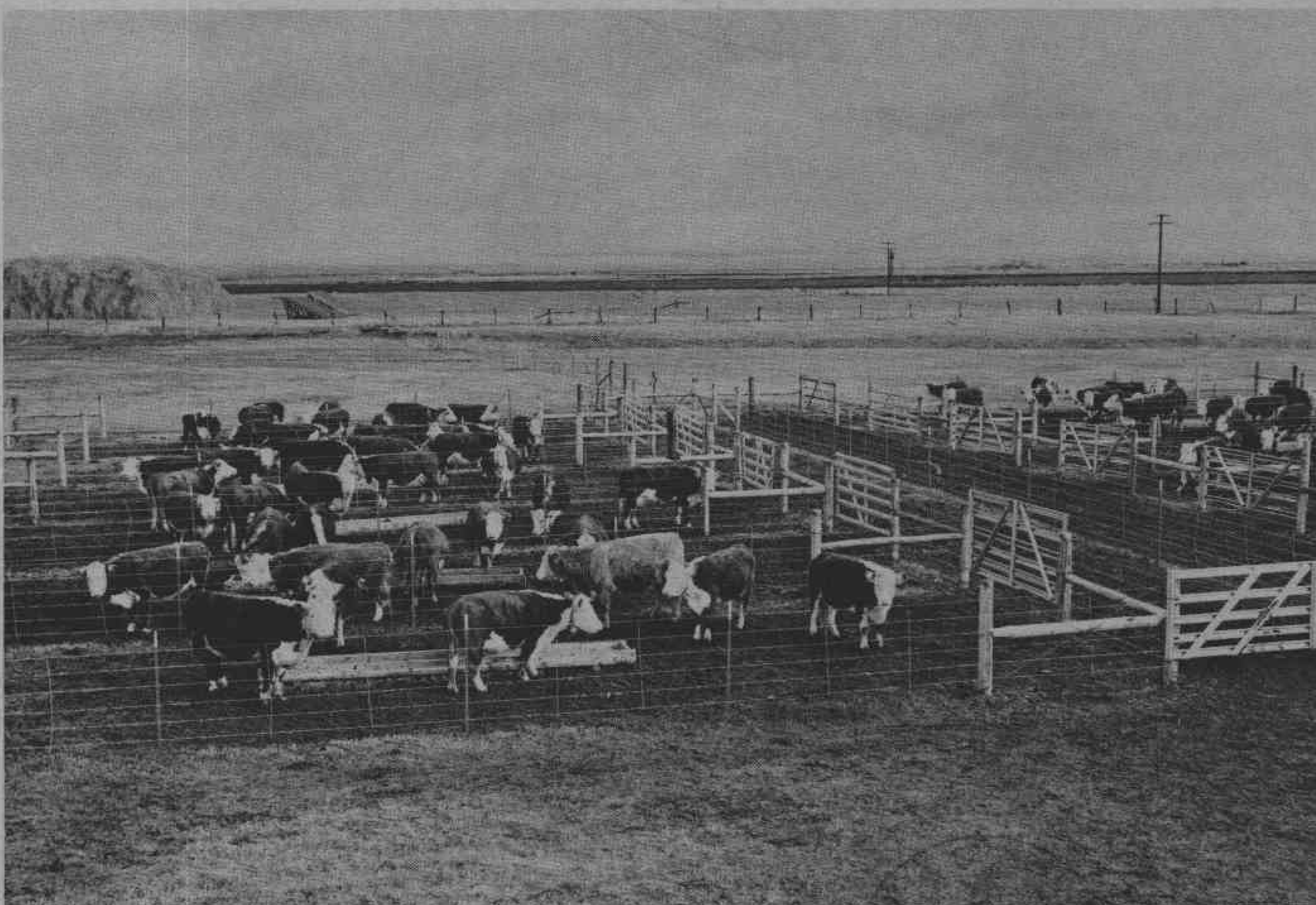
1970 Progress Report . . .

Research in Beef Cattle Nutrition and Management



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1970 PROGRESS REPORT

RESEARCH IN BEEF CATTLE NUTRITION AND MANAGEMENT

R. J. Raleigh, H. A. Turner, and R. L. Phillips

COMMERCIAL COW HERD SELECTION AND CULLING PRACTICES

The rising costs of beef production, coupled with a rather constant pricing of product, makes culling of cows that are not paying their way and selection of replacements increasingly important. Basically, selection is keeping the desirable animals and discarding the rest.

Many traits have been included in selection and culling programs, such as fertility, age, size, color, feet and legs, freedom from cancer eye, weaning weights, conformation, feed efficiency, rate of gain, temperament, milking ability, etc. Obviously we can not effectively select for all of these traits. The reproductive rate in cattle does not permit culling on many traits at a time.

The economic importance and heritability of traits are the primary determinants for their inclusion in a selection program. Very little, if any, progress can be made through selection of a trait with a low heritability value. Management practices are generally more effective in improving these traits. Crossbreeding can improve some of the lowly heritable traits in a short time, whereas selection alone may take a lifetime or more to reach the same point. Inclusion of traits with low economic value reduces the selection pressure that can be applied to the more important traits. Table 1 presents a ranking of a few traits according to overall importance to the net income of the producer.

Table 1. Ranking of traits according to overall importance to net income of the beef breeder 1/

Traits	Economic importance	Heritability	Combined importance
Yearling weight	4	2	1
Weaning weight	2	5	2
Daily gain	6	3	3
Mature weight	8	1	4
Calf crop %	1	8	5
Days to finish	3	7	6
Yield grade (cutability)	7	6	7
Feed efficiency	9	4	8
USDA slaughter grade	5	9	9

1/ The ranking of these traits will vary considerably for individual operators and with changing marketing and management practices.

Most of our economically important production traits, such as weaning weight, post-weaning gains and feed efficiency are moderate to highly heritable. Fertility, which is of great economic importance, has low heritability making progress through selection slow. However, a rigid culling program for fertility factors, along with management improvements, will greatly improve the fertility level.

There are several selection systems, such as the tandem, independent culling level, and index. The tandem involves selecting for one trait until it reaches a satisfactory level before starting on a second trait, etc. This method is only effective where all traits selected for are entirely independent, or, the desirable trait receiving the selection pressure is associated with other desirable traits. The independent culling level establishes a level at which animals will be culled or retained for each trait. If an animal does not meet the minimum level for any one of these traits it is culled. Both of these methods have serious limitations. The index is probably the most effective method of selection. All important traits of each animal are evaluated, based on heritability, particular needs of the herd, and economic importance, into one figure with which all the animals may be compared. The following discussion will not attempt to set up a selection system, but point out some of the tools and production considerations that should be used when selecting and culling a beef cow herd.

Fertility refers not only to the cow's ability to produce a normal healthy calf each year but also an early calf. However, it is very important economically and determines the number of calves available for selection. The heritability of fertility level is very low. Selection of replacement heifers based on the fertility level of their dams is relatively unimportant. However, culling of the brood stock based on fertility level is important because the repeatability of fertility level is high. Cows that fail to conceive and late calvers generally continue to have open years and late calves throughout their productive life. Late calving cows will usually establish a late-calving pattern even after skipping a year. Late calves mean lighter weaners, extended calving seasons, and a lack of uniformity in the calf crop.

Pregnancy testing is a useful aid in culling cows for fertility. Rectal palpation to determine pregnancy can be performed 60 to 90 days after last service. This allows selling of the open cows in the fall and saves the winter feed costs. It is important that the palpator is competent, because mistakes can be costly. Cows found open should be sent to slaughter, unless known circumstances such as nutrition, disease, breeding practice, or other management practices are responsible for the failure to conceive. Some ranchers prefer to leave the bulls in all summer and, in lieu of a pregnancy test, cull the late calving cows as a cow-calf pair the following fall. This practice is satisfactory if a rigid culling program is maintained. Individual records are essential for proper identification of the various traits and factors responsible for the cow's performance.

Weaning weight is a combination of birthweight, birth date, milk production of the dam, and genetic capacity for growth of the calf. This weight is very important in a selection and culling program. However, the association of weaning weight and post-weaning gain is not high enough that all selecting can be done at weaning time. It would be advisable for ranchers selling their calves at weaning to save more replacement calves than needed so some selection can be done on post-weaning gain.

Individual identification of cows is a valuable aid in analyzing weaning weights for selection purposes. This allows weaning weights to be adjusted for age of dam, age of calf, and sex differences. All weaners should be compared to calves born in the same year; it would be a mistake to select a large number of heifers one year because they weaned heavy and none another year because of poor weaning weights. Year to year variations are due to environmental factors and not genetic factors. Weaners should be selected after the previously mentioned adjustments have been made. The weaning weight of a cow's first calf or two is a good indication of future weaning weights of her calves and can be used as a culling criteria. Weaning weights of calves that have been adjusted due to aged cows are useful in selection of replacement heifers but should not be used when considering culling the cow.

Individual records of the cows permit the husbandman to eliminate replacement selection from cows with a history of undesirable traits such as cancer eye and vaginal prolapse. Also, culling of the cow herd, particularily after the calves have been weaned, is very ineffective in the absence of records. Individual identification of both cow and calf is essential to an effective culling and selection program. In the absence of individual cow identification all a rancher can do is select his heaviest weaners for replacements. Although this is a fairly effective way of selecting, not nearly as much progress can be made as when individual records are available.

Yearling or long yearling weight is a measure of both weaning weight and post-weaning gain. This weight is important in a selection and culling program. Individual identification of cows and calves allows you to determine post-weaning rate of gain which is highly heritable and, when all calves have been fed alike, is a reliable indicator of an animal's genetic capacity for growth.

The combination of adjusted weaning weights and post-weaning gain is probably the most important criteria in a selection and culling program. However, in the absence of individual records, the yearling weight is the single most important weight you can use for selection. Both weaning weights and capacity for growth of calves will be increased by selecting the heaviest yearlings. All traits listed in Table 1 will be improved, with the exception of calf crop percent and slaughter grade, by applying selection pressure on yearling weight.

Feed efficiency is highly heritable and economically important. However, the practice of individually feeding animals is generally not practical for the commercial producer. Fortunately feed efficiency is closely related to daily gain, and progress for efficiency will be made by selecting for rapid gain.

Visual appraisal of replacement stock can be a useful tool in picking up inherent defects, physical abnormalities or other physical weaknesses that would make a heifer impractical as a brood cow. However, when a grade and conformation score is included in the selection index, selection is often not as effective. Numerous studies have shown that when replacement stock is picked on the production traits previously mentioned, grade and conformation score, or a combination of the two, that the selection progress is greatest for those selected on production traits alone, followed by, a combination of production traits and conformation score. Herds in which replacements were selected on grade and conformation score alone actually decreased in productive ability. The effectiveness of visual appraisal is dependent on the experience and competence of the appraiser.

Cows should not be culled at a set age. Some cows are old at 9 and others at 15. If all cows are culled at age 10, for example, many of these cows would be capable of raising 4 or 5 more good calves. Cows that have remained in the herd this long should be some of the outstanding breeding stock. A long productive life ranks high in economic importance. This type of cow is generally a good producer of replacement stock. However, old cows should be culled the first year they show a substantial drop in performance. Also, they will usually bring a good market price at this time, whereas if left for another year they may bring little. Table 2 demonstrates that aged cows will actually increase the herd weaning weight average when cows are culled on yearly performance rather than at a set age. This table represents data of the Squaw Butte Station over a ten year period.

Table 2. Average 205-day weaning weights of calves from aged cows compared with average of calves from all cows, cows 4 through 9 years of age and cows 2 and 3 years of age

			Average weaning weights 1/	
Age class	Aged cows	All cows 2/	4-9 yr. cows 2/	2 & 3 yr. cows 2/
yrs	(lb.)	(lb.)	(lb.)	(lb.)
10	396	371	398	338
11	383	361	384	322
12	383	363	387	326
13	376	359	385	331
14 and over	380	371	390	335

1/ Weaning weights shown are averages of steer and heifer calves.

2/ These averages change because only those years corresponding to years of available data on cows of different age classifications were used in each determination.

No mention has been made concerning bull selection. Each cow can only raise one calf per year, whereas bulls can sire from 20-60 calves. Obviously bull selection is extremely important. The responsibility of raising the kind of bulls the commercial man needs rests on the purebred breeders. Records and other information should be made available to the commercial breeder so he can select the type of bulls needed. These bulls should be fast gaining, from good milking cows, free from inherent defects, homozygous for many of the desirable traits, and capable of hanging carcasses that not only will grade high, but score well on cutability. Bull selection for the purebred breeder must be much more detailed and intensive than the selection program discussed here for commercial cow herds. These purebred bulls should be so much better in production and carcass traits than the commercial herds in which they will be used that a producer can not afford to use anything less. If these kinds of purebred bulls are not available, then the producer might as well select the top bull calves from other commercial herds. Practices such as feed efficiency and progeny testing, which are generally impractical for a commercial producer, are almost a must for selection of herd sires for purebred breeders.

WEANING AND POST-WEANING MANAGEMENT OF SPRING BORN CALVES

Range forages on the sagebrush-bunchgrass ranges are usually fully mature by early July and thereafter decline steadily in nutritive value. Consequently, milk production of range cows and weight gain of their offspring during the later part of the summer grazing period is greatly reduced.

Research has shown that total feed shortage can penalize the daily gain of suckling calves as much as a pound per head per day and restricted animals will show effects of the setback at 12 and 18 months of age. These findings show importance of maintaining adequate feed supplies during the suckling period and subsequent winter.

TIME OF WEANING

Several years ago the Squaw Butte Experiment Station conducted studies comparing performances of calves weaned in mid-September and mid-October. The effect of time of weaning on the post-weaning or winter performance of range calves was studied over a 70-day period and over a 208 day period during the winter of two consecutive years.

One group of calves was weaned in early September during each year with comparable animals left on the cow and weaned 30 days later. After weaning each group of calves was put in the winter feedlot and fed chopped meadow hay, free choice, plus 2 pounds of barley and 1 pound of cottonseed meal per head daily. During each year the early-weaned calves gained significantly more than the late-weaned and produced a greater net profit (Table 3).

Spring born suckling calves on range will gain about 1.75 pounds daily during May and June, 1.25 pounds during July, less than a pound per day during August and relatively no gain after September 1. Figure 1 was developed from long term records of the Station and shows that suckling calves are gaining about 0.85 pounds per day on August 1 and about 0.3 pounds in September 1. During the past three years Station calves weaned about September 1 gained 0.8 pounds per head daily during the 45-day period after weaning. These calves were weaned, put on crested wheatgrass pasture and fed 2 pounds of

Table 3. Effect of time of weaning on post-weaning performance of calves

Weaning date	Trial 1 (70 days) Sept. 9	Oct. 7	Trial 2 (208 days) Sept. 15	Oct. 18
No. calves per treatment	10	10	27	27
Age at weaning, days	169	189	177	214
Avg. initial weight, lb.	312	296	370	380
Avg. final weight, lb.	399	359	618	594
Avg. daily gain, lb.	1.24	0.90	1.19	1.03
Avg. total gain, lb.	87	63	248	214
Avg. feed cost, $ 1/	11.76	6.41	38.37	33.29
Value of gain @ $30 cwt., less feed cost, $	14.34	12.49	36.03	30.91

1/ Feed costs used were 20, 50, and 90 dollars per ton for meadow hay, barley, and cottonseed meal, respectively.

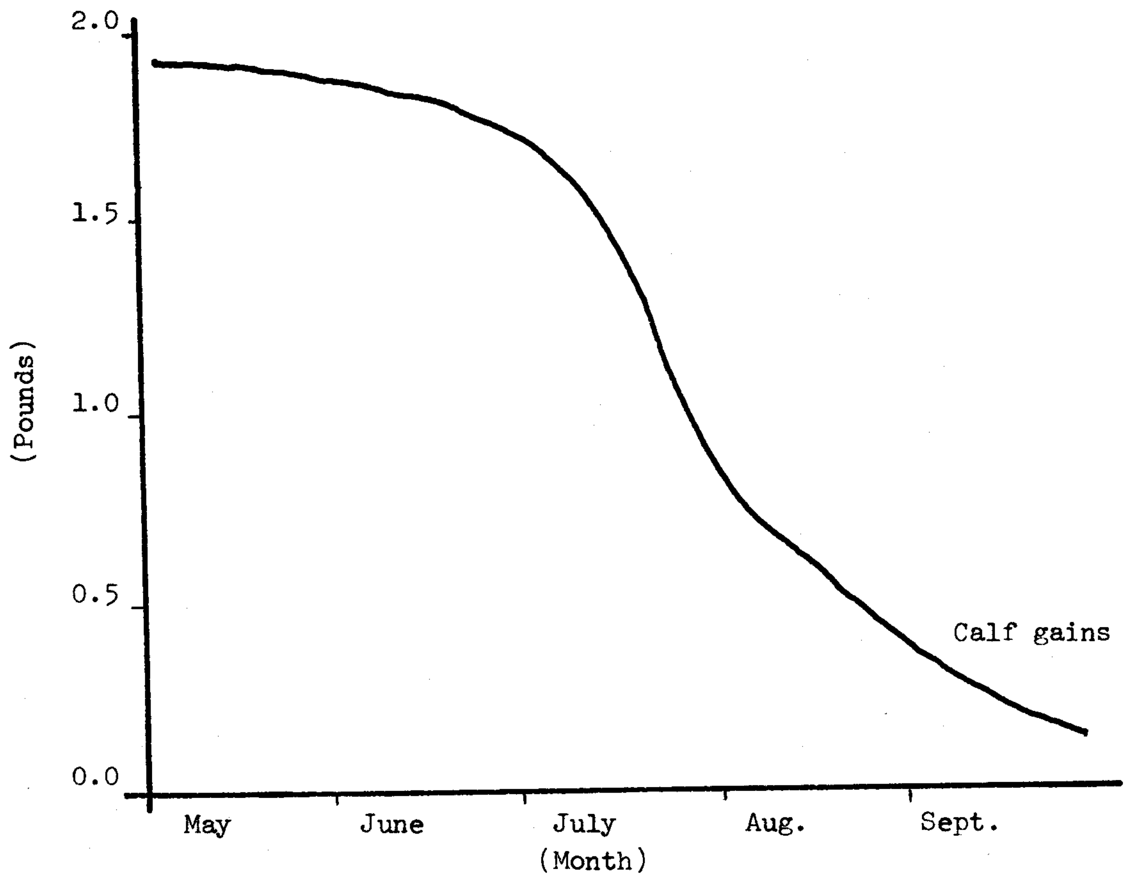

Figure 1. Average suckling gains of calves during the grazing season from cows on range forage.

rolled barley and 1 pound of cottonseed meal per head daily. Assessing no cost for the forage, since the calves would have been on range if they were not weaned, and a cost of $50 and $90 per ton for the barley and cottonseed meal, respectively, this gives a cost of supplement of 9 1/2 cents per day. The increase in rate of gain was 0.5 pounds or more. With calves worth 30 cents per pound this will give a profit of 5 1/2 cents per head per day.

Early weaning also makes it possible to get better use out of poor quality forage as mature dry cows will do very well on late season low quality forage and will come into the winter in better condition than the cow with a calf at her side. After the calf has been weaned the dry cows will range and forage further making better use of range inaccessable to the cow-calf pair.

PRECONDITIONING

Preconditioning has been a rather controversial term since its origin in the cattle industry. The word sounds all inclusive yet can include a variety of disease prevention, nutrition, and management factors. Probably more concern should be placed with the various practices involved than the term itself. Almost any type of treatment that can be applied to reduce weaning stress will usually be beneficial. The use of vaccines or other preconditioning treatments depends on the future treatment of the calves. If calves are going to a local feedlot, they can be vaccinated to take care of diseases specific to the area and when calves are sold by contract the type of vaccination program can be specified. In most cases we cannot recommend a shotgun treatment for all calves.

The time to vaccinate calves is generally controlled by the management program of the livestock operator and usually is done at weaning time. This adds more stress to the animal at a time it is already under heavy stress from weaning. Consideration should be given to vaccinating a couple of weeks prior to weaning. If this is possible or practical it can pay big dividends. The alternative is to hold vaccination of the calves for 2-3 weeks, or until they have overcome the stress of weaning. This may be undesirable if the calves are moved directly to the feedlot or other congested area, but if calves can be put on fresh pasture usually immediate vaccination is not necessary.

The only specific program that can be recommended is if the owner of the calves puts them in his own yards for wintering or finishing. Some authorities recommend vaccination before weaning and others at weaning time. Treatment of calves should be oriented to the specific ranch operation. The method of the Squaw Butte Station is discussed here and may serve as a guideline for other operators.

Calves are weaned in early September (as previously discussed) and put on well-fenced range pasture similar to range they were just removed from. Necessary vaccination is done at weaning time. The cows should be moved to a distant pasture so neither group will ride the fence looking for the other. Both protein and energy feed grain supplements are supplied within a few days after weaning and increased to a level of 2 pounds of barley and 1 pound of cottonseed meal per head daily, which is the level used for wintering these animals, as rapidly as possible. With this type of treatment Station calves have come through the stress of weaning and gained about 0.8 pounds per head daily during the first 45 days after weaning.

There are several other practices that can be applied to reduce the stress of weaning. It will help if calves can become familiar with feed bunks, watering troughs, and used to eating grain and hay before weaning or as soon after weaning as possible. In some cases it might pay to creep feed calves to help reduce weaning stress. Rumen activity will be maintained or increased if calves are kept on a full feed of medium-quality roughage during the weaning stress.

THE COMPARATIVE VALUE OF HAY AND BARLEY IN THE WINTERING RATION OF WEANER CALVES

Several factors go into determining the comparative value of grains and roughages. The value of either grains or roughages varies with the class of animal utilizing it and the level and type of production. Roughages have a net energy value for maintenance nearly double that for production, whereas feed grains have a value for net energy of production equal to about two-thirds that of maintenance.

Weaner calves wintered on good-quality native meadow hay alone will do little more than maintain their weight. This is due to the limitation in intake as a result of the bulk density ratio, the low protein content and the very low value of net energy for production of this hay. Weaner calves fed a full feed of meadow hay plus 2 pounds of barley and 1 pound of cottonseed meal will gain between 1 and 1.5 pounds daily during the winter feeding period. Studies were conducted to determine the replacement value of barley for meadow hay in the wintering ration of weaner calves, and to determine the response of calves of different weight classes to various hay:grain ratios. The gains of these calves the following summer were obtained to relate rate of summer gain to level of grain in the winter ration. Previous studies were reported in the 1969 Field Day report.

EXPERIMENTAL PROCEDURE

Twenty-seven steers averaging 375 pounds were stratified by weight and placed in three treatment groups. The three treatments were: (1) meadow hay fed free choice plus 1.25 pounds of cottonseed meal and 2 pounds of barley per head per day, (2) sixty percent of the hay of treatment 1 plus 1.25 pounds of cottonseed meal and 2 pounds of barley plus a replacement for hay calculated at 3 pounds of barley for 5 pounds of hay (3:5 barley for hay), and (3) sixty percent of the hay of treatment 1 plus 1.25 pounds of cottonseed meal and 2 pounds of barley plus a replacement for the hay calculated at 4 pounds of barley for 5 pounds of hay (4:5 barley for hay).

The animals were individually fed. Hay was weighed in daily and refusals weighed out weekly. Water, salt, and a salt bonemeal mixture were available to the animals at all times. The steers were tied daily at 7:00 a.m. to 11:00 a.m. then released for one hour so they could drink. They were retied at 12:00 noon until 3:30 p.m.

The animals were weighed at the start of the trial and each four weeks during the 140-day trial. The experimental treatments and nutrient composition of the ration ingredients are presented in Tables 4 and 5, respectively.

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 by wt.
3	60	1.25	2 + 53% of hay by wt.

1/ The animals on this treatment will be fed hay on a free choice basis with animals on treatments 2 and 3 fed 60% of that amount consumed by animals on treatment 1.

Table 5. Nutrient composition of ration ingredients

Ingredient	Nitrogen	Digestible energy
	(%)	(kcal/lb.)
Cottonseed meal	6.56	1320
Hay	1.28	1080
Barley	1.92	1560

OBSERVATIONS

Feed consumption, gain data, cost per pound of gain, and return over feed costs are presented in Table 6. Average daily gains were 1.17, 1.40, and 1.48 pounds with feed requirements per pound of gain of 10.9, 8.0, and 8.1, for animals on treatments 1, 2, and 3, respectively. The animals on treatment 1 required 12,855 kcal. of digestible energy per pound of gain while treatments 2 and 3 required 10,272 and 10,531 kcal. per pound of gain, respectively. This indicates the inefficiency of the roughage when used for production when compared to the barley. Returns over feed cost were 12.08, 17.70, and 18.14 dollars for treatments 1, 2, and 3, respectively. The effect of tying on the total hay consumption of the animals needs further evaluation, as hay intake values are somewhat below that of lot fed animals on similar studies.

Table 6. Feed consumption, gain data, cost data, and returns over feed costs

	Treatments		
	1	2	3
Total feed consumption, lb.	12.7	11.1	11.9
Hay, lb.	9.4	5.6	5.7
Barley, lb.	2.0	4.3	4.9
CSM, lb.	1.25	1.24	1.24
Initial wt., lb.	379	368	378
Final wt., lb.	544	564	587
Avg. daily gain, lb.	1.17	1.40	1.48
Cost/hd./day, $	0.208	0.225	0.242
Feed/lb. gain, lb.	10.9	8.0	8.1
Digestible energy/lb. gain, kcal.	12,855	10,272	10,531
Cost/lb. gain, $	0.178	0.161	0.164
Return over feed cost, $ 1/	12.08	17.70	18.14

1/ Feed costs used were: barley @ $50, cottonseed meal @ $90, and hay @ $20 per ton with gain valued at 25¢ per pound.

The effect of size of the animal on the utilization of the three treatment rations is shown in Table 7. The average daily gains were equal for all size groups with the lighter animals more efficient with feed conversions of 8.2, 8.9, and 9.8 pounds, respectively, for the light, medium, and heavy groups.

Table 7. Feed consumption, gain data, and feed conversion data

	Body weight groups		
	Light	Medium	Heavy
Total feed consumption, lb.	11.1	11.8	12.9
Initial wt., lb.	324	373	427
Final weight, lb.	514	563	617
Average daily gain, lb.	1.35	1.34	1.35
Feed/lb. gain, lb.	8.2	8.9	9.8
Digestible energy/lb. gain, kcal.	10,388	11,130	12,140

The performance of these animals on summer range is presented in Table 8. All animals received a supplement on crested wheatgrass pasture during this period. There were no significant differences in rate of summer gain as related to winter treatments. The animals receiving the higher level of grain supplements during the winter (treatment 3) made average daily gains of 2.34 pounds compared to 2.47 and 2.48 pounds for treatments 1 and 2, respectively.

These data indicate that high levels of barley can be used as a replacement for meadow hay without an adverse effect on summer gain. With the prices

Table 8. Summer gains of steers

Winter treatment	Number of animals	Average Daily gain winter	Average weight 5/17	Average weight 8/4	Average daily gain summer
		(lb.)	(lb.)	(lb.)	(lb.)
1	9	1.22	604	799	2.47
2	9	1.40	604	800	2.48
3	9	1.48	623	808	2.34

used, the economic data favors the 4:5 barley for hay ratio. However, the feed conversion data indicates greater efficiency from the 3:5 barley for hay ratio. The relative prices of barley, hay, and the animal product should be used in determining the ration combination.

ALFALFA HAY FOR WEANER CALVES

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Considerable interest concerning the value of alfalfa hay in warm-up rations has recently developed in the intermountain area. Results reported by various experiment stations, from feeding trials using top quality, long alfalfa hay have demonstrated that animal gains of 2 pounds per day may be obtained under optimum feedlot conditions. These data suggest that much of the alfalfa grown in the intermountain area has been given an inferior energy value in relation to its true feeding value. Published feeding guides usually indicate that to get gains in excess of 1 1/2 pounds per day on growing cattle an additional energy source, such as grain, must be included in the ration along with alfalfa hay. Results based on over 100 digestion trials recently conducted at Nevada, using alfalfa hay produced throughout the state during a 4 year period, indicate that average hay contained 56% TDN. Top quality alfalfa had TDN values of 63%, considerably higher than most standard values for alfalfa in use today, and net energy values for production (NE_p) of 42 megacalories per 100 pounds of hay (Table 9).

Feeding trials to evaluate alfalfa hay in warm-up and finishing rations were conducted at the Newlands Field Station at Fallon, Nevada. Initial emphasis was placed on the study of various ratios of alfalfa and corn silage in warm-up rations. Rations varied from 100% alfalfa hay to 25% hay and 75% silage. Results from these studies indicate that the alfalfa contained approximately the same energy level as did the corn silage, on an equal dry matter basis. It is of interest to note that with only 25% of the ration consisting of alfalfa, protein still appeared adequate to promote optimum growth.

1/ Professor of Animal Nutrition, Department of Animal Science, University of Nevada. Currently on leave for further study with Oregon State University.

Table 9. Composition of alfalfa hay grown in Nevada 1/

Hay quality	Protein	Fiber	TDN	NE_p
	(%)	(%)	(%)	(megcal/100 lb.)
Poor quality	10.1	40.0	46.8	25
Average quality	14.8	30.0	56.0	36
Top quality	18.5	21.0	63.0	42

1/ Based on 108 digestion trials using alfalfa produced throughout Nevada. Values are adjusted to 90% dry matter content.

Additional feeding trials were conducted to measure the feeding value of alfalfa hay with more typical warm-up rations consisting of 2/3 hay and 1/3 grain, usually barley and wheat. Inclusion of grain in the latter third of the warm-up period improved both gain and efficiency, and decreased days on feed to reach a constant weight of 650 pounds (Table 10). Alfalfa used in this study tested 54% TDN, indicating it was below Nevada average (Table 9). Animals on this ration gained 1.52 pounds per day which is below optimum. Using values of $25 per ton for alfalfa and $50 for grain, the feed costs of the two rations are identical, both being 11.8¢ per pound of gain. When a flat yardage fee of 10¢ per head per day is used, the economics swing slightly in favor of the hay-grain ration, due to the shorter period these animals were on feed.

Table 10. Production data from warm-up studies using all alfalfa and alfalfa-grain rations 1/

Treatment	Beginning weight	Final weight	Daily gain	Feed intake	Days on feed	Feed efficiency
	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)
Alfalfa and grain	429	651	1.82	14.4	122	7.9
Alfalfa	432	648	1.52	14.3	142	9.4

1/ Grain was fed at 1% of body weight during the last 52 days of this trial. All weights are in pounds, with gain and intake expressed on a daily basis. Efficiency is based on pounds of feed to produce 1 pound of gain.

Probably the basic reason for using grain in warm-up rations is the price ratio of grain and hay, and the quality of hay. Based on data from these studies it appears that the feed cost per pound of gain does not appreciably change when concentrates are included, providing the cost per ton of grain is twice as much as hay. Based on $25 hay, the economics swing in favor of all alfalfa rations when the price of grain is $50 or more per ton, while the opposite is true if the grain price is lowered to $45. Although these studies were not designed to directly measure the effect of hay quality in to grain use, it can generally be assumed that grain will have less effect on warm-up response when fed with top quality alfalfa hay, as compared to its use with a poor quality alfalfa.

Field cubers and other processing techniques, which promise to eliminate much of the labor involved in handling baled hay, has stimulated interest in various forms of hay processing. Earlier work indicated pelleting alfalfa generally improved feeding quality, and more recent studies have indicated this same response exists when feeding alfalfa cubes, although not to the same extent that it does when pellets are fed. A trial was conducted at Fallon to determine the replacement value of alfalfa pellets for grain concentrates in alfalfa rations. The animals were carried to slaughter weights, but the results are of interest and would be applicable to warm-up rations. The data from this trial are presented in Table 11. Grain supplements improved gain and efficiency, and decreased days on feed, when compared with all alfalfa rations. Inclusion of alfalfa pellets, in place of grain, did not give the same magnitude of response; however, the improvement of efficiency and gain was still considerably above the all long hay rations. Calculations from these data indicate that the alfalfa pellet contained approximately 80% as much NE as the grain supplement. Pelleting improved the apparent NE of alfalfa by approximately 27%. Other studies indicate that the full benefit of pelleting alfalfa will be obtained when only one-third of the ration is pelleted. Pelleting costs approximately $10 per ton; thus, if hay is valued at $25, then alfalfa pellets would be worth $35. Based on this study and using the $35 per ton figure for alfalfa pellets, grain was actually worth $46 per ton. Therefore, if the price of grain exceeds $46, an economic advantage exists for alfalfa pellets, while the opposite is true if the price of grain is below $46.

Table 11. Comparison of grain and alfalfa pellet supplements with alfalfa on steer growth 1/

Ration	Beginning weight	Final weight	Daily gain	Feed intake	Days on feed	Feed efficiency
	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)
Hay and grain	664	956	2.66	23.8	110	9.0
Hay and alfalfa pellets	672	957	2.38	23.8	121	10.1
Hay	656	954	1.96	21.9	154	11.3

1/ Grain and alfalfa pellets were fed at 1% of body weight for the entire trial. Hay was fed free choice. All weights are in pounds, with gain and intake expressed on a daily basis. Efficiency is based on pounds of feed required to produce one pound of gain.

The preceding data suggest the obvious need for measures to determine quality of alfalfa forage. Studies were conducted to determine factors in alfalfa that would serve as indicators of quality to describe the hay. The most readily determined quality factors include estimates of protein and fiber.

Using these factors, equations have been developed for predicting the feeding quality of alfalfa.

Top production in the warm-up lot requires not only good quality hay, but optimum feeding conditions and management. These studies have indicated that under ideal conditions, warm-up calves will consume about 3% of their body weight daily. This can be improved slightly by feeding some pellets or cubes in the ration; however, intakes of 3.5% have not been maintained thus far on all alfalfa rations for more than 1 to 2 weeks. The data in Table 12 indicate how this information can be put to use in predicting feedlot gain on all alfalfa rations, based on different levels of intake. Average daily gain ranges from a low of 0.8 pounds to a high of 2.2 pounds per day.

Table 12. Estimated daily gain and profit or loss per head in the warm-up lot related to protein content and feed intake (based on steers weighing from 400 to 650 pounds or an average weight of 550 pounds) 1/

Percent protein	Daily dry matter intake: 13 pounds		14 pounds		15 pounds	
	Gain	Profit	Gain	Profit	Gain	Profit
	(lb.)	($)	(lb.)	($)	(lb.)	($)
12	0.8	-29	1.0	-16	1.2	- 7
14	1.1	- 3	1.3	4	1.5	9
16	1.3	6	1.6	14	1.8	17
17	1.5	13	1.8	19	2.0	21
20	1.7	18	2.0	21	2.2	24

1/ Profit or loss is based on cattle in at $35/cwt and out at $31/cwt. Hay was valued at $25/ton and yardage at 10¢ per head per day.

Several factors will influence daily feed consumption but probably management and protein content are most important. As indicated earlier the total management of a feeding operation will be necessary to achieve maximum feed intake. However, the quality of the hay, represented by the protein content, will play a very important role in regulating feed intake. For example, in Table 12 it would be unlikely that animals consuming alfalfa hay with 12% protein would consume 15 pounds per day. The 15 pound intake would probably not be achieved until hay containing at least 16% protein was fed. The data in Table 12 indicates the importance of high quality hay to obtain profit in the warm-up period.

The management of alfalfa stands for the production of quality factors will not be discussed in this report, except to say that the harvesting of alfalfa at a more immature state is one of the most effective means of increasing quality. This procedure would appear to decrease total tonnage of dry matter, but tonnage often may be increased or at least maintained, by obtaining an additional cutting. Furthermore, when production is measured in pounds of beef produced per acre, the difference in favor of early harvest becomes large.

The importance of management in the feeding of alfalfa has previously been stressed, but it should be further indicated that the successful feeding of high levels of quality alfalfa presents new management problems in itself. One of the main problems that often develops is bloat. This can be combated in a number of ways, often by including other feeds in the ration. Corn silage when available has been effective in reducing bloat. Also, such feeds as straw can effectively reduce bloat; however, this will also reduce the energy content of the ration. The recent development of new bloat preventative medicines also offers promise of controlling bloat in alfalfa rations. Inclusion of certain grains, such as barley, along with high-quality alfalfa are thought to increase the incidence of bloat. Although this phenomenon has not been demonstrated experimentally, it is well established that including grain in an alfalfa ration certainly does not decrease the incidence of bloat. It has been our experience that the best way to prevent bloat is to avoid variation in day-to-day consumption of alfalfa. Bloat problems have only occurred on these feeding regimes when daily feed consumption has varied greatly.

In summary, alfalfa hay may successfully be included at higher levels, in the growing ration than has previously been considered possible, without sacrificing the level of production demanded by today's market. However, in order to accomplish this, the hay must contain sufficient energy to produce the required gain. In western livestock areas utilization of alfalfa in growing beef rations can offer an additional source of income.

INDEX

PREVIOUS LIVESTOCK FIELD DAY REPORTS
SQUAW BUTTE EXPERIMENT STATION

These reports are available upon request from the Squaw Butte Experiment Station, P. O. Box 833, Burns, Oregon 97720.

Special Report 106. 1961 — Page

Performance of Calves as Influenced by Time of Weaning - - - - - - - 1

Feed Intake and Performance of Steer Calves Wintered on Meadow Hay With and Without Added Protein - 2

The Effect of Copper and Iron Injections on Rate of Gain and on Hemoglobin and Packed Cell Volume of the Blood of Range Calves From Birth to Weaning - 6

The Influence of An Anitbiotic Supplement, A Flavor Additive, and an Arsenical Appetite Stimulant on Weaner Calf Performance - - - - 9

Low Levels of Alfalfa in the Winter Ration for Weaner Calves - - - - 11

Special Report 126. 1962

Influence of Different Levels of Salt in a Cottonweed Meal Supplement for Yearling Cattle on Crested Wheatgrass Range - - - - - - - 1

The Influence of Salt and Water Intake on the Performance of Protein Supplemented Yearlings - 4

Response of Weaner Calves to Various Levels of Energy and Protein Supplementation - 8

The Influence of Enzyme Additions to Meadow Hay Rations for Weaner Calves - 11

Special Report 145. 1963

Protein and Energy Supplements for Yearlings on Crested Wheatgrass Pasture - 1

Energy, Protein, and Urea Supplements with a Meadow Hay Roughage for Weaner Calf Rations - 6

Digestibility Measurements on Native Meadow Hay and Their Effect on Animal Performance - 9

Wintering Mature Cows on Limited Rations - - - - - - - - - - - - - - - 12

Performance Traits in Weaner Calves as Indicators of Future Performance and as Related to Weight of Their Dams - - - - - - - - - - 15

Special Report 171. 1964

Supplemental Energy and Protein Requirements for Weaned Calves Fed Early and Late Cut Meadow Hay - 1

Supplementing Yearlings on Native Range - - - - - - - - - - - - - - - - - - 4

Calf Production from Aged Cows in the Squaw Butte Breeding Herd - - - 9

Comparison of Hereford and Charolais x Hereford Cattle - - - - - - - - 14

Special Report 189. 1965

Nutritive Value of Range Forage and Its Effect on Animal Performance 1

Yearling Cattle Gains on Native Range Forage and Bunched Hay - - - - 7

Performance of Calves Fed Vitamin A with Baled and Chopped Meadow Hay 10

Vitamin A Nutrition and Performance of Hereford Heifers Fed Different Levels of Nitrate -12

Special Report 210. 1966

Slaughter Steers from Range Feed - 1

Urea in the Ration of Weaner Calves - - - - - - - - - - - - - - - - - - 4

Level of Protein for Two-Year-Old Heifers During Pregnancy - - - - - 8

Fall Calving Program - 11

Special Report 232. 1967

Urea in a Growing Ration for Beef Cattle - - - - - - - - - - - - - - - 1

Digestibility of Rye Hay - 3

Production of Fall Calves - 6

Finishing Steers on Range Feed - 9

Special Report 251. 1968

Comparative Value of Barley and Meadow Hay with Two Sources of Nitrogen for Wintering Calves - 1

Vitamin A in Range Livestock Production - - - - - - - - - - - - - - - - 5

Biuret, Urea, and Cottonseed Meal as Supplemental Nitrogen for Yearlings on Range Forage - 9

High Quality Fall Range Feed by Chemical Curing - - - - - - - - - - - -14

Special Report 270. 1969

Fall Calf Production - 1

Nonprotein Nitrogen for Wintering Calves - - - - - - - - - - - - - - - 3

Energy Sources for Wintering Calves - - - - - - - - - - - - - - - - - - 5

Comparative Value of Alfalfa and Meadow Hay in the Wintering Ration of Weaner Calves - 8