THE EFFECTS OF ALFALFA HAY LEVEL, GRAIN TYPE AND GRAIN PROCESSING METHOD ON PERFORMANCE OF FINISHING STEERS: SUMMARY OF TRIALS (1976-1980)

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When alfalfa hay prices are favorable, a financial advantage may exist in cattle feeding for the substitution of alfalfa hay for grain. Digestion trials conducted at the University of Arizona have indicated that flaked milo only slightly depressed the digestibility of alfalfa hay in high concentrate diets. These results were not anticipated since fiber digestibility is expected to decline dramatically with additions of starch to the diet. It is possible that alfalfa hay grown in Arizona and the desert southwest responds differently than other roughages when incorporated into milo diets. In other studies conducted at this station there was no reduction in the digestible energy of alfalfa hay when milo levels were increased in alfalfa-milo diets. These studies were inconclusive with respect to fiber digestibility.

Over the last several years there has been increased corn usage in Arizona feedlots. This has been a result of both increased Arizona corn acreage and competitively priced corn transported from the midwest. Prior to the trials reported in this paper, corn had not been used at the University feedlot facility in Tucson. Since no information was available for corn with Arizona type diets it was decided to conduct certain comparisons with this grain.

It is well acknowledged that milo must be processed by one of the newer systems for acceptable gains and feed conversions to result when feeding cattle high concentrate diets. Other experiment stations using various methods of process corn have shown the greatest response in animal performance with flaking. However, with the increased energy costs for operating intensive grain processing systems, alternate methods must be utilized which require lower energy input. One of the alternatives is feeding whole corn in a minimum roughage diet.

Several trials have been summarized to evaluate 1) four alfalfa levers (40, 30, 20 and 10%) with dry rolled corn or flaked milo, 2) three corn processing methods (flake, dry roll or whole) with high concentrate diets and 3) corn versus milo.

PROCEDURE

Between September, 1976 and May, 1980 five feeding trials were conducted with 441 steers at the University of Arizona Tucson feedlot facility. All cattle originated from Texas and were placed on starting experiments prior to the finishing trials. During the starting experiments cattle were castrated and dehorned as necessary, branded, eartagged and treated for grub control.

The number of steers and trials for each grain treatment and roughage level are shown in Table 1. The 5% roughage level represents the amount of cottonseed hulls in the whole corn diet, and roughage levels 10 to 40% represent average amounts of alfalfa hay fed during the feeding trials with the respective grain treatments. The feeding system used to obtain these average alfalfa levels is given in Table 2. Experimental diets are shown in Tables 3 and 4; however, formulation for all roughage levels indicated in the feeding system is not given. Tallow was added to the corn diets when necessary to give the same ether extract as the milo diets which contained 3% added fat. Rumensin was added at 30 g per ton of diet to all treatments with the exception of trial 1 (flaked milo with 40, 30, 20 and 10% alfalfa).

In all trials steers were allotted by weight and type to experimental treatments, and two day initial and final weights were recorded with interim single day weights at 28 days. Depending upon the length of each feeding trial, steers were implanted at least once and sometimes twice with diethylstilbestrol and at least once with Synovex-S.

Using equations published by Lofgreen and Garrett (Journal of Animal Science 27:793) and regression analysis, net energy values were claculated for alfalfa hay, dry rolled corn and flaked milo (Table 7). Net energy values were derived from the following data: shrunk initial weights, daily feed intakes, feed dry matters, days on feed and shrunk daily gains from trials presented in Tables 5 and 6.

RESULTS

There was nc effect of alfalfa hay level on average daily gain of steers fed dry rolled corn (Table 5). Feed intake tended to increase with decreased amounts of dry rolled corn in the diet with intake on the 20% alfalfa diet being significantly lower than the 30 and 40% alfalfa diet being significantly lower than the 30 and 40% alfalfa diets. Feed efficiency increased linearly with decreased amounts of alfalfa hay in the diet with steers fed the 10 and 20% alfalfa diets being significantly more efficient than those fed the 30 and 40% alfalfa levels.

Unlike the dry rolled corn treatments, average daily gains for the flaked milo fed steers increased as alfalfa level was increased in the diet (Table 6). Steers fed the 10% alfalfa diet had a significantly lower average daily gain compared to steers on the 30 and 40% alfalfa treatments. Feed intake decreased linearly with increased levels of flaked milo with feed intake being significantly higher on the 30 and 40% alfalfa diets than for the 10% alfalfa level. Also, both average daily gain and feed intake were significantly higher for the 40% alfalfa treatment when compared to the 20% alfalfa diet. There were no significant differences in feed efficiency among steers fed the 10, 20, and 30% alfalfa diets or the 20, 30 and 40% alfalfa diets. However, feed efficiency was significantly improved for the 10% alfalfa treatment when compared to the 20% alfalfa level. The feed efficiency data suggests that dry rolled corn and flaked milo affect the utilization of alfalfa hay differently.

Net energy values for alfalfa hay, corn and milo from feeding trials conducted at the University of Arizona are compared with National Research Council (NRC) values (Table 7). From our station two different values for both net energy of maintenance (NEm) and net energy of gain NEg) were calculated for alfalfa hay: one set of values for alfalfa hay fed with flaked milo diets and one set of values for alfalfa hay fed with dry rolled corn diets. The NEm and NEg values for alfalfa hay fed with flaked milo diets and 10 and 17% higher (75 vs 68 and 49 vs 42 Mcal/100 lb) than the respective values for alfalfa hay fed with dry rolled corn diets. This indicates that alfalfa hay has a higher feeding value with flaked milo than with dry rolled corn. The net energy values for alfalfa hay from Arizona are markedly higher than values published by NRC, indicating that alfalfa grown in the desert southwest is of much higher quality than that represented by average NRC values.

The net energy values published by NRC for number 2 US corn grain were very similar to values for dry rolled corn from Arizona. The NEm and Neg values from this station for flaked milo were 26 and 27% higher (106 vs 84 and 71 vs 56 Mcal/100 lb) than for the respective values published by NRC for milo grain. It is suggested that adequate values be placed in the NRC publication to account for the increased value of certain grains due to the newer processing systems.

There was no significant difference in average daily gain among corn processing treatments (Table 8). Steers fed the whole corn diet had a significantly higher feed intake than those fed the flaked corn diet, but both treatments were not significantly different from the dry rolled corn diet. Feed efficiency was significantly higher for the flaked corn treatment when compared to the dry rolled and whole corn diets. The 9% improvement in diet efficiency for flaked corn over dry rolled corn is in general agreement with previous studies conducted at other experiment stations. Feed efficiency was 2% higher for the dry rolled corn diet than for the whole corn treatment. With small differences observed in animal performance between dry rolled and whole corn diets, and since whole corn diets are relatively easy to mix and feed, and processing and equipment costs are minimal, whole corn feeding is an attractive alternative to dry rolled corn in high concentrate diets.

There was no significant difference in average daily gain between grain type or processing method (Table 9). Feed intake was significantly higher for the dry rolled corn diet when compared to the flaked corn or milo treatments. Steers fed flaked corn or milo had a significantly higher feed efficiency than those fed dry rolled corn. The data indicates that both flaked corn and milo have the same feeding value when diets are equalized for ether extract content since both had the same improvement in diet efficiency (8%) over the dry rolled corn treatment.

OBSERVATIONS

1. Alfalfa has a higher feeding value when fed with flaked milo than with dry rolled corn.
2. Arizona net energy values for alfalfa hay and flaked milo are higher than NRC values.
3. Flaked corn improved feed efficiency 8% compared to dry rolled corn.
4. Whole corn is a satisfactory alternative to dry rolled corn in a high concentrate diet.
5. When diets were equalized for ether extract content there was no difference in steer performance between flaked milo and flaked corn.

TABLE 1. NUMBER OF STEERS[a] AND TRIALS

	GRAIN TYPE AND PROCESSING METHOD			
		CORN		
	Flaked Milo	Flake	Dry Roll	Whole
Roughage Level, %				
40	48 (3)[b]	--	32 (2)	--
30	48 (3)	--	31 (2)	--
20	48 (3)	--	32 (2)	--
10	77 (5)	47 (3)	47 (3)	--
5	--	--	--	31 (2)

[a]441 Steers.
[b]No. of trials.

TABLE 2. FEEDING SYSTEM

10% Roughage

25%, First 28 Days
10%, After 28 Days

20% Roughage

60%, First 28 Days
35%, 29-56 Days
25%, 57-84 Days
10%, After 84 Days

30% Roughage

60%, First 84 Days
25%, 85-112 Days
10%, After 112 Days

40% Roughage

60%, First 84 Days
40%, 85-140 Days
20%, 141-168 Days
10%, After 168 Days

TABLE 3. MILO DIETS

Roughage Level, %	60	25	10
Alfalfa Hay[a]	60.00	25.00	10.00
Milo	31.10	65.55	79.70
Molasses	4.00	4.00	4.00
Tallow	3.00	3.00	3.00
Urea	---	0.35	0.75
Dical	0.40	0.45	0.45
Salt	0.50	0.50	0.50
Limestone	---	0.15	0.60
Rumensin Premix	1.00	1.00	1.00
	100.00	100.00	100.00
Vitamin A-10-P, g	10	10	10
Nutrient composition (as fed basis)			
Protein, %	12.80	11.50	11.50
Calcium, %	1.00	0.52	0.52
Phosphorus, %	0.31	0.32	0.31

[a]Ground with 1% tallow to control dust.

TABLE 4. CORN DIETS

Roughage level, %	60	25	10	5[a]
Alfalfa Hay[b]	60.00	25.00	10.00	---
Cottonseed Hulls	----	----	----	5.00
Corn	32.15	67.85	82.05	90.00
Molasses	4.00	4.00	4.00	---
Tallow	2.00	1.00	1.00	---
Urea	---	0.25	0.45	---
Dical	0.35	0.30	0.30	---
Salt	0.50	0.50	0.50	---
Limestone	---	0.10	0.70	---
Rumensin Premix	1.00	1.00	1.00	---
WC Supplement	---	---	---	5.00
	100.00	100.00	100.00	100.00
Vitamin A-10-P, g	10	10	10	---
Nutrient composition (as fed basis)				
Protein, %	12.90	11.50	11.40	10.80
Calcium, %	1.02	0.54	0.53	0.50
Phosphorus, %	0.32	0.32	0.33	0.30

[a]Whole corn diet.

[b]Ground with 1% tallow to control dust.

TABLE 5. ALFALFA LEVELS WITH DRY ROLLED CORN[a]

Item	Avg. Alfalfa Level, %			
	40	30	20	10
No. Steers	32	31	32	31
Initial Wt., lb.	463	464	453	456
Gain, lb.	2.95	3.03	2.95	3.05
Feed, lb.	20.3[b]	20.2[b]	18.6[c]	18.8[bc]
Feed/gain	688[b]	668[b]	632[c]	616[c]

[a]Two trials; avg. 200 days. Feed intake based on 88% dry matter; gains based on unshrunk weights.

[b,c]$P < .05$

TABLE 6. ALFALFA LEVELS WITH FLAKED MILO[a]

Item	Avg. Alfalfa Level, % 40	30	20	10
No. Steers	48	48	48	46
Initial Wt., lb.	459	459	453	459
Gain, Lb.	2.94[b]	2.92[b]	2.75[cd]	2.73[d]
Feed, lb.	19.1[b]	18.1[bc]	17.1[cd]	16.1[d]
Feed/Gain	654[b]	620[bs]	623[bc]	597[c]

[a]Three trials; avg. 200 days. Feed intake based on 88% dry matter; gains based on unshrunk weights.

[b,c,d]P <.05

TABLE 7. COMPARISON OF NET ENERGY VALUES[a] FOR ALFALFA HAY, CORN AND MILO

Item	No. of Trials	No. of Steers	NEm (Mcal/100 lb)	NEg (Mcal/100 lb)
Alfalfa Hay				
- Arizona Station				
With flaked milo diets	3	190	75	49
With dry rolled corn diets	2	126	68	42
- National Research Council				
Hay, S-C, Late Vegetative (1-00-054)			57	28
Hay, S-C, Mid-Bloom (1-00-063)			53	22
Corn				
- Arizona Station				
Dry Rolled	2	126	101	68
- National Research Council				
Grain, GR 2 US (4-02-931)			104	67
Milk				
- Arizona Station				
Steam Processed & Flaked	3	190	106	71
- National Research Council				
Grain (4-04-444)			84	56

[a]All values expressed on a complete dry matter basis.

TABLE 8. CORN PROCESSING[2]

Item	Dry Roll	Flake	Whole
No. Steers	32	31	31
Initial Wt., lb.	519	523	517
Gain, lb.	3.03[bc]	2.96[b]	3.10[c]
Feed, lb.	19.2[b]	17.2[c]	20.1[b]
Feed/Gain	635	580	646
Improvement, %	---	9	-2

[a]Two trials; avg. 180 days. Feed intake based on 88% dry matter; gains based on unshrunk weights. Dry rolled and flaked corn diets contained 10% alfalfa hay; whole corn diet contained 5% cottonseed hulls.

[b,c]P <.05

TABLE 9. GRAIN TYPE AND PROCESSING METHOD[a]

Item	Corn		Flaked
	Dry Roll	Flake	Milo
No. Steers	47	47	46
Initial Wt., Lb.	507	514	509
Gain, Lb.	3.07	2.98	3.00
Feed, lb.	19.2[b]	17.2[c]	17.2[c]
Feed/Gain	626[b]	577 [c]	574 [c]
Improvement, %	---	8	8

[a]Three trials; avg. 180 days. Feed intake based on 88% dry matter; gains based on unshrunk weight. All diets contained 10% alfalfa hay.

PERFORMANCE OF GROWING CALVES FED KENAF HAY

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Summary

Research was initiated at this station in 1976 to evaluate kenaf as a forage crop in Arizona. Kenaf traditionally has been grown to maturity and used in making twine, cloth or paper. However, limited data from other stations suggested kenaf might be useful under immature harvesting systems as a forage crop.

Our initial studies, presented in the 1977 and 1978 Arizona Cattle Feeders Day Reports, showed that kenaf forage planted in April and harvested as sun-cured hay after 130 days growth was readily consumed by lambs and steers but was less digestible than alfalfa hay. Results of a small-plot study conducted to obtain information on the relationship between stage of maturity and nutritive value of kenaf forage were reported in 1979. Kenaf planted at Yuma in late June and harvested within 60 days appeared to be competitive with alfalfa hay in terms of crude protein content and in vitro digestibility. In comparison with conventional annual forages, kenaf had higher protein content at all stages of growth and, through 45 days, higher in vitro digestibility. However, from 60 to 105 days post-planting the quality of kenaf forage declined rapidly which is consistent with its history as a fiber crop. Estimated dry matter yields of kenaf were consistently lower than those of the conventional forages.

These data suggested that if kenaf were properly managed it might have potential as a forage crop in Arizona. Since there was no information on the levels of animal performance which might be attained on diets containing kenaf hay, this study was conducted to compare the performance of calves fed growing diets based on kenaf or alfalfa hay.

PROCEDURE

Kenaf hay used in this study was produced on the Yuma Experimental Farm. It was planted on July 9, 1979 and harvested 67 days later on September 13. The hay was cut and baled with conventional equipment but when compared with alfalfa hay harvested at the same time required an additional day of drying in the windrow before baling. Yield of baled hay was approximately two tons per acre. This hay appeared to be similar in quality to that harvested after 60 days growth in the earlier small plot study, although the crude protein content was slightly lower (10.8 vs 12.2%). As a point of reference, the in vitro digestibility of the 60-day samples from the small plot study was approximately the same as for alfalfa hay.