Managing Glyphosate-Resistant Horseweed in Conservation-Tillage Cotton Production: Final Summary and Recommendations

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RESEARCH PROBLEM

Glyphosate-resistant horseweed (*Conyza canadensis*), also called marestail, has been a significant problem for cotton producers in Arkansas since 2003. Without glyphosate to control horseweed populations and with the rapid spread of the resistant population, there was an urgent need to develop reliable, economical options to control the weed. Without economical alternatives for management of the resistant biotype, many farmers may have abandoned conservation-tillage practices, which would have increased labor and machinery costs and jeopardized soil conservation efforts.

BACKGROUND INFORMATION

Of the weeds that can cause a problem in Arkansas cotton fields, horseweed was not a concern until 2002-3 (Matthews et al., 2004; McClelland et al., 2004). Why is it only a recent problem? Before conservation-tillage practices became the norm on much of our cotton acreage, horseweed was controlled with tillage. Even with the elimination of primary tillage, horseweed was easily controlled with glyphosate (Roundup® and other trade names), the herbicide used extensively for burndown of winter and early spring weeds. However, failures of horseweed control with glyphosate were reported in Mississippi County in 2002; it was suspected that the biotype was resistant because Tennessee had confirmed resistance in 2001 in counties near the Mississippi River, and Bob Hayes, Tennessee weed scientist, predicted its spread to neighboring counties in Arkansas (Hayes et al., 2002; Mueller et al., 2003). Whether the glyphosate-resistant population came from Tennessee, just happened to evolve about the same time, or was a combination of the two, the population surged in 2003-4. Extension agents were fielding anxious calls from producers – "I have it; what do I do?" A united front of extension personnel, University of Arkansas researchers, producers, and Cotton Incorporated was

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established to evaluate horseweed samples sent by county agents for level of glyphosate resistance and to determine how to control horseweed without glyphosate in conservation-tillage systems in cotton.

RESEARCH DESCRIPTION

Horseweed plant and seed samples from fields suspected of having glyphosate-resistant horseweed were evaluated in greenhouse experiments at Fayetteville for level of glyphosate resistance. Glyphosate rates of 0, 0.375, 0.75 (labeled 1X rate), 1.5 (2X), 3 (4X), 6 (8X), and 12 (16X) lb ae/acre were evaluated.

Approximately 40 field experiments were conducted in Arkansas from 2004 through 2006 to evaluate herbicides that could replace or complement glyphosate for control of horseweed. Experiments were conducted at sites in Crittenden, Mississippi, Poinsett, Washington, Lee, Phillips, and Desha counties, most with a glyphosate-resistant population. Preplant, preemergence, and postemergence herbicides were evaluated. All experiments were conducted on a randomized complete block design with four replications, and standard small-plot procedures were used.

RESULTS AND DISCUSSION

The original Mississippi County population contained plants resistant to 3 lb/acre glyphosate, a resistance factor of 4X, and control was complete with 6 and 12 lb/acre. Plants that emerged and were collected and tested a few weeks later from that same population were susceptible to 6 lb/acre (58% control), and four out of six plants showed some resistance to 12 lb/acre (resistance factor = 16X). Plants from seed collected in another location in Mississippi County had a resistance factor of 16X, with control of only 59% from 12 lb/acre 27 days after treatment (DAT). Few samples were sent for evaluation in 2005 and 2006, probably because most producers were already aware of resistance in their fields.

An obvious choice to replace glyphosate as a burndown treatment was Ignite® (glufosinate) because it has a broad spectrum of activity and can be applied up to planting. However, horseweed control with Ignite alone was inconsistent across experiments. At early ratings, control with Ignite appeared to be good, but significant regrowth from the terminal bud occurred if any live tissue was present. Similar regrowth was seen with Gramoxone® (paraquat). However, whether due to environment or size of plants, control with both herbicides was sometimes >90%. Valor® (flumioxazin) and Aim® (carfentrazone) were of interest initially, but neither herbicide had postemergence activity on horseweed, and the soil activity reported for Valor to give residual horseweed control was not apparent in these experiments. In 2005 and 2006, herbicides were evaluated for residual control of horseweed and included Dual Magnum® (metolachlor), Cotoran® (fluometuron), Lorox® (linuron), Direx® (diuron), Staple® (pyrithiobac), Caparol® (prometryn), and Envoke® (trifloxysulfuron).

Clarity® (dicamba) and 2,4-D, especially Clarity®, consistently controlled emerged horseweed. Even with a 21-day preplant restriction, Clarity remained the most con-

sistent, effective herbicide and could be mixed with glyphosate, Gramoxone Inteon®, Ignite®, or residual herbicides that would aid in control of seedlings that might emerge between burndown and planting.

PRACTICAL APPLICATION

Recommendations Resulting from Project

Horseweed recommendations for Arkansas cotton in 2007 are: apply Clarity at 3 to 4 weeks before planting cotton (and after a 1-in. accumulation of rainfall or irrigation); Gramoxone Inteon® or Ignite® can be applied at planting to remove newly emerged horseweed seedlings if needed; Direx®, Caparol®, and Cotoran® provide residual horseweed control and should be applied at planting to maximize the length of in-crop control; if horseweed seedlings are a problem at planting, consider in subsequent years mixing a residual herbicide with Clarity at burndown, realizing that the length of in-crop residual control will be reduced; Envoke® can be applied over-the-top of cotton to control horseweed seedlings that emerge after the residual herbicides have dissipated.

A final result of this project was the significant and successful educational effort. The problem of glyphosate-resistant horseweed developed quickly, but the response of Arkansas extension, researchers, and Arkansas producers through Cotton Incorporated was also rapid and probably saved a number of cotton fields from the plow, allowing conservation-tillage systems to continue. These exceptional educational programs bode well for Arkansas producers as they face the problem of new resistant weeds.

ACKNOWLEDGMENTS

Cotton Incorporated provided funding for this research. Collaborative efforts of Dr. Bob Nichols, project director for Cotton Incorporated, are greatly appreciated. The authors also appreciate the efforts of extension service personnel and the producers who generously allowed research plots in their fields in the counties of testing; Susan Matthews (Scott), then Mississippi County agent; University of Arkansas experiment station personnel; industry personnel who provided herbicides for the project; and Drs. Ron Talbert and Jim Barrentine, who were instrumental in establishing the research project. Support for this research was provided by the Division of Agriculture, University of Arkansas.

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