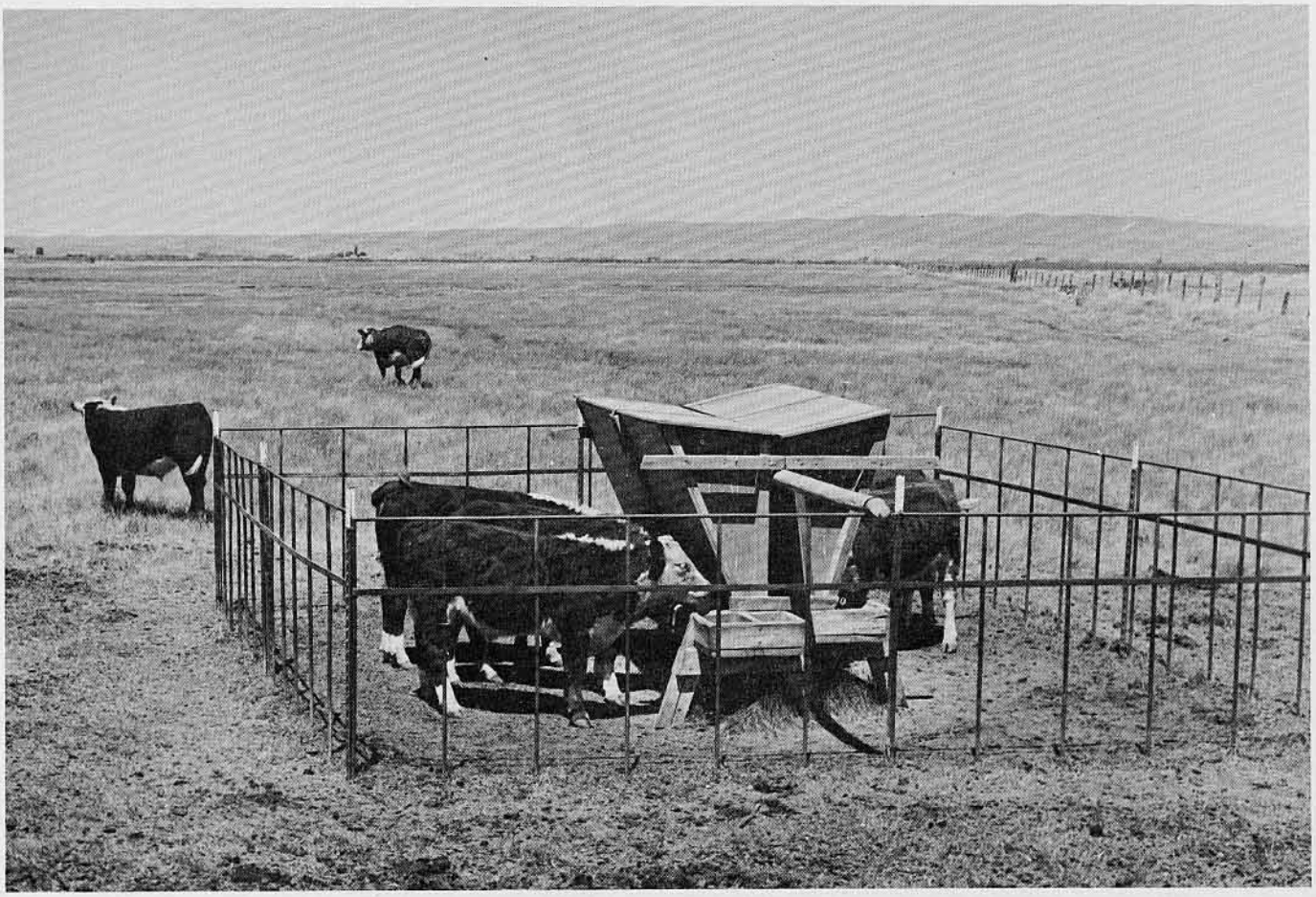
1969 Progress Report . . .

Research in Beef Cattle Nutrition and Management



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1969 PROGRESS REPORT

RESEARCH IN BEEF CATTLE NUTRITION AND MANAGEMENT

Robert J. Raleigh and Harley A. Turner

FALL CALF PRODUCTION

A fall calving program was initiated in 1964 when 60 cows were held out of the regular spring calving herd and bred in the winter of 1965 to calve in October and November of 1965. Each year, additional animals were switched to the spring calving herd so that we now have equal numbers in the fall and spring herds.

Fall calving, while increasing the wintering feed costs, provides a larger calf to go on range in spring, which makes better use of the high-quality range feed through May, June, and July. This should permit weaning an 8 to 9 month-old calf weighing in excess of 500 pounds that can go directly to the feedlot or to irrigated pasture. Also, winter management of these fall-calving cows and their calves is more adaptable for intensive management and nutrition practices to increase both efficiency of production and reproduction.

The objectives of the study were to compare costs and management problems of fall and spring calving and to study the nutritional requirements of wintering the lactating cow and of creep feed rations for the calf. Records on production, reproduction, costs, diseases, and other management problems are kept on both herds to provide information for making recommendations which will aid the livestock operator in making decisions. Data on the first crop of calves from the fall-calving herd were presented in our Field Day Report in 1966. This report will cover the fall calves born in 1966 and 1967 and weaned in 1967 and 1968.

EXPERIMENTAL PROCEDURES

The cows were bred to calve in October and November of each year. There were 84 calves in the 1966-67 crop and 109 in the 1967-68 crop. During each of the winters, the calves were creep fed a ration consisting primarily of alfalfa pellets, rolled barley, and cottonseed meal. The ration was fortified with vitamin A and terramycin. The 66-67 calf crop received no creep feed on range, but the 67-68 calf crop was creep fed on range in 1968.

From calving until going on range, the cows received one pound of cottonseed meal or the equivalent and about two pounds of rolled barley or equivalent per head per day in addition to meadow hay free choice. All cows were pregnancy tested in late May, at which time a decision was made to either cull the open ones or put them into the spring herd for a second chance. This gives the rancher an opportunity to give an animal a second chance at conception without waiting a full year if both a spring-calving and fall-calving herd are maintained.

Animals on range were grazed on native pastures from turnout in April to about the end of May and on crested wheatgrass the last of May until the calves were weaned about the first of August in 1967. However, due to the drouth in 1968, the pastures planned for the fall-calf herd did not produce enough feed for this period and the cows, with their calves, were moved to the meadows at Section Five on June 17 and remained there until weaning on August 4.

OBSERVATIONS

The fall calves took to the creep feed readily, with about 90% of them on feed after a week of exposure to the creep. The others followed shortly after, and it is believed that all the calves in the study were eating from the creeps. Calfhood diseases such as scours and pneumonia were minimal. There was no evidence that any of the cows had weaned their calves prior to weaning time.

The performance data of all calves for each of the two years are shown in Table 1. The average weaning weight of the 1966-67 fall calves was 485 pounds compared to a weaning weight of 352 pounds for the spring calves. The 67-68 fall calves weaned at an average of 506 pounds, while the spring calves weaned at 309 pounds. This gives an extra weight of 132 pounds per calf for 1967 and 197 pounds for 1968 or an average increase in weaning weights of 165 pounds for the fall calves over the spring calves. Spring calves on the Station are born in March and April and weaned in September. Weaning spring calves in September is recommended since very little if any gain is made by the calves after this time because of the greatly reduced quality of the forage.

Table 1. Average birth date, birth weight, average daily gain (ADG), weight on range, weaning weight, and weaning age of fall calves

Measure of performance	Year		Average
	1966-67	1967-68	
Number of calves	84	109	96
Birth date	11/3/66	10/30/67	11/1
Birth weights, lb.	70	70	70
Weight on range, lb.	311 (4/26/67)	295 (4/11/68)	302
ADG (birth to on range), lb.	1.38	1.37	1.37
ADG (on range to weaning), lb.	1.93	1.87	1.90
ADG (birth to weaning), lb.	1.57	1.58	1.58
Weaning age, days	264	277	270
Weaning weight, lb.	485 (7/25/67)	506 (8/2/68)	497

Feed costs for the 1966-67 calf crop were lower since creep feeding was not continued into the summer. The additional cost for carrying the fall-calving cow and her calf through the winter of 1966-67 was calculated to be $9.94 more than the cost of carrying the spring-calving cow. This figure was $20.75 for the 1967-68 calf crop which was more than double that of the previous year but also included about $4.50 for the cost of the summer creep ration. This year-to-year variation results from differences in the feeding and management regimes, which are experimental to provide information on levels of nutrition and management, that will give optimum performance in both weaning weight of the calf and reproductive efficiency of the cow. The gains and costs presented here are averages of all of these treatments.

On good quality range forage, the conception rate of the fall-calving herd has exceeded that of the spring-calving herd bred in June and July.

NONPROTEIN NITROGEN FOR WINTERING CALVES

Urea has been used as a substitute for vegetable protein in the ruminant diet for many years. With the increased competition for the vegetable proteins, the role of urea and other nonprotein nitrogen compounds in animal feeds has taken on added importance. Urea has been used successfully at relatively high levels in high energy fattening rations and also at low levels in growing rations when extreme caution is excercised in mixing and balancing the ration. However, results from urea with low energy, high roughage, or limited feeding programs can be disappointing and, in some cases, hazardous. High levels of urea can cause losses in efficiency of production, and they also can be toxic to the animal, resulting in sickness or death.

Biuret 1/ is not a new compound; it has been researched by scientists in ruminant studies over the last two decades. The increased pressure for a nonprotein nitrogen compound for ruminant diets without the adverse affects associated with urea has stepped up research with biuret. Kedlor feed-grade biuret is a condensation product of urea containing 37% nitrogen with a protein equivalence of 231%. One pound of Kedlor feed-grade biuret will replace about 5.6 pounds of cottonseed meal containing 41% protein.

Biuret, upon entering the rumen, releases ammonia more slowly than urea. This permits the bacteria to utilize the nitrogen of the released ammonia to synthesize protein, which in turn is utilized by the digestive system of the ruminant. Results from toxicity experiments have shown that urea drenched or fed at levels as low as 10 to 20 grams per 100 pounds of body weight has resulted in death with unadapted animals, whereas no toxic or distress symptoms were evident when biuret was fed or drenched at 10 times those levels. Biuret is also more palatable and acceptable to the animal than urea.

1/ Kedlor (feed-grade biuret) is a product of The Dow Chemical Company. Appreciation is expressed to The Dow Chemical Company for providing Kedlor and financial assistance for this research.

Kedlor feed-grade biuret, urea, and cottonseed meal as nitrogen supplements for wintering weaner calves were compared in trials conducted during the past two winters at the Squaw Butte Station.

EXPERIMENTAL PROCEDURES

Biuret and cottonseed meal were fed alone and in combination as the N supplement to 36 steer calves in trial 1. There were two pens of six animals on each of the three N treatments. All calves received native meadow hay containing 8% crude protein. Rolled barley was fed in addition to provide for a daily gain of about 1.25 pounds.

Trial 2 was designed to compare biuret, urea, and cottonseed meal in the ration for wintering weaner calves. Fifty-four steer calves were allotted to pens of six each with three pens, then allotted to each of the N supplemental treatments. This gave 3 replications or a total of 18 animals per treatment. Native meadow hay containing 8% crude protein was fed free choice, and rolled barley was fed to provide the necessary energy for about 1.25 pounds daily gain.

The animals were handled in a similar manner for each trial. The meadow hay was chopped and fed in covered mangers daily with refusals weighed out weekly. The supplements were fed in feed troughs each morning. Fresh water, salt, and a salt-bonemeal mixture were available free choice in all lots. The diets within each trial were balanced to be as nearly equal in N and energy as possible. A trace mineral mixture and sulfur were added to each diet.

OBSERVATIONS

Results of trial 1 are presented in Table 2. There were no significant differences in gains from any of the treatments. The steers receiving biuret and cottonseed meal in combination gained 1.32 pounds per day, while those on cottonseed meal gained 1.28 and those on biuret 1.21 pounds per day. Feed required per pound of gain was 10.7, 10.3, and 9.8 pounds for the biuret, cottonseed meal, and combination, respectively.

Table 2. Results of trial 1 comparing sources and combinations of N for growing steer calves

Item	N sources		
	Biuret	Cottonseed meal	Biuret and cottonseed meal
Number of animals	12	12	12
Initial weight, lb.	466	481	472
Final weight, lb.	601	625	620
Total gain, lb.	135	144	148
Daily gain, lb.	1.21	1.28	1.32
Feed/lb. gain, lb.	10.7	10.3	9.8

Table 3 shows the results of trial 2. The average daily gain was 1.06, 1.03, and 1.21 pounds for the steers receiving biuret, urea, and cottonseed meal, respectively. Feed required per pound of gain was lowest for the cottonseed meal group, followed by the biuret-fed animals, with the urea-fed animals least efficient.

Table 3. Results of trial 2 comparing sources of N for growing steer calves

Item	N sources		
	Biuret	Urea	Cottonseed meal
Number of animals	18	18	18
Initial weight, lb.	415	426	415
Final weight, lb.	535	543	552
Total gain, lb.	120	117	137
Daily gain, lb.	1.06	1.03	1.21
Feed/lb. gain, lb.	10.8	11.7	10.2

There were no problems in getting the animals to eat their daily supplements. However, the urea-fed animals took more time and would leave the feed trough and return to it, whereas the other groups consumed their supplements readily.

No toxicity was apparent in any of the rations, although in past studies rations containing urea in amounts similar to levels in these studies have caused toxicity and sometimes death when fed under less controlled conditions.

ENERGY SOURCES FOR WINTERING CALVES

Most of the cattle in the western range country are wintered, with or without supplementation, on low quality forage produced locally. Native flood meadow hay is the primary forage used for wintering cattle in southeastern Oregon. This forage will vary in quality, ranging from as low as 3% to a high of about 9% crude protein. The net energy value is closely correlated to the protein content with the higher protein forage having a higher net energy value. Net energy values of meadow hay expressed for maintenance will range from a high of 510 kcal. per pound to a low of about 410 kcal. per pound. Expressing the net energy values in terms of production above maintenance gives a range from a high of about 250 kcal. per pound to a low of less than 100 kcal. per pound for high-quality to low-quality forage, respectively. We can see that the net energy value of a roughage for production purposes is less than half the value of this same forage for maintenance of the animal. The spread is even greater as the forage becomes more mature.

Barley provides an average of 870 kcal. of net energy per pound for maintenance purposes and 580 kcal. per pound for production above maintenance. This is a reduction of about 22% in net energy value of barley when used for maintenance as compared to use for production. There is a 50% or more reduction in the net energy value of meadow hay between use for maintenance and use for production.

The uses that are to be made of both low quality roughages and feed grains should therefore be factors in establishing relative prices. These are probably most critical in years such as last year (1968) when drouth reduced the local hay crop by more than 50%. The major problems that need to be answered are the extent to which feed grains can replace the roughage for growing calves and the relative dollar values of hay and feed grain in terms of animal production.

The objectives of the study reported here were to determine the replacement value of barley for hay in the wintering ration of weaner calves and to study the effect of high grain feeding in the wintering ration on subsequent performance on range. Some of this work is completed and other studies are still in progress at this time.

EXPERIMENTAL PROCEDURES

Thirty weaner heifers were stratified by weight to 3 treatments with 10 replications. The three treatments were: (1) meadow hay free choice plus 1.25 pounds of cottonseed meal and 2.0 pounds of barley per head per day; (2) 60% of the hay of treatment 1 plus 1.25 pounds of cottonseed meal and 2.0 pounds of barley plus a replacement for the hay calculated at 40% of the hay intake; and (3) the same as treatment 2 except the replacement was calculated at 53% of the hay intake. Experimental treatments are shown in Table 4.

Table 4. Experimental treatments

Treatment number	Ration ingredients		
	Hay	Cottonseed meal	Barley
	(%)	(lb.)	(lb.)
1	100 1/	1.25	2
2	60	1.25	2 + 40% of hay intake
3	60	1.25	2 + 53% of hay intake

1/ Animals on this treatment were fed hay on a free-choice basis. Animals on treatments 2 and 3 were fed 60% of the amount consumed by animals on treatment 1.

The heifers were individually fed in the barn at the Section Five winter quarters of the Station. Hay was weighed in daily and hay refusals were weighed out each week. The animals were tied daily from 7:00 a.m. to 11:00 a.m., then released for one hour for drinking and tied again to the feed mangers from 12:00 noon to 3:30 p.m. The animals were in a common lot while not tied to their feed mangers. Water, salt, and a salt-bonemeal mixture were available to the animals in the lot.

OBSERVATIONS

Feed consumption, gain data, cost of gain, and return over feed costs are presented in Table 5. The study was designed to adjust the intake of animals in treatments 2 and 3 with a comparable mate in treatment 1. However, this turned out to be impractical as the trial progressed, so hay intake of animals in treatments 2 and 3 was calculated at 60% of the average hay intake of animals in treatment 1 in the proceeding week, and barley was calculated as a percentage of hay intake for treatments 2 and 3 (table 5). This resulted in slightly more intake in treatments 2 and 3 than initially planned.

Table 5. Feed consumption, gain data, cost data, and return over feed cost for the 112-day study period 1/

	Treatments		
	1	2	3
Total feed consumption, lb.	11.0	9.9	11.2
Hay, lb.	7.7	4.8	5.3
Barley, lb.	2.0	3.9	4.7
Cottonseed meal, lb.	1.25	1.25	1.25
Initial wt., lb.	400	390	403
Final wt., lb.	520	531	557
Avg. daily gain, lb.	1.07	1.26	1.38
Cost/hd/day, ¢	19.0	20.8	23.3
Feed/lb. gain, lb.	10.3	7.9	8.1
Cost/lb. gain, ¢	17.8	16.5	16.8
Return over feed cost, $	8.74	12.04	12.54
Summer gain (4/24-8/22), lb. 2/	1.24	1.24	1.29

1/ Feed costs used were barley @ $50, cottonseed meal @ $100, and hay @ $20 per ton with gain valued @ 25¢ per pound.

2/ Average daily gain the summer following winter treatment of six animals on each of treatments 1 and 2 and seven animals on treatment 3.

Average daily gains were 1.07, 1.26, and 1.38 for treatments 1, 2, and 3, respectively. Costs per pound of gain were quite similar for all treatments, with 17.8, 16.5, and 16.8 cents for treatments 1, 2, and 3, respectively. Return over feed cost was highest from treatment 3 at $12.54, followed by treatment 2 at $12.04, and treatment 1 at $8.74. This is generally to be expected, if feed costs are not too far off the average. Animals making the greatest gain are the most efficient and usually will return more dollars to the feeder.

Results from this study are somewhat contradictory to a similar trial conducted at this Station last year. However, in last year's trial hay was limited to 50% of the full-fed group and hay was replaced at a ratio of three pounds of barley per five pounds of hay. This controlled the intake of the

high grain group to a level less than voluntary or free-choice, whereas the 60% level of hay was high enough, with grain replacement based on a percentage of hay intake, in the current study to come closer to permitting free-choice intake.

The second objective of the study was to determine the effect of the high grain ration on subsequent summer gain on range. Previous work at this Station has shown that we can feed calves to gain 1.5 to 1.75 pounds without an economic effect on summer gain on range. However, data from previous work were from animals fed a full feed on hay plus enough grain for the gain. In the current study, grain supplied about half the maintenance as well as the gain. It was planned to carry all of the heifers on this study through the summer to measure summer performance. However, as a result of the drouth, only 19 of the 30 were kept for replacement heifers.

Summer gains of the 19 heifers were not affected by the winter treatments. Gains for the entire summer period were 1.24, 1.24, and 1.29 pounds per day for treatments 1, 2, and 3, respectively. The entire study is being repeated this winter, and summer performance will be obtained this year. However, preliminary data indicate that barley can successfully replace a large portion of the hay in a growing ration for weaner calves without adverse effects. Availability and prices of grain and hay are the determining factors in the type of program to choose.

COMPARATIVE VALUE OF ALFALFA AND MEADOW HAY IN THE WINTERING RATION OF WEANER CALVES

The majority of range cattle in eastern Oregon are fed meadow hay as the forage in their winter rations. In recent years more alfalfa hay is being produced on dry and irrigated land. How and where this higher quality forage can provide the greatest return to livestock producers needs to be studied.

There are extreme variations in the quality of each forage type, and protein content can vary as much as 100% within each, depending on cultural practices. However, in general, meadow hay will average about 7% crude protein and alfalfa about 14%. Differences in energy values are usually not significant.

The study presented here was one of a series of studies designed to determine the comparative values of alfalfa and meadow hay fed in different forms to various classes of livestock for varying production levels. This particular study was designed to compare chopped and long alfalfa and meadow hay fed with a supplement to provide for gains of about 1.25 pounds per day by weaner calves.

EXPERIMENTAL PROCEDURES

Forty-eight weaner steer and heifer calves, averaging about 390 pounds, were stratified by sex and weight and allotted to one of four treatments with

six animals per lot and two replications per treatment. Meadow and alfalfa hay were fed as long or chopped hay in a 2 x 2 factorial trial (Table 6).

Table 6. Experimental design

Hay	Form fed	
	Long	Chopped
Meadow	6 1/	6
Alfalfa	6	6

1/ Represents numbers of animals per lot. Each lot contained 4 heifers and 2 steers and there were 2 replications or 12 animals per treatment.

Composition of feedstuffs is presented in Table 7 and the daily ration in Table 8. The rations were balanced as nearly as possible with regard to nitrogen and digestible energy. However, hay was fed free choice since determining voluntary intake was one of the objectives of the study.

Table 7. Composition of feedstuffs 1/

Feedstuff	Nutrients		
	Crude protein	TDN	D. E.
	(%)	(%)	(kcal.)
Meadow hay	8.2	54	1080
Alfalfa hay	13.1	49	971
Barley	13.0	78	1560
Cottonseed meal	41.0	66	1320

1/ Crude protein values are based on chemical analysis. TDN (total digestible nutrient) and D. E. (digestible energy) are calculated values.

The grain portion of the ration was fed daily in feed troughs and the hay was fed in mangers. Hay was weighed in daily with refusals weighed out each week.

Hay samples were taken daily and composited for analysis. Fresh water, salt, and a salt-bonemeal mixture were available in the lots at all times. The animals were weighed at 28-day intervals after an overnight restriction from water.

The trial was initiated on November 6, 1968. The data reported here include the first 97 days of the trial which is scheduled to run for 140 days.

Table 8. Composition of the daily diet per head

Diet	Ingredient			
	Meadow hay	Alfalfa hay	Barley	Cottonseed meal
	(lb.)	(lb.)	(lb.)	(lb.)
Alfalfa 1/				
Long	---	11.5	2	--
Chopped	---	12.4	2	--
Meadow 1/				
Long	9.3	----	2	1
Chopped	9.0	----	2	1

1/ All hay was weighed in daily and fed free choice, with refusals weighed back weekly.

OBSERVATIONS AND RESULTS

Past studies have indicated that under these conditions weaner calves should be fed to gain from 1.0 to 1.5 pounds per day during the winter to get the greatest return from yearlings going on range the following summer. Supplements were provided with the various roughages to provide for calf gains of 1.25 pounds daily.

Feed cost, average daily gain, return over feed cost, and comparative value of the forages are presented in Table 9.

Table 9. Production and cost data on weaner calves fed long and chopped meadow and alfalfa hay

	Meadow hay		Alfalfa hay	
	Long	Chopped	Long	Chopped
Initial wt., lb. 1/	397	381	390	395
Feed cost/hd/day, ¢ 2/	19.3	19.0	16.5	17.4
Average daily gain, lb.	1.23	1.13	1.17	1.36
Cost/lb. gain, ¢	15.7	16.8	14.1	12.8
Return over feed cost, $ 3/	10.90	9.07	12.40	16.00
Relative value of hay/ton, $ 4/	20.00	15.80	22.60	28.60

1/ Initial weight was taken on November 6, 1968, and data are summarized to February 11, 1969, for a total of 97 days.

2/ Barley was valued @ $50, cottonseed meal @ $100, and alfalfa and meadow hay @ $20 per ton.

3/ Gain was valued @ 25¢ per pound.

4/ Long meadow hay was valued @ $20 per ton and all other hays were valued according to their return over feed cost in relation to baled meadow hay.

Intake of long or chopped meadow hay was comparable. Intake of alfalfa was 2.5 to 3.0 pounds more than meadow hay per head per day. The calves consumed one pound more chopped alfalfa per head per day than long alfalfa. Meadow hay intake leveled off early in the study, while alfalfa intake increased linearly, so these differences should be greater as the trial continues.

The highest daily gain was made by the calves fed chopped alfalfa. These animals gained 1.36 pounds per head per day, followed by the long meadow hay, long alfalfa, and chopped meadow hay at 1.23, 1.17, and 1.13 pounds, respectively. Feed costs per pound of gain followed the same order as daily gain, with a low of 12.8 cents per pound of gain for chopped alfalfa and a high of 16.8 cents for chopped meadow hay.

Calves fed chopped alfalfa returned $16.00 over feed costs and those on long alfalfa $12.40, while those fed long meadow hay and chopped meadow hay returned $10.90 and $9.07, respectively. Gain was valued at 25¢ per pound and feed values were $50 per ton for barley and $100 for cottonseed meal.

All hay was valued at $20 per ton to provide a constant value from which the comparative values of these hays could then be derived. Using baled meadow hay as a base at $20 per ton, the relative values of the other hays were calculated. By this evaluation chopped meadow hay would be worth $15.80 per ton. Prior studies with long versus chopped meadow hay have shown that intake, daily gain, and returns were comparable. No explanation is offered for the poorer performance from the chopped hay in this study. The animals on chopped meadow hay were about 10 pounds lighter than those on the long hay at the start of the trial, but this should not account for the difference in performance since intake was nearly equal.

Long alfalfa should have a value of $22.60 per ton and chopped alfalfa $28.60, as compared to $20.00 for long meadow hay. This means that if you can chop alfalfa hay for less than $6.00 per ton, the operation would pay.

Comparative values of alfalfa and meadow hay would vary tremendously, depending on the class of livestock fed, the quality of the hay, and the production level desired. Calves wintered on meadow hay alone will gain about 0.25 pounds per day on 10 pounds of hay, making a cost of 40 cents per pound of gain with hay valued at $20 per ton. Calves wintered on alfalfa hay alone should gain no less than 0.75 pounds per day and consume about 13 pounds of hay. With a value of $20 per ton for alfalfa, this gain would cost 17 cents per pound. This means the price of alfalfa could be $35 per ton to equal the return of meadow hay. However, in either case, feed costs would be greater than the value of the gain, and this fact further supports the value of grain supplements for growing animals.

In other situations, the value of alfalfa and meadow hay may be virtually equal. The comparative feeding value of meadow and alfalfa hay depends on the class of animal, how it is fed, the production level desired, the quality of the hay, and other factors. These factors should be kept in mind when purchasing and feeding these forages.