
37	P.S.	2.39	2.37	2.40	2.39	2.29	65.60	
39	S.S.	2.83	2.72	2.83	2.73	2.64	63.90	
42	P.A.	2.33	2.17	2.41	2.40	2.27	66.10	
45	S.S.	2.22	2.43	2.44	2.49	2.44	67.60	
49	P.A.	2.08	1.89	1.92	1.93	1.85	63.90	
54	S.A.	2.20	2.19	2.31	2.31	2.27	65.90	
58	P.S.	2.14	1.87	1.99	2.06	2.08	64.00	
	Total	23.29	22.76	23.72	23.95	23.36		
	Average	2.329	2.276	2.372	2.395	2.336		

Table No. IX

LOT II. Steer Number	Previous Treatment	Average Gain Per Head Per Day By Lots					Average for 180 Days	Dressing per- centage Warm
		Average for 60 Days	Average for 90 Days	Average for 120 Days	Average for 150 Days	Average for 180 Days		
5	S.A.	2.03	1.96	2.26	2.28	2.32	62.90	
19	S.S.	1.08	1.11	1.13	1.27	1.48	63.30	
25	P.A.	2.89	2.87	2.65	2.46	2.37	63.50	
30	P.S.	1.95	2.19	2.14	2.21	2.18	63.60	
32	P.A.	2.56	2.76	2.74	2.72	2.84	60.90	
33	P.A.	2.06	2.09	1.99	2.26	2.27	62.90	
44	P.S.	1.81	1.87	1.90	1.99	1.94	62.80	
52	S.S.	2.70	2.52	2.56	2.58	2.65	63.10	
57	S.A.	2.45	2.41	2.18	2.24	2.21	65.50	
64	S.S.	2.14	2.31	2.53	2.52	2.60	63.30	
	Total	21.67	22.09	22.08	22.53	22.86		
	Average	2.167	2.209	2.208	2.253	2.286		

Table No.X

LOT III Steer Number	Previous Treatment	Average Gain Per Head Per Day By Lots						Average Per- centage Warm
		Average for 60 Days	Average for 90 Days	Average for 120 Days	Average for 150 Days	Average for 180 Days	Dressing Per-	
3	S.S.	2.28	2.24	2.47	2.54	2.39	61.40	
29	P.A.	1.53	1.74	1.85	1.88	1.94	63.80	
31	S.A.	2.08	2.33	2.38	2.37	2.12	64.80	
36	S.A.	2.25	2.50	2.46	2.63	2.28	62.90	
56	P.S.	2.22	2.15	2.11	2.12	2.23	62.10	
59	P.S.	2.78	2.80	2.60	2.38	2.50	63.80	
61	P.A.	1.92	2.00	1.92	1.34	1.74	64.00	
62	S.A.	1.97	2.09	2.19	2.09	1.91	63.30	
63	P.S.	1.61	1.46	1.43	1.68	1.63	63.50	
66	S.S.	1.86	2.07	2.06	2.08	2.16	63.30	
	Total	20.50	21.38	21.47	21.11	20.90		
	Average	2.05	2.138	2.147	2.111	2.090		

Table No. XI

LOT IV. Steer Number	Previous Treatment	Average Gain Per Head Per Day By Lots						Average for 180 Days	Dressing per- centage Warm
		Average for 60 Days	Average for 90 Days	Average for 120 Days	Average for 150 Days	Average for 180 Days			
8	S.A.	2.20	2.57	2.39	2.58	2.44	64.30		
11	P.A.	1.70	1.96	1.85	1.34	1.76	60.20		
17	S.A.	1.39	1.76	1.74	1.92	1.96	63.40		
23	P.S.	1.72	1.98	1.99	2.19	2.10	63.60		
20	S.S.	1.92	2.22	2.13	2.30	2.38	59.20		
26	S.S.	2.45	2.52	2.60	2.68	2.61	63.60		
35	P.A.	1.72	1.98	2.07	1.83	2.13	64.00		
46	S.A.	2.14	2.15	2.03	1.89	1.75	62.90		
55	P.S.	2.06	2.15	2.15	2.36	2.35	62.20		
60	P.S.	3.41	3.61	3.21	2.83	2.83	65.30		
	Total	20.71	22.90	22.16	21.92	22.31			
	Average	2.071	2.290	2.216	2.192	2.231			

Table No. XII

LOT V. Steer Number	Previous Treatment	Average Gain Per Head Per Day By Lots					Average for 180 Days	Dressing Per- centage Warm
		Average for 60 Days	Average for 90 Days	Average for 120 Days	Average for 150 Days	Average for 180 Days		
2	S.S.	1.58	1.50	1.67	1.90	1.88	65.80	
9	P.S.	2.42	2.17	2.13	2.17	2.07	65.80	
13	P.A.	2.11	1.35	2.31	2.51	2.50	63.60	
14	P.S.	2.06	2.09	2.15	2.36	2.28	63.80	
22	S.S.	2.03	2.13	2.14	2.34	2.23	60.90	
28	S.S.	1.33	1.67	1.96	2.03	2.14	63.70	
34	P.A.	2.39	2.59	2.65	2.86	2.75	63.30	
41	S.A.	1.67	1.94	1.96	1.76	1.79	63.90	
51	P.A.	1.86	1.96	2.06	2.11	2.24	63.60	
65	S.A.	2.20	2.19	2.06	1.98	2.12	63.10	
	Total	19.65	19.59	21.09	22.02	22.00		
	Average	1.965	1.959	2.109	2.202	2.200		

Table No. XIII

LOT VI Steer Number	Previous Treatment	Average Gain Per Head Per Day By Lots						Average Per- centage Warm
		Average for 60 Days	Average for 90 Days	Average for 120 Days	Average for 150 Days	Average for 180 Days	Dressing Per-	
6	S.S.	2.06	1.76	1.82	1.92	2.14	70.50	
7	S.S.	3.22	2.93	2.82	2.89	2.69	65.90	
10	P.A.	2.17	1.94	1.92	2.00	2.26	64.40	
15	P.S.	2.47	2.51	2.49	2.46	2.57	65.70	
16	S.A.	1.33	1.72	1.79	1.17	2.17	65.90	
24	P.S.	1.67	1.89	2.04	2.13	2.21	65.00	
38	P.A.	2.03	2.19	2.01	2.04	2.12	65.10	
47	P.S.	1.83	1.67	1.75	1.80	2.01	61.90	
48	S.A.	2.25	2.11	2.20	2.33	2.36	64.80	
50	S.A.	2.86	2.52	2.47	2.58	2.67	64.50	
	Total	21.89	21.27	21.31	21.32	23.20		
	Average	2.189	2.127	2.131	2.132	2.320		

Table XIV  
Pastured Beet Tops and Alfalfa Hay

Lot Number	Steer No.	Initial Weight	Pastured Beet Tops						Alfalfa Hay						Average Daily Gain by Periods			
			Weight at 60 Days	Gain for 60 Days	Weight at 90 Days	Gain for 90 Days	Weight at 120 Days	Gain for 120 Days	Weight at 150 Days	Gain for 150 Days	Weight at 180 Days	Gain for 180 Days	60	90	120	150	180	
1	1	716	830	114	925	209	1020	304	1100	384	1166.7	454	1.9	2.33	2.53	2.56	2.52	
1	42	850	990	140	1045	195	1140	290	1210	360	1260.0	410	2.33	2.17	2.41	2.40	2.27	
1	49	650	795	125	820	170	880	230	940	290	983.3	333.3	2.08	1.89	1.92	1.93	1.85	
2	25	711.7	885	173.3	970	258.3	1030	318.3	1080	368.3	1140.0	428.3	2.89	2.87	2.65	2.46	2.37	
2	32	831.7	985	153.3	1080	248.3	1160	328.3	1240	408.3	1343.3	511.6	2.56	2.76	2.74	2.72	2.84	
2	33	661.7	785	123.3	850	188.3	900	238.3	1000	338.3	1071.7	410.0	2.06	2.09	1.99	2.26	2.27	
3	29	808.3	900	91.7	965	156.7	1030	221.7	1090	281.7	1158.3	350.0	1.53	1.74	1.85	1.88	1.94	
3	61	610.0	725	115.0	790	180.0	840	230.0	885	275.0	923.3	313.3	1.92	2.0	1.92	1.83	1.74	
4	11	703.0	805	101.7	880	176.7	925	221.7	905	201.0	1021.7	318.4	1.70	1.96	1.85	1.34	1.76	
4	35	761.7	865	103.3	940	178.3	1010	248.3	1085	323.3	1146.7	385.0	1.72	1.98	2.07	2.16	2.13	
5	13	748.3	875	126.7	870	121.7	1025	276.7	1125	376.7	1198.3	450.0	2.11	1.35	2.31	2.51	2.50	
5	34	716.7	860	143.3	950	233.3	1035	318.3	1145	428.3	1211.7	495.0	2.39	2.59	2.65	2.86	2.75	
5	51	753.3	865	111.7	930	176.7	1000	246.7	1070	316.7	1156.7	403.4	1.86	1.96	2.06	2.11	2.24	
6	10	670.0	800	130.0	845	175.0	900	230.0	970	300.0	1078.3	408.3	2.17	1.94	1.92	2.00	2.26	
6	38	648.3	770	121.7	845	196.7	890	241.7	955	306.7	1030.0	381.7	2.03	2.19	2.01	2.04	2.12	
Total											31.25	31.81	32.88	33.46	33.0			
Average											2.08	2.12	2.19	2.20	2.24			

Lot II		Table No. XV Pastured Beet Tops and Wheat Straw																
Lot Number	Steer No.	Initial Weight	Weight at 60 Days	Gain for 60 Days	Weight at 90 Days	Gain for 90 Days	Weight at 120 Days	Gain for 120 Days	Weight at 150 Days	Gain for 150 Days	Weight at 180 Days	Gain for 180 Days	Average Daily Gain by Periods					
													60	90	120	150	180	
1	37	711.7	855	147.3	925	213.3	1000	288.3	1070	358.3	1125	413.3	2.39	2.37	2.40	2.39	2.29	
1	58	631.7	760	138.3	800	168.3	870	238.3	940	308.3	1006.7	375.0	2.14	1.87	1.99	2.06	2.08	
2	30	748.3	865	116.7	945	196.7	1005	256.7	1080	331.7	1141.7	393.4	1.95	2.19	2.14	2.21	2.18	
2	44	671.7	780	108.3	840	168.3	900	228.3	970	298.3	1020.0	248.3	1.81	1.87	1.90	1.99	1.94	
3	56	671.6	805	133.3	865	193.3	925	253.3	990	318.3	1073.7	403.0	2.22	2.15	2.11	2.12	2.23	
3	59	758.3	925	166.7	1010	251.7	1070	311.7	1115	356.7	1210.0	451.7	2.78	2.80	2.60	2.38	2.50	
3	63	778.3	875	96.7	910	131.7	950	171.7	1030	251.7	1073.3	295.0	1.61	1.46	1.43	1.68	1.63	
4	23	681.7	785	103.3	860	178.3	920	238.3	1010	328.3	1105.0	430.0	1.72	1.98	1.99	2.19	2.38	
4	55	656.7	780	123.3	850	193.3	915	258.3	1010	353.3	1080.0	423.3	2.06	2.15	2.15	2.36	2.35	
4	60	845.0	1050	205.0	1170	325.0	1230	385.0	1270	425.0	1355.0	510.0	3.41	3.61	3.21	2.83	2.83	
5	9	795.0	940	145.0	990	195	1050	255	1120	325.0	1166.7	371.7	2.42	2.17	2.13	2.17	2.07	
5	14	711.7	835	123.3	900	188.3	970	258.3	1065	353.3	1123.3	411.7	2.06	2.09	2.15	2.36	2.28	
6	15	701.7	850	148.3	930	228.3	1000	298.3	1070	368.3	1165.0	463.3	2.47	2.54	2.49	2.46	2.57	
6	24	810.0	910	100.0	980	170.0	1055	245.0	1130	320.0	1208.3	398.3	1.67	1.89	2.04	2.13	2.21	
6	47	580.0	690	110.0	730	150.0	790	210.0	850	270.0	941.7	361.7	1.83	1.67	1.75	1.8	2.01	
Total												32.5432	4132.4835	1333.55				
Average daily gain for 150 days - 2.20#												Average	2.16	2.16	2.16	2.34	2.23	



Table XVI

Lot III		Beet Top Silage and Alfalfa Hay										Average Daily Gain by Periods									
Lot Number	Steer No.	Initial Weight	Weight at 60 Days	Gain for 60 Days	Weight at 90 Days	Gain for 90 Days	Weight at 120 Days	Gain for 120 Days	Weight at 150 Days	Gain for 150 Days	Weight at 180 Days	Gain for 180 Days	60	90	120	150	180				
1	18	740	900	160	940	200	1015	275	1080	340	1170	430	2.67	2.22	2.29	2.27	2.38				
1	54	643.3	775	131.7	840	196.7	980	276.7	990	346.7	1053.3	410	2.20	2.19	2.31	2.31	2.27				
2	5	678.3	800	121.7	855	176.7	950	271.7	1020	341.7	1096.7	418	2.03	1.96	2.26	2.28	2.32				
2	57	773.3	920	146.7	990	216.7	1035	261.7	1110	336.7	1171.7	398.4	2.45	2.41	2.18	2.24	2.21				
3	31	715.0	840	125.0	925	210.0	1000	285.0	1070	355	1096.7	281.7	2.08	2.33	2.38	2.37	2.12				
3	36	775.0	910	135.0	1000	225.0	1070	295.0	1170	395	1186.7	411.7	2.25	2.50	2.46	2.63	2.28				
3	62	711.7	830	118.3	900	188.3	975	263.3	1025	313.3	1056.7	345.0	1.97	2.09	2.19	2.09	1.91				
4	8	803.0	935	131.7	1035	231.7	1090	286.7	1190	386.7	1243.3	440.0	2.20	2.57	2.39	2.58	2.44				
4	17	611.7	695	83.3	770	158.3	820	208.3	900	288.3	965.0	353.3	1.39	1.76	1.74	1.92	1.96				
4	46	726.7	855	128.3	920	193.3	970	243.3	1010	283.3	1088.3	316.6	2.14	2.15	2.03	1.89	1.75				
5	41	635.0	735	100.0	810	175.0	870	235.0	900	265.0	956.7	321.7	1.67	1.94	1.96	1.76	1.79				
5	65	803.3	935	131.7	1000	196.7	1050	246.7	1100	296.7	1185.0	381.7	2.20	2.19	2.06	1.98	2.12				
6	16	835.0	915	80.0	990	155.0	1050	215.0	1010	175.0	1225.0	390.0	1.33	1.72	1.79	1.17	2.17				
6	48	700.0	835	135.0	890	190.0	965	265.0	1050	350.0	1125.0	425.0	2.25	2.11	2.20	2.33	2.36				
6	50	633.3	805	171.7	860	226.7	930	296.7	1020	386.7	1115.0	481.7	2.86	2.52	2.47	2.58	2.67				
Total												31.6932	6632.7132	4032.75							
Average daily gain for 150 days - 2.16#												Av erage	2.11	2.18	2.18	2.16	2.19				

Table No. XVII

Lot Number	Steer No.	Initial Weight	Beet Top Silage and Wheat Straw								Average Daily Gain by Periods								
			Weight at 60 Days	Gain for 60 Days	Weight at 90 Days	Gain for 90 Days	Weight at 120 Days	Gain for 120 Days	Weight at 150 Days	Gain for 150 Days	Weight at 180 Days	Gain for 180 Days	60	90	120	150	180		
			60 Days	90 Days	120 Days	150 Days	180 Days	180 Days	180 Days	180 Days	180 Days	180 Days	180 Days	180 Days	180 Days	180 Days	180 Days		
1	27	738.3	890	151.7	975	236.7	1050	311.7	1160	421.7	1210	471.7	2.53	2.63	2.60	2.81	2.62		
1	39	550.0	720	170.0	795	245.0	890	340.0	960	410.0	1026.7	476.7	2.83	2.72	2.93	2.73	2.64		
1	45	781.7	915	133.3	1000	218.3	1075	293.3	1155	373.3	1221.7	440.0	2.22	2.43	2.44	2.49	2.44		
2	19	610.0	675	65.0	710	100.0	745	135.0	800	190.0	876.7	266.7	1.08	1.11	1.13	1.27	1.48		
2	52	793.3	955	161.7	1020	226.7	1100	306.7	1180	386.7	1271.7	478.4	2.70	2.52	2.56	2.58	2.65		
2	64	676.7	805	128.3	885	208.3	980	303.3	1055	378.3	1145.0	468.3	2.14	2.31	2.53	2.52	2.60		
3	3	653.3	790	136.7	855	201.7	950	296.7	1035	381.7	1085.0	431.7	2.28	2.24	2.47	2.54	2.39		
3	66	683.3	795	111.7	870	186.7	930	246.7	995	311.7	1073.3	390.0	1.86	2.07	2.06	2.08	2.16		
4	20	675.0	790	115.0	875	200.0	940	255.0	1020	345.0	1060.0	378.3	1.92	2.22	2.13	2.30	2.10		
4	26	663.3	810	146.7	890	226.7	975	311.7	1065	401.7	1133.3	470.0	2.45	2.52	2.60	2.68	2.61		
5	2	745.0	840	95.0	880	135.0	945	200.0	1030	285.0	1085.0	340.0	1.58	1.50	1.67	1.90	1.88		
5	22	668.3	790	121.7	860	191.7	925	256.7	1020	351.7	1070.0	401.0	2.03	2.13	2.14	2.34	2.23		
5	28	650.0	730	80.0	800	150.0	885	235.0	955	305.0	1036.7	386.7	1.33	1.67	1.96	2.03	2.14		
6	6	731.7	855	123.3	890	158.3	950	218.3	1020	288.3	1118.3	386.6	2.06	1.76	1.82	1.92	2.14		
6	7	776.7	970	193.3	1040	263.3	1115	338.3	1210	433.3	1261.7	485.0	3.22	2.93	2.82	2.89	2.69		
Total											32.2332	32.7633	32.7635	34.77					
Average daily gain for 150 days - 2.23#											2.15	2.18	2.25	2.34	2.32				

Average daily gain for 150 days - 2.23#

## SUMMARY AND CONCLUSIONS

A test was conducted to compare pastured and ensiled beet tops as a fattening feed for yearling steers, preliminary to finishing with grain rations; and to study the latent effect of these two methods of feeding beet tops on the subsequent gains made by fattening steers.

The experiment was begun October 26, 1922 and was continued until all of the beet tops pastured in the field were consumed. This was on November 25, 1922, which made a total of 30 days.

Four lots of 15 grade Hereford steers each were fed 30 days on the following rations:

Lot 1. Pastured Beet Tops and Alfalfa Hay - self fed.

Lot II. Pastured Beet Tops and Wheat Straw - self fed.

Lot III. Beet Top Silage - hand full fed twice daily; and Alfalfa Hay - self fed.

Lot IV. Beet Top Silage - hand full fed twice daily; and Wheat Straw - self fed.

All lots self fed block salt.

No grain was fed to any of the lots, this being merely a preliminary feeding period before the steers were reallocated and started on the regular fattening rations.

At the end of this preliminary test the cattle were reallocated into six lots of 10 head each and fed the following rations for 180 days:

Hand full fed twice daily

Lot I. Wet Beet Pulp.

Beet Molasses.

Cottonseed Cake.

Lot II. Sunflower Silage.

Ground Barley.

Beet Molasses.

Lot III. Sunflower Silage.

Ground Barley.

Lot IV. Sunflower Silage.

Ground Barley.

Cottonseed Cake.

Lot V. Sunflower Silage.

Dried Molasses Beet Pulp.

Cottonseed Cake.

Lot VI. Corn Silage.

Dried Molasses Beet Pulp.

Cottonseed Cake.

All lots self fed alfalfa hay and block salt.

In the reallocation previous treatment was taken into consideration and an equal number of steers from each of the preliminary four lots was placed in each of the six lots.

The laxative effect of the beet tops became apparent in Lots I and II on the third day, while in Lots III and IV this did not occur until the seventh day. All of the lots had returned to normal by the end of the second week.

The average daily gain of the four lots was as follows:

Lot I - 1.53 pounds.

Lot II - 1.48 pounds.

Lot III - 1.47 pounds.

Lot IV - 0.65 pounds.

The cost of 100 pounds of gain of the four lots was as follows:

Lot I - \$8.17.

Lot II - \$5.52.

Lot III - \$9.92.

Lot IV - \$9.05.

Feeding alfalfa hay with pastured beet tops resulted in a slightly higher gain, but a much more expensive gain. Beet top silage and alfalfa hay gave a good average daily gain, but the most expensive gain. Beet top silage and wheat straw produced a low average daily gain and the next to the highest cost of gain. Pastured beet tops and wheat straw gave a good average daily gain and the cheapest gain of the four lots.

From four years work on pastured beet tops at the

Colorado Agricultural Experiment Station it may be concluded that under favorable weather conditions it is cheaper to utilize the beet tops in this manner, while under unfavorable weather conditions the tops can be better fed in the feed lots as beet top silage or dried beet tops. The average weather conditions for the beet top pasturing period in a given beet growing district must be taken into consideration in determining the method of utilizing the beet tops.

Placing the beet tops in small piles in the field preserves them in better shape, prevents the stock from tramping many of them into the ground, and makes possible a greater utilization of the tops under conditions that may not be altogether favorable.

The kind of beet top ration fed during the 30 day period made no appreciable difference in the gains made by the steers after they were reallocated and fed on the grain rations referred to on page 49 for a period of 180 days.

Tables XVIII, XIX, XX, and XXI report the weights of the steers at the beginning and at the close of the 30 day period during which they were on the beet top rations; while reports 1, 2, 3, and 4 are feeding reports of the experiment.

Table XVIII

Weights of Animals

Weighing Report in Pastured vs Ensiled Beet Tops  
 First Weight - October 26, 1922. Last Weight November 25, 1922

Lot No. I. Ration - Pastured Beet Tops - 5 Acres and Alfalfa Hay Self-fed

No. Animals in Lot - 15 Steers

No. of Animals	Cond. Oct. 25	Wt. Oct. 25	Wt. Oct. 26	Wt. Oct. 27	Average Initial Wt. Oct. 26	Wt. Nov. 24	Wt. Nov. 25	Wt. Nov. 26	Average Weight Nov. 25
1	G	645	645	660	650	720	700	715	711.7
10	G	645	635	650	643.3	685	665	660	670.0
11	F	670	680	700	683.3	705	690	715	703.3
13	M	680	685	705	690.0	750	745	750	748.3
25	G	665	680	670	671.7	715	700	720	711.7
29	M	740	745	750	745.0	805	800	820	808.3
32	G	795	800	810	801.7	830	820	845	831.7
33	F	630	635	635	633.3	670	650	665	661.7
34	G	660	655	670	661.7	725	700	725	761.7
35	G	705	725	710	713.3	765	760	760	761.7
38	F	595	595	600	596.7	655	635	655	648.3
42	G	735	755	775	755.0	850	870	830	850.0
49	G	615	640	600	618.3	660	645	645	650.0
51	M	725	710	725	720.0	760	740	760	753.3
61	F	565	565	570	566.7	615	600	615	610.0
Total		10070	10150	10230	10150.	10910	10720	10880	10836.7

Table XIX

## Weights of Animals

## Weighing Report in Pastured vs Ensiled Beet Tops

First Weight October 26, 1922 - Last Weight November 25, 1922

## Lot II. Ration - Pastured Beet Tops - 5 Acres and Wheat Straw Self-fed

## No. Animals in Lot - 15 Steers

No. of Animals	Condition Oct. 25	Weight Oct. 25	Weight Oct. 26	Weight Oct. 27	Average Initial Wt. Oct. 26	Weight Nov. 24	Weight Nov. 25	Weight Nov. 26	Average Final Weight Nov. 25
9	G	755	745	750	750	810	775	800	795
14	M	680	680	685	681.7	730	705	700	711.6
15	G	660	650	645	651.7	725	680	700	701.7
23	M	645	645	665	651.7	710	665	670	681.7
24	G	735	760	730	741.7	805	815	810	810.0
30	M	730	715	700	715.0	765	735	745	748.3
37	G	665	665	665	665.0	710	705	720	711.7
44	G	630	645	640	638.3	680	655	680	671.7
47	F	545	545	565	551.7	580	570	590	580.0
55	F	610	620	630	620.0	665	640	665	656.7
56	G	620	620	630	623.3	680	655	680	671.7
58	F	590	595	585	590.0	655	615	625	631.7
59	M	690	710	700	700.0	755	750	770	758.3
60	G	790	790	785	788.3	835	845	855	845.0
63	G	720	720	715	718.3	795	750	790	778.3
Total		10065	10105	10909	10086.7	10900	10560	10800	10753.4



Table No. XX  
Weight of Animals  
Weighting Report in Pastured vs Ensiled Beet Tops  
First Weight October 26, 1922. Last Weight November 25, 1922.

Lot III. Ration - Beet Top Silage and Alfalfa Hay

Number of Animal	Number Animals in Lot		- 15 Steers		Average Initial Wt. Oct. 26	Wt. Nov. 14	Wt. Nov. 24	Wt. Nov. 25	Wt. Nov. 26	Average Weight Nov. 25	Final
	Cond. Oct. 25	Wt. Oct. 25	Wt. Oct. 26	Wt. Oct. 27							
5	M	635	620	640	631.7	670	675	680	680	687.7	
8	G	735	740	740	738.3	795	800	810	800	803.3	
16	G+	780	790	785	785.0	820	845	840	820	835.0	
17	F	560	565	580	568.3	600	615	610	610	611.7	
18	G	685	690	700	691.7	735	740	740	740	740.0	
31	G	650	665	650	655.0	710	700	725	720	715.0	
36	G	725	720	725	723.3	780	765	775	785	775.0	
41	M	590	600	600	596.7	635	630	650	625	635.0	
46	M	665	685	695	681.7	730	720	735	725	726.7	
48	F	675	665	660	666.7	700	710	705	685	700.0	
50	M	620	625	625	623.3	650	640	620	640	633.3	
54	G	605	620	605	610.0	650	650	645	635	643.3	
57	G	725	715	730	723.3	755	765	770	785	773.3	
62	M	665	665	670	666.7	715	715	710	710	711.7	
65	G	755	780	750	761.7	810	800	810	800	803.3	
Totals		10170	10145	10155	10123.4	10755	10770	10825	10760	10785.4	

Table No. XXI  
Weights of Animals  
Weighing Report in Pastured vs Ensiled Beet Tops  
First Weight October 26, 1922. Last Weight November 25, 1922

Lot IV. Number of Animals	Ration - Beet Top Silage and Wheat Straw										Average Final Weight Nov. 25
	Cond. Oct. 25	Wt. Oct. 25	Wt. Oct. 26	Wt. Oct. 27	Average Initial Wt.Oct.26	Wt. Nov. 14	Wt. Nov. 24	Wt. Nov. 25	Wt. Nov. 26		
2	G	725	735	730	730	730	745	750	740	745	745
3	G	635	620	660	638.7	650	650	650	660	653.3	653.3
6	G+	740	755	730	741.7	735	745	735	715	731.7	731.7
7	F	765	765	750	760.0	775	770	755	785	776.7	776.7
19	F	565	570	570	568.3	595	610	610	610	610.0	610.0
20	G	685	680	685	683.3	680	675	670	680	675.0	675.0
22	M	655	660	650	655.0	680	665	665	675	668.3	668.3
26	M	620	620	620	620.0	660	660	670	660	668.3	668.3
27	M	715	705	705	708.3	740	740	735	740	738.3	738.3
28	F	600	600	615	605.0	655	655	640	655	650.0	650.0
39	G	540	540	550	543.3	555	555	550	545	550.0	550.0
45	G	760	770	779	766.7	790	775	790	780	781.7	781.7
52	G	760	765	760	761.7	790	775	795	810	793.3	793.3
64	F	655	675	660	663.3	685	680	680	670	676.7	676.7
66	M	650	675	650	658.3	685	685	680	685	683.3	683.3
Totals		10070	10135	10105	10103.6	10405	10385	10395	10410	10396.6	10396.6

ANIMAL INVESTIGATIONS SECTION

Colorado Experiment Station

Report No. 1

Feeding Report in Pastured vs Ensiled Beet Tops  
 First Feed October 26, P.M., 1922. Last Feed November 5, A.M., 1922

Number Animals per Lot - 15 Steers

Lot No.	Ration Fed	1		2		3		4		Remarks			
		Alfalfa Hay	Wheat Straw	Beet Top Silage	Alfalfa Hay	Beet Top Sil.	Wheat Straw	Salt Lot	Salt Lot	Salt Lot	Salt Lot	Salt Lot	Salt Lot
Oct. 26	M.									20	26	17	33
	P.M.	1105	480	50	1125	50	570						
	A.M.	113		50		50							
27	M.												
	P.M.			50		50							
	A.M.			55		55	1180						
28	M.												
	P.M.			55		55							
	A.M.			60		60							
29	M.												
	P.M.			60		60							
	A.M.			60		60							
30	M.												
	P.M.			65	2115	65		65					
	A.M.			65		65		65					
31	M.												
	P.M.			80		80		80					

Report Number 1 - Continued

Lot No.	Ration Fed	1		2		3		4		Remarks			
		Alfalfa	Hay	Wheat	Straw	Beet Top	Alfalfa	Wheat	Beet	Salt	Salt	Salt	Salt
				Silage	Hay	Straw	Straw	Top Sil.	Straw	Lot	Lot	Lot	Lot
Nov. 1	A.M.			90				90		1			
	M.												
	P.M.			100				100					
	A.M.			110				110					
	M.												
	P.M.			120				120					
	A.M.			130				130					
	M.												
	P.M.			140				140					
	A.M.			150				150					
	M.												
	P.M.			160				160					
	A.M.			170				170					
<b>Total</b>		<b>1218</b>		<b>1820</b>	<b>3240</b>	<b>480</b>	<b>1750</b>	<b>1820</b>	<b>1750</b>	<b>20</b>	<b>26</b>	<b>17</b>	<b>33</b>

Lots 1 and 2 pastured each on a 5 acre tract of beet tops.

Block salt was supplied to all lots, self fed.

ANIMAL INVESTIGATIONS SECTION

Colorado Experiment Station

Report No. 2

Feeding Report in Pastured vs Ensiled Beet Tops  
 First Feed November 5, P.M., 1922. Last Feed November 15, A.M., 1922

Number Animals per Lot - 15 Steers

Date	Ration Fed	1		2		3		4		Remarks			
		Alfalfa	Hay	Wheat	Straw	Beet Top	Alfalfa	Beet Top	Wheat	Salt	Salt	Salt	Salt
Lot NO.							Hay	Silage	Straw	Lot	Lot	Lot	Lot
Nov 5	M. P.M.					170				1			
	A.M.			170		170	1860						
6	M. P.M.			170		170							
	A.M.			170		180							
7	M. P.M.			170		180							
	A.M.			170		180			1020				
8	M. P.M.			170		185							
	A.M.			170		190							
9	M. P.M.			170		190							
	A.M.			170		190							
10	M. P.M.			170		190							

Report Number 2 - Continued.

Lot No.	Ration Fed	1		2		3		4		Remarks					
		Alfalfa Hay	Wheat Straw	Beet Top Silage	Alfalfa Hay	Beet Top Sil.	Wheat Straw	Salt Lot	Salt Lot	Salt Lot	Salt Lot	Salt Lot	Salt Lot		
	A.M.			170				190				1	2	3	4
Nov.	M.														
11	P.M.			170				190							
	A.M.			170				190							
12	M.														
	P.M.			170				190							
	A.M.			170				190							
13	M.														
	P.M.	540		170				190							
	A.M.			170				190							
14	M.														
	P.M.			170				190							
15	A.M.			170				190							
Total		540		3400		1860		3705		1020					



Report Number 3 - Continued.

Lot No.	1		2		3		4		Remarks			
	Ration Fed	Alfalfa Hay	Wheat Straw	Beet Top Silage	Alfalfa Hay	Beet Top Sil.	Wheat Straw	Salt Lot 1	Salt Lot 2	Salt Lot 3	Salt Lot 4	
Date	A.M.			170		190	855					
Nov. 21	M.			170		190						
22	P.M.			170		190						
	A.M.											
	M.											
	P.M.			170		190						
23	A.M.			170		190						
	M.											
	P.M.			170		190						
24	A.M.			85		95						
	M.											
	P.M.	225	110	170		190						
25	A.M.											
Total		935	110	3145	1780	3515	855					



ANIMAL INVESTIGATIONS SECTION

Colorado Experiment Station

Report No. 4

Feeding Report in Pastured vs Ensiled Beet Tops  
 First Feed October 26, P.M., 1922. Last Feed November 25, A.M., 1922

Number Animals per Lot - 15 Steers

Date	Ration Fed	Number Animals per Lot - 15 Steers				Remarks							
		1	2	3	4	Salt Lot 1	Salt Lot 2	Salt Lot 3	Salt Lot 4				
Oct. 26 to		Alfalfa Hay	Wheat Straw	Beet Top Silage	Alfalfa Hay	Beet Top Silage	Wheat Straw	Beet Top Silage	Wheat Straw	Salt Lot 1	Salt Lot 2	Salt Lot 3	Salt Lot 4
Nov. 5	M.												
Nov. 5 to	P.M.	1218	480	1820	3240	1820	1750	1820	1750	20	26	17	33
Nov. 15	A.M.	540		3400	1860	3705	1020						
Nov. 15 to	P.M.												
Nov. 25	A.M.	935	110	3145	1780	3515	855						
Total		2693	590	8365	6880	9040	3625	20	26	17	33		
Weighted back					925		1010					6.5	15
Total		2693	590	8365	5955	9040	2615	20	26	10.5	18		