

Feeding Values of Sugar Beet By-Products

E. J. MAYNARD¹

THE PURPOSE of this discussion is to present a general summary of results secured in various carefully controlled feeding experiments with sugar beet by-products to demonstrate their approximate values in terms of corn and alfalfa hay.

In a previous report to the Society in 1944 on the Feed-Replacement Values of Sugar Beet By-Products.² I reported these replacement feed values in terms of corn or alfalfa hay by a conversion of the digestible nutrients in the feeds saved or replaced by these by-products.

As such a conversion has tended to be somewhat confusing to the layman, the study presented here has been based directly on the actual amounts of both grain and hay that were replaced.

The summary presented herein includes experimental data from livestock feeding tests conducted at six Western State and Federal Agricultural Experiment Stations where each beet by-product had been fed in a ration with grain and alfalfa hay and where its feed-replacement value had been determined on the basis of feed fed and gains in weight secured on fattening cattle or lambs in comparison with a check lot of comparable livestock fattened with a ration of grain and hay alone in the same experiment.

The summary includes 27 separate tests with field-cured beet tops that were hauled and fed in dry lot; 29 feeding tests with wet beet pulp; 42 tests with dried beet pulp and 6 tests with Steffens discard molasses.

No distinction was made between dried beet pulp and dried molasses beet pulp for the reason that feeding tests with cattle and lambs have shown no significant difference in the feed-replacement values of these two products when they have been used as a fattening feed with grain and alfalfa hay.

The field-cured dried tops were hauled from the field and fed through panels, in troughs or on straw bedding. Grain was hand-fed and alfalfa hay was self-fed in all tests.

The amounts of beet tops fed in these experiments were reported on the basis of tops produced per ton of harvested beets and were assumed to represent an average of 200 pounds of dry substance in tops and crowns per ton of beets harvested. The variation in the amounts of grain

¹General Livestock Consultant, The Great Western Sugar Company.

²American Society of Sugar Beet Technologists, Rept. 1944, page 144.

fed in the different tests produced a rather wide variation in the ratio between grain and alfalfa hay saved or replaced by the beet tops fed.

The feed-replacement value of the tops produced per ton of beets varied from 18 pounds of corn plus 243.5 pounds of alfalfa hay for an average of 6 tests conducted at the Belle Fourche station in South Dakota to 103.2 pounds of corn plus 80.4 pounds of alfalfa hay for an average of 7 tests conducted at substations of the Wyoming Experiment Station.

The weighted average feed-replacement value for the field-cured dried tops produced from a ton of beets and fed with grain and alfalfa hay in all of the 27 feeding tests considered was 46 pounds of corn plus 150 pounds of alfalfa hay.

A California Agricultural Experiment Station digestion trial with steers³ has shown 63.9 pounds of total digestible nutrients in 100 pounds of dry substance in tops. An average of 6 California beet-top samples calculated on these same coefficients of digestibility showed 64.2 pounds of digestible nutrients per 100 pounds of dry matter in tops, while an average of 48 American and European beet-top samples showed 59.5 pounds of digestible nutrients.

On the basis of a 200-pound recovery of dry substance in the tops produced per ton of beets the corn and alfalfa hay replaced by 100 pounds of dry substance in the field-cured beet tops fed in these 27 tests amounted to 56.3 pounds of total digestible nutrients.

Sugar beet tops are a good livestock fattening feed as well as a growth-producing feed. Many cattle and sheep are successfully fattened on rations containing relatively large quantities of beet tops with little or even no grain included.

Beet tops are relatively high in digestible protein which gives them a narrow nutritive ratio very similar to that of alfalfa hay. But beet tops are much lower in fiber content than alfalfa hay and the fiber they do contain is more highly digestible than that in alfalfa hay.

While beet tops are often classed with or compared to alfalfa hay, the amount of grain as well as hay that they can replace apparently justifies their use as a grain substitute in livestock fattening rations.

Possibilities for the mechanical harvest and better conservation of beet tops will be provided with the present transition to mechanical harvesting of sugar beets. But some of these new beet-harvesting methods may result in greater losses to feed nutrients in beet tops than have been experienced in the past or may even cause a total loss of the beet-top crop as a livestock feed unless its true feeding value is more clearly recognized and protected.

³Utilization of Sugar Beet Tops, Calif. Exp. Sta. Rept., 1943. Guilbert, Regan & Miller.

As with beet tops there was a rather wide variation in the ratio between grain and alfalfa hay replaced by the wet beet pulp in the various tests studied.

The overall weighted average for the 29 separate feeding tests showed that a ton of wet beet pulp fed with grain and alfalfa hay replaced 148.6 pounds of corn plus 355.4 pounds of hay.

The digestible nutrients contained in the corn and alfalfa that was replaced by wet beet pulp are considerably in excess of those attributed to a ton of wet beet pulp. This finding, however, only serves to indicate additional beneficial effects provided by this feed.

Possibilities for more efficient conservation of both the dry substance and digestible nutrients in wet beet pulp through the addition of grain or molasses in the siloing process have been well demonstrated in tests conducted by the Spreckels Sugar Company¹ and the California Experiment Station.

One of the most effective methods for obtaining more efficient results from this feed in recent years has come through a recognition of the necessity to guard against a deficiency of phosphorus in rations where it is used in considerable quantity.

There was very little variation in the ratio between grain and alfalfa hay replaced by dried beet pulp.

The weighted average for the 42 feeding tests studied showed that a ton of dried beet pulp fed with grain and alfalfa hay replaced 1,782.2 pounds of corn plus 835.6 pounds of alfalfa hay. Many feeding experiments have conclusively demonstrated that dried beet pulp should always be fed mixed with grain or with corn fodder or silage or with some protein concentrate to realize its full replacement value. In such combinations it is fully equal to and often proves superior to grain, but, fed as a "lone" carbohydrate it generally returns only about $\frac{3}{4}$ of a grain value. Extensive studies with beet molasses have shown that when it is fed in limited amounts with grain and hay to cattle or lambs it has a high feed value.

The average for the 6 feeding tests reported showed that a ton of Steffens' process beet molasses replaced 1,136 pounds of corn plus 1,469 pounds of alfalfa hay.

The experiments reported in this summary were conducted over a wide area and under variable conditions but all tests were carried out under practical farm feeding conditions.

The results reported should approximate those that might be expected on any beet farm where reasonable care is used in the harvesting and conservation of the beet by-products and where these by-products are handled and fed with grain and alfalfa hay in an efficient manner.

¹American Society of Sugar Beet Technologists Rept. 1946--J. E. Coke, R. D. Jones. Spreckels Sugar Co., page 117.

Feed-Replacement Values of Sugar Beet By-products in Terms of Corn and Alfalfa Hay
Corn and Alfalfa Replaced by the By-Products from 1 Ton of Beets

	By-product	Corn pounds	Alfalfa hay pounds	Number of tests
Colorado Experiment Station	Tops	---	248.5	2
	Wet pulp	25.5	87.0	4
	Dried pulp	77.6	42.4	5
Wyoming Experiment Station	Tops	103.2	80.4	7
	Wet pulp	41.0	107.3	10
	Dried pulp	81.1	41.0	6
Nebraska—U. S. Scottsbluff Experiment Station	Tops	29.2	113.6	6
	Wet pulp	22.2	35.6	3
	Dried pulp	83.0	32.0	16
Montana and U. S. Huntley Experiment Station	Tops	29.3	167.6	8
	Wet pulp	52.2	113.1	12
	Dried pulp	77.7	40.6	15
South Dakota—U. S. Belle Fourche Experiment Station	Tops	18.0	243.5	6
California Experiment Station	Tops	---	235.0	6
Weighted average of grain and hay replaced by the by-products	Tops	46.0	150.0	27
	Wet pulp	41.6	99.5	29
	Dried pulp	80.2	37.6	42
	By-product		Corn pounds	Alfalfa hay pounds
Corn and alfalfa replaced by 1 ton of by-product	Tops (70 percent D.M.)	---	322.0	1050.0
	Wet pulp (11 percent D.M.)	---	148.6	355.4
	Dried pulp (90 percent D.M.)	---	1782.2	835.6

Tops dry matter, 10 percent of beet tonnage or 200 pounds.

Wet pulp, 11 percent dry matter, 28 percent of beet tonnage or 560 pounds.

Dried pulp, 90 percent dry matter, 4½ percent of beet tonnage or 90 pounds.

References—Experiment Station Bulletins: Colorado 379,422; Wyoming 191,227,257; Nebraska 194, California report published March 1943; Montana, South Dakota unpublished data.