Evaluation of Kenaf as an Arizona Forage Crop: A Comparison with Conventional Annual Forages

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Research on kenaf as a potential forage crop in Arizona was initiated in response to the need for an annual crop which could be planted following harvest of small grains and be productive during the hot summer months. While kenaf traditionally has been grown to maturity and used as a fiber source for production of items such as twine and cloth, limited data from other stations suggest it might be useful as a forage crop under immature harvesting systems.

Initial studies conducted at this station, and presented in the 1977 and 1978 Arizona Cattle Feeders Day Reports, indicated that kenaf forage harvested after 130 days growth as sun-cured hay was readily consumed by lambs and steers but was definitely lower in quality than alfalfa hay. Chemical composition and in vitro dry matter disappearance data showed that kenaf forage harvested at earlier stages of maturity might be equivalent to alfalfa hay.

There is currently little information on the yield potential of kenaf grown as a short-season crop during the summer months in Arizona. Additional information is also needed on the relationship between stage of maturity and nutritive value of this crop and on the relative usefulness of kenaf forage in comparison with conventional annual forages. Therefore, in this study nutritive value and yield of kenaf was estimated over six harvest dates and compared with data from three conventional forages grown under the same conditions.

PROCEDURE

Four replicate plots (54 m^2) each of kenaf (Everglades 71), forage sorghum (DKFS-25A), sudangrass (Calif. No. 23), and sorghum x sudangrass (DK SX-17) were planted June 29 on the Yuma Experimental Farm. At 14-day intervals beginning 30 days post-planting and extending through six harvests (105 days), approximately 3 m^2 of each plot were harvested. The forages were compared at each harvest date on the basis of percent crude protein, in vitro dry matter disappearances (IVDMD) and yields per hectare of total dry matter, digestible dry matter and crude protein.

RESULTS

Crude protein content of all forages decreased dramatically with increasing maturity (table 1). However, kenaf had the highest ($P < .05$) protein content at all harvest dates and contained more than 10% protein through 60 days growth. There was little difference in protein content among the conventional forages at any harvest and all were below 10% protein for all but the first (30 day) harvest.

The IVDMD data are shown in table 2. Consistent with its background as a fiber crop, IVDMD of kenaf decreased rapidly with increasing maturity. Kenaf forage harvested up to 60 days post-planting was superior or equal to an alfalfa hay standard in IVDMD, but by 90 days the IVDMD was approximately the same as for wheat straw. At 30 and 45 days, kenaf had higher ($P < .05$) IVDMD than the other forages but this advantage was lost by 60 days. From 60 to 105 days, IVDMD of kenaf was similar to that of sorghum x sudangrass and sudangrass. Forage sorghum showed the least decline in IVDMD with advancing maturity and was superior ($P < .05$) to kenaf at 90 and 105 days.

Dry matter yield increased linearly with time for all forages with kenaf consistently producing lower yields than the others (table 3). The differences in yield were particularly apparent at the early harvests (30 through 60 days) when yields from the conventional forages were approximately two to four times greater than the kenaf.

These differences in total yield had a marked effect on yields per hectare of crude protein (table 4) and digestible dry matter (table 5). Despite its higher ($P < .05$) protein content, kenaf did not produce more protein per hectare than did the conventional forages. All forages were similar in protein production per hectare except at the first cutting date when forage sorghum and sorghum x sudangrass yielded twice as much protein ($P<.05$) as kenaf and sudangrass. At all harvest dates, digestible dry matter yields for kenaf were lower ($P < .05$) than the forage sorghum and sorghum x sudangrass, and tended to be lower ($P > .05$) than for sudangrass. Again, this lower production by kenaf was most apparent during the early harvest even though kenaf had a definite advantage over the conventional forages in percent IVDMD.

The protein and IVDMD data confirm earlier observations that kenaf has considerable potential as a feedstuff for ruminants if harvested at an early stage of maturity. It appears that kenaf planted in the Yuma area after harvest of winter wheat and grown for 45 to 60 days would be approximately equal to alfalfa hay, and superior to the conventional annual forages in nutritive value. At later maturities, kenaf would still be competitive with sudangrass and forage sorghum x sudangrass. It is apparent, however, that at this time kenaf is not competitive with the conventional forages in terms of yield. Additional research is needed to determine the yield potential of other varieties of kenaf and

to refine agronomic practices for production of kenaf forage.

OBSERVATIONS

1. Kenaf hay had the highest crude protein content at all harvest dates ranging from 25% at 30 days to 5% at 105 days when compared to the more conventional forages, forage sorghum, sorghum x sudangrass and sudangrass.

2. Kenaf hay had higher IVDMD content when harvested at early stages of maturity (30 to 45 days) than the conventional forages although it showed a steeper rate of decline in IVDMD after 60 days.

3. Dry matter yields of kenaf were lower than those of the conventional forages. The lower dry matter yields of kenaf resulted in a lower nutrient yield per unit of land than for the conventional forages.

4. Additional research is needed to improve yields if kenaf is to become competitive as an annual forage crop.

TABLE 1. CRUDE PROTEIN CONTENT OF KENAF AND OTHER ANNUAL FORAGES AT SIX HARVEST DATES

Harvest, days post-planting	Forage			
	Kenaf	Forage sorghum	Sorghum x sudangrass	Sudangrass
	CP, % of Dry Matter			
30	24.6[a]	15.2[c]	16.5[c]	20.7[b]
45	19.2[a]	8.0[b]	7.3[b]	9.8[b]
60	12.2[a]	5.1[b]	4.4[b]	5.6[b]
75	8.0[a]	3.7[b]	3.5[b]	4.2[b]
90	6.5[a]	3.4[b]	3.5[b]	4.2[b]
105	4.7[a]	3.4[b]	3.4[b]	2.9[b]

[a,b,c]Means on the same line with different superscripts are different ($P < .05$).

TABLE 2. IN VITRO DRY MATTER DISAPPEARANCE[a] OF KENAF AND OTHER ANNUAL FORAGES AT SIX HARVEST DATES

Harvest, days post-planting	Forage			
	Kenaf	Forage sorghum	Sorghum x sudangrass	Sudangrass
	% IVDMD			
30	82.2[b]	66.0[c,d]	63.3[d]	69.5[c]
45	73.9[b]	63.6[c]	64.0[c]	64.7[c]
60	64.6[b]	65.3[b]	61.7[b,c]	59.9[c]
75	56.1[b,c]	60.6[b]	58.7[b,c]	52.5[c]
90	51.0[b]	61.2[c]	57.0[b,c]	50.8[b]
105	53.5[b,c]	62.5[d]	56.9[c]	48.6[b]

[a]Determine by a two-stage technique. The IVDMD of standard alfalfa hay and wheat straw were 64% and 52%, respectively.

[b,c,d]Means on the same line with different superscripts are different ($P < .05$).

TABLE 3. DRY MATTER YIELDS OF KENAF AND OTHER ANNUAL FORAGES AT SIX HARVEST DATES

Harvest, days post-planting	Forage			
	Kenaf	Forage sorghum	Sorghum x sudangrass	Sudangrass
	kg per hectare			
30	182[a]	686[b]	644[b]	255[a]
45	1123[a]	2716[b]	3139[b]	2441[b]
60	3009[a]	8504[c]	6143[b,c]	5051[a,b]
75	4426[a]	10335[c]	8810[b,c]	6901[a,b]
90	8196[a,b]	11107[c]	10905[b,c]	7215[a]
105	9442[a]	15398[b]	13327[b]	9725[a]

[a,b,c]Means on the same line with different superscripts are different (P<.05).

TABLE 4. YIELD OF CRUDE PROTEIN FROM KENAF AND OTHER ANNUAL FORAGES AT SIX HARVEST DATES

Harvest, days post-planting	Forage			
	Kenaf	Forage sorghum	Sorghum x sudangrass	Sudangrass
	kg per hectare			
30	45[a]	105[b]	105[b]	52[a]
45	215	217	229	239
60	374	434	266	288
75	361	382	315	283
90	552	375	387	305
105	444[a,b]	520[a]	395[a,b]	328[b]

[a,b]Means on the same line with different superscripts are different (P < .05).

TABLE 5. YIELD OF DIGESTIBLE DRY MATTER[a] FROM KENAF AND OTHER ANNUAL FORAGES AT SIX HARVEST DATES

Harvest, days post-planting	Forage			
	Kenaf	Forage sorghum	Sorghum x sudangrass	Sudangrass
	kg per hectare			
30	149[b]	455[c]	407[c]	176[b]
45	830[b]	1722[c]	2019[c]	1583[b]
60	1948[b]	5513[d]	3778[c]	3015[b,c]
75	2486[b]	6316[d]	5165[c,d]	3609[b,c]
90	4228[b]	6802[c]	6200[c]	3649[b]
105	5039[b]	9681[c]	7601[c]	4705[b]

[a]Estimated from % IVDMD.

[b,c,d]Means on the same line with different superscripts are different (P< .05).