Increasing Animal Units

The number of animal units could be increase by:

1. Produce higher crop yields.
2. More efficient use of water than estimated. (A larger area could be irrigated)
3. Use of supplementary feed.
4. Improving pasture and efficiency.
5. Controlling parasites and providing shade to increase animal efficiency.
6. Extending feed supply by using non-marketable by-product roughages, such as sorghum stover or barley or wheat straw.

Feeding Forage (alfalfa) to Feedlot Cattle

Feedlot cattle can be finished very efficiently on relatively high roughage (forage) rations. This is born out by a summary of a recent trial at the Arizona Station designed to test this type of program.

Two previous trials with 400 lb. steer calves have shown that a feeding system containing approximately 38% roughage for the entire feeding results in similar performance and carcass grade, as does a low roughage system containing 12% roughage. As expected, feed requirements per unit of gain favored the lower roughage systems. In the high roughage system, the high roughage levels are fed during the latter portions of the trial, and during the latter portions of the trial, a low roughage diet is fed. It appeared desirable to substantiate the findings of the first two trials and to feed a higher roughage level than was fed in those two trials.

The latest trial involved 144 head of 460 lb. steer calves fed the following experimental diets:

12% alfalfa + either milo or wheat
20% " " " "
30% " " " "
40% " " " "

The length of the feeding trial was 194 days.

Results

With milo as the source of grain, the highest feed requirement (673 lb.) was with the 40% alfalfa diet. Compared to the other three alfalfa levels, the feed requirements were nearly 10% higher (763 vs. 613 lb.). When the 30, 20 and 12% alfalfa levels were compared, the highest feed requirement was on the 20% level. This may be due to the fact that the lowest rate of gain of the four 12% alfalfa levels were very similar (609 and 593 lb.). In general, these data agree with those of the previous trial with calves, in that utilization of alfalfa hay with the feeding systems used is higher than previously estimated. Daily gain on the milo diets based on shrunk basis was 2.76 lb. for the 194 day feeding period which can be considered excellent. The low feed requirement noted, no doubt, relates to the high feed intake and very high rates of gain. Feed cost per hundred pound of gain was highest on the high alfalfa level and very similar for the 30 and 12% alfalfa levels. Feed cost of gains were very low and this was due primarily to the low feed requirements for all groups of cattle.

Alfalfa as a Source of Roughage for Finishing Cattle

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A survey of feed analysis tables that list the common roughages fed beef cattle show alfalfa hay has the highest energy availability (table 1). When harvested as hay, certain other legumes also have a high energy value, however, the total volume is usually small and is relatively unimportant as an overall hay crop. When evaluated on a TDN or net energy of production basis, alfalfa hay is clearly more desirable than any other roughage. The difference in feeding value between alfalfa hay and the other roughages cannot be accounted for by its crude fiber content, although some of the low quality roughages are higher in crude fiber than alfalfa hay. From a standpoint of economics, another decided advantage of alfalfa hay is its high protein content. The high protein content, however, does not necessarily relate to the high energy utilization of alfalfa hay.

The TDN of alfalfa hay is decreased by only three percentage units when harvested in the early bloom stage as compared to full bloom stage. With many grass roughages harvested at corresponding stages, the decreased TDN may be as much as 20%. It is obvious that alfalfa hay is unique as a roughage source for cattle. Lignin content of roughages is often considered as a guide to the feeding value of the roughage. This is usually true, however, there are some exceptions. For example, the alfalfa hay harvested in the southwestern part of the United States usually contains about 8% lignin while bermuda straw contains only 5% lignin. Table 1 shows that from the standpoint of net energy of production, alfalfa hay is worth at least four times bermuda straw. While bermuda straw contains more crude fiber than alfalfa hay, the differences in the crude fiber content between the two roughages is not sufficient to account for the differences in the feeding value.

Newer methods of roughage analysis based on the extensive studies of Van Soest and his group has thrown considerable light on the nutritive value of roughages as related to their chemical analysis. A key point in their analysis separates the cell wall fraction from the cell content fraction. The cell wall is poorly utilized by the rumen microorganisms; whereas, the cell content is highly digestible. This appears to account for some of the major differences observed between the roughages. For example, the low quality roughages such as bermuda straw have an extremely high cell wall content; whereas, a roughage such as alfalfa hay has a high level of material contained within the cell. Another important aspect appears to be the relationship between cellulose and hemicellulose. Usually the two components are grouped together under the crude fiber fraction in chemical analysis and digestibility studies. Table 2 clearly shows that of the usual crude fiber fraction, cellulose is the major portion in the case of alfalfa stems; whereas, with bermuda straw the hemicellulose fraction is greater. Milo stalks more closely resemble alfalfa in this respect and it is interesting to note from table 1 that milo stover has a much higher net energy for production value than does bermuda straw. The effect of alkali treatment on nylon bag dry matter disappearance of the three roughages is shown in table 3. Digestibility of alfalfa stems was improved very little with alkali treatment. Digestibility of bermuda straw, which is high in hemicellulose, was approximately doubled due to the alkali treatment. The response of milo stalks to alkali was similar to that of alfalfa and table 2 indicates that the hemicellulose content of milo stalks is considerably less than that of bermuda straw. Digestibility studies with steers showed that the major improvement in digestibility of bermuda straw, due to alkali treatment, was with the hemicellulose fraction.

It is generally accepted that the digestibility of crude fiber of roughages is markedly reduced in high grain diets. Studies have shown that the digestibility of crude fiber in grass hays and straws may be reduced as much as 50% due to high grain feeding. This is due primarily to the lower pH of the rumen when high levels of grain are fed and the cellulose digesting microorganisms are relatively inactive at the low pHs. These findings have been applied to all roughages but may not be applicable with certain legume roughages such as alfalfa hay. Data with alfalfa hay in conjunction with high grain levels is limited, however, the information presented in table 4 would suggest that alfalfa hay may be digested differently in the rumen than the grass hays or straws. Table 4 shows that the addition of starch to alfalfa hay did not appreciably reduce the digestibility of the alfalfa hay. Critical evaluation of the data is difficult due to the fact that the weight of the animals is not known. Of further interest is the low protein level with a high level of starch. It might be expected that at 7.7% protein level of the diet, alfalfa hay digestibility would have been depressed.

Finishing trials conducted with alfalfa hay or a combination of alfalfa hay and cottonseed hulls as the roughage suggest a much higher feeding value to alfalfa hay than is generally used. The results of the feeding trials support the above comments concerning utilization of alfalfa hay.

Several trials have been conducted at the University of Arizona with finishing steers to evaluate alfalfa as a sole roughage as compared to a combination of alfalfa and cottonseed hulls. Initial observations were with yearling steers fed for a 140 day period and the results indicated a much higher feeding value for alfalfa hay than normally considered. The trials with yearling steers were not sufficiently long to give a good estimate of the value of alfalfa hay.

Feeding trials were then conducted with calves to be fed for a 220 to 230 day period. The feeding systems utilized contained four levels of roughage over the entire feeding period. The levels were 12, 20, 30 and 40%. The system used was to feed a high level of roughage during the early portion of the feeding period and reduce the level so that all steers were finished on a 90% concentrate diet. The effect of four levels of alfalfa in finishing diets for steer calves fed for a 226 day period are presented in table 5. Average daily gains were essentially the same for the 40, 30 and 20% roughage levels but considerably lower for the 12% roughage level.

Feed intake decreased as roughage level decreased. As to be expected, feed requirements were highest on the 40% alfalfa diet, however, feed requirements for the three lower roughage levels were similar. These data suggest that alfalfa has an extremely high feeding value when incorporated in high grain rations for finishing calves. The data further suggest that there is not a depression in utilization of alfalfa hay when incorporated into high grain diets. In this respect, it agrees with the previous data given in this paper. The alfalfa hay used was of good quality but not in the excellent quality category.

When the roughage consisted of a 68% alfalfa and 32% cottonseed hull mix, daily gains were very similar for the 40, 30 and 20% roughage level with a decrease in gains for the 12% level (table 6). In this respect, the data agrees with table 5 with alfalfa as the only roughage level. As the roughage level decreased, feed intake also decreased. As the roughage level decreased, there was a decrease in feed requirements per 100 lb. of gain. The decrease was in fairly even increments between each of the roughage levels. This suggests that increase in grain levels results in poor utilization of the cottonseed hulls. When very low levels of roughage are used in a finishing ration, the roughage type becomes less important due to the low contribution of roughage energy in relation to grain energy.

Additional trials conducted with wheat as a source of grain indicate that the results obtained with alfalfa hay is probably not related to type of grain. The effect of various qualities of alfalfa is also not known. Additional research is required in order to determine the effect noted with alfalfa. The results to date suggest that alfalfa may have a feeding value of 80% of that of flaked milo.

TABLE 1. NUTRIENT ANALYSIS OF ROUGHAGES[a]

Roughage	TDN, %	NEm	NEp	Crude fiber, %	Crude protein, %
Alfalfa hay	55	54	30	28	16
Cottonseed hulls	42	42	9	45	4
Wheat straw	43	41	6	45	4
Milo stover	44	42	15	28	6
Bermuda straw	41	41	6	35	4
Sudan hay	50	48	21	28	5

[a]As fed basis.

TABLE 2. CELLULOSE, HEMICELLULOSE AND LIGNIN CONTENT OF VARIOUS ROUGHAGES

Roughage	Cellulose %	Hemicellulose %	Lignin %
Alfalfa stems	45	12	12
Bermuda straw	28	38	5
Milo stalks	40	28	8

TABLE 3. THE EFFECT OF ALKALI TREATMENT ON NYLON BAG DRY MATTER DISAPPEARANCE OF VARIOUS ROUGHAGES

Roughage	Control %	Control + alkali treatment %
Alfalfa stems	46	50
Bermuda straw	34	67
Milo stalks	39	46

TABLE 4. EFFECT OF ADDITION OF STARCH ON DIGESTIBILITY OF ALFALFA HAY

Item Protein level, %:	14.6	11.0	9.0	7.7
Alfalfa hay, lb.	5.0	5.0	5.0	5.0
Starch, lb.	---	2.0	4.0	6.0
Total, lb.	5.0	7.0	9.0	11.0
Alfalfa dry matter digestibility, %	60	59	57	57

TABLE 5. VARIOUS LEVELS OF ALFALFA IN FINISHING DIETS FOR STEER CALVES (226 days)

Item	Roughage level, %: 40	30	20	12
Number of steers	16	16	16	16
Average initial wt., lb.	424	422	422	419
Average daily gain, lb.	2.59	2.57	2.51	2.28
Average daily feed, lb.	17.9	16.6	16.3	14.7
Feed/100 lb. gain, lb.	691	646	649	645

TABLE 6. VARIOUS LEVELS OF AN ALFALFA:COTTONSEED HULL MIXTURE (ALFALFA 68%:COTTONSEED HULLS 32%) IN FINISHING DIETS FOR STEER CALVES (226 days)

Item	Roughage level, %: 40	30	20	12
Number of steers	16	15	15	15
Average initial wt., lb.	429	428	423	421
Average daily gain, lb.	2.43	2.43	2.36	2.30
Average daily feed, lb.	17.8	17.1	15.9	14.6
Feed/100 lb. gain, lb.	732	704	673	635

Alfalfa Variety Test

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Yuma-Mesa Experimental Farm Elevation: 175 feet

Cutting Date	Variety & Yield[1] (lbs/acre) Mesa Sirsa	Hayden	African	WL512	Abunda Verde
05/04/77	3270	3470	3760	4190	3540
06/15/77	3690	3120	3260	3510	3330
07/20/77	4450	3880	3902	3980	4140
08/29/77	4920	4730	4230	3920	4600
09/29/77	2740	2800	2580	2460	2920
10/28/77	3360	3170	3300	2960	3270
12/05/77	2170	1820	1780	1450	1730
Total Yield 1977 (tons/acre)	12.3 a	11.5 a	11.4 a	11.2 a	11.8 a

[1]/Adjusted to a 12% moisture content. Yields followed by the same letter are not significantly different at .05 level by Student-Newman-Keuls' Test. Each yield value in the table is an average of three replications.

Crop History: Planted: October 6, 1976 at 30 lbs/acre. Three replications.

Agri-File Field Crops 272.21.