

Effect of Nitrogen Rate, Tillage Method and Cover Crop on Biomass Yield of Kenaf

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ABSTRACT

Everglades 71 kenaf was planted May 29, 1991 at 8 lb/acre. Before planting 73 lb/acre each of P_2O_5 and K_2O was applied. Nitrogen (N) was applied sidedress when kenaf was 4 inches tall. Tilled plots were roto-tilled prior to planting. Analysis 1. Eleven treatments consisted of 5 N rates (0, 34, 68, 102, and 136 lb/acre) on prepared seedbed, 4 N rates (34, 68, 102, and 136 lb/acre) and two legume cover crops on no-till plots. Highest yields were obtained with 102 lb N/acre with both till and no-till. Lowest yields were with no-till planted in legume cover crops. Kenaf yield from 0 N treatments was not different from highest N treatments. Final plant heights showed no differences due to treatment. Analysis 2; (split plot). In order to more closely study the effect of N rate and tillage method both legumes and the 0 N were deleted. Treatments consisted of two tillage methods and four N rates. No-till planted kenaf had lower initial and final populations than till. There were no differences in final plant height, yield, or lodging due to N rate or tillage.

INTRODUCTION

Kenaf is not a new crop in the United States, but it is experiencing a rebirth of interest. In the early 1970s it was introduced to south Mississippi but lack of effective storage methods made commercialization impossible (2). Solutions to this problem have been found, bringing commercialization closer.

The recommended cultural practice for planting kenaf is a well prepared seedbed. Preparing a seedbed increases production cost and has the potential to increase soil erosion (1).

Limited information is available on the response of kenaf to legume N or tillage method. Research in Florida and Georgia showed that fertilizer N rates greater than 103 kg ha⁻¹ did not increase yields (4). In Kansas, research has shown that N rates over 51.5 kg ha⁻¹ do not increase yields (5). In Alabama, cotton, which is in the same family as kenaf, planted after legume cover crops produced lint yields comparable to cotton fertilized with inorganic N rates up to 68 kg ha⁻¹ (3).

METHODS

Kenaf was planted conventionally and no-till at a rate of 8 lb/acre. Four N rates (34, 68, 102, and 136 lb/acre) were applied to each tillage treatment when the kenaf was 4 inches tall. Three additional treatments were: no-till planted after two cover crops (Tibbee crimson clover and Cahaba white vetch) and a 0 N tilled treatment. Plot size was four 40-inch-wide rows 20 feet long. Cover crops were planted November 1, 1990. Potash and phosphorous were applied at a rate of 73 lb/acre prior to planting. Cover crops were killed with herbicides in early May and kenaf planted May 29 using a John Deere Model 7100 conservation tillage planter equipped with rippled coulters.

Ten plants per plot were measured from the ground to the tip of the stalk and averaged to get plant height. Plant population was determined by counting plants per 12 feet of row at emergence and harvest. Lodging was rated on a value scale at harvest (1=all plants erect, 10=all plants prostrate). Plants from thirteen feet of row were cut two inches above the ground October 13, weighed, and moisture samples taken to determine biomass yield.

Two analyses of this experiment were made:

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one as a randomized complete block, and a second as a split plot comparing N rates between till and no-till after eliminating the cover crop and 0 N treatments.

RESULTS AND DISCUSSION

Analysis 1. RCB design. There were differences in plant height early in the season which continued through mid-season (data not shown) but at harvest there were no significant differences ($P < 0.05$) in height attributable to treatments (Table 1). The highest rates of N did not produce the fastest growing or tallest plants.

There were differences (NS) in plant stand at emergence with more plants per acre in the tilled plots with 0 N and lower N rates than in the other treatments (Table 1). There was a greater percentage loss of stand in the kenaf planted no-till in crimson clover than in plots planted till with the highest N rates.

The greatest lodging was in the no-till planted legume plots. The lowest occurred in the no-till treatment with the three highest N rates and the highest till N rate (Table 1). It appeared that there was a greater incidence of collar rot (*Sclerotium rolfsii*) in the legume cover crop plots.

The lowest yielding treatment was kenaf no-till planted in both legume cover crops (Table 1). This was attributed to disease problems. The yield from the 0 N treatment was not different from either the lowest or highest yielding treatments.

Analysis 2. Split plot design. During the early season plants in tilled plots were taller than those in no-till and plants fertilized with 68 lbs of N were taller than those with 136 lbs (early season data not shown). In both instances as the season progressed differences disappeared. There was no interaction between tillage method and N rate (Table 2).

There were differences in final plant stand attributable to both N rate and tillage method.

Kenaf fertilized with 68 lb/acre of N had more plants per acre than that fertilized with 136 lb/acre but these were not different from the other treatments (Table 3). Kenaf planted no-till had lower plant stands than on a prepared seedbed. There was no interaction between tillage method and N rate.

Lodging ratings ranged from 1.9 to 4.8 but there were no differences attributable to N rate or tillage method. There was no interaction between N rate and tillage method (Table 4).

Yields ranged from 11,000 to 14,000 lb dm/acre but there were no differences in yield attributable to N rate or tillage method (Table 5). There was no interaction between tillage method and N rate.

CONCLUSIONS

These data indicate that kenaf can be a viable crop if a market can be established. Kenaf yield was not adversely affected by no-tillage culture in this study. Kenaf appears to be a crop that is not a heavy user of N making it an even more attractive crop. Cultural practices must be developed which reduce cost, produce economic yields, and conserve soil.

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Table 1. Effect of nitrogen rate, tillage method and cover crop on kenaf plant
stand, plant height, lodging and yield.

N Rate	Cover crop	Tillage	Plant Counts			Plant height	Lodg- ing	Yield
			init.	final	% Loss			
			plants/12 ft			inches	rating'	lb/acre
34	none	NT	24	21	15	106	5.0	9996
68	none	NT	36	32	15	107	1.8	12722
102	none	NT	21	17	22	110	3.2	13862
136	none	NT	15	12	17	109	2.0	9896
0	clover	NT	23	15	36	110	7.7	6916
0	vetch	NT	23	17	25	108	7.0	7904
34	none	T	45	38	15	102	4.5	12135
68	none	T	54	43	19	103	4.2	12785
102	none	T	31	28	8	110	3.5	14754
136	none	T	22	22	2	108	1.8	13188
0	none	T	58	45	21	102	5.0	10107
	Mean		32	26	17	107	4.2	11280
	LSD (.05)		16	13	19	NS	3.1	3997
	CV%		35	35	74	6	52	25

1=all plants erect 10=all plants prostrate.

Table 2. Effect of nitrogen rate and tillage method on kenaf final plant height.

Nitrogen rate (lb/acre)	No - till	Till	Average
34	106	103	104
68	107	103	105
102	110	110	110
136	109	108	108
Mean	108	106	

Table 3. Effect of nitrogen rate and tillage method on kenaf final plant stand.

Nitrogen rate (lb/acre)	No-till	Till	Average
	-----plants/12 ft-----		
34	21.5	37.8	29.6ab
68	31.3	42.5	36.9a
102	17.0	28.5	22.8ab
136	11.8	22.2	17.0b
Mean	20.4b*	32.8a	

• Means followed by the same letter are not significantly different ($P < .05$) according to Duncan's Multiple Range Test.

Table 4. Effect of nitrogen rate and tillage method on kenaf lodging.

Nitrogen rate (lb/acre)	No-till	Till	Average
34	5.0	4.5	4.8
68	1.8	4.3	3.0
102	3.3	3.5	3.4
136	2.0	1.8	1.9
Mean	3.0	3.5	

Table 5. Effect of nitrogen rate and tillage method on yield of kenaf.

Nitrogen rate (lb/acre)	No-till	Till	Average
	-----lb/acre-----		
34	9996	12135	11066
68	12721	12784	12753
102	13862	14574	14218
136	9896	13188	11542
Mean	11619	13171	