Preliminary Experiments With Feeding Beet By-Products to Cattle

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The purposes of the present study were: 1. to compare various methods of ensiling beet tops, 2. to find how best to utilize the ensilage in cattle feeding, and 3. to compare various protein levels in a beet belt ration. The results given here are preliminary since the objectives have been only partially achieved.

Ensiling was selected as a more desirable method of preserving tops than curing because of better carotene and total nutrient recovery per acre with ensiling as compared to field curing, as shown by Wilgus, et al. (3)[2], despite a very slightly lower digestibility of the silage compared to dried beet tops (1, 2). Maynard (4) has shown that the value of tops determined in different years and places varied widely. Lionel Harris and M. A. Alexander, with lambs (5) and Folke Jarl with dairy cows (2) showed that freedom from soil was an important factor in nutritional value.

In 1949, at Swink, Colorado, seven experimental trench silos were prepared, as shown in Table 1. The tops were held in the silos approximately 100 days. For each 100 pounds of material placed into a silo, approximately 80 were recovered in all cases except silo No. 3, which had 11.9 pounds of chopped alfalfa hay for each 88.1 pounds of fresh chopped beet tops. Here

Table 1.—Silo Storage Beet Tops, Swink, Colo., 1949.

Ingredient, by Percentage	Silo Number						
	1-A	1-B	2	3	4	5	6
Chopped tops, fresh	.....	86.5	81.4	88.1	80.8	....	100
Whole tops, slightly wilted	86.5	..	..	....	.....	100	.....
Beet seed screenings	13.5	13.5	14.8	. ....	.....	....	.....
Chopped alfalfa, low grade	.....	.....	. ....	11.9	14.3	.....	.....
Molasses		.	3.8	. .	4.9	. ....	.....
pH of finished silage	4.9	4.9	4.7	4.7	4.15	4.4	4.15
% Recovery of original weight	82.5	82.5	77.7	60.6	79.3	86.0	81.8
% Spoilage Loss	8.7	8.7	8.7	9.4	8.1	1.9	4.3

there was a recovery of only 60.6 percent. The trenches, about 30 feet long x 6 feet deep and 12 feet wide, were filled above ground level, packed by truck and tractor, and covered with sisal-kraft paper to reduce spoilage.

Various materials added to silage (Table 1) were tried in hope that material loss might thus be minimized since dry hay, etc., should act as a "blotter" to reduce drainage. Further work is needed to properly evaluate this concept.

The range in pH values in the silos when opened for feeding was 4.15 to 4.9. From the literature (2, 6, 7) it was expected that the values would be lower—close to pH 4.2. No explanation for this discrepancy is available, especially since one of the silos (No. 2 with pH 4.7) had added molasses to promote lactic acid fermentation. Nevertheless, all silages were sweet and palatable.

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[2] Numbers in parentheses refer to literature cited.

Table 2.—Initial and Final Values for Storage of Beet Tops in a Silo and an Above Ground Stack.

	Days In Storage	Fresh Weight (Pounds)		Percentage Moisture		Percentage Dry Matter		Percentage Protein	
Sample		In	Out	In	Out	In	Out	In	Out
Captive 1	35	50.8	46.5	74.9	71.1	25.1	28.9	2.67	3.13
Captive 4	35	56.3	51.8	76.0	75.8	24.0	24.2	2.91	2.85
Captive 2	61	55.0	51.5	73.0	71.7	27.0	28.3	3.05	3.10
Captive 5	69	52.3	46.3	73.1	71.8	26.9	28.2	3.05	2.94
Captive 3	92	54.0	50.0	73.7	73.2	26.3	26.8	2.79	2.71
Average	58	53.7	49.2	74.1	72.7	25.9	27.3	2.9	2.9
Trench Silo	113	150,520	114,505						
Stack									
Captive 1	27	78.0	55.5	71.9	66.9	28.1	33.1	2.83	3.34
Stack	55	55,770	38,395						

Silage lost from spoilage ranged from 1.9 to 9.4 percent. It consisted of moldy material from the edge of the silo, or material rejected by steers in the feed-lot.

In 1950, at Delta, Colorado, a similar trench silo was constructed. It held 75 tons of slightly wilted, whole beet tops with a covering of 4 inches of wet beet pulp. No silage was lost due to spoilage. An above-ground stack of similar material, containing 28 tons of tops (originally, 6 feet high, 8 feet wide at the base and 20 feet long) was made at the same time. Tables Nos. 2 and 3 compare losses in the two silos. The percentage losses of moisture, dry matter and protein, shown in Table 3, were calculated from original weight times initial percentage of constituent minus final weight times final percentage.

The results are approximations since it would have been desirable to have more captive samples. Evidently, however, losses in fresh weight, dry matter and protein were much greater in the above-ground stack than they were in the trench silo, even though the tops were stored about three times as long in the trench as in the stack. Captive sample 1 was placed directly on the ground inside the trench silo and increased in dry matter and protein

Table 3.—Losses in Storage of Beet Tops in Trench Silo and Above Ground Stack.

Sample	Days in Storage	Fresh Wt. Percent Loss	Moisture Percent Loss	Dry Matter Percent Loss	Protein Percent Loss
1	35	8.4	13.0	—5.5	—7.4
4	35	8.0	8.1	7.5	10.4
2	61	6.4	8.0	1.9	4.8
5	69	11.5	13.1	7.2	14.5
3	92	7.4	8.1	5.2	9.9
Average	58	8.3	10.1	3.3	6.4
Trench Silo	113	23.9[1]			
Stack					
Captive	27	28.8	33.9	16.0	15.8
Stack	55	31.2			

[1] Trench silo had a covering of wet pulp (13.0 per cent of original weight) whose losses are included in this figure.

by drainage from above; the other captive samples were at least 1.5 feet above ground. Morton, Osland and Tom (8) reported briefly on beet top silage; losses of protein calculated from their data were 37.4 percent compared to 6.4 to 15.8 percent reported here. Jarl (2) gives a range of crude protein loss in various silages of 4.6 to 29.4 percent. The lower losses of protein were obtained in silos to which AIV acid, or formic acid, was added. With such a wide range in values further studies appear well justified.

Our estimated cost for the trench silo at Delta was $6.38 per ton of fed silage. This includes payment for tops in the field, fuel and labor at $1.20 per hour. Our haul of 5.5 miles from the field was much longer than most farmers would experience. It was estimated that under normal conditions for ensiling, both at Delta and at Swink, finished silage could be produced for $4.36 per ton. Two of our growers at Delta, W. C. Raymond and Floyd Broughton, ensiled tops for the first time in 1950. Exclusive of a charge for the tops, their costs, respectively, were $1.69 and $2.50 per ton of finished silage.

Table 4.—Rations and Gains, 2-yr.-old Fattening Steers, Jan. 17, 1950 to March 9, 1950, at Swink, Colo.

Lot No.:	13	14	16	13	14	16
Period:	21-day Adjustment Period			30-day Experimental Period		
Lot No.:	13	14	16	13	14	16
Avc. Initial Wt.	1030.9	943.3	959.9	1086.0	977.7	986.3
Avc. Final Wt.	1086.0	977.7	986.3	1155.9	1051.1	1065.5
Avc. Gain	55.1	34.4	26.4	69.9	73.4	77.2
Avc. Daily Gain	2.62	1.64	1.26	2.33	2.45	2.57
Daily Ration						
Pulp	76.37	52.41	34.46	83.11	67.33	..
Corn	4.0	4.0	4.13	4.0	4.0	10.04
V-22 Pellets	1.33	1.33	1.33	1.33	1.33	1.91
Molasses	3.0	3.0	3.0	3.0	3.0	3.5
Alfalfa Hay	7.87	3.48	7.62	7.29	....	4.6
Ensilage	...	20.86	26.57	.. .	28.67	37.0

Feeding Tests

The beet tops ensiled in the fall of 1949 at Swink were fed to steers at Swink from January 17 to March 9, 1950. Each pen contained 75 steers. The experiment is summarized in Table 4.

Pen No. 13 was the control; it was fed the regular commercial feed-lot ration for that year. In Pen No. 14 silage was used to completely replace alfalfa and to partially replce wet beet pulp. In Pen No. 16 part of the hay and all the wet pulp were replaced by silage. Pen No. 14 was felt to be of interest to farmers having wet beet pulp readily available; Pen No. 16 was designed for growers too far from the factory to be able to haul wet pulp. The latter ration required additional corn, it was felt, because of the difficulty experienced by the steers in the 21-day adjustment period in which their ration changed from that of Pen No. 13 to that of Pen No. 16. The V-22 pellets were 22 percent protein pellets which included vitamin and mineral supplements.

During this short study it is evident that gains in the experimental rations were poor during the 21-day adjustment period but were as good,

Table 5.—Steer Feeding Experiment, Delta, Colo., Nov. 7, 1950 to March 7, 1951.

Pen No. 2 Control, Standard Wet Pulp Ration
Average Initial Weight 755 Pounds for 40 Steers

Ration Ingredients Lbs./Head/Day	Pen No. 2 Nov. 7-Dec. 7 30 days	Dec. 7-Dec. 22 15 days	Dec. 22-Jan. 9 18 days	Jan. 9-Jan. 23 14 days	Jan. 23-Feb. 6 14 days	Feb. 6-Feb. 22 16 days	Feb. 22-Mar. 7 15 days	Average for 120 days
Green pulp	86.67	30	....	....	....	....	....	25.42
Ensiled pulp	-	60	90	90	85	85	90	62.50
Beet tailings	10	2	....	....	....	....	....	2.75
43% cottonseed cake	2	2	2	2	2	2	2	2.00
V-22 pellets	....		....	0.46	0.5	0.5	0.5	.23
Hay	4.67	5	5	5	5	5	5	4.92
Molasses	2.9	3	3	3	3	3	3	2.98
Nutrients:								
Dry matter	14.77	17.18	18.46	18.56	18.38	18.24	18.92	17.40
T.D.N.	10.09	12.16	13.17	13.28	13.15	13.17	13.54	12.32
Dig. Protein	1.80	1.79	1.78	1.84	1.84	1.93	2.13	1.86
Nutritive Ratio	1:4.55	1:5.8	1:6.4	1:6.22	1:6.15	1:5.82	1:5.36	1:5.62
Daily Gain								
for period	1.34	3.03	1.71	3.24	0.45	2.41	1.92	
from start	1.34	1.90	1.85	2.10	1.85	1.93	1.93	1.93
Pounds T.D.N. per 100 lbs. gain								638

or better, than the control during the last 30 days. Calculated feed costs per hundred pounds gain for the rations at Swink (using 1949-50 feed costs and $4.36 a ton for silage) were, for the adjustment period, $12.63 for the control, $18.87 for silage replacement of hay (Pen No. 14), and $27.94 for Pen No. 16, where silage replaced wet pulp. The corresponding figures in the second period were $14.47, $12.58 and $18.33.

Table 6.—Steer Feeding Experiment, Delta, Colo., Nov. 7 1950 to March 7, 1951.

Pen No. 1, Standard Wet Pulp Ration with Cottonseed Cake Replaced by "Holly" 22 Percent Protein Meal (see text for composition)
Average Initial Weight 750 Pounds for 15 Steers.

Ration Ingredients Lbs./Head/Day	Pen No. 1 Nov. 7-Dec. 7 30 days	Dec. 7-Dec. 22 15 days	Dec. 22-Jan. 9 18 days	Jan. 9-Jan. 23 14 days	Jan. 23-Feb. 6 14 days	Feb. 6-Feb. 22 16 days	Feb. 22-Mar. 7 15 days	Average for 120 days
Green pulp	86.67	30	....	....	....	....	....	25.42
Ensiled pulp	....	60	90	90	85	85	90	62.50
Beet tailings	10	2	....	.	....	....	....	2.75
43% cottonseed cake	2	0.27	....	....		....	....	0.53
Hay	4.67	5	5	4.64	5	5	5	4.88
Molasses	2.9	3	3	3	3	3	3	2.98
"Holly" 22% Prot. Meal	....	1.73	2	2	2	2	2	1.47
Barley	....	....	..	0.71	1	1	1	0.44
Nutrients:								
Dry matter	14.77	17.15	18.43	18.74	18.78	18.64	19.32	17.56
T.D.N.	10.09	11.90	12.88	13.26	13.27	13.29	13.72	12.30
Dig. Protein	1.80	1.45	1.59	1.44	1.48	1.55	1.76	1.58
Nutritive Ratio	1:4.55	1:7.2	1:8.5	1:8.21	1:8.09	1:7.57	1:6.80	1:6.78
Daily Gain								
for period	1.97	2.71	1.64	2.40	0.71	1.67	2.02	
from start	1.97	2.22	2.05	2.11	1.90	1.86	1.88	1.88
Pounds T.D.N. per 100 lbs. gain								654

Table No. 7.—Steer Feeding Experiment, Delta, Colo., Nov. 7, 1950 to March 7, 1951.

Pen No. 11, Beet Top Silage Partially Replacing Beet Pulp, Hay, and Cottonseed Meal
Average Initial Weight 745 Pounds for 40 Steers

Ration Ingredients Lbs./Head/Day	Pen No. 11 Nov. 7- Dec. 7 30 days	Dec. 7- Dec. 22 15 days	Dec. 22- Jan. 9 18 days	Jan. 9- Jan. 23 14 days	Jan. 23- Feb. 6 14 days	Feb. 6- Feb. 22 16 days	Feb. 22- Mar. 7 13 days	Average for 120 days
Green pulp	67.67	23.3	...	...	...	...	....	24.71
Ensiled pulp	....	46.7	70	70	65	67.5	80	49.64
Beet tailings	10	2	....	....	....	....	....	2.75
45% cottonseed cake	1.2	1	1	1	1	1	1.92	1.15
Molasses	2.9	3	3	3	3	3	3	2.98
Hay	3.17	3	3	1.93	2.00	3.24	4.77	3.02
Barley	....	....	....	0.71	1	1	1	0.44
Silage	21	25	25	25	25	22.19	10.38	22.12
Nutrients								
Dry Matter	18.64	18.91	19.84	19.53	19.31	19.93	20.57	19.42
T.D.N.	12.13	12.76	12.52	13.54	12.86	13.83	14.56	13.15
Dig. Protein	1.74	1.60	1.60	1.61	1.61	1.68	2.20	1.71
Nutritive Ratio	1:5.97	1:6.98	1:6.83	1:7.41	1:6.99	1:7.21	1:5.63	1:6.69
Daily Gain								
for period	1.31	2.52	1.28	2.46	1.95	1.19	2.62	
from start	1.31	1.72	1.58	1.74	1.77	1.67	1.77	1.77
Pounds T.D.N. per 100 lbs. gain								743

Silage produced at Delta was fed from November 7, 1950, to March 7, 1951. Tables Nos. 5, 6, 7, 8 and 9 summarize the rations and gains. The Delta feeding work had three objectives:

1. to study again the use of silage when wet pulp is available (Pen No. 11) ;
2. to study the use of silage when no wet pulp is available (Pen No. 12);
3. to study a protein level lower than that in present feed-lot practice at Delta while using a new source protein (Pen No. 1) .

The new protein source, labelled "Holly 22 percent protein meal" is Table 6 for convenience, consisted of 61.6 percent dehydrated beet tops, 17.5 percent cottonseed meal, 3 percent urea, 1.7 percent linseed meal as a vitamin carrier, 13.7 percent molasses, 2.5 percent mineral supplement. We are indebted to Professor Ray Barmington of Colorado A & M for the dehydrated beet tops. The urea supplied 35 percent of the total crude protein equivalent of the "Holly 22%. protein meal." Pen No. 2, Table 5, was the feed-lot control. The ration was designed to be a fast-growing rather than a strictly fattening ration.

In the protein experiment, the calculated total average daily digestible protein for Pen No. 1 ("Holly protein") was 1.58 pounds, while for the control (Pen No. 2) it was 1.86 pounds. After four months the respective gains per head per day were 1.88 and 1.93 pounds. It should be pointed out that during the first month both pens received identical rations, and then the new protein feed replaced cottonseed meal in the ration. It was felt that no significant difference existed between the two pens. It cost $14.20 per 100 pounds of gain for the control pen, and $14.09 for the lower protein pen. The 22 percent protein meal was calculated to cost $74 a ton, and the cottonseed meal cost $90.

Table 8.—Steer Feeding Experiment, Delta, Colo., Nov. 7, 1950 to March 7, 1951.

Pen No. 12, Beet Top Silage Replacing All Wet Beet Pulp, Part of Hay and Cottonseed Cake Average Initial Weight 751 Pounds for 13 Steers

Ration Ingredients Lbs./Head/Day	Pen No. 12 Nov. 7- Dec. 7 30 days	Dec. 7- Dec. 22 15 days	Dec. 22- Jan. 9 18 days	Jan. 9- Jan. 23 14 days	Jan. 23- Feb. 6 14 days	Feb. 6- Feb. 22 16 days	Feb. 22- Mar. 7 18 days	Average for 120 days
Green pulp	10.1	....	....	....	....	....	....	2.53
Ensiled pulp	....	....	....	....	....	11.88	73.85	9.58
Beet tailings	10	2	....	....	....	....	....	2.75
43% cottonseed cake	1.23	1	1	1	1	1	1.92	1.15
Hay	3.57	3	3	1.07	1.02	2.46	4.92	2.82
Molasses	2.9	3	3	3	3	3	3	2.98
Barley		....	....	0.71	2.5	3.75	1.46	1.03
Silage	30.17	46	50	50	50	45.62	16.51	40.33
Nutrients:								
Dry matter	19.08	18.13	18.50	17.42	18.97	21.53	21.99	19.39
T.D.N.	11.91	11.33	11.51	11.11	12.19	14.49	15.39	12.44
Dig. Protein	1.79	1.56	1.53	1.49	1.67	1.88	2.33	1.74
Nutritive Ratio	1:5.65	1:6.26	1:6.52	1:6.46	1:6.30	1:6.71	1:5.61	1:6.15
Daily Gain								
for period	1.71	1.31	1.36	1.31	1.11	1.69	2.95	
from start	1.74	1.60	1.53	1.49	1.43	1.47	1.63	1.63
Pounds T.D.N. per 100 lbs. gain								763

Silage feeding where wet pulp was available (Pen No. 11, Table 7) was compared to the control. For four months the average daily gain was 1.77 pounds versus 1.93 pounds for the control; corresponding costs per 100-pound gain were $14.04 versus $14.20. These costs include no hauling charge for wet pulp; thus, the silage ration would be even more economical for most growers. Silage cost used in these calculations was $4.36 a ton. Morton, et al. (8) used beet top silage in a wet pulp ration containing large amounts of grain. When silage replaced 60 percent of the alfalfa gains were slightly lower but cheaper. Colorado A & M (9) in another experiment used silage to replace some of the corn and alfalfa in a high grain wet pulp ration in 1943; again gains were cheaper. They were also cheaper when extra wet pulp and silage replaced some of the alfalfa, corn and cottonseed cake. Their costs were based on $2.75 a ton for silage.

Where no beet pulp was used at Delta (Pen No. 12, Table 8) gains were slower, costs higher. For the four months the average gain was 1.63 pounds per head per day at a cost of $16.25 per hundred pounds. Even at $16.25 the profit was attractive, however. Colorado A & M work (10) on a ration containing no beet pulp but using beet top silage also showed slightly lower gains when silage was substituted for part of the alfalfa and all of the wet pulp; 1.71 pounds per head per day compared to 1.83 for the control using wet pulp. These Colorado A & M figures, based on a silage cost of $4 a ton, showed slightly cheaper gains for the silage pen.

The work at Swink and Delta indicates that possibly one should finish silage-fed steers with higher amounts of grain and alfalfa at the expense of silage for the last few weeks. Further work on this point is needed.

Feeding tests were started November 4, 1951, at Hawk Springs, Wyoming. It was felt advantageous to vary the locale for tests in order to stimulate

Table 9.—Summary of Average Daily Gains Delta Experiment, Nov. 7, 1950 to March 7, 1951.

	Average Daily Gain
Control Ration, Pen No. 2	1.93
Pen No. 1—like Control, but using "Holly" 22% Protein Meal	1.88
Pen No. 11—silage partially replacing wet pulp, hay and cottonseed cake	1.77
Pen No. 12—silage completely replacing beet pulp and part of hay and cottonseed cake	1.63

grower interest in feeding beet tops. Table 10 shows the various rations being studied. All pens were given free access to salt and a high-phosphorus mineral mix. The silage pens were fed 1/10 pound per head daily of waste factory lime in addition to the regular ration, and the urea pens were given an additional 1/10 pound per head daily of mineral mix. The objectives this year are:

1. to gain more data on use of silage with and without wet pulp;
2. to study reduction in protein level and to compare cottonseed meal with urea;
3. to compare wet pulp with dried beet pulp;
4. to observe the effect of a small amount of a high molasses pulp (Sugapulp) on a corn belt ration.

Pens Nos. 1, 5 and 9 give three levels of cottonseed cake: 1.5, 1 and 0.5 pounds, respectively. Where the cake is reduced, corn is substituted in equal amount.

Gains for the three pens for the first 92 days were 1.82 pounds, 2.12 pounds and 2.34 pounds per head per day, respectively.

Table 10.—Feeding Experiment, Hawk Springs, Wyo., Winter of 1951-1952. (Preliminary Results)

No.	Description	Pressed Beet Pulp	25% Molasses dried Beet Pulp	Chop'd Alfalfa	Gr'nd Corn	Sugapulp	Molasses	Urea	45% Cottonseed Cake	Beet Top Silage	Pounds Gain for first 92 days
1	"Beet Belt" Control, High Protein	60[1]	....	5	6	....	3	....	1.5	....	1.82
2	Dry Beet Pulp Ration	....	9	8	8	....	1.5	....	....	....	2.15
3	Urea	60	....	5	7	....	2.8	0.2	....	....	2.35
4	Urea and Silage	60	....	2	6	....	2.8	0.2	....	15	2.23
5	Medium Protein "Beet Belt" Ration	60	....	5	6.5	....	3	....	1	....	2.12
9	Low Protein "Beet Belt" Ration	60	....	5	7	....	3	....	0.5	....	2.34
7	"Corn Belt" Control	....	....	8	15	....	....	....	1	....	1.85
6	Sugapulp in "Corn Belt" Ration	....	....	8	13	2	....	....	1	....	2.42
8	Beet Top Silage in "Corn Belt"	....	....	5	14	....	....	....	....	25	1.47

[1] Ration figures in pounds fed per head per day.

Pen No. 2, with the dry pulp ration, showed an average daily gain of 2.15 pounds per head.

Urea was fed in Pens Nos. 3 and 4 at Hawk Springs. Pen No. 3 differs from the control in that 0.2 pound of urea replaces an equal weight of molasses and one pound of corn is used in place of 1.5 pounds of cottonseed cake. Pen No. 4, urea plus silage, differs from Pen No. 3 in that 15 pounds of silage replace 3 pounds alfalfa plus 1 pound of corn. The gain for pen No. 3 was 2.35 pounds per head per day for the 92 days. And in the urea, plus silage, Pen, No. 4, the average daily gain was 2.23 pounds.

The "corn belt" rations are designed for growers who cannot economically obtain pulp. Pen No. 7 is the control (11); Pen No. 8 uses 25 pounds of beet top silage to replace one pound of corn and three pounds of hay. Pen No. 6 differs from control Pen No. 7 by substitution of two pounds of high-molasses pulp (Sugapulp, 80 percent liquid molasses equivalent) for two pounds of corn. The average daily gain for the control, Pen. No. 7, was 1.85 pounds per head per day for the 92 days. The silage pen, No. 8, showed a weak 1.47 pounds per head per day gain. Pen No. 6 has given an average daily gain of 2.42 pounds.

Summary

1. Fresh and slightly wilted beet tops were stored in tightly packed trench silos at Swink, with and without additions of other preservatives, and covered with sisalkraft paper. Weight losses ranged from 14 percent for whole, slightly wilted tops to 39.4 percent for fresh chopped tops in alternate layers with chopped alfalfa. Spoilage losses ranged from 1.9 percent to 9.4 percent on the same two silos.

2. Slightly wilted tops in a tightly packed silo at Delta, were covered with wet beet pulp. No spoilage occurred. Fresh weight loss was 23.9 percent, including the wet pulp covering. Captive samples within the silo indicated less weight loss for the tops alone, 8.3 percent. Dry matter and moisture losses averaged 3.3 percent and 10.1 percent, respectively. Protein losses averaged 6.4 percent.

3. Wilted tops, stacked above ground, showed 31.2 percent weight loss. The one captive sample in the stack showed a weight loss of 28.8 percent. Dry matter loss of 16.0 percent and protein loss of 15.8 percent was indicated by the captive sample.

4. By mechanical handling, silage was produced at Delta, Colorado, at a cost of $6.38 per ton. It was estimated that a similar operation with normal hauling distance and proper equipment available would have allowed silage to be produced at $4.36 per ton.

5. Beet top silage was fed to steers in rations with and without wet pulp. Gains were slightly slower, but more economical when silage replaced part of the wet pulp and part, or all, of the alfalfa in the ration. Where all wet pulp was replaced by silage, slower and more expensive gains resulted.

6. Dehydrated beet tops were used as the main bulk of a 22 percent protein meal in which 35 percent of the protein equivalent was supplied by

urea. The meal was used to replace 43 percent cottonseed meal, pound for pound in a "beet belt" ration.

7. At present, feeding trials are under way to compare the effect of feeding different protein levels in a "beet belt" ration; to further study the place of urea and of beet top silage in a "beet belt" ration; to determine the efficiency of beet top silage in a "corn belt" ration to find whether Sugapulp, a dry feed of high molasses content, is beneficial in a "corn belt" ration, and to determine the economy of a dry pulp versus a wet pulp ration.

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