

# FEEDING SUGAR BEET TOPS in the RED RIVER VALLEY



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# Feeding Sugar Beet Tops in the Red River Valley Area of Northwest Minnesota and Northeast North Dakota

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**A** LARGE ACREAGE of sugar beets is now being grown in the Red River Valley area of Minnesota and North Dakota. Because of the climatic conditions and type of agriculture of the area, little effective use has been made of the sugar beet tops as feed for livestock. In an attempt to determine whether or not it is worth while to develop feeding enterprises to utilize the tops in the Red River Valley, the University of Minnesota Agricultural Experiment Station made a study of feeding plans followed in other beet-growing areas. During each of the last three winters an experiment in the feeding of beet tops to fattening lambs was made at the Northwest Branch Experiment Station at Crookston, Minnesota.

## FEEDING BEET TOPS IN OTHER AREAS

**I**T IS a common practice to utilize beet tops as livestock feed in most sugar beet-growing areas in the United States. The tops are fed by grazing the fields with cattle or sheep soon after the beets are harvested, by piling them in small piles in the field and hauling them into the feed lot as needed, or by hauling them off the field while still

green and making silage of them in trench silos or stacking them in large ricks on the ground.

Fresh green beet tops contain about 15 per cent dry matter and 85 per cent water. The yield of green tops is usually about three-fourths the weight of the yield of beets. A typical 12 to 14 ton-per-acre yield of beets produces a 9-to 11-ton yield of green tops. Because of their high moisture content it is recommended that the tops be allowed

to wilt some and lose some of their moisture before being grazed or stored. This process reduces the weight to about 8 tons per acre.

In experiments at other experiment stations wilted beet tops have been found to have a feeding value slightly higher ton for ton than corn silage. Since corn silage has a feeding value varying from \$5 to \$8 per ton, this would give the beet tops a per-acre value of \$40 to \$60 when used to replace corn silage.

When compared to alfalfa hay an acre of tops was found to have a replacement value of 1.5 tons of good quality alfalfa hay. Valuing alfalfa hay at \$20 per ton, an acre of tops would be worth \$30 when fed to replace alfalfa hay.

The several comparisons made at other experiment stations, therefore, indicate that the per-acre value of beet tops may vary from \$30 to \$60, depending on comparative prices of other feeds which may be replaced by beet tops in feeding rations.

### Methods of Feeding in Other Areas

In irrigated areas where a long stretch of good weather without rain or snow usually follows the beet harvest, tops are often grazed from the fields by pastured or herded cattle or sheep.

Even in areas where the fall season is favorable to pasturing, many beet-top feeders prefer to put part or all of the tops in small piles in the field and allow them to remain there and cure as the season advances. They can then be hauled in to a feed lot and fed as needed. Animals receiving beet tops in this manner can be fed grain and hay in addition and will make more rapid gains and fatten in less time. This often overbalances the lower cost of field grazing.

In all beet-growing areas a favored method of feeding the tops is to haul

them in from the field soon after they are cut and place them in trench silos or stack them in front of the mangers in which they are to be fed. The highest per-acre feed value can be obtained from the tops in this form and, because the crowns soften in the silage heap, the risk of choking is low. In many areas a group of thin lambs or cattle are started by grazing on tops as the only feed for four to six weeks. Then the animals are changed to field-piled tops or silage in the feed lot, and at the same time grain and hay are added to their diet.

## FEEDING BEET TOPS IN THE RED RIVER VALLEY AREA

**T**HE PLAN of grazing beet tops has limited application in the Red River Valley area. One reason for this is that the possible grazing season between the time the first beets are harvested and the first heavy snow is liable to be short. It is almost certain, also, that there will be some wet, cold rains during this period, making the fields of heavy black soil unfit for grazing. Another reason is the risk of death loss from choking and pneumonia contracted by animals lying on the cold, wet soil.

In the Red River Valley the plan of piling the tops in small piles and hauling them in as needed can be used with considerable success. This plan is especially suited to farms with only a few acres of beets and with livestock to which the tops can be fed. It is not as well suited to the large commercial enterprise where a large number of fattening cattle or lambs are being fed, because a large amount of work is required. Also, the piles of tops usually become frozen to the ground and covered with snow within six weeks or two months after they become available.

All possibilities and problems considered, it appears that feeding the tops as silage, made by stacking them above ground adjacent to the lot or shed in which the animals are to be fed, offers the best opportunity for success. The tops can be hauled from the fields and stored as soon as the harvesting is completed and the tops have wilted to 60 per cent moisture content or less. Machinery can be used to load them on to trucks or wagons and to unload them from wagons to the stacks. In this way the largest percentage of tops is recovered and the highest feeding value per acre obtained. Also, the feeding period can be extended throughout the winter if desired.

## THE MINNESOTA EXPERIMENTS

**T**HE ABSENCE of sufficient numbers of suitable livestock to which to feed the tops has delayed the development of beet-top feeding in the Red River Valley. Many farms which have large acreages of sugar beets maintain very little livestock.

In the Red River Valley area it appears that fattening cattle or fattening lambs are best suited to utilizing the tops. If large quantities of tops are to be utilized, it will be necessary first to provide suitable feed yards and shelter and to purchase thin lambs or cattle. Usually either feeder cattle or lambs can be obtained from the western range area in considerable numbers and at the time needed. Straw is plentiful in the area. Straw sheds for shelter would be simple to construct at low cost. Simple feed bunks or troughs and hay racks comprise about all of the additional equipment needed to develop a sizeable cattle- or lamb-feeding enterprise.

The grain and hay necessary to com-

plete a satisfactory fattening ration are available in the area. It would seem that all that is necessary to develop the recovering of the feeding value from the beet tops is interest on the part of sufficient persons in developing feeding enterprises to utilize the quantity of tops produced.

In an attempt to test the soundness of the above theory and develop a successful feeding plan three lamb feeding trials utilizing beet tops were made at the Northwest Branch Experiment Station at Crookston. One hundred and twenty lambs were fed during each of the three winters—1945-46, 1946-47, and 1947-48.

During the first winter the lambs were of the white-face type of western range origin. The second winter they were of native origin obtained on the market at South St. Paul and the third winter they were again the white-face type of western origin obtained on the market at Fargo, North Dakota.

During the first and second winters field-cured tops and stack silage were used. During the third winter stack silage made of clear tops and silage made of alternate layers of beet tops and straw was used. In the first year beet tops were fed rather lightly to two lots and heavier to others. During the second and third year an attempt was made to regulate the feeding to assure the largest possible beet-top consumption. Results of the three experiments are reported in tables 1, 2, and 3.

### Results of Experiment 1

In experiment 1, made during the late fall and early winter of 1945-46, the weather during the beet harvest was warm and dry. The tops were allowed to remain in the field a number of days before being piled or picked up for silage. As a result both the field-dried tops and silage were low in moisture content. A moisture test made on January 30, 1946, near the close of the

feeding experiment, gave the moisture content of a sample of the field-dried tops as 50 per cent and of the top silage as 34 per cent. It is probable that the moisture content of each kind of top was somewhat higher during the early part of the feeding period. It is known, however, that the moisture content of either type does not change much during the winter once the weather has turned cold. During this first year the top silage developed a tobacco brown color and was highly palatable to the lambs.

The lambs fed in this trial had the run of pasture fields for several days after arrival at the experiment station. They were put in the feed lots on November 2. During the first six weeks of the feeding period the principal feed

for all lots was beet tops, with hay and grain fed sparingly. From then on an attempt was made to continue heavy feeding of tops in lots 1 and 4, but the amount of tops fed to lots 2 and 3 was purposely limited to make certain that these two lots would not be put off feed by excessive consumption of tops. In this trial, however, even with heavy top consumption, not a single lamb in lots 1 and 4 went off feed at any time. In this trial no death loss occurred in any lot and not a single lamb appeared to be off feed at any time during the trial. Rapid gains were made, and carcasses of the lambs graded high. Gains were just as rapid and grade of carcass just as high in the two lots receiving a heavy feed of beet tops as in the lots receiving a light feed of tops.

Table 1. Feeding Beet Tops to Fattening Lambs  
November 2, 1945-February 15, 1946 (105 days)\*

	Rations			
	Lot 1	Lot 2	Lot 3	Lot 4
	Barley, Oats, Alfalfa hay, Field-piled tops	Barley, Oats, Alfalfa hay, Field-piled tops	Barley, Oats, Alfalfa hay, Beet-top silage	Barley, Oats, Alfalfa hay, Beet-top silage
Thirty lambs per lot				
Initial weight per lamb, pounds	69.41	69.02	69.33	69.93
Final weight per lamb, pounds	108.61	108.61	109.83	113.86
Average gain per lamb, pounds	39.20	39.59	40.50	43.93
Average daily gain, pounds	.373	.377	.385	.420
Average daily ration, pounds				
Barley	1.006	1.055	1.064	1.045
Oats	.431	.451	.456	.448
Alfalfa hay	1.469	1.841	1.790	1.633
Beet tops	3.331	.817	1.192	4.642
Feed per 100 pounds gain, pounds				
Barley	271.69	279.76	276.32	248.86
Oats	116.43	119.83	118.42	106.65
Alfalfa hay	393.89	488.47	464.97	388.90
Beet tops	892.96	216.80	309.74	1,105.18
Feed cost per 100 pounds gain	\$15.38	\$14.36	\$14.36	\$15.19
Initial cost of lamb per 100 pounds in feed lot	17.40	17.40	17.40	17.40
Initial cost per lamb in feed lot	12.08	12.01	12.06	12.17
Feed cost per lamb	6.03	5.68	5.82	6.67
Total cost per lamb	18.11	17.69	17.88	18.84
Selling price per 100 pounds, Crookston	17.90	17.90	17.90	17.90
Selling price per lamb including subsidy	19.44	19.44	19.66	20.38
Margin over feed cost per lamb	1.33	1.75	1.78	1.54
Beet tops consumed per lamb, pounds	349.75	85.78	125.16	487.4

\* Feed prices charged: Barley, \$1.25 per bushel; oats, \$0.74 per bushel; alfalfa hay, \$15.00 per ton; beet tops as fed, \$6.00 per ton.

Table 2. Feeding Beet Tops to Fattening Lambs  
October 22, 1946-February 11, 1947 (112 days)\*

	Rations			
	Lot 1	Lot 2	Lot 3	Lot 4
	Barley, Oats, Alfalfa hay, Field-piled tops	Barley, Oats, Alfalfa hay, Field-piled tops	Barley, Oats, Alfalfa hay, Beet-top silage	Barley, Oats, Alfalfa hay, Beet-top silage
Thirty lambs per lot				
Initial weight per lamb, pounds	66.11	64.55	65.53	65.83
Final weight per lamb, pounds	96.66	99.66	102.16	97.00
Average gain per lamb, pounds	30.55	35.11	36.63	31.17
Average daily gain, pounds	.273	.313	.327	.278
Average daily ration, pounds				
Barley	.770	.970	.971	.766
Oats	.330	.415	.416	.328
Alfalfa hay	1.010	1.007	.983	1.016
Beet tops	3.283	3.179	3.375	3.476
Feed per 100 pounds gain, pounds				
Barley	282.23	309.43	295.39	275.51
Oats	120.98	132.40	126.60	118.07
Alfalfa hay	370.27	321.23	300.56	365.10
Beet tops	1,203.26	1,013.44	1,026.24	1,249.19
Feed cost per 100 pounds gain	\$18.97	\$19.03	\$18.28	\$18.78
Initial cost per lamb per 100 pounds in feed lot	17.20	17.20	17.20	17.20
Initial cost per lamb in feed lot	11.37	11.10	11.27	11.32
Feed cost per lamb	5.80	6.68	6.70	5.85
Total cost per lamb	17.17	17.78	17.97	17.17
Selling price per 100 pounds, Crookston	21.00	21.00	21.00	21.00
Selling price per lamb, Crookston	20.30	20.93	21.45	20.37
Margin over feed cost per lamb	3.13	3.15	3.48	3.20
Beet tops consumed per lamb, pounds	367.70	355.82	378.00	389.31

\* Feed prices charged: Barley, \$1.50 per bushel; oats, \$0.75 per bushel; alfalfa hay, \$20.00 per ton; beet tops as fed, \$6.00 per ton.

## Results of Experiment 2

Experiment No. 2 was made during the late fall and early winter of 1946-47. During this season the tops were again allowed to remain in the field a number of days before being piled or picked up for silage. This fall season was cloudy and rainy, and the tops were still very high in moisture content when picked up. As a result they ran much higher in moisture content throughout the feeding period than in the 1945-46 experiment. While moisture content was not checked through the feeding period, one test of samples taken December 10, 1946, indicated 63 per cent moisture for the field-piled tops and 81 per cent for the silage. The silage was again made by stack-

ing the whole tops near the feed lot. In this trial the silage developed a slimy, black appearance and a nauseating odor. The lambs ate it readily, however, and did well on it throughout the trial.

Daily rate of gain was somewhat lower in this second trial than in the one the previous winter. This was probably because of the average higher consumption of tops, higher moisture content of the tops, and lower consumption of grain. In this trial the lambs were rested and grazed on pasture a few days before starting the dry lot feeding on October 22. It was intended that they be fed on tops only for six weeks or two months before beginning hay or grain feeding. All lots began scouring severely on the heavy,



Table 3. Feeding Beet Tops to Fattening Lambs  
October 31, 1947-February 13, 1948 (105 days)\*

	Rations			
	Lot 1	Lot 2	Lot 3	Lot 4
	Barley, Oats, Alfalfa hay, Beet-top silage	Barley, Oats, Alfalfa hay, Beet-top silage	Barley, Oats, Beet top-straw mixed silage	Barley, Oats, Alfalfa hay, Beet top-straw mixed silage
Thirty lambs per lot				
Initial weight per lamb, pounds	75.46	75.13	73.46	74.46
Final weight per lamb, pounds	96.43	98.83	94.83	99.31
Average gain per lamb, pounds	20.97	23.70	21.37	24.85
Average daily gain, pounds	.20	.23	.20	.23
Average daily ration, pounds				
Barley	.46	.58	.58	.59
Oats	.30	.39	.39	.40
Alfalfa hay	.75	.48		.78
Beet tops	4.37	4.47	3.67	3.67
Straw			.70	.40
Feed per 100 pounds gain, pounds				
Barley	217.31	255.33	285.00	276.73
Oats	164.72	175.33	193.46	189.36
Alfalfa hay	379.49	215.18		369.50
Beet tops	2,190.77	1,953.58	1,965.05	1,730.03
Straw			344.92	172.44
Feed cost per 100 pounds gain	\$28.49	\$28.58	\$30.49	\$32.01
Initial cost of lamb per 100 pounds in feed lot	19.90	19.90	19.90	19.90
Initial cost per lamb in fed lot	15.02	14.95	14.62	14.82
Feed cost per lamb	5.97	6.77	6.52	7.95
Total cost per lamb	20.99	21.72	21.14	22.77
Selling price per 100 pounds, Crookston	20.85	20.85	20.60	20.85
Selling price per lamb, Crookston	20.11	20.61	19.54	20.71
Loss per lamb	0.88	1.11	1.60	2.06
Beet tops consumed per lamb, pounds	458.85	469.35	385.35	385.35

\* Feed prices charged: Barley, \$2.55 per bushel; oats, \$1.27 per bushel; alfalfa hay, \$20.00 per ton; beet tops as fed, \$6.00 per ton; oats straw as fed, \$10.00 per ton.

high-moisture tops, so hay feeding had to be started after two days in the feed lot. About 1 pound of hay per lamb per day was fed throughout the trial. Grain feeding was begun about mid-December. At this point the lambs again scoured and the amount of tops fed had to be decreased a little. As in the first trial no lambs died during this second experiment. The feeding of either field-piled tops or top silage to lambs again worked out as a very successful method of utilizing the tops.

### Results of Experiment 3

Experiment 3 was made during the late fall and early winter of 1947-48.

During this season no field-piled tops were used. Some top silage was made by stacking the clear tops after being wilted several days in the field, and some was made by stacking alternate layers of tops and straw, the idea being to reduce the moisture content of the silage by adding the straw. Two lots of lambs were fed the clear top silage and two lots the top and straw-mixed silage. The lambs were pastured on a good grass pasture about a month before being started on the feeding experiment on October 31.

Due to good drying weather the moisture content of the tops was so reduced during the wilting period that the clear tops again made a good-

quality tobacco-brown silage. A check on the moisture content of the clear beet-top silage in December gave the moisture as 33 per cent. The silage made by stacking alternate layers of beet tops and oat straw kept well but proved to be too bulky. The lambs refused to eat most of the straw even in lot 3 where no hay was fed throughout the fattening period. Absence of the hay in this lot reduced the rate of gain, lowered the carcass grade, and reduced the selling price per pound. Because of the lower feed cost, however, as compared to lot 4, which received hay in addition to the beet-top straw silage mixture, the lot receiving no hay made a slightly better financial return than the lot receiving the hay.

As shown by table 3 and observations on this experiment no advantage was gained this year by adding the layers of straw to the beet-top silage. Because of the high costs of barley and oats and because the lambs were sold during a temporary weak spot in the market, the financial return was not satisfactory. From all other standpoints, however, this year's experiment was again successful. Only one lamb died during the trial. This lamb was from lot 4, and the results for this lot are figured on the basis of 29 lambs to make them comparable with the other lots on a per lamb basis.

## CONCLUSIONS

(1) Three plans are commonly followed in storing and feeding sugar beet tops to cattle or sheep: a. grazing soon after the beets are removed from the fields; b. piling the tops in small piles in the field to cure, then hauling from the field and feeding as needed; and c. making the tops into stack silage adjacent to the feed lots and feeding as needed. In many areas a combination of two or all three of the methods is used.

(2) Climatic conditions of the Red River Valley area necessitate storing part of the tops as stack silage if full use is to be made of them through the entire length of a normal lamb- or cattle-fattening period.

(3) Three experiments in feeding beet-top silage to fattening lambs made during three different winters at the Northwest Branch Experiment Station, Crookston, Minnesota, indicate that the beet tops stored as stack silage may be fed successfully as a large part of the ration throughout the fattening period.

(4) The best quality beet-top silage is made with tops wilted down to a moisture content of 60 per cent or less when put in the stack.

(5) The beet tops as fed in the Minnesota experiments were arbitrarily charged at \$6 per ton. This figure was used because it seemed to represent as nearly as could be determined the value of the tops compared to other feeds which they would replace. Although an accurate record of the moisture content of the beet tops as fed is not available, it is reasonably certain that the average for all of the tops fed in three trials was between 50 and 60 per cent moisture. An average per acre yield of tops of this moisture content is five to six tons. At \$6 per ton this would give the tops a feeding value of \$30 to \$36 per acre. Since a good profit was made above the \$6 per ton credited to the beet tops in the first two trials, and since unusual circumstances account for the loss in the third trial, it may be concluded that beet tops can be counted upon to have a value upwards of \$30 per acre when fed as a large part of the ration to fattening lambs.

(6) A typical feeder lamb can consume 350 to 450 pounds of 50 to 60 per cent moisture beet-top silage to advantage during a 100- to 110-day fattening period.