COVER CROPS, RESIDUAL HERBICIDES, AND APPLICATION METHOD REDUCE SELECTION PRESSURE POTENTIALLY DELAYING DICAMBA RESISTANCE IN PALMER AMARANTH

L.C. Hand
T.M. Randell
University of Georgia
Tifton, GA
R.L. Nichols
Cotton Inc.
Cary, NC
L.E. Steckel
University of Tennessee
Jackson, TN
A.S. Culpepper
University of Georgia
Tifton, GA

Abstract

Weeds are constantly adapting to weed management practices by developing resistance to herbicidal mechanisms of action. Dicamba-tolerant cotton was commercialized during 2017 and was planted on 55% of cotton acres in the U.S. during 2019. The subsequent increase in dicamba use will lead to dicamba-resistant weeds unless growers make sound management decisions. Thus, experiments were conducted in 2018-2019 in Ty Ty, GA and Jackson, TN to evaluate the reduction in dicamba selection pressure associated with the utilization of integrated weed management strategies.

Treatments were arranged in a split-plot design with the whole-plot being conventional tillage compared to a cereal rye cover crop. Two weeks prior to cotton planting, cereal rye was rolled and chemically terminated generating a dry biomass ranging from 1,575 to 6,019 kg ha^{-1}. In the cover crop systems, cotton was strip-tilled and planted simultaneously in Georgia, while no-till practices were implemented in Tennessee. For conventional systems, beds were roto-tilled and planted. All locations were planted to dicamba-tolerant cotton in May with row spacing of 92-98 cm placing 2 seeds every 23 cm. The split-plot was herbicide system including four systems: (1) no herbicide; (2) 3 POST applications of glyphosate (1.12 kg ha^{-1}) + dicamba (0.57 kg ha^{-1}); (3) fomesafen (0.17 kg ha^{-1}) + diuron (0.57 kg ha^{-1}) PRE fb glyphosate + dicamba POST three times; and (4) fomesafen + diuron PRE fb glyphosate + dicamba POST two times fb diuron (0.84 kg ha^{-1}) + MSMA (1.38 kg ha^{-1}) as a directed layby. Application timing options included 1) immediately after planting, 2) POST 1, 3) POST 2 and 4) POST 3 or layby when cotton was planted, 1-2 leaf, 4-5 leaf, and 8-10 leaf, respectively.

To quantify reductions in dicamba selection pressure associated with cover crops, preemergence herbicides, and layby applications, Palmer amaranth was counted 1 day before each POST herbicide application. Additionally, to quantify which plants were treated with more than one dicamba application, Palmer amaranth were separated into plants damaged by dicamba or not at the POST 2 and POST 3/layby timing. This allowed for dicamba exposure over the entire season to be calculated for each herbicide and tillage system. Cotton was harvested for yield comparison.

At one day before POST 1, the highest Palmer amaranth density was observed in conventional tillage with no herbicide (1.96 million plants ha^{-1}). The addition of a cover crop reduced Palmer amaranth density 75%, while the addition of PRE herbicides reduced density 99%, regardless of tillage option. At POST 2, cover crop and the PRE herbicides were preforming similarly to the level noted at POST 1. In regards to plants surviving the first glyphosate + dicamba application, cover crops and PRE herbicides reduced survivors 43 and 98% when compared to total POST conventional systems, respectively. At time of the POST3/layby, the PRE herbicides reduced dicamba survivors by 97% when comparing relative systems. When exposure to dicamba + glyphosate over the entire season was calculated, the most Palmer amaranth were exposed in conventional tillage with 3 sequential applications of dicamba + glyphosate (2.2 million plants ha^{-1}). Adding a cover crop reduced exposure 65%, while adding a PRE reduced exposure at least 98%. When comparing the PRE fb 3 POST system to the PRE fb 2 POSTs fb layby, a numeric reduction in exposure of 68% was noted. Cotton yield was greatest when PRE herbicides were included; without the PRE applications 16% lower yields were observed. Cover crops were also beneficial with 14% higher yields when compared to conventional systems. The PRE herbicide option was the dominant factor in reducing selection pressure to topically applied dicamba; however, the cover crop was also extremely beneficial.