Non-Glyphosate Programs for Palmer Amaranth Control in Cotton


RESEARCH PROBLEM

Palmer amaranth (Amaranthus palmeri) is a major problematic glyphosate-resistant weed in Arkansas cotton. Palmer amaranth is highly competitive, causing considerable yield reduction and decreasing harvesting efficiency of cotton. Cotton growers can no longer rely on glyphosate for Palmer amaranth control. Therefore, an effective non-glyphosate weed management program is urgently needed.

BACKGROUND INFORMATION

Glyphosate has been the foundation of broad-spectrum weed control in glyphosate-resistant cotton production in Arkansas. However, the continuous use of glyphosate and lack of crop rotation resulted in a serious problem of glyphosate-resistant Palmer amaranth in Arkansas cotton. A total of 630,000 acres of cotton in the mid-south and southeastern U.S. is infested with glyphosate-resistant Palmer amaranth (Nichols et al., 2009). Palmer amaranth is a major problematic glyphosate-resistant weed in cotton because of its competitive growth habit and prolific seed production. Palmer amaranth can reduce lint yield up to 92% and decrease the harvesting efficiency (Rowland et al., 1999; Smith et al., 2000). There is an urgent need to develop an effective, season-long non-glyphosate herbicide program in cotton. We hypothesize that sequential application of residual herbicides with alternative modes of action will provide effective, season-long control of glyphosate-resistant Palmer amaranth. Therefore, the objective of this study was to evaluate crop tolerance and efficacy of sequential residual herbicide programs against Palmer amaranth in cotton.

RESEARCH DESCRIPTION

A field experiment was conducted at the Lon Mann Cotton Research Station, Marianna, Ark. in 2009 to evaluate the cotton response and Palmer amaranth control
efficacy of different non-glyphosate herbicide programs in cotton. Roundup Ready Flex cotton (*Gossypium hirsutum* L.) cv. ST4554 B2RF was planted in late May on a 38-inch row spacing. Experimental plots were 50 ft long and 12.7 ft wide, consisting of 4 rows of cotton. The experiment was organized in a randomized complete block design with a 3 by 3 factorial arrangement of treatments, replicated four times. The treatment factors included: 1) three preplant (PP)/preemergence (PRE) herbicides - Reflex PP (1.0 pt/acre), Cotoran PRE (1.5 pt/acre), and Prowl H2O PRE (2.1 pt/acre); 2) two postemergence (POST) herbicides – Dual Magnum (1.3 pt/acre) at 1-lf and 4-lf cotton; 3) two post-directed (PD) herbicides (Suprend at 1.25 lb/acre and none). A layby application of MSMA (2.7 pt/acre) + Direx (1.6 pt/acre) was made in all herbicide programs at 12-lf cotton. In addition, a non-treated control was included for comparison. Data were collected on percent cotton injury and Palmer amaranth control at biweekly intervals from 4 to 10 wk after planting (WAP). Percent injury and Palmer amaranth control data were subjected to arcsine square-root transformation to stabilize the variances, and back-transformed for presentation purposes. All data were subjected to three-way analysis of variance, and means were separated by Fisher’s protected LSD (α = 0.05).

### RESULTS AND DISCUSSION

Cotton injury was minimal (≤ 2%) in all herbicide programs (data not shown). Herbicide programs including Reflex PP controlled Palmer amaranth 76% to 91% throughout the season (Figs. 1-4). Herbicide programs including Cotoran PRE and Prowl H2O PRE provided no more than 60% and 31% control of Palmer amaranth at 4 WAP, respectively (Fig. 1). However, Palmer amaranth control in these two programs further declined later in the season, with no more than 37% control at 6 WAP (Fig. 2). Weed control in all programs was similar for Dual Magnum POST applied either at 1-lf or 4-lf cotton, regardless of PP/PRE treatment at 6 to 10 WAP (Figs. 2-4). However, the addition of Suprend PD improved Palmer amaranth control at 8 WAP in herbicide programs containing Reflex PP (Fig. 3). Reflex PP, regardless of POST and PD application, when followed by Direx + MSMA at layby controlled Palmer amaranth 84%. However, Palmer amaranth control was 0% in plots treated with Cotoran and Prowl H2O, even after application of POST, PD, and lay-by herbicides (Fig. 4). Therefore, season-long residual control is needed because Palmer amaranth emerges throughout the growing season, and once it emerges, control will be difficult due to its rapid growth (Jha and Norsworthy, 2009). Reflex is critical for early-season residual Palmer amaranth control. However, for consistent season-long control, a system approach with sequential applications of residual herbicides is required (Culpepper and Smith, 2009; Steckel et al., 2009). Seed-cotton was not harvested because of interference in harvesting operation due to Palmer amaranth infestation.
PRACTICAL APPLICATION

This research demonstrates the importance of effective early-season residual herbicide programs for season-long Palmer amaranth management. Using Reflex PP, effective Palmer amaranth control can be maintained throughout the season with POST followed by PD herbicides. In contrast, use of a short-residual herbicide (Cotoran or Prowl H2O) before or at planting will not provide season-long Palmer amaranth control even with the sequential application of residual POST and PD herbicides.

ACKNOWLEDGMENTS

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LITERATURE CITED


Fig. 1. Palmer amaranth control in cotton at 4 wk after planting as influenced by preplant/preemergence (PP/PRE) herbicide program. Means with the same letter are not significantly different according to Fisher's protected LSD ($\alpha = 0.05$).

Fig. 2. Palmer amaranth control in cotton at 6 wk after planting as influenced by preplant/preemergence (PP/PRE) herbicides, averaged over postemergence (POST) herbicides (Dual Magnum at 1- and 4-lf). Means with the same letter are not significantly different according to Fisher's protected LSD ($\alpha = 0.05$).
Fig. 3. Palmer amaranth control in cotton at 8 wk after planting as influenced by pre-plant/preemergence (PP/PRE) and post-directed (PD) (Suprend and none) herbicides, averaged over POST (Dual Magnum at 1- and 4-lf) herbicides. Means with the same letter are not significantly different according to Fisher’s protected LSD (α = 0.05).

Fig. 4. Palmer amaranth control in cotton at 10 wk after planting as influenced by preplant/preemergence (PP/PRE) herbicides, averaged over POST (Dual Magnum at 1- and 4-lf) and PD (Suprend and none) herbicides. Means with the same letter are not significantly different according to Fisher’s protected LSD (α = 0.05).