

KENAF VS ALFALFA HAY FOR GROWING BEEF CATTLE

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Story in Brief

The chemical composition and feeding value of immature kenaf and mature kenaf/crabgrass hays were evaluated relative to alfalfa hay. The protein content of the mature kenaf/crabgrass hay (4.8%) was low compared to the immature kenaf (10.4%) and alfalfa (19.2%). In vitro digestibility showed a similar response. These hays were fed in conjunction with 5.7 lb of a 20% crude protein supplement to 40 crossbred beef heifers (638 lb). After 10 days, heifers fed the immature kenaf consumed only 1.2 lb/day. Upon observation, it was noted that this hay was moldy and odoriferous. These heifers were then switched to the mature kenaf/crabgrass hay for an additional 36 days. Heifers consumed more of the mature kenaf/crabgrass hay (11.9 lb/day) than alfalfa hay (10.1 lb/day). Heifers fed alfalfa hay, however, gained .93 lb/day compared to .43 lb/day for heifers fed the mature kenaf/crabgrass blend. The chemical composition of the immature kenaf hay suggests that it could be used as a forage for beef cattle if the palatability problems can be resolved. Mature kenaf/crabgrass hay, however, does not provide a useful nutritional base for growing cattle.

(Key Words: Beef Cattle, Kenaf, Alfalfa.)

Introduction

Kenaf (*Hibiscus cannabinus*) is an annual herbaceous plant that can be used to make cordage, fire logs, cardboard and a newsprint that is higher in quality than that made from wood pulp. Prior to establishment of an industrial plant to process Oklahoma kenaf, however, adequate acreage must be established to support the industry.

The nutrient profile of immature kenaf is similar to that of alfalfa (Suriyajantratong et al., 1973). In addition, only 45 to 60 growing days are

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needed for kenaf to yield 2 to 3,000 lb of forage/acre. Thus, kenaf could be used as a double crop with wheat if soil moisture is adequate.

Kenaf has been shown to be as digestible as alfalfa for sheep (Suriyajantratong et al., 1973; Phillips et al, 1991). Studies with cattle, however, have utilized only kenaf silage. Consequently, the objective of this study was to evaluate the nutritional and feeding value of kenaf hay relative to early bloom alfalfa hay for beef cattle.

Materials and Methods

Kenaf was grown on two plots east of Stillwater, OK. Seed was planted in clean-tilled soil on July 1 for the first plot and on August 1 for the second plot. Fertilization and weed control were identical for both plots. Crabgrass was prevalent in the first plot while weed growth in the second plot was minimal. Hay was harvested in square bales on October 1.

Forty crossbred heifers (638 lb average weight) were randomly assigned to four pens for a growth study. Two pens received alfalfa hay while the remaining two pens received the kenaf (Trial 1) or kenaf/crabgrass (Trial 2) hay. Hay bales were core-sampled, weighed and fed in round bale feeders. In addition to the hay, each heifer was individually fed 5.7 lb of a feed that provided 1.0 lb of supplemental protein plus adequate calcium, phosphorus, salt and vitamin A (Table 1). Heifers were weighed following a 12-h withdrawal from feed and water. Trial 1 was aborted on day 10 because the heifers would not consume adequate quantities of the immature kenaf hay. The heifers were switched to the mature kenaf/crabgrass hay for an additional 36 days (Trial 2).

Table 1. Composition and feeding rate of supplemental feed.

Feed	% (as-is basis)
Ground corn	48.2
Wheat middlings	46.0
Molasses	3.1
Limestone	1.8
Trace mineralized salt	.90
Rumensin 60	.044
Vitamin A (30,000 IU/g)	.014
Feeding rate (lb/day)	5.71

Hay samples were ground and analyzed for dry matter, ash and crude protein content. Digestibility was estimated using the Tilley and Terry two stage in vitro procedure with ruminal fluid collected from a cannulated steer fed a 50:50 concentrate:roughage diet.

At the end of the growth study, ruminal samples were collected from three heifers in each pen. Ruminal pH was measured immediately. Ruminal samples were then acidified and frozen for later analysis of ammonia and volatile fatty acid concentrations.

Data from the growth study were subjected to least square analysis with heifer and initial heifer weight (covariate) included in the model. An F-test was used to evaluate treatment differences. Treatment differences for the laboratory analyses were determined with the LSD test.

Results and Discussion

Immature kenaf hay contained 10.4% crude protein (CP) and 16.0% ash with an in vitro digestibility of 51.0% (Table 2). The elevated ash content (16.0%) is higher than observed in previous studies (Suriyajantratong et al., 1973; Swingle et al., 1978) and cannot be explained. In contrast, the mature kenaf/crabgrass blend contained much less ($P < .05$) protein (4.8%) and was less ($P < .05$) digestible (42.5%) than the immature kenaf hay. The alfalfa hay used as a control in these studies contained 19.2% CP and was 55.4% digestible. The protein content and in vitro digestibility of the immature kenaf hay suggests that it could be a useful forage for cattle although the nutrient content of the mature kenaf/crabgrass suggests limited utility.

The growth study was initiated with heifers allocated to either immature kenaf or alfalfa hay. After 10 days, however, heifers consumed only 1.2 lb immature kenaf hay per day in addition to the 5.7 lb of supplemental feed. We noted that the immature kenaf hay was extremely moldy and odoriferous which

Table 2. Chemical composition and in vitro dry matter digestibility (IVDMD) of kenaf, kenaf/crabgrass and alfalfa hay.

	Kenaf	Kenaf/crabgrass	Alfalfa	SE
	----- % (DM basis) -----			
Ash	16.0 ^a	8.3 ^b	8.6 ^b	.21
Crude protein	10.4 ^b	4.8 ^c	19.2 ^a	.12
IVDMD	51.0 ^b	42.5 ^c	55.4 ^a	1.42

abc Means within a row with different superscripts differ ($P < .05$).

probably decreased the acceptability of the hay. Consequently, the heifers were switched to the mature kenaf/crabgrass hay.

In Trial 2, heifers consumed more mature kenaf/crabgrass hay (11.9 lb/d) than alfalfa hay (10.1 lb/d, Table 3). Total and daily gains, however, were doubled ($P < .001$) for heifers fed alfalfa hay compared to those fed the mature kenaf/crabgrass hay. Approximately 17 lb of total feed (hay plus supplement) were required to produce a pound of gain in the alfalfa group compared to 41 lb for the kenaf/crabgrass blend. Although the heifers fed the kenaf/crabgrass hay did gain weight, their performance was markedly inferior to heifers fed alfalfa hay.

Increased ruminal ammonia ($P < .0001$) and total VFA ($P < .003$) concentrations coupled with lower ($P < .007$) ruminal pH suggests that heifers fed alfalfa hay received a higher protein and more highly fermentable diet than heifers fed the mature kenaf/crabgrass blend (Table 4). In addition, reduced ($P < .006$) acetate (mol/100 mol) and a tendency for increased propionate ($P = .28$) and butyrate ($P = .08$) suggests that the fermentation in alfalfa-fed heifers produced a VFA profile that was more energetically favorable than in the kenaf/crabgrass heifers.

These studies suggest that immature kenaf has some nutritional characteristics that could justify its use as a livestock feed. The mold growth that occurred during haying must be reduced, however, to resolve the palatability problem. This hay was crimped and then baled after five days of normal, dry weather. The stalks were still moist at the time of baling and probably contributed the moisture for mold growth. The mature kenaf/crabgrass hay was harvested too late to be a useful forage for growing beef cattle. Because the nutritional value of immature crabgrass is quite high, it is reasonable to assume that an immature kenaf/crabgrass blend could be useful. This question remains to be resolved. Further studies are being conducted in an attempt to improve the quality of immature kenaf hay.

Table 3. Performance of beef heifers fed kenaf/crabgrass or alfalfa hay.

	Kenaf/crabgrass	Alfalfa	SE	Probability
Heifer body weight, lb				
Initial	626.3	649.8	9.10	
Final	641.8	683.1	9.50	
Change	15.5	33.3	3.58	.001
Gain, lb/day	.43	.93	.099	.001
Hay intake, lb DM/hd/d	11.9	10.1		

Table 4. Characteristics of ruminal fluid collected from beef heifers fed either kenaf/crabgrass or alfalfa hay.

	Kenaf/crabgrass	Alfalfa	SE	Probability
Ammonia, mg/dl	2.4	9.5	.91	.0001
pH	6.5	6.1	.10	.007
Total VFA, mmol/l	79.9	101.6	4.69	.003
VFA, mol/100 mol				
Acetate	61.0	58.4	.62	.006
Propionate	24.1	25.2	.70	.28
Isobutyrate	1.4	1.3	.06	.58
Butyrate	11.6	12.9	.53	.08
Isovalerate	1.4	1.2	.09	.20
Valerate	.6	1.0	.07	.0003
Acetate:propionate ratio	2.6	2.3	.09	.08

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