

Home-Grown Feeds for
Fattening Yearling Steers
in the Snake River Valley, Oregon

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Foreword

Livestock producers are constantly confronted with the problem of how to utilize home-grown feeds most profitably. What proportions of the various feeds should be given? How should the locally available feeds be supplemented so that the animals may utilize them to best advantage.

The advent of irrigation in the Snake River Valley and the increased crop production has accentuated the problem of utilization of home-grown feeds for fattening beef cattle in that area.

To help livestock producers with their feed problems, studies have been carried on at the Malheur Experimental Area since 1943. Results of feeding trials are reported in this publication.

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Dean and Director

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Summary

Results reported in this bulletin include: 1. A comparison of ground shelled corn and corn-and-cob meal (ground ear corn); 2. Value of wet beet pulp in a hay and corn ration; 3. The need for added protein in the form of cracked soybeans or soybean meal; 4. Value of beet-top silage.

1. Ground shelled corn and corn-and-cob meal are equal in feeding value when proper allowance is made for the cobs. Corn-and-cob meal contains approximately 80 per cent grain.

2. Wet beet pulp in a hay-corn ration reduced the feed cost per pound of gain an average of two cents. Daily gains were similar. Because of its high water content it does not appear that it can be transported great distances profitably.

3. When good quality alfalfa hay is fed, there does not appear to be a need for protein supplement. The use of these supplements usually produces slightly faster gains but also increases the cost.

4. Beet-top silage appears to be too costly in relation to its feeding value. Most present-day mechanical beet-harvesting equipment destroys beet tops as a source of livestock feed.

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Home-Grown Feeds for **Fattening Yearling Steers**

in the Snake River Valley, Oregon

E. N. Hoffman and Ralph Bogart*

The Snake River Valley produces large quantities of good quality grains and hays and, because of the sugar-beet production in this area, large quantities of beet byproducts are available. The problem with which the farmer is faced is how to market these home-grown crops and byproducts so that the greatest net return is realized and the fertility of the soil is maintained at a high level. The feeding of livestock generally offers a home market for crops at prices above the sale price and helps maintain soil fertility through the manure that is produced.

Several factors existing in the Snake River Valley area are conducive to the fattening of beef cattle: Feeder cattle are available in abundance from nearby ranges; the farmer can feed cattle during the winter at a season when his farming requires less of his time; no expensive shelter is necessary because of the dry winters; all the feeds necessary for fattening beef cattle are or can be produced on each farm, consequently no investment in expensive supplements is necessary.

Beef cattle feeding trials at the Malheur Experimental Area from 1943 to 1947 were aimed at finding how the farmers of that area could make the most effective use of home-grown corn, alfalfa hay, and sugar-beet byproducts. These trials included: 1. A comparison of ground shelled corn with corn-and-cob meal; 2. Value of wet beet pulp in a hay and corn ration; 3. The need for added protein; and 4. The value of beet top silage.

The cattle fed were representative of Malheur and adjoining counties. Uniformity in cattle was emphasized in selecting the animals to go on feed. They were allotted to the various pens on the basis of weight after the extremes were eliminated. The cattle were fed in open corrals but with ample bedding provided. The animals had free access to salt and water at all times.

* These trials were designed and conducted by Dudley L. Sitton, superintendent of the Malheur Experimental Area from 1942 to 1946. D. E. Richards, superintendent of the Eastern Oregon Branch Experiment Station at Union, Oregon, advised in the design and conduct of trials at the Malheur Experimental Area until February, 1945. Since January, 1946, E. N. Hoffman, superintendent of the Malheur Experimental Area, has designed and conducted the trials. Ralph Bogart, animal husbandman, and Minaruth Galey, research assistant at the Oregon Agricultural Experiment Station, analyzed the data, and E. N. Hoffman and Ralph Bogart wrote the bulletin.

Ground Corn Compared with Corn-and-Cob Meal

Unless pigs are to be run after cattle on feed to pick up the grains passing through whole, such grains as corn must be ground to prevent this loss. The running of pigs after steers requires fencing that is hog-tight, however, and since most of the feed lots in the area are not fenced for hogs this practice has limited use.

With the big majority of farmers grinding the grains, the question came up of whether corn needed to be shelled before grinding. If it could be ground with the cob, the time-taking and inconvenience of shelling the corn would be eliminated.

Procedure

In the tests, coarsely ground corn was compared with corn-and-cob meal (ground ear corn) for fattening yearling steers during the winters of 1945, 1946, and 1947. Chopped alfalfa hay was used as the roughage and source of protein.

The corn was good quality yellow dent with a protein content of 9.23 per cent for the ground corn and 8.19 per cent for the corn-and-cob meal. The average protein content of the chopped alfalfa hay fed to both groups was 11.93 per cent. The trial covered a period of 3 years in each of which 10 yearling Hereford steers of average quality were fed each ration.

Results of the test

Ground corn and corn-and-cob meal were found equal in value provided the same amount of grain is given when corn-and-cob meal is fed as when ground corn is fed. Gains per day, feed per 100 pounds gain, and cost of gains either as feed or on a monetary basis were the same for the two rations. Statistical analysis showed that the differences in gains per day lacked significance; therefore, one would conclude that corn in either form has the same feeding value. It must be stressed that when corn-and-cob meal is fed it takes 1.25 times as much as is required if ground corn is fed because approximately 20 per cent of the corn-and-cob meal is cob and approximately 80 per cent is corn (1).*

Comparisons of ground corn and corn-and-cob meal made at other stations have given variable results. Vaughan (1) concludes that cobs have a feeding value equal to that of wheat straw, and steer and pork gains per unit of grain on shelled corn were equal to that made on corn-and-cob meal. Allison (2) concludes that ground corn is superior to corn-and-cob meal. Recent studies at the Ohio Sta-

* Numbers in parenthesis refer to Literature Cited on page 4.

tion (3) indicate that under certain conditions cobs may have considerable value and that corn-and-cob meal might be superior to ground corn when equal amounts of grain are given. It appears that our conclusion is justified that corn-and-cob meal is equal to ground corn provided the same amount of grain is given.

Although recent studies at the Ohio Experiment Station and at other stations have indicated that cobs may have feeding value, the results at the Malheur Experimental Area indicate that the cobs cost about as much in energy of digestion as they add in food value.

Table 1. SUMMARY OF THREE-YEARS' FEEDING TRIAL COMPARING GROUND CORN WITH CORN-AND-COB MEAL FOR FATTENING YEARLING STEERS.

Weight, feed, and costs	Alfalfa hay and corn	Alfalfa hay, corn-and-cob meal
<i>Average weight and gain per head*</i>	<i>Pounds</i>	<i>Pounds</i>
Initial weight	770.0	809.0
Final weight	1,016.0	1,042.0
Total gain	243.0	233.0
Daily gain	1.9	1.9
<i>Average daily feed per head</i>		
Hay consumed	18.4	17.6
Corn consumed	7.4	.....
Corn-and-cob meal consumed .....	.....	9.1
<i>Average total feed per head</i>		
Hay consumed	2,279.0	2,104.0
Corn consumed	933.0	.....
Corn-and-cob meal consumed .....	.....	1,103.0
Salt consumed	5.2	5.5
<i>Feed per 100 pounds of gain</i>		
Hay	938.0	903.0
Corn	384.0	.....
Corn-and-cob meal .....	.....	473.0†
<i>Total feed costs per head‡</i>		
Hay	\$23.86	\$21.71
Corn	21.93	.....
Corn-and-cob meal .....	.....	22.26
Salt	0.11	0.12
Total all feeds	\$45.90	\$44.09
TOTAL FEED COST PER POUND OF GAIN	\$ 0.19	\$ 0.19

* Figures based on lots of 10 steers for each of three years.

† Costs based on average values of feed at the Experimental Area.

‡ The corn content of the corn-and-cob meal is approximately 80 per cent. Thus on the basis of corn this group required 378 pounds corn per 100 pounds gain.

Value of Wet Beet Pulp in the Fattening of Yearling Steers

When sugar beets were first grown in this area, wet beet pulp was a waste product because facilities for drying beet pulp had not been installed at the plant. Feeding trials were designed to determine the value of wet beet pulp when included in the ration for yearling steers in quantities that were not so great as to make a wasty, low-selling finished steer at the end of the feeding period but in sufficient quantities to make it worth while feeding the beet pulp. Since these trials were started, facilities for drying beet pulp have been installed and wet beet pulp is no longer a waste product.

Procedure

Ground corn and chopped alfalfa hay were compared with ground corn, chopped alfalfa hay, and wet beet pulp. These trials were conducted during the winters of 1943-44 and 1946-47.

The ground corn fed to both groups was yellow dent with a protein content of 8.81 per cent. The chopped alfalfa hay given to both groups contained 12.75 per cent protein. The wet beet pulp fed as part of the ration for one of the groups of steers contained 11.5 per cent dry matter at the Station.

Average yearling Hereford steers coming from different breeding herds were used in trials. They were allotted to the pens as equally as possible.

The favorable results with wet beet pulp in giving greater gains and reducing costs of gains indicate that the addition of dried beet pulp might be beneficial in a ration of corn and alfalfa.

Results of the test

As much as 26 pounds wet beet pulp can be used with a ration of corn and alfalfa hay for fattening yearling steers with no ill effects, trials showed (Table 2). Data are not available on the maximum amount of wet beet pulp that can be successfully fed but feeders in this area report success with considerably greater amounts. The gains per day were about the same for the steers on corn and alfalfa as for those getting corn and alfalfa plus wet beet pulp.

In making 100 pounds of gain 1,208 pounds of wet beet pulp replaced 231 pounds of chopped alfalfa hay and 22 pounds of corn. At feed prices of \$20.00 per ton for hay and \$46.50 for corn, wet beet pulp containing 11.5 per cent dry matter was worth \$4.68 per ton at the feed lot. This means that although wet beet pulp is a good feed for fattening yearling or older cattle, one cannot pay high

prices for it or pay high transportation costs and make a profit from feeding it. One other factor that must be considered is that wet beet pulp varies greatly in water content (4 and 5). The results reported in this study were secured using wet beet pulp containing 11.5 per cent dry matter. Wet beet pulp with 8.5 per cent dry matter would have only about three-fourths the feeding value.

Table 2. COMPARATIVE DATA ON WET BEET PULP ADDED TO A DIET OF GROUND CORN AND CHOPPED ALFALFA FOR FATTENING YEARLING STEERS.

Weight, feed, and costs	Alfalfa hay and corn	Alfalfa hay, corn, and wet beet pulp
<i>Average weight and gain per head*</i>	<i>Pounds</i>	<i>Pounds</i>
Initial weight	709.0	713.0
Final weight	974.0	994.0
Total gain	265.0	281.0
Daily gain	2.0	2.1
<i>Average daily feed per head</i>		
Hay consumed	17.1	13.2
Corn consumed	7.7	7.7
Wet beet pulp consumed .....	.....	25.8
<i>Average total feed per head</i>		
Hay consumed	2,253.5	1,739.5
Corn consumed	1,005.7	1,005.6
Wet beet pulp consumed .....	.....	3,394.0
Salt consumed	5.5	5.5
<i>Feed per 100 pounds of gain</i>		
Hay	850.0	619.0
Corn	380.0	358.0
Wet beet pulp .....	.....	1,203.0
<i>Total feed costs per head†</i>		
Hay	\$24.15	\$18.80
Corn	25.02	25.02
Wet beet pulp .....	.....	2.70
Salt	0.06	0.06
Total all feeds	\$49.23	\$46.58
TOTAL FEED COST PER POUND OF GAIN	\$ 0.19	\$ 0.17

* Figures based on lots of 10 steers for each of two years.

† Costs based on average values of feed at the Experimental Area.

Need for a Protein Supplement

A. VALUE OF SOYBEANS WHEN WET BEET PULP IS INCLUDED IN THE RATION

Beet pulp is low in protein. When it is included in the ration to replace part of the grain and hay, the ratio of protein to other nutrients is changed. It was necessary to determine if the change in ratio of protein to other nutrients brought about by feeding 25 to 30 pounds of wet beet pulp per day was enough to create a protein deficiency. Soybeans produced on the station were used as the protein supplement.

Procedure

Ground corn and chopped alfalfa; ground corn, chopped alfalfa, and wet beet pulp; and ground corn, chopped alfalfa, wet beet pulp, and cracked soybeans were compared as rations for fattening yearling steers. The cracked soybeans were mixed with the ground corn for feeding. This trial was conducted during the winter of 1943-44.

Ground yellow dent corn with a protein content of 8.43 per cent, chopped alfalfa hay containing 12.18 per cent protein, cracked soybeans containing 36.77 per cent protein, and wet beet pulp with dry matter content of 11.5 per cent were used in making the various rations fed.

Yearling Hereford steers above average in quality were used.

Results of the test

The results (Table 3) indicate that the addition of protein supplement in the form of cracked soybeans may have some advantage by balancing the protein need created when wet beet pulp, a low-protein material, is fed. However, the cost of the soybeans (\$3.25 per hundred pounds) during the period when this trial was conducted was so great that there was little financial advantage from its use. Cattle fed soybeans did not bring more money than the others. At prices of \$20.00 per ton for chopped hay, \$46.50 per ton for ground corn, \$65.00 per ton for cracked soybeans, wet beet pulp was worth \$3.31 per ton in the ration of ground corn, chopped alfalfa hay, and wet beet pulp. It was worth \$4.05 per ton in the ration of ground corn, chopped alfalfa hay, cracked soybeans, and wet beet pulp. Both of these figures are lower than the one previously reported of \$4.68 per ton for feeding value of wet beet pulp. This emphasizes again the variations in wet beet pulp and stresses the fact that its water content influences feeding value.

Our data are in agreement with the work at the Colorado Station (5) indicating that cottonseed cake is so expensive that when it is used in a ration of corn, wet beet pulp, and legume hay, it costs more than the value of the gains it gives.

It can be seen (Table 3) that feed costs were lower when wet beet pulp was fed in this trial just as they were in the trial previously discussed.

Table 3. SUMMARY OF ONE YEAR'S FEEDING TRIAL COMPARING THREE RATIONS (1) GROUND CORN AND CHOPPED ALFALFA, (2) GROUND CORN, CHOPPED ALFALFA, AND WET BEET PULP, AND (3) GROUND CORN, CHOPPED ALFALFA, WET BEET PULP, AND CRACKED SOYBEANS.

Weight, feed, and costs	Alfalfa hay and corn	Alfalfa hay, corn, and wet beet pulp	Alfalfa hay, wet beet pulp, corn, and soybeans
<i>Average weight and gain per head*</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>
Initial weight	689.0	685.0	687.0
Final weight	959.0	976.7	988.0
Total gain	270.0	291.7	301.0
Daily gain	2.0	2.2	2.3
<i>Average daily feed per head</i>			
Hay consumed	17.7	13.2	12.1
Corn consumed	6.9	6.9	6.9
Wet beet pulp consumed .....	.....	27.7	27.8
Cracked soybeans consumed .....	.....	.....	1.2
<i>Average total feed per head</i>			
Hay consumed	2,364.9	1,767.9	1,623.1
Corn consumed	920.3	920.1	920.1
Wet beet pulp consumed .....	.....	3,709.9	3,718.8
Cracked soybeans consumed .....	.....	.....	156.7
<i>Feed per 100 pounds of gain</i>			
Hay	876.0	606.0	539.0
Corn	341.0	315.0	306.0
Wet beet pulp .....	.....	1,272.0	1,235.0
Cracked soybeans .....	.....	.....	52.0
<i>Total feed costs per head†</i>			
Hay	\$24.73	\$18.78	\$17.56
Corn	18.41	18.40	18.40
Wet beet pulp .....	.....	2.32	2.32
Cracked soybeans .....	.....	.....	4.70
Total all feeds	\$43.14	\$39.50	\$42.98
TOTAL FEED COST PER POUND			
OF GAIN	\$ 0.16	\$ 0.14	\$ 0.14

* Figures based on lots of 10 steers.

† Costs based on average values of feed at the Experimental Area.

B. VALUE OF SOYBEAN MEAL ADDED TO A RATION OF CORN AND ALFALFA

It has long been considered that corn supplemented with a good quality alfalfa hay makes a satisfactory ration for fattening yearling steers. Whether additional protein in the form of a concentrate such as soybean meal can be added economically to a ration of corn and alfalfa hay needed to be determined. Consequently, during the winter of 1946-47 a ration consisting of ground corn and chopped alfalfa hay was compared with one composed of ground corn, chopped alfalfa hay, and soybean meal.

Procedure

The ground corn fed was good quality yellow dent with a protein content of 9.25 per cent, the chopped alfalfa hay was good quality and contained 12.82 per cent protein, and the soybean meal contained 44 per cent protein.

Yearling Hereford steers of average quality coming from several breeding herds were used.

Results of the test

With a good quality of alfalfa high in protein there is no need for adding a protein concentrate to a ration of corn and alfalfa hay, the results (Table 4) show. The gains per day were essentially the same for the two lots. The high cost of soybean meal made the cost of the ration in which it was included higher and this brought the cost of each pound of gain up to the extent that it cost one cent more per pound of gain. Twenty-seven pounds of soybean meal saved 12 pounds of alfalfa hay and 9 pounds of corn in making 100 pounds of gain.

Thus, it took \$2.03 worth of soybean meal to replace 12 cents in corn and 12 cents in hay. Consequently, one cannot see a financial gain by feeding soybean meal in a ration of corn and alfalfa hay if the hay is of good quality.

The Malheur data are supported by Black (6) who concludes from data reported in the Midwest that good legume hay provides plenty of protein to supplement corn in the fattening of beef cattle.

It must be remembered that these results are based on a trial of only one year and that additional studies might show more in favor of soybean meal, particularly if soybean meal were less expensive.

If one is feeding hay of low protein content due to cutting at an advanced stage of maturity, high grass content, or curing under

unfavorable climatic conditions, additional protein supplement might be needed. Also with younger animals in which there is a higher requirement for protein or in a feeding program in which there is a large quantity of grain fed in relation to hay, one might find it necessary to feed additional protein in the form of a concentrate.

Table 4. SUMMARY OF ONE YEAR'S FEEDING TRIAL IN WHICH THE NEED FOR PROTEIN SUPPLEMENT IN A RATION OF CORN AND ALFALFA FOR FATTENING YEARLING STEERS WAS DETERMINED.

Weight, feed, and costs	Alfalfa hay and corn	Alfalfa hay, corn, and soybean meal
<i>Average weight and gain per head*</i>	<i>Pounds</i>	<i>Pounds</i>
Initial weight	729.0	735.0
Final weight	988.0	1,000.0
Total gain	259.0	265.0
Daily gain	2.0	2.1
<i>Average daily feed per head</i>		
Hay consumed	16.6	16.7
Corn consumed	8.5	8.5
Soybean meal consumed .....	.....	0.6
<i>Average total feed per head</i>		
Hay consumed	2,142.0	2,159.0
Corn consumed	1,091.0	1,091.0
Soybean meal consumed .....	.....	72.0
Salt consumed	5.5	5.5
<i>Feed per 100 pounds of gain</i>		
Hay	421.0	412.0
Corn	827.0	815.0
Soybean meal .....	.....	27.0
<i>Total feed costs per head†</i>		
Hay	\$23.56	\$23.75
Corn	31.64	31.64
Soybean meal .....	.....	3.78
Salt	0.06	0.06
Total all feeds	\$55.26	\$59.23
TOTAL FEED COST PER POUND OF GAIN	\$ 0.21	\$ 0.22

* Figures based on lots of 10 steers for one year.

† Costs based on average values of feed at the Experimental Area.

Feeding Beet Tops as Beet-Top Silage

Beet tops are palatable and beef cattle make good gains on them. Better use of them could be made if they were ensiled and could be stored for feed as needed. However, labor costs in making beet-top silage are high and the greater benefit of the silage over utilizing beet tops by pasturing the beet fields after the beets are harvested may not be enough to pay the cost of making silage.

Procedure

During the winter of 1944-45, ground corn and chopped alfalfa hay was compared with ground corn, chopped alfalfa hay, and beet-top silage.

The ground corn was yellow dent with a protein content of 8.5 per cent, the chopped alfalfa hay contained 11.69 per cent protein, and no analyses were made on the beet-top silage.

Yearling Hereford steers of good quality were allotted as equally as possible to each of the two pens. Eleven steers were fed in each lot.

Results of the test

Beet-top silage is a satisfactory feed because steers getting this in addition to ground corn and chopped alfalfa hay made slightly better gains than steers getting only the hay and corn, the results (Table 5) show. However, the cost of making beet-top silage plus the value of beet tops in the field on which the cattle may feed makes the cost of beet-top silage so great that the cost per pound of gain was 21 cents as compared with 19 cents for the group fed corn and alfalfa hay. In making 100 pounds of gain, 1,281 pounds of beet-top silage replaced 272 pounds of hay and 24 pounds of corn. At \$20.00 per ton for chopped alfalfa hay and \$46.00 per ton for ground corn, the feed replaced by the beet-top silage is worth \$3.28, which would give a value of \$5.12 per ton for beet-top silage. However, during the year it was fed, it cost \$8.00 per ton.

Feeding trials at the Colorado Station (5 and 7) indicate that cheaper gains are made when cattle are pastured on beet leaves following harvesting than when the leaves are made into silage. This is in complete agreement with the data obtained at the Malheur Experimental Area.

Since beet tops can be harvested in the field by cattle to better advantage, the problem resolves itself primarily into one of management.

Table 5. COMPARATIVE DATA ON BEET-TOP SILAGE ADDED TO A DIET OF GROUND CORN AND CHOPPED ALFALFA HAY FOR FATTENING YEARLING STEERS.

Weight, feed, and costs	Alfalfa hay and corn	Alfalfa hay, corn and beet-top silage
<i>Average weight and gain per head*</i>	<i>Pounds</i>	<i>Pounds</i>
Initial weight	892.0	906.0
Final weight	1,103.0	1,120.0
Total gain	201.0	214.0
Daily gain	1.8	1.9
<i>Average daily feed per head</i>		
Hay consumed	21.0	17.0
Corn consumed	7.0	7.0
Beet-top silage consumed .....	.....	24.4
<i>Average total feed per head</i>		
Hay consumed	2,331.0	1,901.0
Corn consumed	788.0	788.0
Beet-top silage consumed .....	.....	2,741.0
Salt consumed	5.0	5.0
<i>Feed per 100 pounds of gain</i>		
Hay	1,160.0	888.0
Corn	392.0	368.0
Beet-top silage .....	.....	1,281.0
<i>Total feed costs per head†</i>		
Hay	\$23.31	\$19.01
Corn	15.76	15.76
Beet-top silage .....	.....	10.94
Salt	0.05	0.05
Total all feeds	\$39.12	\$45.76
TOTAL FEED COST PER POUND OF GAIN	\$ 0.19	\$ 0.21

* Figures based on lots of 11 steers for one year.

† Costs based on average values of feed at the Experimental Area.