

WEED SCIENCE

GLYPHOSATE-RESISTANT PALMER AMARANTH CONTROL WITH HERBICIDE MIXTURES CONTAINING 2,4-D

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THE ENLIST WEED CONTROL SYSTEM REPRESENTS THE NEXT STEP IN MANAGEMENT OF GLYPHOSATE-RESISTANT PALMER AMARANTH BECAUSE IT ALLOWS APPLICATION OF MULTIPLE HERBICIDE MODES OF ACTION THAT ARE EFFECTIVE FOR CONTROL OF THIS SPECIES.

Since the first documentation of herbicide resistance in Palmer amaranth to the dinitroaniline herbicide family (Group 3), this species has evolved resistance to multiple herbicide modes of action, including acetolactate synthesis inhibitors (Group 2), EPSP synthase inhibitors (Group 10), 4-hydroxyphenylpyruvate dioxygenase inhibitors (Group 27), photosystem II inhibitors (Group 5), and protoporphyrinogen oxidase inhibitors (Group 14). Currently, there is no documentation of Palmer amaranth resistance to 2,4-D, dicamba, or glufosinate.

2,4-D is one of the oldest and most widely used synthetic herbicides. It controls several broadleaf weeds including *Amaranthus*, or pigweed, species and is applied in aquatic, lawn, and agricultural settings. Corn, cotton, and soybean varieties resistant to 2,4-D have been developed and deregulated. This technology was developed by Dow Agrosiences and will be marketed



Palmer amaranth

as the Enlist Weed Control System. The Enlist Weed Control System could offer soybean growers more flexibility for weed control because Enlist soybean varieties are also resistant to glyphosate and glufosinate, and herbicide applications including only one mode of action are no longer recommended. Previous research has shown that

mixtures of glufosinate and 2,4-D can improve control of a variety of weeds.

Glyphosate-resistant (GR) weeds, primarily GR Palmer amaranth, are the principal weed control issue facing row crop growers in Mississippi. Understanding control of GR Palmer amaranth with 2,4-D and other herbicide modes of action is crucial for Mississippi soybean growers. Research was conducted at the Missis-

sippi State University Delta Research and Extension Center to evaluate mixtures of glyphosate, glufosinate, and/or 2,4-D for control of different sizes of GR Palmer amaranth.

Two separate field studies were conducted to evaluate control of different sizes of GR Palmer amaranth with multiple rates of 2,4-D alone and in mixtures with glyphosate and/or glufosinate. An Early Application Study targeting 2- to 4-inch GR Palmer amaranth was conducted once in 2013 and twice in 2014. A Late Application Study targeting 6- to 8-inch GR Palmer amaranth was conducted once in 2013 and once in 2014. In both studies, glyphosate (Roundup WeatherMax) at 0 and 22 oz/ac, glufosinate (Liberty 280) at 0 and 29 oz/ac, and 2,4-D (2,4-D Amine) at 0, 1, and 2 pt/ac were applied in all possible combinations. Treatments were applied using a tractor-mounted sprayer when GR Palmer amaranth in each plot uniformly reached designated growth stages for each study. Visual estimates of GR Palmer amaranth control were recorded 7, 14, 21, and 28 days after treatment (DAT). At 28 DAT, GR Palmer amaranth density and aboveground dry weight were determined in each plot.

Based on this two-year study, treatments containing multiple herbicide modes of action provided the greatest GR Palmer amaranth control. 2,4-D was not beneficial to any mixture except glyphosate in the Late Application Study. 2,4-D alone at 2 pt/ac pro-

vided similar control to that of two- and three-way herbicide mixtures 28 DAT in the Early Application Study. At 28 DAT, glyphosate plus 2,4-D at 1 or 2 pt/ac provided GR Palmer amaranth control comparable to all other mixtures applied at early application timings; however, when applied at the later timing, mixtures of glufosinate and 2,4-D provided the greatest control of GR Palmer amaranth 28 DAT. Control was similar with glufosinate alone or all mixtures containing glufosinate in the Early Application Study, but glufosinate alone controlled less GR Palmer amaranth than glufosinate plus 2,4-D mixtures in the Late Application Study. 2,4-D alone at 2 pt/ac provided comparable control to all 2,4-D, glyphosate, and/or glufosinate mixtures 28 DAT in the Early Application Study.

Herbicide mixtures that contained glufosinate provided the greatest control of 6- to 8-inch GR Palmer amaranth; however, no mixtures provided 100% control. Optimal GR Palmer amaranth control with glyphosate plus 2,4-D is dependent upon application timing. Glufosinate and 2,4-D both provide options to be included in herbicide programs for GR Palmer amaranth control; however, 2,4-D added no benefit to any herbicide mixture except glyphosate.