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Options for Controlling Herbicide-Resistant Palmer Amaranth Along Ditchbanks

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Background

Palmer amaranth (pigweed) with resistance to glyphosate (Group 9) and acetolactate synthase (ALS) (Group 2)-inhibiting herbicides is a widespread problem in agronomic crops across the Mid-South. Palmer amaranth's prolific growth allows it to exert significant damage to all infested crop acres. In recent years, there has been tremendous effort to prevent any Palmer amaranth escape from producing seed within a field to avoid rapid replenishment of the soil seedbank and spread of resistance (Barber et al., 2015; Norsworthy et al., 2014). However, management must go beyond the borders of the field if growers are to be successful long-term in their fight against this weed.

Non-cropped ditchbanks and field borders are prime habitats for weeds like Palmer amaranth to reproduce because the soil is often barren and there is no crop to compete with the weed. While some growers may consider this portion of the farm to be of little consequence to the overall farming operation, the amount of weed seed produced by Palmer amaranth in these non-cropped areas can be considerable, with much of this weed seed eventually returning to the adjacent fields where much effort has been put into keeping fields weed-free. Palmer amaranth seed can be dispersed into fields by wind during natural senescence, by rainfall events or flooding because the seed readily float and through field edge maintenance involving tillage or mowing following seed production (Bagavathiannan et al., 2013). When inhabiting these non-cropped areas, problematic weeds have greater opportunities to contaminate other areas, add to the soil seedbank and restrict water flow in ditches without competition from crops (Charles et al., 2002) (Figure 1).

Figure 1. Occurrence of problematic weeds along roadsides in eastern Arkansas. *(Photo by M.V. Bagavathiannan)*

Historically, glyphosate has been the most widely used herbicide for weed control along field edges due to its ease of application, low cost and efficient control of weeds. Due to the widespread existence of Palmer amaranth along field edges and roadsides today (Korres et al., 2015) and the fact that > 95 percent of this Palmer amaranth is resistant to glyphosate (Roundup®) (Bagavathiannan and Norsworthy, 2013), glyphosate is no longer an effective option for controlling this weed along field edges. With this in mind, producers have been forced to rely upon other control methods, such as tillage and mowing, which are often ineffective or contribute to dispersal back into the

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field unless routinely practiced prior to seed production. Other challenges exist in regard to controlling weeds in these non-cropped areas because the number of herbicide options labeled for use along field margins is limited (Norsworthy et al., 2012). Additionally, many producers are reluctant to manage weeds in these non-cropped areas due to time constraints and additional management costs. The long-term management benefits outweigh the costs.

Labeled Ditchbank Herbicides

Currently, there are approximately 12 herbicides labeled for use along field margins, including ditchbanks adjacent to row crop fields. These consist of both residual and nonresidual herbicides, including glyphosate (Roundup®), 2,4-D (Weedar®), dicamba (Clarity®), triclopyr (Garlon®), aminopyralid (Milestone®), glufosinate (Rely®), diuron (Direx®), diquat (Reward®), fluridone (Sonar), imazapyr (Arsenal®), saflufenacil (Sharpen®) and indaziflam (Alion®). However, many issues have been noted about using several of these herbicides for controlling herbicide-resistant Palmer amaranth in these non-cropped areas.

First, the additional use of Rely in these areas over the current use in row crops could likely increase the selection pressure for weed resistance, further reducing our in-crop herbicide options. Second, many of the these postemergence herbicides, including 2,4-D, Clarity, Garlon, Reward and Rely, provide no residual control of Palmer amaranth and other broadleaf weeds; hence, frequent applications over an extended period (May-September) are needed, which is a challenging, unrealistic and likely an exorbitant management cost. Third, Arsenal is not likely to be an effective option because ALS-resistant Palmer amaranth is as prevalent as glyphosate-resistant Palmer amaranth in Arkansas (Bagavathiannan and Norsworthy, 2013). Fourth, 2,4-D use on ditchbanks is currently banned after April 15 in some counties, and dicamba should not be used on ditchbanks adjacent to soybean/peanut fields, which further limits control options. With the number of labeled herbicide options reduced further, soil-residual herbicides appear to be the best option to ensure effective, extended control.

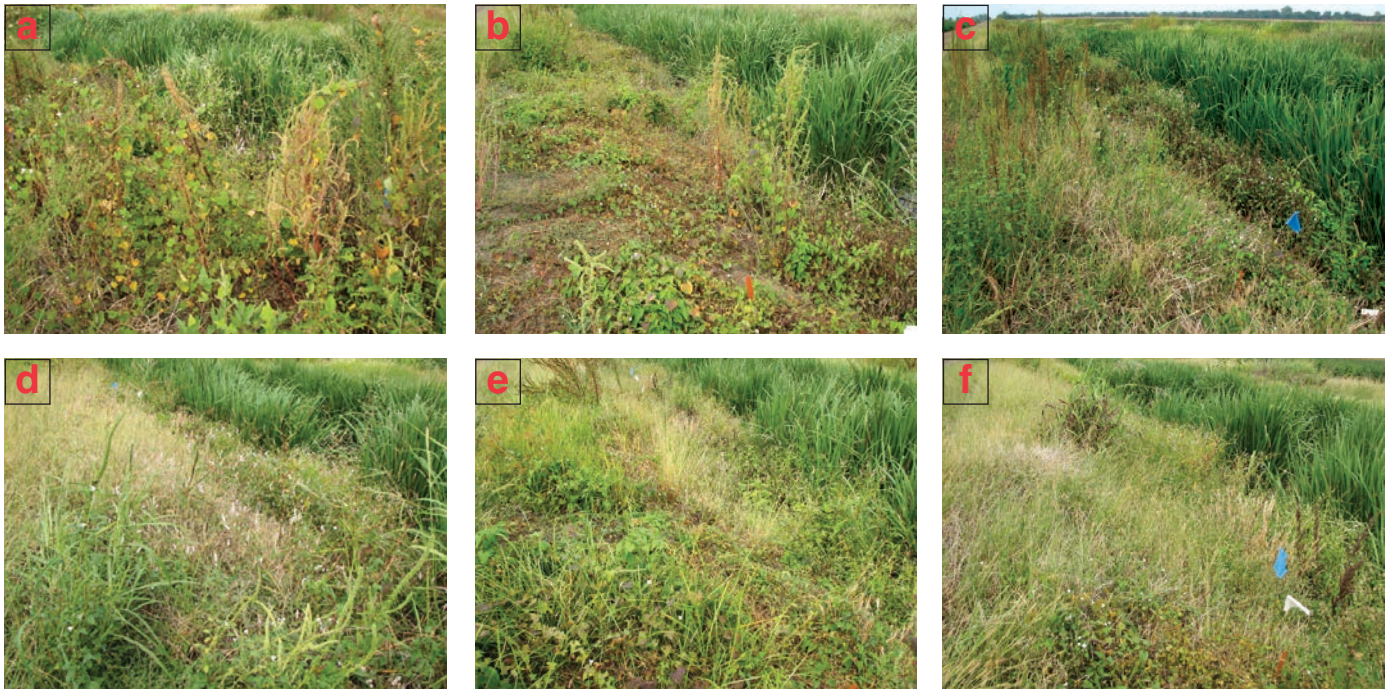
In order to control herbicide-resistant Palmer amaranth along ditchbanks and turnrows, higher herbicide use rates than those commonly used in crops or pastures will be needed to provide extended control throughout the spring and summer months. As a result of the high use rates, the likelihood of causing injury to existing grass groundcover is high with some of these herbicides, which could result in increased risk for erosion (Figure 2). Preferable plant groundcover, typically a low-growing, dense-forming grass, has been reported to aid in reducing soil erosion as well as suppressing weed emergence along field margins (Grover et al., 1980). With herbicide-resistant weeds emerging predominantly along roadsides and ditchbanks in eastern Arkansas, alternative herbicides are needed that provide extended control of Palmer amaranth as well as provide high levels of grass groundcover.

Figure 2. Soil erosion along a ditchbank lacking grass groundcover. (*Photo from www.in.gov)*

Recent Research

Recently, a study was conducted in eastern Arkansas to determine the level of herbicide-resistant Palmer amaranth control and grass tolerance to spring-applied, soil-residual herbicides labeled for use on ditchbanks. Of the 12 labeled herbicides listed above, only Sonar, Direx, Milestone, Alion, Sharpen and Arsenal provide residual Palmer amaranth control; hence, these were evaluated in the trial. Following a single application of these herbicides in March, the treatments were evaluated during the summer months through early fall (October).

For the herbicides evaluated, grass groundcover ranged from 33 to 66 percent in early fall following herbicide application (Figures 3a-f; Figure 4). Arsenal was not an effective option due to the existence of ALS-resistant Palmer amaranth on the ditchbank (Figure 3c; Figure 4). Milestone and Sharpen allowed for the greatest level of grass groundcover (Figures 3d and f; Figure 4), which was not surprising because both herbicides are primarily used in pasture and/or turf for broadleaf weed control. Milestone and Sharpen also provided at least 95 percent Palmer amaranth control throughout the summer months, which was superior to other tested treatments (Figure 4). In addition to the residual Palmer amaranth control provided by Milestone and Sharpen, it is likely that the increased presence of grasses on the ditchbank aided suppression of Palmer amaranth emergence throughout most of the summer months, in addition to limiting soil erosion when these two herbicides were applied.



Figures 3a-f. Evaluation at 27 weeks after application: (a) Sonar (fluridone) at 2 qt/A, (b) Direx (diuron) at 12 qt/A, (c) Arsenal (imazapyr) at 40 fl oz/A, (d) Milestone (aminopyralid) at 7 fl oz/A, (e) Alion (indaziflam) at 6.5 fl oz/A and (f) Sharpen (saflufenacil) at 6 fl oz/A.

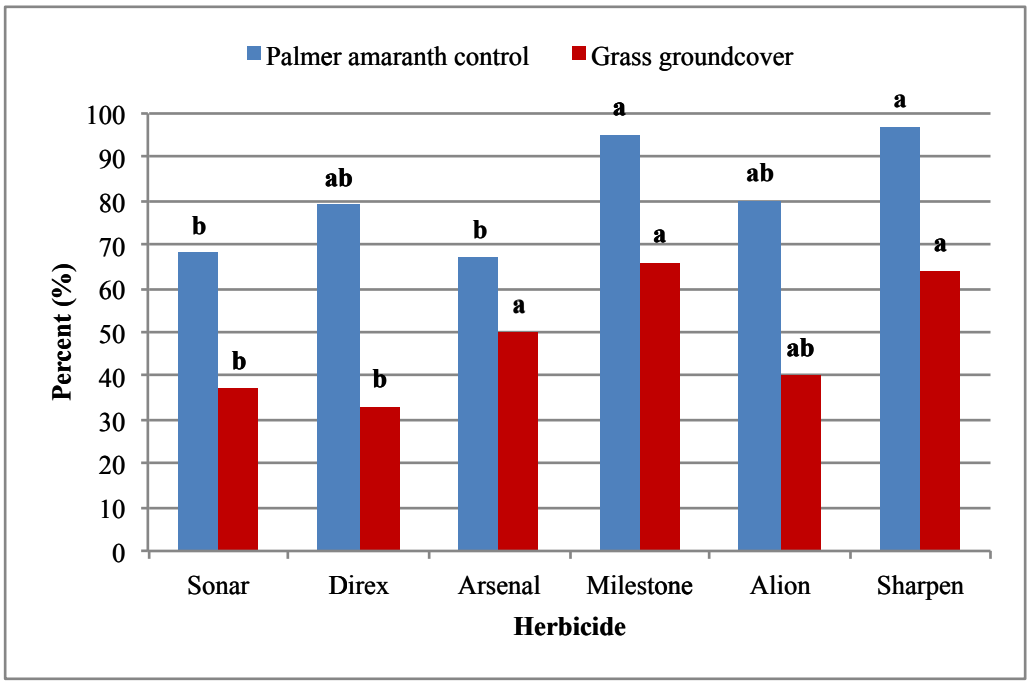


Figure 4. Palmer amaranth control and grass groundcover in October following a March application of herbicides labeled for use on ditchbanks. Means separated using Fisher's protected LSD (α = 0.05).

Concluding Remarks

Preventing the spread of herbicide-resistant weeds is paramount to successful weed management, and this includes managing the weeds in fields as well as adjacent non-cropped areas. Although some may believe that controlling weeds in non-cropped areas is not feasible due to time restraints and costs, producers must be reminded that these non-cropped areas are prime habitats for Palmer amaranth to reproduce without interference from crops. The use of soil-residual herbicides to control problematic weeds along field margins is highly beneficial. Based on our recent research, it appears that Milestone at 7 fl oz/A and Sharpen at 6 fl oz/A applied in March or early April are the best options for controlling Palmer

amaranth while minimizing the risk for erosion in the treated areas. Neither of these products is labeled for postemergence use in agronomic crops, except for Sharpen in rice. If applications are made later in the year after crop emergence, there is increased risk for injury to adjacent crops from both of these products.

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