Multiple-resistant Palmer amaranth management strategies in corn

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Introduction

- Palmer amaranth has been identified in nine Michigan counties.
- Several of Michigan's Palmer amaranth populations have been confirmed resistant to glyphosate- and ALS-inhibiting herbicides.
- In addition to multiple herbicide resistance issues, the ability of Palmer amaranth to emerge throughout the season, grow rapidly, and produce tremendous amounts of seed makes it one of the biggest weed threats to Michigan field crop growers.
- Several more herbicide sites of action are available for use in corn than in other field crops, therefore Michigan growers may have a greater opportunity to manage Palmer amaranth in corn.

Objective

- To evaluate the effectiveness of several management strategies for season-long control of multiple-resistant Palmer amaranth in corn.

Materials and Methods

- Field study conducted in a commercial corn field near Middleville, Michigan (2013)
  - High Palmer amaranth population (485 m^{-2})
- Randomized complete block design; 4 replications
- Herbicide programs: preemergence (PRE) fb. postemergence (POST), one-pass total POST (EPOS), and 2-pass POST (Table 1)
- PRE herbicide applications were made after planting and EPOS and POST applications were made when Palmer amaranth were ~8 cm in height
- Weed control evaluations were made throughout the season until harvest (145 DAP) and biomass was collected at 60 DAP
- Data were analyzed in PROC MIXED in SAS; means were separated using Fisher's protected LSD ($p \leq 0.05$)

Results and Discussion

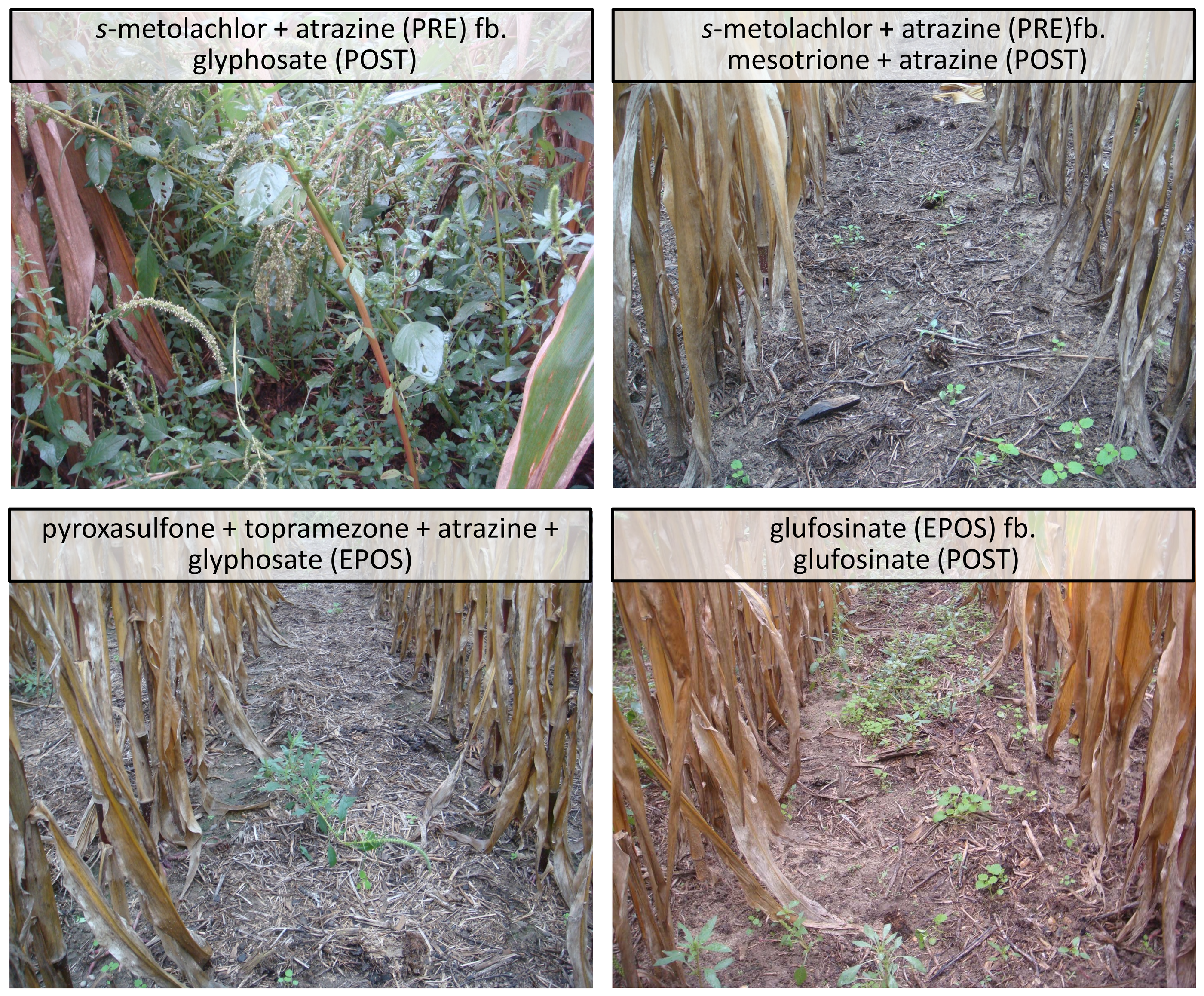

Figure 1. Palmer amaranth control at harvest

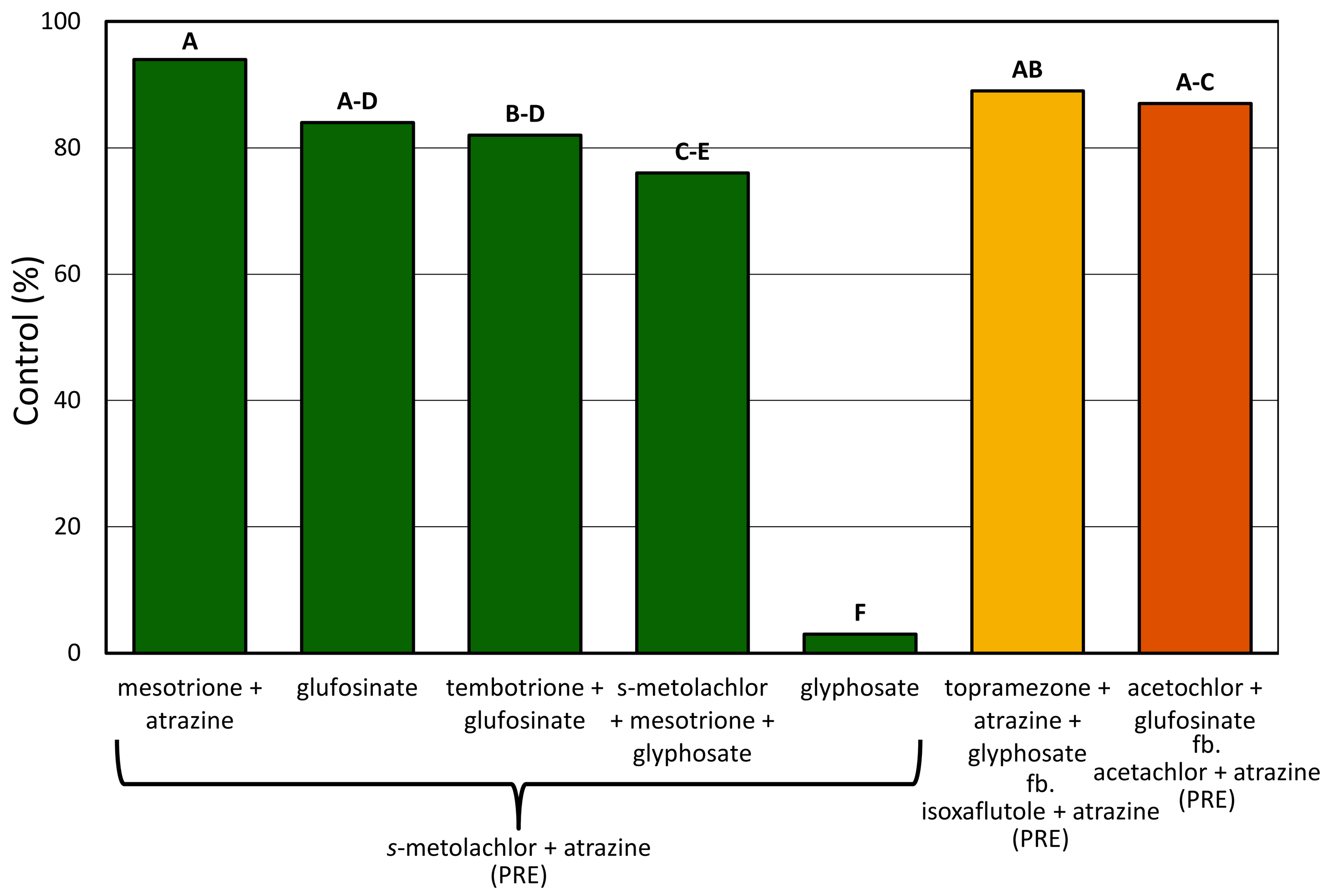

Figure 2. Atrazine (PRE fb. POST) programs for Palmer amaranth control at harvest

- The corn herbicide program that provided the greatest overall control of multiple-resistant Palmer amaranth was *s*-metolachlor + atrazine (PRE) fb. mesotrione + atrazine (POST) (Figures 1 & 2).
- Of the other 10 PRE fb. POST programs, 5 showed similar levels of control at harvest (Figures 2 & 3).
- Of the 3 one-pass EPOS programs evaluated only one showed similar levels of control to the best PRE fb. POST program (Figure 4).
- The programs that most effectively controlled Palmer amaranth season-long generally consisted of three effective modes of action.
- Greater than 80% weed control was observed with multiple applications of glufosinate; however the timing of these applications is critical.

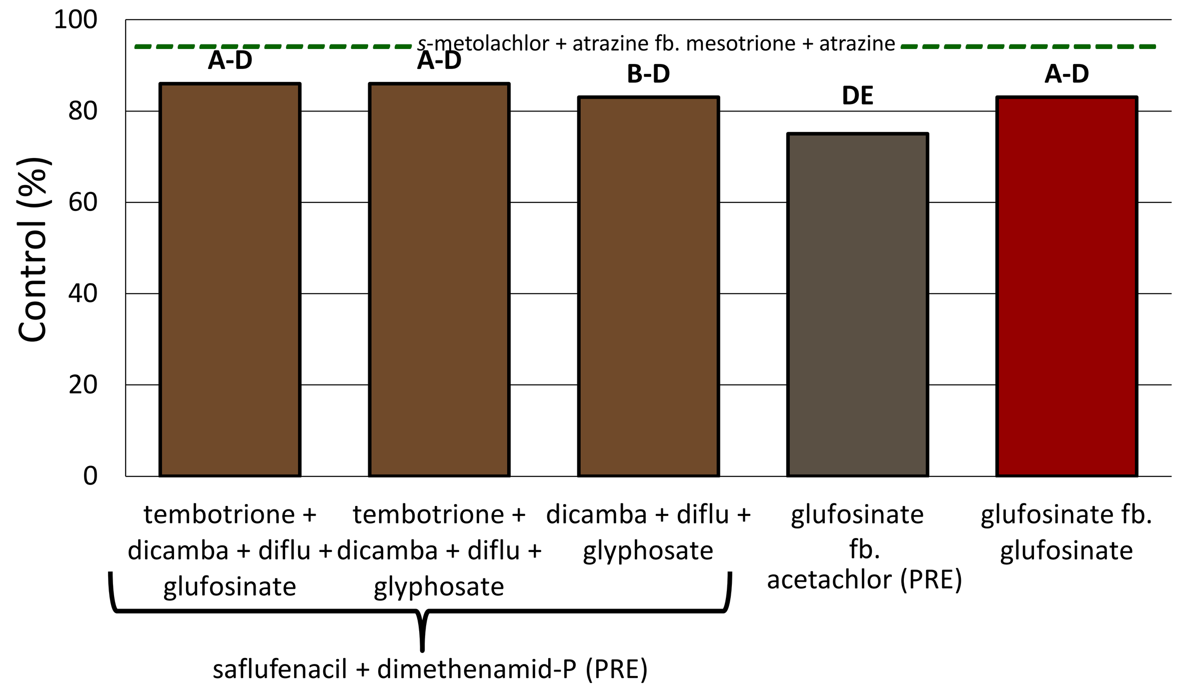

Figure 3. Non-atrazine programs for Palmer amaranth control

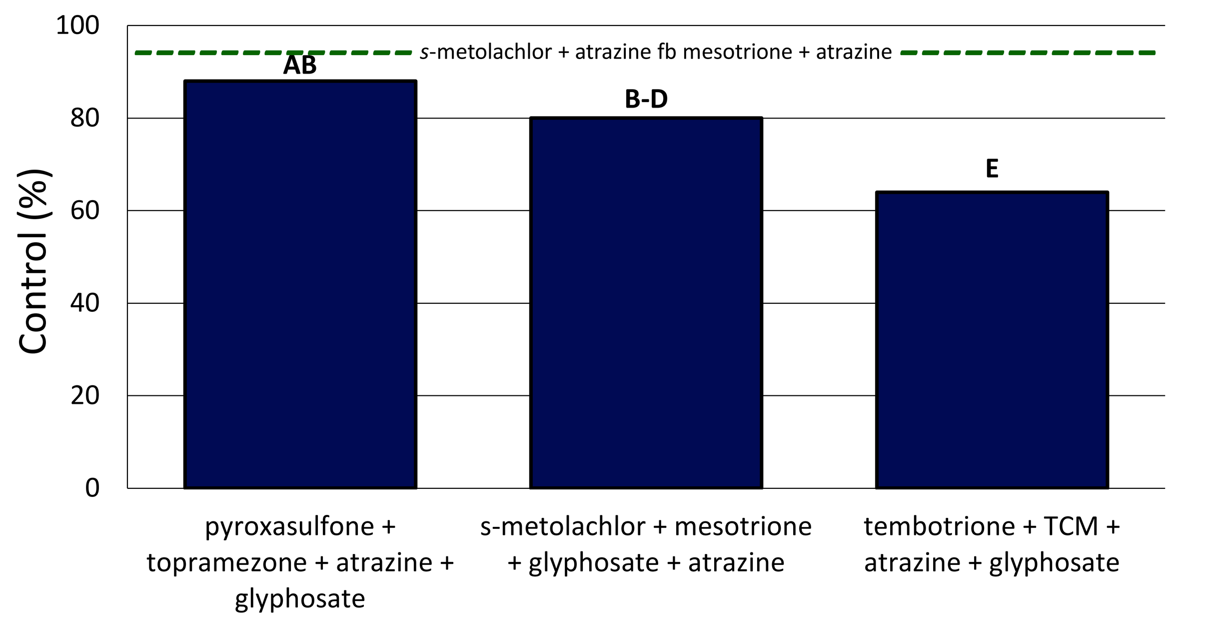

Figure 4. EPOS one-pass programs for Palmer amaranth control at harvest

Herbicide Programs

Table 1. Herbicide programs evaluated in 2013 to manage multiple-resistant Palmer amaranth in corn

Atrazine PRE fb. POST programs	
PRE (kg ai/ha)	POST* (kg ai/ha)
s-metolachlor + atrazine (1.4 + 1.8)	mesotrione + atrazine (0.1 + 0.7)
	glufosinate (0.6)
	tembotrione + glufosinate (0.04 + 0.6)
	s-metolachlor + mesotrione + glyphosate (0.105 + 1.1 + 1.1)
	glyphosate (0.84)
isoxaflutole + atrazine (0.07 + 1.1)	acetachlor + glufosinate (1.3 + 0.6)
acetachlor + atrazine (1.7 + 1.4)	topramezone + atrazine + glyphosate (0.02 + 0.6 + 0.84)

non-Atrazine programs	
PRE (kg ai/ha)	POST* (kg ai/ha)
saflufenacil + dimethenamid-P (0.08 + 0.7)	tembotrione + dicamba + diflufenzopyr + glufosinate (0.05 + 0.14 + 0.06 + 0.6)
	tembotrione + dicamba + diflufenzopyr + glyphosate (0.05 + 0.14 + 0.06 + 0.84)
	dicamba + diflufenzopyr + glyphosate (0.14 + 0.06 + 0.84)
acetachlor (1.57)	glufosinate (0.6)
No PRE	glufosinate fb. glufosinate (0.6 fb 0.6)

One-Pass EPOS
EPOS* (kg ai/ha)
pyroxasulfone + topramezine + atrazine + glyphosate (0.15 + 0.02 + 1.7 + 0.84)
s-metolachlor + mesotrione + glyphosate + atrazine (0.11 + 1.1 + 1.1 + 1.1)
tembotrione + TCM + atrazine + glyphosate (0.08 + 0.01 + 1.1 + 0.84)

* All EPOS and POST applications included appropriate adjuvants to maximize efficacy.

Conclusions

- For effective management of multiple-resistant Palmer amaranth in corn, PRE herbicide applications should include atrazine in combination with a seedling shoot inhibitor and POST applications need to contain at least two modes of action with foliar activity as well as have some residual component for season-long control.
- While this research did show that acceptable levels of Palmer amaranth control can be achieved with a one-pass program, the recommended approach for Palmer amaranth management would be a PRE followed by POST program.

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