Cultural practices to support Palmer amaranth management in Michigan

Kelsey M. Rogers, Christy L. Sprague and Karen A. Renner
Department of Plant, Soil and Microbial Sciences, Michigan State University, East Lansing, MI

Introduction

- Palmer amaranth is a new threat to Michigan soybean growers.
- Herbicide-resistance, including resistance to glyphosate, coupled with Palmer amaranth's ability to emerge throughout the growing season and grow rapidly makes it extremely difficult to manage with herbicides alone.
- One approach to improve management of glyphosate-resistant Palmer amaranth in soybean is to add cultural practices such as cover crops and planting soybean in narrow rows.

Objective

- To examine the effects of a cereal rye cover crop, soybean row width and herbicide programs on the management of glyphosate-resistant Palmer amaranth.

Materials and Methods

- A field study was conducted near Middleton, MI with a known population of glyphosate-resistant Palmer amaranth.
- 'Wheeler' cereal rye was planted on October 23, 2014 at 100 kg/ha (1.6 US bu/A) and terminated on May 14, 2015 (Feeke's 6).
- 'DF 9221' LibertyLink soybean was planted May 27, 2015 2 weeks after rye termination.
- Split-split plot design, 4 replications

Cover Crop (main plot)	Soybean row width (sub-plot)	Herbicide strategy (sub-sub plot)
No cover crop	19 cm rows 370,000 seeds/ha	No management
Rye - terminated with glyphosate	76 cm rows 494,000 seeds/ha	Low management
Rye - terminated with flail mower		High management

- Palmer amaranth management strategies

Timing	No	Low	High
PRE	--	flumioxazin (71 g ai/ha)	flumioxazin (71 g ai/ha)
POST (7.5 cm Palmer)	--	glufosinate (593 g ai/ha)	glufosinate + acetochlor (593 + 1260 g ai/ha)

- Soybean harvested October 19, 2015

Data collection and analysis

- Cereal rye and weed biomass at the time of termination
- Weekly Palmer amaranth emergence counts
- Rye and Palmer amaranth control was evaluated throughout the growing season
- Palmer amaranth biomass and densities (July 21)
  - Biomass – no management plots
  - Counts – low and high management plots
- Soybean canopy light interception
- Soybean population at harvest and yield
- Data were analyzed in PROC MIXED in SAS; interactions tested; means separated using Fisher's protected LSD ($p \leq 0.05$)

Results and Discussion

Cover crop effects

- Cereal rye produced 1200 kg/ha of dry biomass at the time of termination (30 cm height).
- Winter annual and early summer annual weed biomass suppression was 77% compared with the no cover control.
- Cereal rye was not adequately terminated by flail mowing.
- An additional 1280 kg/ha of dry biomass was produced one week after mowing and then was terminated with glyphosate (Figure 1).
- Soil moisture at planting was not influenced by cover crop at a 7.5 or 12 cm depth.
- Palmer amaranth emergence was not affected by the rye cover crop or termination method. Emergence began on June 16, 33 days after rye termination.
- Cereal rye did not affect Palmer amaranth density, control or soybean yield regardless of termination method.

Figure 1. Cereal rye one week after the time of termination

Management effects

- Palmer amaranth control was similar between the high and low management strategies (data not shown).
- Soybean yields were greater in the high management compared with the low management system in 19 cm rows (Figure 2).
- In the no management systems, soybean yields were reduced 37 and 25%, respectively, in the 19 and 76 cm row widths compared with the high management system.

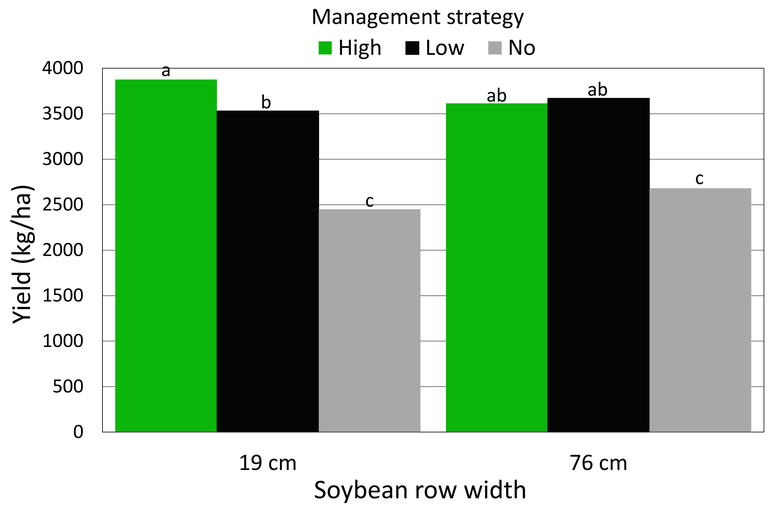

Figure 2. Effect of soybean row width and management strategy on soybean yield

Row width effects

- Soybean canopy closure occurred 16 days earlier in 19 cm rows compared with 76 cm rows (Figures 3 & 4).
- 19 cm row width and herbicide applications reduced emergence of late season Palmer amaranth by 52% compared with the 76 cm rows (data not shown).
- Fifty percent of cumulative Palmer amaranth emergence occurred five days earlier in 19 cm rows compared with 76 cm row widths (p=.00002) (Figure 5).

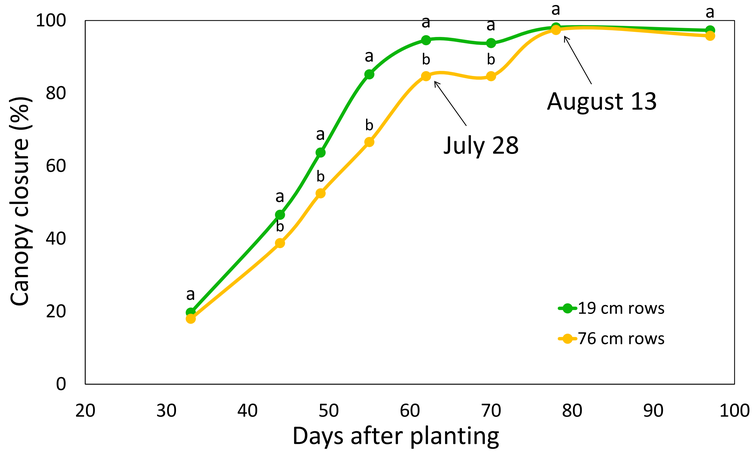

Figure 3. Soybean canopy closure in the 19 and 76 cm row widths

Figure 4. Effect of soybean row width on Palmer amaranth emergence

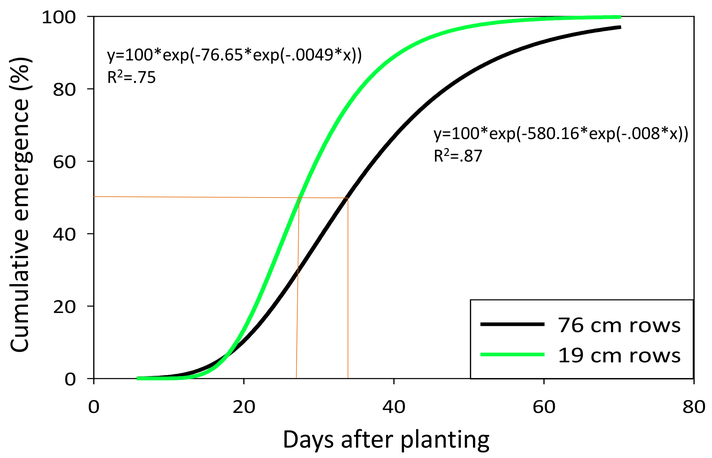

Figure 5. Cumulative Palmer amaranth emergence for 19 and 76 cm row widths combined over cover crop treatments

Conclusions

- Overall, the cereal rye cover crop and termination method had minimal effects on Palmer amaranth control, possibly due to the low cereal rye biomass that was produced.
- Planting soybean in narrow rows and applying a PRE followed by a POST herbicide application was an effective management strategy in reducing late Palmer amaranth emergence in the first year of our study.

Acknowledgements

MSPC
MICHIGAN SOYBEAN PROMOTION COMMITTEE
Project GREEEN