

Table 1.—Pelleted Prairie Hay for Wintering Calves.

Level of Feeding Lot Number Hay Preparation	Low		High	
	1 Long	2 Pelleted	3 Long	4 Pelleted
Number of heifers	10	10	10	10
Average weight per calf (lbs.)				
Initial 12-11-59	414	415	424	419
Final 3-23-60	444	462	518	538
Gain (103 days)	30	47	94	119
Daily gain	.29	.46	.91	1.16
Average daily feed consumption (lbs.)				
Prairie hay	10.1	12.3	7.6	7.5
Supplement				
Cottonseed meal	.5	.5	1.5	1.5
Ground milo			4.5	4.5
Hay per lb. of gain (lbs.)	34.7	27.0	8.3	6.5
Increased value of hay due to pelleting (\$ per ton)		4.30		16.40

reduced 22 percent (8.3 vs. 6.5 lbs.). When value of gains and costs of feeds were considered the increased value of the hay due to grinding and pelleting was \$16.40 per ton.

Summary

Grinding and pelleting prairie hay increased winter gains of heifer calves 17 lbs. when a low level of supplemental concentrates was fed and 25 lbs. when fed a high level of supplemental concentrates. Pelletting increased hay consumption 2.2 lbs. at the low level of supplementation and decreased consumption 0.1 lb. at the high level. Hay required per pound of gain was reduced 22 percent in both tests. However, the increased value of the hay due to pelleting was \$4.30 and \$16.40 per ton when calves were fed a low and a high level of supplement, respectively.

Further Studies on Pelleting Rations for Steers

*J. E. McCroskey,
L. S. Pope, Kenneth Urban*

Numerous experiments have been conducted to determine the feasibility of pelleting feeds for ruminants, and to determine the types of rations which are best adapted for pelleting. Several tests have shown little or no advantage from pelleting fattening-type rations, whereas pelleting high roughage rations has given marked improvement in performance.

Previous work at this station and elsewhere has indicated that improved gains due to pelleting high roughage rations are due, in part, to an increase in feed consumption. In contrast, it has been observed that feed intake and rate of gain are often depressed by pelleting highly concentrated rations. Moreover, work at other stations indicates a greater response from pelleting low quality roughages than good quality roughages.

Many workers believe that the improvement from pelleting high roughage mixtures is due mainly to increased feed intake. A rather consistent improvement in feed efficiency has been noted, and it has been suggested that increased gains may be due, in part, to physical or chemical changes taking place in the feed during the pelleting process. Also, it has been shown that pelleted feeds have a more rapid rate of passage through the digestive tract, resulting in less energy expended in the digestive process. It has been postulated that pelleting high-concentrate mixtures may reduce the coarseness of the ration, thereby causing a decrease in rumination and a consequent depression of appetite.

This report concerns two feeding trials (designated as Trials II and III) in a continuing experiment on the effects of pelleting different rations for beef cattle. The results from the first test (Trial I) were reported in the 1958-59 Feeders Day Report. Trial II was a repetition of Trial I and concerns the effects of pelleting two rations containing widely differing ratios of concentrate-to-roughage (1:4 and 4:1). Trial III was designed to study the causes of this response to pelleting high roughage mixtures.

Procedure

Trial II

This trial was designed to study the effects of pelleting 1:4 and 4:1 concentrate-to-roughage ratios. The mixtures fed are shown in Table 1, together with the chemical composition and cost of each ration. Ground milo, cottonseed meal and molasses were the concentrates fed; the roughage was composed of equal parts of chopped alfalfa hay and cottonseed hulls. The rations were completely mixed and fed free-choice. Half of each ratio was fed in the loose form while the other half was made into 3/8 inch pellets.

A uniform group of twenty-four yearling Hereford steers was obtained from the Jeffrey herd near El Reno. Six steers were allotted to each treatment on the basis of initial weight and feeder grade. The steers were fed in individual pens, with an adjoining open shed under which the self-feeders were located. All cattle had access to fresh water and a mineral mix (2 parts salt and 1 part bonemeal) at all times.

The cattle were started on feed in late April and were fed for 148 days. Prior to taking the initial weights, the steers were gradually

Table 1.—Composition and Estimated Cost of Rations.

C:R Ratio	1:4	4:1
Feeds used (%)		
Ground milo	1.0	65.1
Cottonseed meal	12.0	7.0
Molasses	7.0	7.0
Cottonseed hulls	40.0	10.0
Chopped alfalfa	40.0	10.0
Ground limestone	--	0.9
Ration composition (%)		
Dry matter	90.67	88.93
Ash	9.26	5.14
Crude protein	15.48	13.51
Ether extract	1.95	3.05
Crude fiber	33.96	10.96
N-free extract	39.35	67.34
Estimated T.D.N. content (%)	51.28	70.83
Cost per ton (\$)	22.40	31.00

worked up to a full-feed of their respective rations. Therefore, no adjustment period is included in the data reported. In addition to the feeding trial a digestibility study was conducted, using chronic oxide as an indicator. At the end of the feeding period the cattle were slaughtered and information was obtained on the grade, yield, and composition of the carcass.

Trial III

This test was designed to study some of the factors which might be responsible for greater gains from pelleted feeds. The relationship of physical form of the ration, feed intake, and the pelleting process itself were studied. The 1:4 concentrate-to-roughage mixture fed in Trial II was employed in this study. This mixture was fed as meal, pellets and reground pellets.

A group of twenty-four Hereford steer calves was selected from the station herd at weaning and divided into four treatment groups according to shrunk weight, feeder grade, and sire. Six calves were assigned to each of the following treatments: Lot 1—meal; Lot 2—reground pellets; Lot 3—pellets, and Lot 4—limited-fed pellets. The cattle were fed in individual pens as in Trial II with access to water and the mineral mix described previously. Lots 1, 2 and 3 were self-fed, whereas Lot 4 was hand-fed once daily according to the average feed intake of Lot 1 in order to compare pellets and meal at an equal feed intake.

The calves were started on feed in early November after a short readjustment period following weaning. The study is currently in progress and will terminate about the first of May. Upon completion of the test, slaughter information will be obtained as to carcass grade and yield.

Results

Trial II

Results of Trial II are shown in Table 2. The most rapid gains were made on the 4:1 concentrate-to-roughage ratio fed in pelleted form. There was essentially no difference in rate of gain between the meal and pelleted forms of the 4:1 mixture; however, rate of gain on the 1:4 ratio was greatly increased by pelleting. Other stations have reported similar results from pelleting.

Average daily feed intake on the 1:4 mixture was increased approximately 19 percent by pelleting. In contrast, pelleting the 4:1 ratio resulted in a slight decrease in feed consumption. It has been suggested that the improvement in rate of gain by pelleting high roughage rations is due mainly to increased feed intake; these results tend to substantiate this theory.

Efficiency of feed conversion on both concentrate-to-roughage ratios was improved by pelleting, with the greatest improvement occurring on the 4:1 mixture. Cattle fed the 4:1 ratio required considerably less feed per pound of gain than those on the 1:4 mixture.

Table 2.—Effect of Pelleting Different Concentrate to Roughage Ratios.

	1:4 C:R Ratio		4:1 C:R Ratio	
	Meal	Pelleted	Meal	Pelleted
No. of calves/group	6	6	6	6
Days on feed	148	148	148	148
Ave. weights (lbs.)				
Initial 4-21-59	634	629	622	623
Final 9-16-59	912	967	977	986
Gain	278	338	355	363
Ave. daily gain	1.88	2.28	2.40	2.45
Ave. daily feed (lbs.)				
Roughage	19.9	23.7	6.3	5.8
Concentrate	6.7	7.9	19.0	17.2
Total	26.6	31.6	25.3	23.0
Feed/cwt. gain (lbs.)	1418	1385	1056	941
Feed cost/cwt. gain (\$)¹	15.88	19.67	16.37	17.41
Marketing data				
Ave. yield (%)	59.4	59.9	61.8	63.1
Ave. carcass grade²	7.1	6.8	4.8	5.8
On-foot value/cwt. (\$)³	26.42	26.82	28.62	28.78
Net return/calf (\$)⁴	-12.76	-13.83	+16.45	+15.26

¹ A cost of \$6.00 per ton for pelleting was included in determining the cost of the pelleted rations.

² Carcass grades are based on the values: Choice=4, High Good=6, Ave. Good=7, etc.

³ On-foot value was computed from carcass value according to grade and yield, and based on final live weight at Ft. Reno.

⁴ Net value per calf was calculated from market value minus cost of calf and feed.

In a digestibility study conducted in conjunction with the feeding trial, no significant differences in nutrient digestibilities were observed between pelleted and meal forms of either ratio. However, there was a tendency toward a reduction in digestibility of the fibrous portion and an increase in digestibility of the more soluble parts of both rations due to pelleting. The increased feed efficiency on the pelleted rations was probably due in part to improved digestibility and partly to a more efficient utilization of the nutrients. Although feed efficiency on both ratios was improved by pelleting, feed cost per unit gain was higher than for the meal due to the added cost of pelleting.

Slaughter data show that cattle fed the 4:1 concentrate-to-roughage ratio had higher yields and carcass grades than those on the 1:4 ratio. There was little difference in dressing percent between steers on the meal and pelleted forms of the 1:4 ratio; however, pelleting the 4:1 mixture resulted in a 1.3 percent increase in dressing percent. Carcass grades were improved slightly by pelleting the 1:4 ratio, but were decreased one-third of a grade by pelleting the 4:1 mixture.

Physical separation of a three-rib cut of each carcass showed that cattle fed the 4:1 ratio were fatter than those on the 1:4 ratio. Moreover, rib-cuts from steers fed the 1:4 pelleted ration contained slightly more fat than those from cattle on the same mixture in meal form. There was little difference in composition of rib-cuts of cattle fed either form of the 4:1 ratio. Thus, it appears that over-all carcass merit is improved by pelleting high-roughage mixtures, whereas pelleting high concentrate rations tends to be of little or no advantage.

Steers on the 4:1 ratio had a higher live value than those fed the 1:4 ratio. However, it can be seen that there was little difference in live value per cwt. between cattle fed meal or pellets on either ratio. Net return per calf was greater for steers fed the 4:1 ratio; in fact, a negative return was shown by steers on the 1:4 ratio. The added cost of pelleting resulted in a slight decrease in net return on both ratios.

It should be remembered, however, that labor costs or other expenses of feeding have not been included, and since unpelleted rations are more bulky and harder to handle under some feedlot situations there may be a greater labor cost involved with loose rations than with pelleted mixtures.

Trial III

Results of Trials I and II showed that gains are markedly improved by pelleting a 1:4 concentrate-to-roughage mixture. Many theories have been advanced as to the possible reasons for this response, but none have been conclusively demonstrated. This trial was conducted to study the effects of physical form of the mixture on feed intake, and possible changes in the feed due to the pelleting process itself which might increase performance.

Results of the first 131 days of a trial now in progress are presented in Table 3. It can be seen that the most rapid gains were obtained from cattle full-fed pellets (Lot 3). Gains of cattle fed reground pellets were almost identical to those full-fed pellets. Lowest average daily gains were observed with steers fed the meal ration, while those on the limited-fed pellets were slightly greater. Average daily feed intake on full-fed pellets and reground pellets was slightly higher than on the meal rations. Feed required per cwt. gain was highest for the meal ration (Lot 1) and lowest for the group receiving a limited amount of pellets (Lot 4), with little difference between Lots 2 and 3.

Table 3.—Effect of the Physical Form of a 1:4 Concentrate-to-Roughage Ratio Fed to Steer Calves.

Lot Number	1	2	3	4
Treatment	Meal	Reground Pellets	Pellets	Limited Pellets
No. of calves/lot	6	6	6	6
Days on feed	131	131	131	131
Ave. weights (lbs.)				
Initial 11-13-59	483	470	483	483
131 days 3-23-60	730	750	763	739
Gain to 3-23-60	247	280	280	256
Ave. daily gain	1.89	2.14	2.14	1.96
Ave. daily feed (lbs.)	23.0	24.2	23.8	21.3
Feed/cwt. gain (lbs.)	1213	1122	1107	1063

From these results it can be seen that feed intake and rate of gain were similar for cattle on the full-fed pellets and reground pellets. Both feed intake and rate of gain in these lots were greater than for cattle fed the meal. Although feed consumption in Lot 4 was limited to about that consumed by Lot 1, Lot 4 cattle gained slightly more rapidly. In this test the pelleted feed was twice as heavy per unit volume as the meal, while the reground pellets were about one-third heavier than the meal. The relative weights may have affected daily feed intake.

These data suggest that, for cattle of this age, the improvement in gain due to pelleting such a high roughage mixture is due mainly to an increase in feed efficiency, and to a lesser extent to increased feed intake. Furthermore, the physical form of the feed itself appears to affect feed efficiency, since gain and feed intake in Lots 2 and 3 were similar but feed efficiency was slightly greater for the pellets.

A comparison of Lots 1 and 2 shows only a slightly greater feed intake on the reground pellets, but a rather marked increase in feed efficiency and rate of gain, indicating that perhaps some chemical or physical change occurred in the feed during the pelleting process.

Summary

Two feeding trials were conducted using 48 Hereford steers to study the effects of pelleting 1:4 and 4:1 concentrate-to-roughage ratios, and to study possible causes of response to pelleting high-roughage rations.

In the study of the effects of pelleting the two different concentrate-to-roughage ratios, pelleting the 1:4 ratio improved rate of gain, feed intake, feed efficiency, and carcass merit. Pelleting the 4:1 mixture caused no appreciable change in rate of gain, but resulted in an increase in feed efficiency and decreased feed intake and carcass grade. Feed cost per cwt. gain on both ratios was increased by pelleting.

Preliminary results from a further study indicate that the improved gain from pelleting the high-roughage mixture may be due to a combination of increased feed intake, increased feed efficiency, and the physical form in which it was fed. The increased efficiency of feed utilization appeared to be the most important factor.

Soybean Meal Vs. Urea Supplement, With and Without Trace Minerals, In Rations Containing Sorghum Silage or Cottonseed Hulls

J. H. Sellers,
L. S. Pope, Kenneth Urban,
L. E. Walters, George Waller, Jr.

In a previous trial, yearling steers full-fed ground milo and sorghum silage were able to utilize a urea-milo-bone meal supplement as efficiently as soybean meal, when each was fed to supply the same amount of crude protein. No advantage was gained by adding a trace mineral mixture to either supplement.

During the past year, this study was repeated, with each supplement fed with two different roughages, sorghum silage and cottonseed hulls. It was possible, therefore, to compare the utilization of a high-urea supplement to that of soybean meal on a silage vs. hull type ration, as well as to study the possible need for additional trace minerals with each type of roughage.¹

Procedure

Sixty-four yearling Hereford steers averaging 725 lbs. were selected from the Experiment Station herd at Lake Carl Blackwell in October. During the previous summer these cattle were part of an experiment on

¹The urea feed compound used in these trials were generously supplied by the Chemical Division of Deere & Co., Pryor, Oklahoma, and the trace mineral mixture by Calcium Carbonate Co., Chicago, Illinois.