msucares
Coordinated Access to the Research and Extension System
Mississippi Agricultural and Forestry Experiment Station

The Effect of Post-Directed and Over-the-top Application of Herbicides on Kenaf

Bulletin 1046 -- June 1996

Mark E. Kurtz
Plant Physiologist
Delta Research and Extension Center

Published by the Office of Agricultural Communications (Publications), Division of Agriculture, Forestry, and Veterinary Medicine, Mississippi State University.

Introduction

Dempsey, (6) compiled an extensive review of the literature covering many aspects of kenaf (*Hibiscus cannabinus* L.) production. Kenaf has been grown for food and fiber for centuries in the tropics (20) but has not yet been commercialized on a large scale in the United States. Interest in using various end-products has spurred renewed agronomic research on kenaf (4, 7, 10, 15, 17). Initially, kenaf was intended for use as paper pulp, but other plant characteristics indicated its applicability to livestock feed, particle board, broiler litter, extraction-molded plastics using kenaf fibers, oil and water absorption products, and erosion mats (2, 12, 14, 16, 18).

While et al. (19) stated that no weed control is needed in drilled narrow row plantings in Southern Florida, but conceded that ultimately a preplant or preemergence application of an effective herbicide would help to control weeds until kenaf plants are well established.

In order to obtain optimum kenaf yields in Mississippi, weeds must be controlled. Moderate to large yield reductions in kenaf have been reported from weed competition. For example, yield has been reduced 0.44 ton/A (21) without mention of interfering species, and as much as 85% from a johnsongras [*Sorghum halepense* (L.) Pers.] and common cocklebur (*Xanthium strumarium* L.) mixture (19).

Research has demonstrated the effects of soil-applied herbicides on kenaf (3, 5, 7, 8, 12). Many herbicides caused excessive injury or are no longer available. Other studies have been conducted with herbicides that are presently available. Orsenigo (13) found a 50% stand reduction with diuron applied preemergence. Kurtz and Neill (9) observed 60% injury with a preemergence application of diuron 28 days after emergence (DAE), whereas cyanazine caused little or no injury and fluometuron resulted in 18% kenaf injury. These trials received 7 inches of rainfall within 24 hours after treatment, and kenaf was replanted into herbicide-treated soil. However,

postemergence-directed (POST-Dir) applications of diuron (0.5 lb/A) and cyanazine (0.8 lb/A) caused <10% injury 14 days after treatment (DAT) with no yield loss (11).

An experiment conducted with lactofen, applied over-the-top on cotyledonary and 14-inch tall kenaf, caused >85% injury at both growth stages (10), but when applied POST-Dir at 0.18 lb/A, injury was <10% 14 DAT with no yield loss (11).

Kurtz (11) evaluated MSMA (2.0 lb/A) mixed with one rate of cyanazine (0.8 lb/A),diuron (0.5 lb/A), or lactofen (0.18 lb/A). Injury to the lower one-third of kenaf stems was as follows: cyanazine ranged from 5 to 16% in five out of six tests, with a high of 76% in one test; diuron ranged from 4 to 14%, with a high of 70% in another test; lactofen ranged from 9 to 39%, with a high of 99% in one test where herbicide spray covered the lower one-half of the stem. All of these injury symptoms were <10% by 14 DAT, and yield was not affected. An experiment conducted with acifluorfen (0.38 lb/A), lactofen (0.15 lb/A), and fomasafen (0.25 lb/A) applied over-the-top (OT) on cotyledonary and 14-inch tall kenaf plants caused >95% injury with aciflurofen, >88% injury with lactofen and fomasafen (10).

The objective of these studies was to evaluate the tolerance of kenaf to selected herbicides at three rates applied as POST-Dir sprays and MSMA at three rates and three timings applied OT.

Materials and Methods

Field studies were conducted in 1993 at the Delta Research and Extension Center, Stoneville, MS, on a Dundee clay loam (fine-silty, mixed, thermic, Aeric Ochraqualfs) soil with a pH 6.2 and 1.8% OM; and in 1994 on a Tunica clay loam (clayey over loamy, montmorillonitic, nonacid, thermic, Vertic Haplaquepts) soil with a pH 5.5 and 1.8% OM. Kenaf was planted May 17, 1993, and April 29, 1994. Herbicides were applied POST-Dir (on a 15-inch band) to the base (approximately 2 inches high) of kenaf stems or OT to 3, 12, and 24-inch kenaf to evaluate crop tolerance. Application equipment used was a compressed air spray system attached to a tractor-mounted four-row cultivator and calibrated to deliver 20 gallons per acre (gpa) of spray solution in the POST-Dir study and with a CO_2-pressurized backpack sprayer in the OT study.

Herbicides evaluated (POST-Dir) were: Bladex® (cyanazine 0.8, 1.0, and 1.6 lb ai/A), Blazer® (acifluorfen 0.38, 0.5, and 0.75 lb ai/A), Cobra® (lactofen 0.20, 0.25, and 0.40 lb ai/A), Cotton Pro® (prometryn 0.5, 0.65, and 1.0 lb ai/A), Direx® (diuron 0.59, 0.79, and 1.2 lb ai/A), Meturon® (fluometuron 1.0, 1.3, and 2.0 lb ai/A), or Reflex® (fomesafen 0.38, 0.5, and 0.75 lb ai/A). Bueno-6® (MSMA 1, 2, and 3 lb ai/A) was evaluated OT in 1994. X-77® (0.25% v/v) was used as an adjuvant in 1993 for all treatments.

In 1994, Agri-Dex® (1.0% v/v) was used with Direx and Reflex and Latron AG-98® (0.25% v/v) was used with all other POST-Dir herbicides. No additional adjuvant was used in the OT study. Kenaf was 12 to 14 inches tall in 1993 and 14 to 20 inches tall in 1994 at the time of the POST-Dir herbicide application, and four-row plots (10 to 20 feet) planted on 30-inch spacings were simutaneously cultivated and sprayed. All treatments were arranged in a randomized complete block design with four replications in 1993 and three replications in 1994.

Kenaf tolerance was evaluated based on visual estimates of plant leaf injury on a scale of 0 to 100% with 0% = no injury and 100% = complete necrosis resulting in death 2 weeks after treatment (WAT), plant height in inches (24 DAT), girdling and yield, reported on an oven-dry basis (158 °F drying for 72 hours). Girdling describes a form of injury symptom at the base of kenaf stems, where vertical lesions (usually one), discoloration, and stalk swelling occur in a band around the base. Visual estimates of girdling were rated on a scale of 0% = no plants affected and 100% = all plants affected.

Kenaf was grown to maturity (180 days) and 17 feet of the center two rows were hand-harvested at ground level. All plots were maintained weed free with cultivation and hoeing. All data were subjected to analysis of variance. Where year by treatment interactions occurred, data are reported by year. Where a significant F Test was found, mean values were separated using Least Significant Difference (LSD) at $P \geq 0.05$.

Results and Discussion

Bladex (Table 1). Bladex did not cause leaf injury at any of the three rates tested by 2 WAT. These finding agree with an earlier study (11) where Bladex at 0.8 lb/A caused <10% injury 2 WAT. These treatments did not reduce plant height or cause stem girdling. Kenaf yield was not reduced by any of these treatments when compared to the untreated check.

Blazer (Table 2). Treatment with Blazer did not result in leaf injury at any of the three rates tested. This is not in conflict with an earlier report (10) where Blazer caused >95% injury when applied over-the-top. If Blazer is directed towards the base of kenaf stems and kept off of the apical terminal, lasting injury will not occur. Stem height was not reduced by any rate of Blazer. All three rates of Blazer caused girdling and ranged from 23 to 65%. Although no yield loss was associated with these treatments, further investigation with Blazer is needed to determine if detrimental effects such as severe lodging will occur from girdling.

Cobra (Table 3). Cobra did not cause leaf injury at any of the three rates tested. In earlier studies when applied over-the-top of kenaf (10) extensive injury occurred but when applied at 0.18 lb ai/A POST-Dir, injury was <10%. There was no associated height reduction or girdling with these treatments nor was there any yield loss. Cobra (0.2 lb ai/A) received a Section 24 (C) registration in Mississippi (January 1996) as a POST-Dir application to 10-inch kenaf or taller.

Cotton Pro (Table 4). Cotton Pro was another excellent treatment. There was no leaf injury from any of the three rates of Cotton Pro. Kenaf plant height was not reduced. Stem girdling did not occur, and yield was not reduced at any rate. Cotton Pro (0.5 lb ai/A) received a Section 24(C) registration in Mississippi (April 1996) as a POST-Dir application to 8- to 10-inch kenaf plants.

Direx (Table 5). Leaf injury with Direx was not rate dependent but ranged from 16 to 22% by 2 WAT. Kenaf stem-height was not affected by any rate of Direx, nor did the herbicide cause any girdling. There was a treatment-by-year interaction for yield so data are reported by year. In 1993 there were no differences caused by Direx, however, in 1994 Direx at 1.2 lb/A caused a 19% reduction in yield. This should not be a problem because Direx is currently recommended for weed control in cotton in Mississippi at 0.2 to 0.5 lb/A and would be registered at similar rates in kenaf.

Meturon (Table 6). The three application rates of Meturon were very safe on kenaf. No plant leaf injury, height reduction, girdling, or yield losses occurred. This herbicide will provide excellent weed control (1) with a wide margin of safety if this herbicide is registered for use in kenaf.

Reflex (Table 7). Reflex injured kenaf leaves at all three rates. Even though leaf injury occurred at <15%, kenaf height was reduced 11%. The combination of leaf injury along with stem girdling of up to 83% did not result in a yield decrease. In 1989 and 1990 (10), Reflex (0.25 lb ai/A) caused 99 and 89% kenaf injury, respectively, when applied over-the-top of 14-inch kenaf. Even though these POST-Dir treatments did not result in yield loss, the severity of girdling is cause for alarm. Further investigations with Reflex are warranted to determine if girdling will cause other effects such as lodging.

Bueno-6 (Table 8). When Bueno-6 was applied at 1 lb/A, no leaf injury was caused to kenaf at any growth stage. The 2-lb rate caused 7% leaf injury to 3-inch, and 22% leaf injury to 24-inch kenaf. Kenaf leaf injury caused by the 3-lb rate was 15, 12, and 45% at 3-, 12-, and 24-inch growth stage, respectively. Even though leaf burning did occur, kenaf yield was not affected by any of these treatments. A similar study was conducted in 1995 but was destroyed by flooding. Bueno-6 (2.0 lb ai/A)is currently registered (Section 24C) for use in kenaf as a POST-Dir application to 3-inch kenaf. These data show that Bueno-6 can be used effectively as an OT spray at 3-inch to 12-inch kenaf without excessive leaf injury. Further evaluation will be conducted in 1996 to verify these findings.

Conclusions

The results show that Blazer and Reflex caused excessive stem girdling. Even though these symptoms did not reduce yield, more extensive research should be conducted to elucidate the effects on kenaf production. The author is very concerned that yield might be drastically affected if kenaf stems are weakened and lodging occurs. These experiments also show that Bladex, Direx, Meturon, Cobra, or Cotton Pro can be safely used in

kenaf production. If registration is obtained for these herbicides, they will very effectively control a broad spectrum of weeds (1). Bueno-6 is registered for use in Mississippi as a POST-Dir spray. These data show promise for giving the option to spray over-the-top. Cobra and Cotton Pro are also registered for use in Mississippi as POST-Dir applications.

A Section 24(C) registration is issued yearly by the Mississippi Department of Agriculture and Commerce Division of Plant Industry. If you choose to use herbicides with this type of registration, you should check with the Division to be sure the registration is current.

Acknowledgment

This research was funded through a cooperative agreement with USDA-ARS, Jamie Whitten Delta States Research Center, Stoneville, MS. The author thanks Rodney Coleman and Daniel M. Robertshaw for their technical assistance, and Debbie Boykin and Judy Norwood for statistical support.

References

1. Anonymous. 1995. 1995 Weed control guidelines for Mississippi. Miss. State Univ., Publication 1532.

2. Bledsoe, R., F. burns, L. Hurse, V. Hiltbruner-Bledsoe, and C.L. Webber, III. 1991 Kenaf production, processing, and products. Proc. Int. Kenaf Assoc. 3:32.

3. Burnside, O.C., and J.H. Williams. 1968. Weed control methods for kinka oil, kenaf, and sun crotalaria. Agron. J. 60:162-164.

4. Ching, A., C.L. Webber III, and S.W. Neill. 1993. Effect of location and cultivar on kenaf yield components. Ind. Crops and Prod. 1:191-196.

5. Dean, M.L., and C. Parker. 1971. The preemergence selectivity of some recently developed herbicides in jute, kenaf, and sesamum; and their activity against *Oxalis latifolia*. Tech. Rep. A.R.C. Weed Res. Organ. no. 19, 24p.

6. Dempsey, J.M. 1975. Fiber Crops. The University Presses of Florida, Gainesville, pp. 203-304.

7. Fageiry, K.A. 1978. Effects of some herbicides on weed control and yield of kenaf. Annu. Rep. Kenana Res. Stn. Sudan.

8. Hickman, M.V., and A.W. Scott. 1989. Preemergence herbicides for kenaf production. Proc. Assoc. Adv. Ind. Crops 1:2 Peoria, IL, Oct. 1989.

9. Kurtz, M.E., S.W. and Neill. 1990. Tolerance of kenaf to selected herbicides applied preemergence and postemergence. Miss. Agric. For. Exp. Stn. Info. Sheet 1325.

10. Kurtz, M.E., S.W. Neill. 1992. Tolerance of kenaf to selected postemergence herbicides. Weed Technol. 6:125-128.

11. Kurtz, M.E., 1994. Tolerance of kenaf (*Hibiscus cannabinus* L.) to postemergence-directed herbicides. Ind. Crops and Prod. 3:145-149.

12. Malone, G.W., H.D. Tilmon, and R.W. Taylor. 1990. Evaluation of kenaf core for broiler litter, the Delaware experience. Proc. Int. Kenaf Assoc. 2:12.

13. Orsenigo, J.R. 1964. Weed control in kenaf, in Proc. Second Int. Kenaf Conf., Palm Beach, FL. p. 177-187.

14. Phillips, W.A., S.C. Rao, and T.H. Dao. 1989. The nutritive value of immature whole plant kenaf and tops of

mature kenaf for growing ruminants. First Ann. Conf. Assoc. Adv. Ind. Crops. 1:62.

15. Smith, D.B., G.W. Lawrence, K.S. McLean, M.E. Kurtz, S.W. Neill, and M.J. Fuller. 1991. Moisture measurements for whole kenaf stalks. Miss. Agric. For. Exp. Stn. Res. Rep. Vol. 16, No. 14.

16. Sweeten, J.M. 1991. Composting poultry manure using kenaf. Proc. Int. Kenaf Assoc. 3:21.

17. Webber III, C.L., 1992. The influence of metolachlor and trifluralin on kenaf (*Hibiscus cannabinus* L.) yield components. Ind. Crops. Prod. 1:17-20.

18. Werber, F.X., 1993. Kenaf product and process research ins. ARS. Proc. Int. Kenaf Assoc. 5:106-199.

19. White, G.S., D.G. Cummins, E.L. Whiteley, W.T. Fike, J.K. Greig, J.A. Martin, G.B. Killinger, J.J. Higgins, and F.T. Clark. 1970. Cultural and harvesting methods for kenaf..an annual crop source of pulp in the southeast. ARS, U.S. Dep. Agric. prod. Res. Rep. 113.

20. Williams. J.H. 1966. Influence of row spacing and nitrogen levels on dry matter yields of kenaf (*Hibiscus cannabinus* L.). Agron. J. 58:166-168.

21. Wilson, F.D., and J.F. Joyner. 1969. Effects of age, planting, spacing and other variables on growth, yield, and fiber quality of kenaf (*Hibiscus cannabinus* L.), Agric. Res. Ser., U.S. Dept. Agric. Tech. Bull. 1404.