made to develop Iranian agriculture. Among other things, the Shah has ordered that Iran, within five years, shall produce its full supply of sugar.

"The Shah (himself) has paid for the construction of eight beet sugar factories, He plans to build five more beet factories and also one cane sugar mill. However, the question arises in our minds whether Iran with its old farming methods can grow enough sugar beets to supply 13 factories."

The colored photographs of which over 100 were shown, were taken by Dr. Siegumfeldt during his three months sojourn in Iran during the summer of 1939.

The beet fields seen were usually small and often would be under an acre in size. There is practically no fam machinery in Iran, and the land is usually "dug" by heavy hoes and picks. The owner of an oxen-pulled wooden plough is regarded as rather modern, and the usual preparation of the field consists of breaking up the heavy clods which are pulled over by a long-handled hoe used like a pick.

The beet seed has been imported across Southern Europe, or more commonly from Denmark via the North Sea, the Mediterranean and the Black Sea. The beet seed is sown broadcast by hand and raked into the ground. All beet crops must be irrigated, and the areas planted to beets are limited by the scarcity of irrigation canals.

The beets, not being in rows, cannot be cultivated, but the weeds are removed by "pulling" or by hoeing. The weeds are valuable as feed for the farm animals and so are taken home by the field workers for cattle feed.

The beet crop is harvested by hand digging or pulling and the beets usually transported to the local factory by camel. Often a factory manager may have several thousand camels coming to his factory each morning, loaded with factory beets in 300 pound lots.

Danish engineers have built the sugar factories and are assisting in factory operation. The Shah is apparently very much interested in the beet crop and was seen in a number of pictures inspecting the beet fields.

Yields of sugar beets are still very low and variable because of poor land preparation and faulty irrigation, but the agricultural leaders are striving to modernize the farming practices and teach the peasants better ways of farming.

Several slides of beautiful gardens, brilliant with a variety of flowers, showed that Iran has its beauty spots and can produce plants of excellent quality. The agriculturists have many problems to solve during the next 5 years if they are to complete the sugar program of their Shah.

FEED VALUE OF BEET TOPS

N. J. Muscavitch1

By beet tops we mean the leaves, stems and portion of the beet crown which compose the by-product resulting from a normal topped sugar beet. Analyses were made on samples taken from average beet fields near the Scottsbluff plant of The Great Western Sugar Company, at topping time, tops cured on drying racks to keep them out of contact with soil and to allow for the rapid and free circulation of air for rapid drying, and samples fully cured in the

1/ Great Western Sugar Co.

field by recommended practice. Tests to determine the amount of soil incorporated with the tops at topping time were made during the 1939 harvest. Also during the 1937 season analyses were made on two samples of a good grade, locally grown, second and third cutting alfalfa hay to be used as a basis of nutrition value comparison.

Analysis on Beet Tops at Topping Time

The samples were taken immediately following the toppers and therefore very little loss of moisture occurred before analysis. Date samples were taken and year are shown in the tabulation below:

Date	Oct. 7	Oct. 26	Oct. 19	
Tear	1937	1938	1939	Average
Dry substance	19,32	23.62	16.80	19,91
Sugar (Polarization)	3.51	5.80	3.40	4.24
Crude Protein	2.38	3.37	2.13	2.63
Crude Fibre	2.38	3.17	2,12	2.54
Ash	4.10	3.56	4.59	4.08
Crude Fat	.24	(-)	. (-)	(-)
Nitrogen Free Extract	6.71	(7.72)	(4.56)	(6.42)

Crude fat was not determined on samples analyzed on the 1938 and 1939 crops and is included in the figures for nitrogen free extract.

We have a maximum variation of 6.82% in dry substance over the three year period. This can be explained by the influence of the seasons, the maturity of the crop, leaf spot, and light frost affects on the leaves.

Loss of Nutrients and Dry Substance Due to and During Field Curing

During the 1937 season special comparative tests were made on field cured tops and tops dried on special racks to determine the loss of nutrients.

Sampled Date Sampled	From Field	From Drying Racks 1-4-35
Moisture	21.77	15.66
Calculated to Dry Basis		
Crude Protein	11.00	11.80
Crude Fibre	13.62	14-07
Crude Fat	1.33	.94
Ash	18.38	18.10
Nitrogen Free Extract	55.67	55.09

Although the rack drying method is not practical, it does indicate more thorough drying and demonstrates the possibilities of preventing nutrient loss through proper handling of tops during the curing period. The loss of dry substance in curing is further demonstrated by actual weights of beet tops before and after curing as shown: (1)

	Weight of Tops (Lbs.)	% Dry Substance	Substance
10-7-37 Green Tops 10-3-38 Cured Tops	3920 770	19.32 84.32	757.34 649.42
Loss due to curing % Loss			107.92 14.25

A portion of the loss shown due to curing is the loss of soil which falls off in the handling of the dried tops but clings to the crisp green leaves. The amount of soil incorporated in the green tops at topping time was determined on a sample taken on October 15, 1939. 200 pounds of tops were divided into two equal portions, one portion thoroughly washed in the factory laundry machine, using cold water, and then both samples were prepared for analysis. The results calculated to a dry basis are shown below:

Beet Tops at Topping Time

	Unwashed	Washed
% Crude Protein	12.66	13.12
% Crude Fibre	12.64	15.87
% Ash	27.34	14.95
% Nitrogen Free Extract		
Crude Fat	47.36	56.06

Loss in ash, as soil, due to washing is approximately 12%. Since analysis on green and cured tops averages for two years show only 2% difference in ash content on dry substance basis, apparently most of the soil is removed in handling before the roughage reaches the feed yard.

Yield and Analysis on Field Cured Tops

The following data on yield was collected covering two harvests: (1)

Harvest	1937	1938	Totals & Averages
Acres in Field	10,48	7.60	18.08
Tons Topped Beets (Short Tons)	238.60	144.90	383.50
Tons Topped Beets per Acre	22.83	19.07	21.21
Weight of Cured Tops (1bs.)	63090	33400	96490
% Dry Substance - Cured Tops	78.23	85.11	80.61
Weight of Dry Substance	49355	28427	77782
Weight of Dry Substance per ton		-	
of beets	206.8	196.6	203

The ratio of dry substance in cured tops to beets harvested is slightly higher than one to ten. Knowing the yield of beets, from this proportion the grower may easily calculate the tons of feed he has available for feeding operations. Tests conducted on yield of tops at Colorado State during some beef fattening experiments report slightly higher yields. Quoting from this report - "The results of this experiment showed that for each 1000 pounds of beets produced the farmer can expect approximately 640 pounds of green tops at topping time containing 80% moisture."(4) If we were to deduct the loss (14.25%) in dry substance due to curing, as found in our tests, Colorado tests yield 17 pounds more dry substance per ton of beets than the Nebraska tests.

In order to make sharper comparisons on the value and change in fodder value due to curing in the field, analyses shown below are calculated to a dry substance basis. The average of two analyses on a good grade of second and third cutting alfalfa hay is included as a basis for valuating the beet tops:

		Su	gar Beet	Tops			1937
	193	7	19	38	Aver	ages	Alfalfa Hay
	Topping	Cured	Topping	Cured	Topping	Cured	2nd & 3rd
% Crude Protein	12.34	11.80	14.28	13.78	13.36	12.79	15.07
% Crude Fibre	12.31	14.07	13.43	15.43	12.87	14.75	36.02
% Ash	21.24	18.10	15.07	14.16	18.16	16.13	11.40
% Crude Fat	1.26	.94	(*)	()	()	()	
% Nitrogen Free Extract	52.85	55.09	(57.22)	(56,63)	(55.61)	(56.33)	(37.51)
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Dry Substance on Original	19.32	78.23	23.62	85.11	21.47	81.67	94.80

Comparing the two roughages on protein value, dry substance basis, field cured beet tops for the two years shown have 85% the value of a good grade of alfalfa hay. Loss in protein due to curing was 4.27%.

Well cured beet tops contain a high percentage of nitrogen free extract and closely approach small grains in this nutrient value.

Feed Replacement Value of Beet Tops as Found in Actual Tests

My work on this subject has been primarily with chemical analysis of the fodder. I will now quote from articles on the replacement value of beet tops in various fattening and milk production rations, these appearing in "Through the Leaves," and mimeographed reports issued by the Scottsbluff Experiment Farm.

Conditioning Ewes

On a farm test near Fort Collins, Colorado, a sheep raiser reports "Ewes conditioned on beet tops before the breeding season increased the lamb yield and that as high as 120 lambs to 100 ewes were docked." A percentage he has not been able to achieve on range grass. (2)

Fattening Lambs

The following was taken from feed lot reports issued by the Scottsbluff Experiment Farm. The tests covered a period of three years, ten lots of thirty lambs each, and the tabulation, for brevity, contains all the feeds used in the various rations but only one high and one low feet cost lots from each year of the tests are shown.

Food	Concumed	(Tha)	++0	Dradingo	100	Paunda	· of	Rain	
2004	von semen	(TDD+)	1 10	TTOURCO	100	1 amins	5 U.L	natn	

*	-	row re	ed Cost H	ations	High Fe	ed Cost R	ations	
	No	v.1938	11-8-37	11-9-36	Nov.1939	11-8-37	11-9-36	
		to	to	to	to	to	to	
	Fe	b.1939	2-12-38	3-9-37	Febr.1939	2-12-38	3-9-37	
No. of days in feed lot		100	96	120	69	96	120	
Lot. No.	arrenteeds	8	10	7	1	2		
Shelled corn		-	-	-	511	259	-	
Barley		191	125			-	261	
Dried Beet Pulp		-	125	-	-		-	
Dried Molasses Pulp		-	-	213	berg	-	-	
Beet Molasses (Johnstown	C)		111	-	-		-	

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(continued)

(continued)	Low Nov.1938 to Feb.1939	Feed Cost 11-8-37 to 2-12-38	Rations 11-9-36 to 3-9-37	High Nov.1939 to Febr.1939	Feed Cost 11-8-37 to 2-12-38	Rations 11-9-36 to 3-9-37
Cull Beans	191	-	152	-	-	-
Bone Meal		- 4		-	11	15
Wet Best Pulp	-	789		-	-	
Cotton Seed Meal				-	85	85
Alfalfa Hay	1110	185	274	832		
BEET TOPS	539	370	636	-	-	
Corn Fodder (ears on)	**	**		-		528
Corn Fodder (no ears)		-	-	-	373	-
Feed Cost per 100# Gain	\$4.80	\$4.66	\$4.87	\$8.14	\$7.13	\$13.30

Feed costs were calculated from values prevailing locally during the months and year indicated in the tabulation. It is evident that the rations showing the lowest feed cost per 100 pounds gain contain a large proportion of beet tops, whereas this roughage is entirely absent from the high cost lots.

Mr. E. J. Maynard, in an article on "Decentralized Feeding in Montana" gives the following summary on the value of beet tops in a steer feeding ration. (6) (3).

"The Standard Daily Ration could be summarized about as follows:"

Dried Beet Tops	14 - 16	pounds
Wet Beet Pulp	50 - 75	pounds
Grain	2 - 4	pounds
Dried Pulp	2 - 4	pounds
Bone Meal	1/10	pound

"Variations in the above ration include "C" molasses, mill feed, cut corn fodder, and in a few instances tankage. Indicated daily gains on cattle being fattened on the above rations ranged from 2 to 2-3/4 pounds. An analysis of the ration fed seems to indicate that beet tops were providing the cheapest and most efficient fattening feed in the ration. One pen of 125 cattle pastured on beet tops alone, with alfalfa stubble, for a six week feeding period before being put in the fattening pen had produced an average daily gain of 1.7 pounds per head. Fed in the dry lot rations, beet tops were apparently replacing grain at the rate of 2-1/2 pounds of well cured, dried tops to one pound of grain."

"Based on relative feed values and costs, each ton of dried cured tops (from five tons of beets, and valued at 35 cents per ton of beets) costing \$1.75 per ton, was replacing about 800 pounds of grain at a grain equivalent cost of 22 cents per cwt. This low cost grain equivalent value in tops, compared to the 75 cent per cwt. cost of most grains, indicates the saving possible by the use of tops, and also emphasizes the importance in proper conservation and feeding of tops in fattening rations.

Dairy Cattle

Quoting Mr. Paul C. Swanson, Animal Husbandman at the Scottsbluff Field

Station, on the value of beet tops when used in a dairy cow ration: "In comparing the value of alfalfa and beet tops as a cured roughage, the following results are reported: (7) "During the first year's test, 1 pound of alfalfa was equal to 1.1 pounds of beet tops when compared on a dry matter basis. In other words in this test beet tops were 91% as valuable as alfalfa (D.M.B.) without considering the increase in milk yield. In the second year (1938-39) of the experiment, 1 pound of alfalfa was equal to 1.1 pounds of beet tops not considering the increase in milk yield. This gives beet tops a value 83% as great as alfalfa. Taking a mean of the two years together the tops were worth 87% as much as alfalfa on a dry matter basis."

"Estimating cured alfalfa in the stack at 90% dry matter and cured beet tops in piles or stacks at 70% dry matter, beet tops were worth \$5.64 per ton the first year and \$5.18 per ton the second year when alfalfa is worth \$8.00 per ton. The mean of the two years gives beet tops a value of \$5.41 per ton when alfalfa is worth \$8.00 per ton. (7)

Summary

Dried beet tops are a source of nutrients approaching alfalfa in protein content and the small grains in nitrogen free extract when calculated on a dry basis. Too much emphasis cannot be placed on the value of proper curing and storing of the feed to prevent nutrient loss from unfavorable weather conditions or negligence.

Feeding operations by men who are investigators on the subject have demonstrated the value of Beet tops in the replacement of a large portion of concentrates and alfalfa in rations for fattening cattle and in the production of milk from a dairy herd.

Literature Cited and Other Sources of Data

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- (2) Mr. R. A. Brackenburg, "Through the Leaves," November 1939, page 192.
- (3) Mr. E. J. Maynard, "Through the Leaves," November 1939, page 181.
- (4) Mr. R. C. Rom, "Through the Leaves," November 1939, page 187.
- (5) Mr. M. A. Alexander & Mr. Paul C. Swanson, Mimeographed Circulars, Scottsbluff Experiment Station, Sheep Feeding Operations for the three years 1936-37, 1937-38 and 1938-39.
- (6) Mr. E. J. Maynard, "Through the Leaves," September 1939, pages 156-7.
- (7) Mr. Paul C. Swanson, "Through the Leaves," March 1939, page 59.

DUSTING AND SPRAYING FOR THE CONTROL OF BLIGHT OF THE SUGAR BEET

H. C. Young

It is difficult to estimate the annual loss incurred by Cercospora leaf blight of beets. The disease has been present in our fields almost since beet growing started. More than 30 years ago experiments on dusting and spraying

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