Effect of Deep Tillage and Rye on Palmer Amaranth Seed Burial and Emergence in Cotton

J. D. DeVore, J.K. Norsworthy, J.A. Still, G.M. Griffith, and D.B. Johnson

RESEARCH PROBLEM

Glyphosate-resistant Palmer amaranth (*Amaranthus palmeri*) is fast becoming a major concern of Arkansas crop producers. Palmer amaranth is causing many problems in Arkansas cotton fields by lowering yields and reducing harvesting efficiency. With Arkansas cotton producers relying heavily on glyphosate-resistant cotton, an alternative solution to controlling resistant Palmer amaranth is needed.

BACKGROUND INFORMATION

For several years, many farmers have been relying on glyphosate as their primary herbicide for weed control. During this time, weeds such as Palmer amaranth have evolved resistance to glyphosate due to repeated applications annually. Glyphosate-resistant Palmer amaranth is the most problematic weed for cotton producers across the South. Some of the reasons Palmer amaranth is so troublesome are: season-long emergence (Jha et al. 2006), high competitiveness and rapid growth rate of up to 6 ft or more (Garvey 1999; Norsworthy et al. 2008), resistance to herbicides, and exorbitant seed production (Keeley et al. 1987). This rapidly growing weed can greatly reduce cotton lint yields by as much as 92% at only 0.08 plant/ft² (Rowland et al. 1999). With ever-increasing production costs, an efficient and effective management strategy must be developed. Control is critical in small infested areas to prevent spread even further. It was reported by Griffith et al. (2009) that if glyphosate-resistant Palmer amaranth is not controlled in the first year of its occurrence, it is capable of moving up to 375 feet across a field from the original source in just one year. The importance of controlling an outbreak of glyphosate-resistant Palmer amaranth is evident.

1Graduate assistant, associate professor, program technician, graduate assistant, respectively, Crop, Soil, and Environmental Sciences Department, Fayetteville.
RESEARCH DESCRIPTION

A field experiment was conducted at the Lon Mann Cotton Research Station in Marianna, Ark., in which a rye cover crop was tested in combination with deep tillage and no tillage to determine the impact on Palmer amaranth emergence and soil seedbank numbers. This experiment was organized in a randomized complete block design with a two by two factorial arrangement of treatments replicated four times. The first factor was no tillage and deep tillage using a mouldboard plow. The second factor was no cover and a rye cover crop. A 22 ft^2 area was marked in the center of each plot (8 rows by 200 ft) by GPS. Once marked, 500,000 glyphosate-resistant Palmer amaranth seed were placed within the 22 ft^2, and then the plot was disked twice. Half of the plots were deep tilled and half were not (factor A – tillage). During the growing season, five counts were taken to determine the number of Palmer amaranth that emerged within the center of the plot. Soil cores were taken at 0 to 6 inches and 6 to 12 inches in the fall of 2008 immediately after deep tillage and again in the fall of 2009. Evaluation of the seed content in these cores is ongoing in the greenhouse.

RESULTS AND DISCUSSION

Both the tillage and the cover crop reduced Palmer amaranth emergence in cotton but the combination of the two provided the greatest control with an 85% reduction in emergence (Table 1). With an average of 2.4 to 2.9 plants/ft row, there was no impact on stand counts among the treatments. Yield was not impacted for both the cover crop and no cover crop treatments, averaging 2400 to 2430 lbs/A of seedcotton. Obviously, cover crops and deep tillage will not eliminate glyphosate-resistant Palmer amaranth; however, use of these tools will likely reduce the risks of failures associated with residual herbicides. Additional efforts should focus on the integration of the best practices identified in this research with use of residual herbicides.

PRACTICAL APPLICATION

This research demonstrates the importance of using cultural practices as a means of controlling glyphosate-resistant Palmer amaranth. Using these methods in combination with a non-glyphosate herbicide program could effectively control resistant Palmer amaranth. However, these data do not suggest that all cotton producers should move back to deep tillage practices on vast acreage as it is not environmentally sound, nor is it going to remain an effective form of weed control if deep tillage is implemented year after year. These data suggest that if a producer has an outbreak of resistant Palmer amaranth, then a one-time turning of the soil with a mouldboard plow in the infested area should effectively bury most of the Palmer amaranth seed where it can then be managed using a cover crop and a non-glyphosate herbicide program.
ACKNOWLEDGMENTS

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LITERATURE CITED


Table 1. Palmer amaranth emergence in cotton.

<table>
<thead>
<tr>
<th>Tillage</th>
<th>Cover crop</th>
<th>Counting date</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Total emergence</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>None</td>
<td>2064 a¹</td>
<td>1751 a</td>
<td>518 a</td>
<td>31 a</td>
<td>20 a</td>
<td>4384 a</td>
</tr>
<tr>
<td>None</td>
<td>Rye</td>
<td>471 b</td>
<td>611 b</td>
<td>387 a</td>
<td>28 a</td>
<td>3 a</td>
<td>1500 b</td>
</tr>
<tr>
<td>Mouldboard</td>
<td>None</td>
<td>631 bc</td>
<td>626 b</td>
<td>346 a</td>
<td>26 a</td>
<td>2 a</td>
<td>1631 b</td>
</tr>
<tr>
<td>Mouldboard</td>
<td>Rye</td>
<td>108 c</td>
<td>298 c</td>
<td>216 a</td>
<td>23 a</td>
<td>0 a</td>
<td>645 c</td>
</tr>
</tbody>
</table>

¹ Means within a column followed by the same letter are not significantly different (P = 0.05). Different letters within each column represent a statistically significant difference in mean emergence between treatments.