INVESTIGATING THE NUMBERS: CAN WE PROTECT POSTEMERGENCE HERBICIDES THROUGH A COMBINATION OF PRE HERBICIDES, COVER CROPS, AND TIMELY APPLICATIONS

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Abstract

Auxin-tolerant cotton and soybean technologies were commercialized in 2017, in part, to combat glyphosate-resistant Palmer amaranth. Since it was discovered in 2003, this devastating weed has cost the Georgia cotton industry over $1.8 billion in management costs. To preserve the utility of the auxin herbicides, integrated weed management strategies that reduce the selection pressure placed upon postemergence (POST) herbicide applications must be implemented. Thus, two field studies were conducted during 2020 to quantify the reduction in selection pressure placed on Palmer amaranth, by 2,4-D applied POST in tolerant cotton, as influenced by 1) cover crop versus conventional tillage production systems, 2) preemergence (PRE) herbicides, 3) POST herbicide tank mixes, and 4) timely versus delayed POST applications.

The experimental design was a split-plot, with production system as the whole-plot and herbicide system as the split-plot. Within the whole-plot, cotton was either strip-tilled into a terminated cereal rye cover crop or planted into conventionally tilled bareground. Herbicide treatments included: (1) PRE (acetochlor at 840 g ai ha^{-1}+ fomesafen at 210 g ai ha^{-1}) fb 3 timely POST applications (glyphosate at 1,541 g ai ha^{-1} + 2,4-D choline at 1,065 g ai ha^{-1}), (2) PRE (acetochlor + fomesafen) fb 3 delayed POST applications (glyphosate + 2,4-D choline), (3) 3 timely POST-only applications (glyphosate + 2,4-D choline), (4) 3 delayed POST-only applications (glyphosate + 2,4-D choline), (5) 3 delayed POST-only applications (POST 1 of glyphosate + 2,4-D choline; POST 2 and 3 of glufosinate at 656 g ai ha^{-1} + 2,4-D choline at 1,065 g ha^{-1}), and a (6) no herbicide control (NTC).

All timely POST programs were initiated when Palmer amaranth was 8-13 cm in height, and delayed POST treatments began at heights of 20-25 cm. Application timings relative to cotton growth included the following: PRE at day of planting, POST 1 at 1-2 leaf, POST 2 at 4-5 leaf, and POST 3 at 8-10 leaf. To quantify selection pressure, Palmer amaranth plants present prior to each POST herbicide application were counted to determine the number of plants being exposed to the herbicide; an additional count was made late-season to determine plant survival. Additionally, to determine the number of plants exposed to multiple applications of 2,4-D tank mixtures, the number of plants present at each assessment were separated into "newly emerged" or "previously damaged" categories.

Over 700,000 Palmer amaranth plants ha^{-1} were treated with the POST 1 application in the conventionally tilled no-herbicide system; the cover crop and PRE herbicide mix reduced that density by 78 and 99%, respectively. The POST 2 application treated 7 to 72, 371 to 872, 19,254 to 40,701, and 38,552 to 61,930 plants ha^{-1} in the PRE-timely POST, PRE-delayed POST, timely POST, and delayed POST systems, respectively; lower values with each herbicide program were noted when using the cover crop. For the entire season, the cover crop or either PRE herbicide program reduced the number of Palmer amaranth treated with 2,4-D mixtures by at least 72 and 99%, respectively, when compared to all of the total POST programs.

Palmer amaranth plants exposed to multiple applications of 2,4-D were lowest when using the PRE herbicide mixture regardless of production system (7 to 101 plants ha^{-1}), followed next by the timely total POST program utilizing a cover crop (19,491 plants ha^{-1}). Greater selection pressure was observed in conventional tillage with timely POST only herbicide applications and in both delayed total POST programs using a cover crop (38,045 to 45,154 plants ha^{-1}). The greatest number of Palmer amaranth treated multiple times with 2,4-D mixtures was noted with the two delayed POST programs using conventional tillage (63,153 to 78,788 plants ha^{-1}).