Weed Management Programs with Trifloxysulfuron (Envoke®) in Cotton

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RESEARCH PROBLEM

Glyphosate-tolerant cotton (Roundup Ready) is a boon to cotton producers in that it allows postemergence control of a wide range of grass and broadleaved weeds. However, because glyphosate is weak on some weed species, other herbicides may need to be added to a glyphosate weed control program to provide maximal season-long control. Additionally, some producers may choose to use conventional cotton cultivars with conventional weed management programs. Trifloxysulfuron (Envoke™) is a relatively new herbicide that can be used in either Roundup Ready or conventional cotton. The objective of this research was to determine the best fit for trifloxysulfuron in either system.

BACKGROUND INFORMATION

Trifloxysulfuron (formerly CGA-362622), or Envoke™, is a sulfonylurea herbicide developed for postemergence (POST) over-the-top or post-directed applications in cotton. Pyrithiobac (Staple™) is thus far the only herbicide labeled for POST over-the-top control of emerged weeds in either conventional or Roundup Ready (glyphosate-tolerant) cotton (Porterfield et al., 2002). Metolachlor may be applied over-the-top but is ineffective for control of emerged weeds. The spectrum of control of pyrithiobac covers several important weeds in cotton (Jordan et al., 1993), but control of sicklepod (Senna obtusifolia), tall morningglory (Ipomoea purpurea), and several other weeds is poor (Jordan et al., 1993; Porterfield et al., 2002; Wilcut et al., 2000). Trifloxysulfuron controls several economically important weeds in cotton, including pitted morningglory, Palmer amaranth, hemp sesbania, and sicklepod, at very low use rates ranging from 0.1 to 0.25 oz/acre (Branson et al., 2002; Wells, 2000). Cotton injury, manifested as yellowing and stunting, normally dissipates quickly and does not affect yield (Holloway, 1993; Porterfield et al., 2002; Wilcut et al., 2000). Trifloxysulfuron controls several economically important weeds in cotton, including pitted morningglory, Palmer amaranth, hemp sesbania, and sicklepod, at very low use rates ranging from 0.1 to 0.25 oz/acre (Branson et al., 2002; Wells, 2000). Cotton injury, manifested as yellowing and stunting, normally dissipates quickly and does not affect yield (Holloway, 1993; Porterfield et al., 2002; Wilcut et al., 2000).
Trifloxysulfuron also has preemergence activity, but injury has been a concern (up to 49% injury) (Branson et al., 2002) and it is not labeled for preemergence use in cotton. Studies are ongoing in Arkansas to define the fit of trifloxysulfuron in Arkansas cotton production.

**RESEARCH DESCRIPTION**

Experiments were conducted at Marianna and Fayetteville, AR, on silt loam soil to evaluate trifloxysulfuron in conventional and Roundup Ready (glyphosate-tolerant) cotton herbicide systems and to compare efficacy of trifloxysulfuron and pyrithiobac (Staple). Each experiment was conducted in a randomized complete block design with four replications. Plots were 13 by 40 ft at Marianna and 3.3 by 27 ft at Fayetteville, except for the trifloxysulfuron/pyrithiobac comparison at Fayetteville, which was a multispecies experiment with 12 species planted across 6.5-ft-wide plots. Cotton (Paymaster 1218BR) was planted 21 May at Marianna and 2 June at Fayetteville. The multispecies experiment at Fayetteville was planted 10 June. Treatments in conventional cotton were prometryn + pendimethalin (1 + 0.75 lb ai/acre) PRE or metolachlor, 0.95 lb ai/acre + fluazifop-P, 0.125 lb ai/acre over-the-top (OT) applied to one- to two-leaf cotton (EOT) followed by (fb) trifloxysulfuron, 0.0071 lb ai/acre OT to five- to six-leaf cotton, alone or fb prometryn + trifloxysulfuron (A12474), 0.8 lb ai/acre at layby. In Roundup Ready cotton, glyphosate (Touchdown™), 0.75 lb ae/acre or glyphosate + metolachlor, 0.95 lb/acre was applied OT to one- to two-leaf cotton fb trifloxysulfuron, 0.0071 lb/acre OT or 0.0094 lb/acre post-directed (DIR) to seven- to eight-leaf cotton. In trifloxysulfuron/pyrithiobac comparison experiments, trifloxysulfuron was applied OT at 0.0071 lb/acre to two-leaf cotton and 0.0094 lb/acre to four-leaf cotton, pyrithiobac at 0.063 OT to two- and four-leaf cotton, and trifloxysulfuron, 0.0047 lb/acre or pyrithiobac, 0.063 lb/acre + glyphosate, 0.75 lb ai/acre to two- and four-leaf cotton. Trifloxysulfuron was applied with nonionic surfactant at 0.25% vol/vol. Herbicides were applied with a tractor-mounted or backpack sprayer at 15 to 20 gal/acre carrier volume. Data were analyzed by analysis of variance, and means were separated by LSD at the 0.05 level of significance.

**RESULTS**

Conventional programs that used metolachlor + fluazifop-P early over-the-top (EOT) as a prior treatment for trifloxysulfuron were generally ineffective because the metolachlor program failed to control *Amaranthus* species early in the season (Table 1). At Fayetteville, all broadleaved species in plots with EOT treatments were uncontrolled, and trifloxysulfuron was not effective on large weeds. Metolachlor should be applied before weeds emerge or after cultivation to be effective. Trifloxysulfuron following a PRE treatment and fb A12474 at layby controlled pitted morningglory (*Ipomoea lacunosa*), velvetleaf (*Abutilon theophrasti*), and prickly sida (*Sida spinosa*) 88 to 99%.
In the Roundup Ready experiment, two applications of glyphosate (Touchdown™) controlled Palmer amaranth (*Amaranthus palmeri*) better than glyphosate fb trifloxsulfuron at Marianna (91% vs 60% with OT application and 70% with DIR application) (data not shown). For control of annual grasses, a follow-up glyphosate application or metolachlor with the one-to-two-leaf glyphosate application was needed. A12474 was also effective for late-season Palmer amaranth and grass control (>90%). Control of pitted morningglory (83 to 100%), velvetleaf (95 to 100%), sicklepod (88 to 95%), and prickly sida (75 to 100%) did not differ among treatments.

Trifloxsulfuron and pyrithiobac controlled *Amaranthus* species, pitted morningglory, and velvetleaf equally in the trifloxsulfuron/pyrithiobac comparison experiment at Marianna (Fig. 1). At Fayetteville, control of Palmer amaranth and velvetleaf was better with pyrithiobac treatments than with trifloxsulfuron. Pitted morningglory was controlled better with trifloxsulfuron (83% averaged over treatments) than pyrithiobac (58% average), a difference more pronounced at the four-leaf than two-leaf cotton stage. Control of barnyardgrass (*Echinochloa crus-galli*), seedling johnsongrass (*Sorghum halepense*), and sicklepod was better with trifloxsulfuron than with pyrithiobac, but prickly sida control was better with pyrithiobac treatments (Fig. 2).

Cotton injury is a concern with trifloxsulfuron applied over-the-top. In the conventional tests, injury was 5 to 20% 1 week after trifloxsulfuron application to five-to-six-leaf cotton but was <3% by 2 weeks after treatment (WAT). Injury in the trifloxsulfuron/pyrithiobac comparison tests was 18 to 30% 1 wk after four-leaf treatments. After 3 weeks, injury was 13 to 18% at Marianna and 0 to 15% at Fayetteville, with the higher injury from trifloxsulfuron + glyphosate. Injury from trifloxsulfuron DIR was <11% 1 WAT, while injury from OT applications was as high as 39% in tank mixture with glyphosate. Pyrithiobac injury was not as severe as trifloxsulfuron injury in most experiments, and cotton recovered from visual symptoms from both herbicides.

**PRACTICAL APPLICATION**

Trifloxsulfuron can be used postemergence in either conventional or Roundup Ready cotton. Preemergence herbicides will usually be needed for effective control with trifloxsulfuron in conventional cotton. If metolachlor postemergence is used as a prior treatment for trifloxsulfuron, weeds should be cultivated before metolachlor application because it is not effective on emerged weeds. Glyphosate plus metolachlor applied early over-the-top followed by trifloxsulfuron is a good program for broad-spectrum control in Roundup Ready cotton. Barnyardgrass, seedling johnsongrass, and sicklepod are controlled better with trifloxsulfuron than with pyrithiobac, but prickly sida control is very poor with trifloxsulfuron. Visual cotton injury from trifloxsulfuron can occur, and trifloxsulfuron should probably not be applied in tank mixture with glyphosate for over-the-top applications.
LITERATURE CITED


Table 1. Control of Palmer amaranth (AMAPA), pitted morningglory (IPOLA), velvetleaf (ABUTH), and prickly sida (SIDSP) with trifloxysulfuron (Envoke) programs 2 wk after layby treatments in conventional cotton at Marianna (M) and Fayetteville (F), AR, 2002.

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<th>AMAPA F</th>
<th>IPOLA M</th>
<th>IPOLA F</th>
<th>ABUTH M</th>
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* PRE = prometryn+pendimethalin; EOT = metolachlor+fluazifop-P at 1-ft cotton; fb = followed by; layby = prometryn+Envoke (A12474); Staple = pyrithiobac at 0.031 lb ai/acre.

† Envoke applied at 0.0071 lb ai/acre at 5- to 6-leaf cotton.
Fig. 1. Control of Palmer amaranth (AMAPA), pitted morningglory (IPOLA), and velvetleaf (ABUTH) with Envoke and Staple, averaged over the herbicides alone and with glyphosate, 3 to 4 wk after 4-lf treatments at Marianna and Fayetteville. (Rates and timing listed in Research Description).
Fig. 2. Control of hemp sesbania (SEBEX), sicklepod (CASOB), prickly sida (SIDSP), seedling johnsongrass (SORHA), and barnyardgrass (ECHCG) with Envoke and Staple, averaged over the herbicides alone and with glyphosate, 3 to 4 wk after 4-lf treatments at Marianna and Fayetteville. (Rates and timing listed in Research Description).