

1970 PROGRESS REPORT

RESEARCH IN BEEF CATTLE NUTRITION AND MANAGEMENT

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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, particularly 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

Age class	Aged cows	All cows <u>2/</u>	Average weaning weights 1/ 4-9 yr. 2 & 3 yr.	
			cows <u>2/</u>	cows <u>2/</u>
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)		Trial 2 (208 days)	
	Sept. 9	Oct. 7	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, \$ $\frac{1}{2}$	11.76	6.41	38.37	33.29
Value of gain @ \$30 cwt., less feed cost, \$	14.34	12.49	36.03	30.91

$\frac{1}{2}$ / Feed costs used were 20, 50, and 90 dollars per ton for meadow hay, barley, and cottonseed meal, respectively.

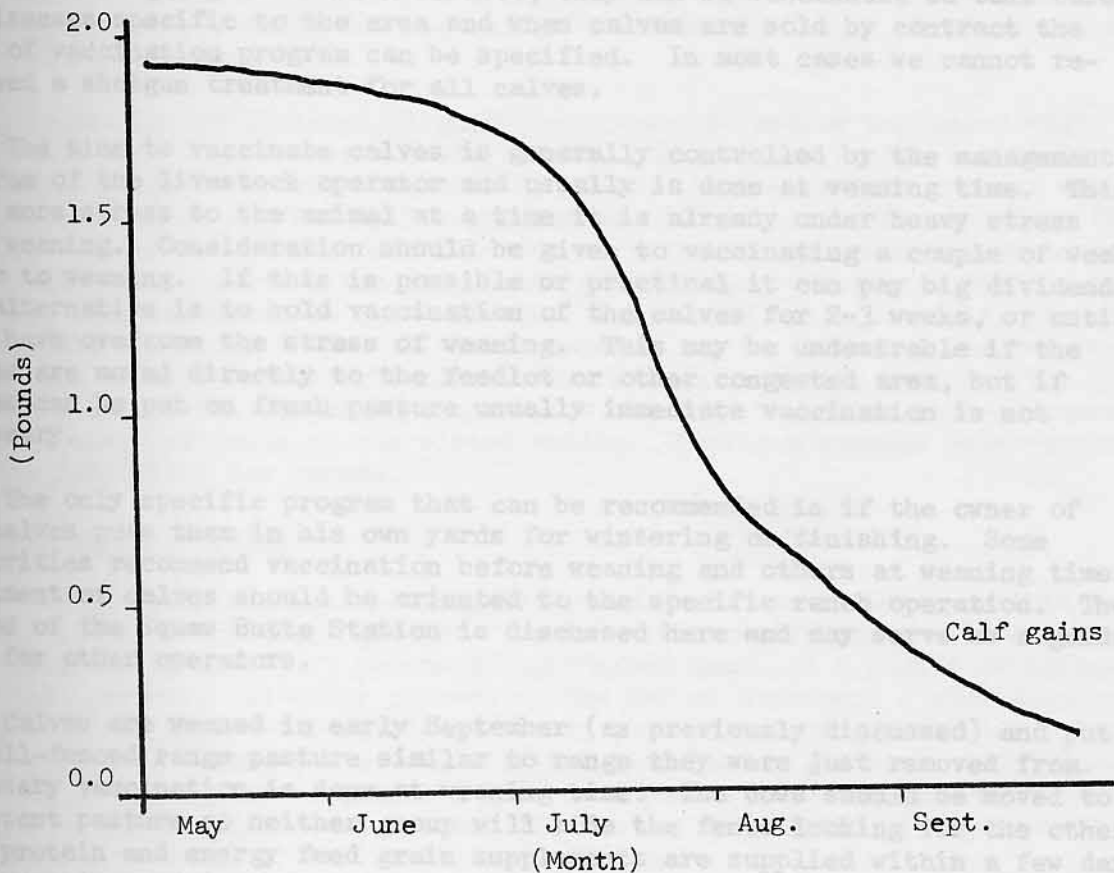


Figure 1. Average suckling gains of calves during the grazing season from cows on range forage.

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 inaccessible 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 <u>1/</u>	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, \$ <u>1</u> /	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.

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