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WEED SCIENCE

Wild Okra Control with Bromoxynil and Pyrithiobac

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INTERPRETIVE SUMMARY

Unique weed species often become established in localized areas as a result of climate, cropping history, and selection pressure. When these species become a problem in agricultural production systems, there is usually little information available on their biology and control. An example is wild okra, a highly competitive weed that infests cotton and other crops in some areas of the southeastern USA. Wild okra became a weed after the cotton-okra sharecropping era ended and volunteer okra emerged from seed remaining in the soil. Natural selection favored the survival and spread of okra cultivars with dormancy.

Development of pyrithiobac and transgenic cotton varieties resistant to bromoxynil gives growers an option to selectively control broadleaf weeds with the convenience of postemergence over-the-top application. Wild okra response to pyrithiobac and bromoxynil applied postemergence has not been reported. Our research, conducted in 1995 and 1996, indicated that wild okra can be controlled well by bromoxynil. Bromoxynil applied postemergence at rates of 0.38 to 0.5 lb a.i. per acre (0.75 to 1 pt per acre of Buctril 4 EC) controlled four-leaf wild okra 88 to 100%. Pyrithiobac, applied postemergence at 0.12 lb a.i. per acre (2.4 oz per acre of Staple 85 SP), which is twice the registered rate, controlled wild okra <70%.

ABSTRACT

Wild okra [*Abelmoschus esculentus* (L.) Moench], a summer annual, is a potentially serious weed in cotton (*Gosssypium hirsutum* L.) fields of the southeastern United States. This study was conducted in 1995 and 1996 to evaluate wild okra control by bromoxynil (3,5-dibromo-4- hydroxybenzonitrile) and pyrithiobac {2-chloro-6-[(4,6-dimethoxy-2-pyrimidinyl)thio]benzoic acid} applied postemergence. Bromoxynil at 0.4 kg a.i. ha^{-1} controlled four-leaf wild okra 88 to 100% 25 days after treatment and reduced biomass 87 to 100%. Bromoxynil at 0.6 to 1.1 kg a.i. ha^{-1} controlled wild okra 99 to 100% and reduced biomass similarly. Pyrithiobac applied postemergence at rates up to 0.14 kg a.i. ha^{-1} controlled wild okra less than 70%.

Wild okra infests cotton and other crops in areas of the southeastern United States. Cultivated okra became a weed after the cotton-okra sharecropping era ended and volunteer okra emerged from seed remaining in the soil (Elmore and Dale, 1982). It was first reported as a weed in 1980 (Blackmon et al., 1980). At that time, light to severe infestations were present on about 4000 ha in Louisiana and Mississippi.

Wild okra, a member of the Malvaceae, is a strong competitor with cotton because of its similar growth and development patterns. A review of weed competition data by Coble and Byrd (1992) indicated wild okra is one of the most competitive weeds in cotton. Wild okra at densities of one, two, and four wild okra plants per 6 m of row reduced cotton yield 9, 18, and 36%, respectively (Bridges and Chandler, 1984).

In addition to its competitive ability, wild okra produces a large number of seed. The impermeable seed coat of wild okra enhances dormancy and increases seed longevity in the soil (Egley and Elmore, 1987). It has been suggested that natural selection favored the survival and spread of domestic okra cultivars with dormancy (Egley and Elmore, 1987).

Weed management systems in cotton have traditionally employed preplant incorporated, premergence, and postemergence-directed herbicides and cultivation to control weeds (Buchanan, 1992).

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Development of pyrithiobac and bromoxynil-resistant cotton are major breakthroughs for selective postemergence broadleaf weed control in cotton. Pyrithiobac controls broadleaf weeds such as pitted morningglory (*Ipomoea lacunosa* L.), entireleaf morningglory *(Ipomoea hederacea* var. *integriuscula* Gray), velvetleaf (*Abutilon theophrasti* Medic.), common cocklebur (*Xanthium strumarium* L.), hemp sesbania [*Sesbania exaltata* (Raf.) Rydb. ex A.W. Hill], Venice mallow (*Hibiscus trionum* L.), devil's claw [*Proboscidea louisianica* (Mill.) Thellung], and *Amaranthus* spp. (Baumann and Williams, 1993; Dotray et al., 1996; Everson et al., 1991; Jordan et al., 1993a; Jordan et al., 1993b; Sunderland and Coble, 1994). Bromoxynil and pyrithiobac control a similar spectrum of weeds. However, bromoxynil is more effective on tall morningglory [*Ipomoea purpurea* (L.) Roth.] and pyrithiobac is more effective on *Amaranthus* spp. (Holshouser and Chandler, 1991).

In greenhouse studies, fluometuron {*N*, *N*-dimethyl-*N*'-[3-(trifluoromethyl)phenyl]urea} and cyanazine{(2-[[4-chloro-6-(ethylamino)-1,3,5-triazin-2-yl]amino]-2-methylpropanenitrile} applied premergence controlled wild okra (Elmore and Dale, 1982). However, no data on field efficacy of these and other herbicides on wild okra have been reported. Additionally, no information is available on the efficacy of bromoxynil and pyrithiobac on wild okra. The objective of our research was to evaluate wild okra control with bromoxynil and pyrithiobac applied postemergence.

MATERIALS AND METHODS

Field studies were conducted in 1995 and 1996 at the Texas A&M University Field Laboratory near College Station, TX, on a Ships clay soil (very-fine, mixed, thermic Udic Chromustert) with 1.4% organic matter and pH 7.7. Wild okra seed was collected from fields in eastern Texas. Prior to planting, seeds were scarified with concentrated sulfuric acid (18 *M*) for 15 minutes to improve germination. Thirty-nine wild okra seeds per meter of row were planted 15 June 1995 and 16 May 1996 in four-row plots measuring 2 m wide and 4 m long.

Herbicides were applied perpendicular to the wild okra rows using a CO_2-pressurized backpack sprayer equipped with Teejet XR11003 flat fan nozzles (Spraying Systems Co., Wheaton, IL) calibrated to deliver 187 L ha^{-1} at 206 kPa. Treatments included pyrithiobac at 0.03, 0.07, and 0.14 kg ha^{-1} and bromoxynil at 0.42, 0.56, 0.84, and 1.12 kg ha^{-1} applied when wild okra was 7.6 cm tall with four leaves. A nontreated check also was included. Pyrithiobac was applied with a nonionic surfactant (X-77 Spreader, alkylarylpolyoxyethylene glycols, free fatty acids, and isopropanol from Valent USA Corp., Walnut Creek, CA) at 0.25 % (v/v). Conditions were favorable for good herbicide efficacy at the time of application. Air temperature and relative humidity were 22 and 24°C and 85 and 100% in 1995 and 1996, respectively.

Visual estimates of percent wild okra control were recorded 10 and 25 days after treatment using a scale of 0 to 100% with 0 = no control and 100 = complete control. Aboveground live tissue biomass (hereafter referred to as biomass) was collected 25 days after treatment by hand-harvesting a 2 m section of row in each plot. Percentages of biomass reduction were calculated by comparing fresh weight of weeds from each plot within a replication to the fresh weight of weeds in the nontreated check within the same replication. The experimental design was a randomized complete block with treatments replicated four times. Data were subjected to analysis of variance and means were separated using Duncan's multiple range test at $P = 0.05$. Data for biomass reduction and visual estimates of weed control were arcsin transformed before analyses. Nontransformed means are presented with the Duncan's alphabet notation based on transformed values. Treatment by year interactions were significant, therefore data are presented separately for each year.

RESULTS AND DISCUSSION

Bromoxynil at 0.56 kg ha^{-1} or greater controlled wild okra 99 to 100% 10 and 25 days after treatment and reduced biomass 100% (Tables 1 and 2). Bromoxynil at 0.42 kg ha^{-1} controlled wild okra 100 and 88% 25 days after treatment in 1995 and 1996, respectively.

Pyrithiobac did not adequately control wild okra. At the registered rate of 0.07 kg ha^{-1}, pyrithiobac controlled wild okra 0 and 53% 25 days after treatment in 1995 and 1996, respectively (Tables 1

Table 1. Wild okra control and biomass reduction with bromoxynil and pyrithiobac applied postemergence in 1995.†

		Control		Biomass reduction
Herbicide	Rate	10 DAT‡	25 DAT	25 DAT
	kg a.i. ha^{-1}	%		
Bromoxynil	0.42	91b	88b	87a
Bromoxynil	0.56	99a	100a	100a
Bromoxynil	0.84	100a	100a	100a
Bromoxynil	1.12	100a	100a	100a
Pyrithiobac	0.03	0d	0d	13cd
Pyrithiobac	0.07	3cd	0d	20c
Pyrithiobac	0.14	5c	28c	36b
Nontreated	0.00	0d	0d	0d
CV (%)		6	20	22

† Means within a column followed by the same letter are not different according to Duncan's multiple range test at $P = 0.05$.

‡ DAT = days after treatment.

Table 2. Wild okra control and biomass reduction by bromoxynil and pyrithiobac applied postemergence in 1996.†

		Control		Biomass reduction
Herbicide	Rate	10 DAT‡	25 DAT	25 DAT
	kg a.i. ha^{-1}	%		
Bromoxynil	0.42	100a	100a	100a
Bromoxynil	0.56	100a	99a	100a
Bromoxynil	0.84	100a	99a	100a
Bromoxynil	1.12	100a	100a	100a
Pyrithiobac	0.03	23d	18d	30 c
Pyrithiobac	0.07	40c	53c	54bc
Pyrithiobac	0.14	55b	64b	69b
Nontreated	0.00	0d	0d	0d
CV, %		10	14	16

† Means within a column followed by the same letter are not different according to Duncan's multiple range test at $P = 0.05$.

‡ DAT = days after treatment.

and 2). Wild okra biomass was reduced 20 and 54% in 1995 and 1996, respectively. Pyrithiobac at 0.14 kg ha^{-1}, or twice the registered rate for postemergence application, controlled wild okra only 28 and 64% in 1995 and 1996, respectively.

Greater control by bromoxynil at the lowest rate and by pyrithiobac at all rates in 1996 as compared with 1995 may have been due to more favorable environmental conditions after application. In 1995, no rainfall occurred during the first 5 days after treatment, and only 0.4 cm of rainfall was received on the sixth days after treatment. In 1996, 1.2 cm of rainfall was received 3 days after treatment, and 1.9 cm rainfall ocurred within 6 days after treatment. Pyrithiobac is readily absorbed by plant roots after postemergence application (Crowder et al., 1992). Pyrithiobac may have been moved deeper in the soil in 1996, resulting in greater root absorption and improved wild okra control.

Our results indicate that bromoxynil at normally recommended use rates effectively controls four-leaf wild okra whereas pyrithiobac at registered rates is not adequately effective. Further research is needed to determine response of larger wild okra to bromoxynil. Additionally, more research is needed to determine wild okra control by herbicide systems containing pyrithiobac applied postemergence in combination with later directed sprays of other herbicides. Although pyrithiobac alone did not adequately control wild okra, it did suppress its growth as evidenced by the reductions in biomass. The pyrithiobac-induced growth suppression could help create the height differential needed for postemergence-directed herbicide applications. Similar responses to pyrithiobac have been observed with sicklepod [*Senna obtusifolia* (L.) Irwin and Barneby] (Brown et al., 1996). Although pyrithiobac does not control sicklepod, it will suppress its growth sufficiently to gain a height differential to facilitate follow-up postemergence-directed herbicide application. Similar results might be observed with wild okra.

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