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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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.