WEED SCIENCE

POSTEMERGENCE CONTROL OF GLYPHOSATE-RESISTANT PALMER AMARANTH WITH CALLISTO-BASED HERBICIDE COMBINATIONS

Jason Bond, Paul Mangialardi, Ben Lawrence, Jimmy Peeples, and Matthew Edwards

ALTHOUGH THE TECHNOLOGY REQUIRES MORE IN-DEPTH STUDY, THE USE OF CALLISTO AND OTHER HPPD-INHIBITING HERBICIDES COULD ACT AS ANOTHER TOOL TO HELP MANAGE GLYPHOSATE-RESISTANT PALMER AMARANTH IN MISSISSIPPI SOYBEAN.

Continual use of herbicides with the same mode of action as the only means of weed control increases the probability of herbicide resistance. Multiple resistance, such as Palmer amaranth resistant to both glyphosate and acetolactate synthase (ALS) herbicides, is common. Populations of Palmer amaranth have evolved resistance to six different herbicide modes of action including glyphosate (Group 10), ALS inhibitors (Group 2), dinitroanilines (Group 3), triazines (Group 5), 4-hydroxyphenylpyruvate dioxygenase (HPPD; Group 27), and protoporphyrinogen oxidase inhibitors (Group 14). Herbicide resistance has allowed Palmer amaranth to become the most common and troublesome weed of soybean in Mississippi.

Mesotrione was developed by Syngenta for the control of broadleaf and grass weeds in corn and has been marketed as Callisto. It is also a component of herbicide premixes such as Halex GT and Lexar EZ. Mesotrione inhibits the HPPD enzyme, causing the bleaching symptoms characteristic of Group 27 herbicides. Originally developed for corn, mesotrione is now labeled in a variety of agricultural, fruit, and vegetable crops. Depending on the crop, it can be applied as a preemergence or postemergence treatment for control of annual broadleaf and grass weeds.

A new herbicide-resistant crop technology is being developed in soybean that confers resistance to mesotrione. The technology is being developed by Syngenta and is currently named MGI (Mesotrione, Glufosinate, and Isoxaflutole). Isoxaflutole is the active ingredient


Photo 1


Photo 2

in Balance Flexx, which is another HPPD herbicide labeled for corn. Glufosinate is the active ingredient in Liberty 280 and is used for non-selective weed control in LibertyLink crops. Research is needed to determine how to utilize mesotrione with current soybean herbicides. Research was conducted at the Mississippi State University Delta Research and Extension Center to evaluate glyphosate plus different rates of Callisto with and without Flexstar for control of glyphosate-resistant (GR) Palmer amaranth.

A study to evaluate mixtures of glyphosate, Callisto, and Flexstar was conducted once in 2013 and twice in 2014. Callisto at 0, 1.5, 3, and 4.5 oz/ac was applied with and without Flexstar at 16 oz/ac. Glyphosate (Roundup WeatherMax) at 22 oz/ac was included in all treatments. Treatments were applied with a tractor-mounted sprayer once GR Palmer amaranth plants uniformly averaged 2 to 4 inches in height. Visual estimates of Palmer amaranth control were recorded 7, 14, 21, and 28 days after treatment (DAT). Following the final visual evaluation, GR Palmer amaranth densities and aboveground dry weight was determined in each plot.

Glyphosate alone controlled GR Palmer amaranth 35% 28 DAT. Applications of glyphosate alone and in mixtures with Callisto at 1.5 oz/ac provided similar GR Palmer amaranth control 14, 21, and 28 DAT. Palmer amaranth control was greater when glyphosate was combined with Callisto at 3 and 4.5 oz/ac compared with glyphosate alone or in mixture with Callisto at 1.5 oz/ac 14, 21, and 28 DAT. Flexstar applied in mixtures with glyphosate or glyphosate plus all rates of Callisto controlled GR Palmer amaranth ≥ 93, 92, and 90% 14, 21, and 28 DAT. No differences in plant density or dry weight were observed in plots treated with Callisto at 0 and 1.5 oz/ac. However, plant densities and dry weight were lower in plots treated with Callisto at 3 and 4.5 oz/ac compared with plots receiving no Callisto.

No differences in control were observed when Callisto, Flexstar, and glyphosate were applied in mixtures compared with Flexstar alone. Although this data indicates control was optimized with glyphosate plus Flexstar, adding Callisto to postemergence applications of glyphosate plus Flexstar may provide increased residual control of GR Palmer amaranth and slow the spread of resistance by applying multiple herbicide modes of action. Therefore, the ability to use Callisto preemergence in soybean will likely aid in maintaining GR Palmer amaranth control following postemergence applications.

Herbicide combinations targeting glyphosate-resistant Palmer amaranth
Photo 1: *nontreated.*
Photo 2: *Glyphosate + Callisto at 3 oz/ac.*
Photo 3: *Glyphosate + Flexstar at 16 oz/ac.*
Photo 4: *Glyphosate + Flexstar at 16 oz/ac + Callisto at 3 oz/ac.*