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Preemergence Herbicide Trials in Kenaf

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Introduction

Kenaf (*Hibiscus cannabinus*) has been grown as a source of soft fiber for several thousand years in Africa even though commercial production did not occur until after World War II. An extensive review of kenaf research was compiled as far back as 1795 (6).

Kenaf has been under investigation as a potential alternative crop in the United States for many years (2, 5, 13). Research thrusts have investigated cultivar assessment (4), plant density (3), fertilization rates (15), and planting rates (3).

While commercial endeavors with kenaf now look promising, commercialization depends partly on the development of safe, economical, weed control practices. Williams (15) reported an 810 lb/A yield loss from weed competition. Kurtz and Neill (10, 11) found 75 to 85% kenaf yield reductions from a common cocklebur (*Xanthium strumarium* L.) and johnsongrass [*Sorghum halepense* (L.)) pers.] mixture. Hickman (8) observed substantial competition from parthenium ragweed (*Parthenium hysterophorus* L.), and Fageiry (7) reported >38% yield reduction by weeds.

Early weed control research efforts (2, 5, 13) evaluated several herbicides for weed control, some of which are no longer available. Dean and Parker (5) reported excellent kenaf selectivity with Lasso® at 0.9 lb/A and Hickman (8) saw no visual injury symptoms from Lasso at 2.0 or 4.0 lb/A. Neither investigation reported yield from mature kenaf. Orsenigo (13) reported a 25% and 38% kenaf stand loss from Aatrex® at 2.68 lb/A from granular and sprayable applications, respectively.

In preliminary research, Kurtz and Neill (10) saw 64% kenaf injury from Aatrex (2.4 lb/A), and 94% kenaf

injury from Canopy® (0.60 lb/A) 28 days after emergence. They also reported 18% injury from Command® (1.5 lb/A), 8% with Bladex® (1.8 lb/A), 60% with Direx® (1.2 lb/A), 18% with Meturon® (1.8 lb/A), 94% with Scepter® (0.15 lb/A), 41% with Sencor® (0.45 lb/A), and 44% with Zorial® (1.6 lb/A).

Hickman (8) found that Sonalan® applied preemergence (PRE) at 0.99 and 1.5 lb/A caused no visual injury symptoms, and kenaf yield was not different from the untreated control. Kurtz and Neill (12) observed the effects of postemergence (POST) treatments of Scepter (0.06 lb/A) and Pursuit® (0.03 lb/A) on cotyledonary and 14 inch kenaf. Kenaf injury for both compounds was >50% at the cotyledonary growth stage and >56% injury for both treatments at the 14-inch growth stage.

Webber (14) and Hickman (8) each tested the response of kenaf to Dual® and found no reduction in yield. However, Webber observed significant stand reductions when compared to the weed-free control. Fageiry (7) evaluated the response of kenaf to Prowl® (1.0 lb/A), recording no visible crop injury or yield loss.

Since production of kenaf in Mississippi has increased to a commercial level, it is of utmost importance that herbicides be registered for use in this new crop. Kenaf will be grown on less productive cotton (*Gossypium hirsutum* L.) land and all soil types capable of producing soybeans (*Glycine max*). The total estimated losses due to weeds for these two crops in Mississippi in 1994 was $107,526,000 (1), with losses occurring from a combination of increased herbicide costs, reduced yield, loss in quality, extra land preparation and cultivation, and increased cost of harvesting. Therefore, weed control is essential for economic kenaf production on these soil types in Mississippi.

The objective of this research was to evaluate the influence of several preemergence herbicides on kenaf stand, phytotoxicity, height, and yield.

Materials and Methods

Herbicide trials were conducted near Charleston, Mississippi, on a Cascilla silt loam soil (fine-silty, mixed, thermic, Fluventic Dystrochrepts) in 1990 and on a Falya silt loam (coarse-silty, mixed, acid, thermic Ardic argiustolls) in 1992. Herbicides were applied PRE with a CO_2-powered backpack sprayer calibrated to deliver 20 gpa. Soil temperature was 64 and 75 °F in 1990 and 1992, respectively, and was moist at the time of application. Kenaf was planted and treatments applied on May 8, 1990 and May 21, 1992. In 1990, 3 inches of rainfall occurred 4 days after treatment (DAT). No rainfall occurred within 2 weeks after treatment (WAT) in 1992.

Plots consisted of four 15-foot rows spaced 30 inches apart in 1990 and four 20-foot rows spaced 40 inches apart in 1992. Herbicides evaluated were Aatrex (atrazine 2.4 lb/A), Bladex (cyanazine 1.8 lb/A), Canopy (chlorimuron + metribuzin 0.6 lb/A), Command (clomazone 1.5 lb/A), Direx (diuron 1.2 lb/A), Dual (metolachlor 2.7 lb/A), Lasso (alachlor 3.0 lb/A), Meturon (fluometuron 1.8 lb/A), Prowl (pendimethalin 1.2 lb/A), Pursuit (imazethapyr 0.08 lb/A), Scepter (imazaquin 0.15 lb/A), Sencor (metribuzin 0.45 lb/A), Sonalan (ethalfluralin 0.9 lb/A), or Zorial (norflurazon 1.5 lb/A).

Treatments were arranged in a randomized complete block design with four replications. Kenaf tolerance was evaluated based on stand counts taken before kenaf reached 12 inches in height; visual estimation of phytotoxicity on a scale of 0 to 100%, with 0% = no injury and 100% = complete necrosis and death; plant height; and yield, reported on an oven-dry basis (160 °F drying for 72 hours). Kenaf was grown to maturity (at least 180 days) and 17 feet or 13 feet were harvested from the center two rows in 1990 and 1992, respectively. Plots were maintained weed-free on an as-needed basis by hand hoeing.

In 1995, Staple® [DPX-PE350, 0.1 lb ai/A PRE, 0.05 lb/A PRE, 0.05 lb/A PRE followed by (fb) 0.05 lb/A POST and 0.026 lb/A PRE fb 0.026 lb/A POST] and Treflan® (trifluralin 1.0 lb ai/A preplant incorporated (PPI)] were evaluated for effects on kenaf height and yield at the Delta Branch Experiment Station, Stoneville,

Mississippi. The soil type was a Tunica clay loam (clayey over loamy, Montmorillonitic, nonacid, thermic, Vertic Haplaquepts). The herbicides were applied the same as in 1990 and 1992. Plots consisted of four 33-foot rows spaced 30 inches apart. Treatments were arranged in a randomized complete block design with four replications. Visual estimates of phytotoxicity, height measurements, and yield were determined as in 1990.

All data were subjected to analysis of variance within and across years except for the Treflan and Staple data where only one year was available. Where a significant F test was found, mean values were separated using LSD at P=0.05 level of probability. Data for each year are presented separately because of significant (P=0.05) year-by-treatment interactions.

Results and Discussion

Stand

Kenaf stand was reduced in 1990 by Lasso, Meturon, Pursuit, or Zorial when compared to the untreated control. Stand was reduced both years by Aatrex, Bladex, Canopy, Command, Direx, Scepter, or Sencor when compared to the untreated control. Stand was not affected either year by Dual, Prowl, or Sonalan (Table 1). Stand reductions have been reported (14) without a corresponding yield reduction. Since stem diameter is considered a component of yield along with height, the author feels that the ability of kenaf to increase in stem diameter as population decreases is a major reason for no yield reduction at low plant densities. This occurred with Command, Lasso, and Pursuit in 1990 and with Bladex and Pursuit in 1992 (Tables 1 and 4).

Research needs to be conducted to determine the degree of stand reduction that can occur before yields are impacted negatively. A possible explanation as to why certain chemicals reduced stand in 1990 and not in 1992 could be attributed to rainfall. In every case, when stand reduction occurred in one out of two years, it happened in 1990. In 1990, 3 inches of rainfall occurred within 4 DAT and no rainfall occurred within 2 WAT in 1992. The rain-free period allowed kenaf ample time to germinate and possibly establish roots below the herbicide-treated zone.

Phytotoxicity

Phytotoxicity ratings were more consistent from year to year than the stand reduction ratings. The following herbicides did not cause kenaf injury symptoms expressed in phytotoxicity: Dual, Lasso, Prowl, Pursuit, and Sonalan. Aatrex, Bladex, Canopy, Command, Direx, Meturon, Scepter, Sencor, or Zorial injured kenaf when compared to the untreated control both years (Table 2).

In a study by Kurtz(9), Bladex and Direx were used safely in kenaf when applied postemergence-directed to the lower one-third of kenaf stem. Webber (14) concluded that Dual did not injure kenaf in either year of a 2-year study. Hickman (8) saw no injury symptoms with Lasso or Sonalan. The findings of this research were also consistent with Fageiry (7) for no injury with Prowl. These data agree with a preliminary study (10), finding kenaf injury with Aatrex, Bladex, Canopy, Command, Direx, Meturon, Scepter, Sencor, and Zorial. The experiment in 1995 with Treflan and Staple did not show any kenaf phytotoxicity (data not shown).

Height

Aatrex, Canopy, Direx, Meturon, or Scepter caused kenaf height reduction in both years compared to the control (Table 3). Applications of Bladex, Command, or Sencor caused height reduction in one out of two years when compared to the control. Dual, Lasso, Prowl, Pursuit, Sonalan, or Zorial did not reduce kenaf height. In every case where height was reduced one out of two years, it happened in 1990 with the exception of Command. This also might be explained by rainfall as previously described. In 1995, Treflan and Staple (Table 5) did not reduce kenaf height at any rate or application method.

Yield

Of the herbicides tested, only Dual, Lasso, Prowl,Pursuit, or Sonalan did not reduce kenaf yield below the untreated control. Studies by Fageiry (7), Hickman (8), and Webber (14) substantiate these findings. Aatrex, Canopy, Direx, Meturon, or Sencor reduced yield both years when compared to the untreated control. Bladex, Command, Scepter, or Zorial reduced yield one out of two years when compared to the untreated control (Table 4). No yield loss was associated with Treflan or Staple (Table 5). However, there was a lower (practical) yield associated with the Treflan treatment because of associated weed interference (personal observation).

Conclusion

Aatrex, Canopy, and Direx caused stand reduction, significant phytotoxicity, height reduction, and yield loss when applied PRE to kenaf in both years of this study. In addition to these herbicides, Bladex, Command, Scepter, and Sencor caused stand reduction and significant phytotoxicity in both years plus height or yield reductions in some cases.

The herbicides Dual, Lasso, Prowl, Pursuit, or Sonalan did not decrease yield. These herbicides control many problem weeds in Mississippi and will be recommended for registration in Mississippi under the Federal Insecticide, Fungicide, and Rodenticide Act, Section 24(c).

Treflan has a Section 3 registration in kenaf, and further studies need to be completed with Staple before a decision can be made about its acceptability in kenaf production. These herbicides provide control of many problem weeds in Mississippi. Registration of these herbicides for use in kenaf would provide the producer effective, crop tolerant weed control.

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Table 1. Preemergence herbicide influence on kenaf stand in 1990 and 1992, Charleston, Mississippi.

Herbicide	Application	Kenaf stand	
Treatment	**Rate**	**1990**	**1992**
	lb ai/A	**plants/A**	
Aatrex	2.4	0	18,295
Bladex	1.8	435	37,570
Canopy	0.6	0	4,247
Command	1.5	27,878	2,940
Direx	1.2	435	28,749
Dual	2.7	50,530	79,388
Lasso	3	37,461	76,121
Meturon	1.8	0	63,706
Prowl	1.2	47,045	78,735
Pursuit	0.08	37,897	71,548
Scepter	0.15	37,026	49,332
Sencor	0.45	2,178	38,877
Sonalan	0.9	57,935	76,774
Zorial	1.5	9,583	64,360
Untreated	0.00	54,450	85,596
LSD P=0.05[a]		8944	23872

[a]For comparison of any two means within a column.

Table 2. Preemergence herbicide influence on kenaf

phytotoxicity in 1990 and 1992, Charleston, Mississippi.

Herbicide	Application	Kenaf phytotoxicity	
Treatment	**Rate**	**1990**	**1992**
	lb ai/A	**%**	
Aatrex	2.4	100	76
Bladex	1.8	95	59
Canopy	0.6	100	99
Command	1.5	51	99
Direx	1.2	95	40
Dual	2.7	0	0
Lasso	3.0	0	4
Meturon	1.8	100	33
Prowl	1.2	0	0
Pursuit	0.08	8	16
Scepter	0.15	13	46
Sencor	0.45	95	79
Sonalan	0.9	0	0
Zorial	1.3	90	30
Check	0.0	0	0
LSD P=0.05[a]		9	20

[a]For comparison of any two means within a column.

Table 3. Preemergence herbicide influence on kenaf height in 1990 and 1992, Charleston, Mississippi.

Herbicide	Application	Kenaf height	
Treatment	**Rate**	**1990**	**1992**
	lb ai/A	**%**	
Aatrex	2.4	0	68
Bladex	1.8	0	157
Canopy	0.6	0	30
Command	1.5	104	61
Direx	1.2	0	122
Dural	2.7	99	159
Lasso	3.0	106	163
Meturon	1.8	7	128
Prowl	1.2	101	174
Pursuit	0.08	93	152
Scepter	0.15	69	119

Sencor	0.45	0	149
Sonalan	0.9	101	175
Zorial	1.5	103	162
Untreated	0.00	105	172
LSD P=0.05[a]		19	28

[a]For comparison of any two means within a column.

Table 4. Preemergence herbicide influence on kenaf yield in 1990 and 1992, Charleston, Mississippi.

Herbicide	Application	Kenaf yield	
Treatment	Rate	1990	1992
	lb ai/A	%	
Aatrex	2.4	0	1.65
Bladex	1.8	0	4.42
Canopy	0.6	0	0
Command	1.5	4.91	0
Direx	1.2	0	3.52
Dual	2.7	5.21	5.29
Lasso	3.0	7.01	6.14
Meturon	1.8	0.22	3.19
Prowl	1.2	5.56	5.04
Pursuit	0.08	4.56	5.41
Scepter	0.15	3.47	3.82
Sencor	0.45	0	2.69
Sonalan	0.9	6.86	5.76
Zorial	1.5	3.32	4.74
Untreated	0.00	5.66	5.44
LSD P=0.05[a]		1.96	1.75

[a]For comparison of any two means within a column

Table 5. Influence of Treflan and Staple on kenaf height and yield in 1995.

Herbicide	Application	Method of		
Treatment	Rate	application	Height	Yield
	lb ai/A		ft	t/A
Staple	0.1	Pre	4.76	7.1
Staple	0.05	Pre	4.87	6.7
Staple	0.05	Pre	4.73	6.5

	fb 0.05	Post		
Staple	0.026	Pre	4.83	6.9
	fb 0.026	Post		
Treflan	1.0	PPI	4.73	5.9
LSD P=0.05	NS	NS		