

Herbicide Programs for Control of Atrazine- and HPPD Inhibitors-Resistant Palmer amaranth in Glufosinate-Resistant Corn



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Introduction

- Palmer amaranth (*Amaranthus palmeri* S. Wats.), also known as Careless weed, is one of the most troublesome and economically important weed in corn, soybean, and other crops.
- Prolonged and repeated use of single mode-of-action herbicides has resulted in evolution of resistance in Palmer amaranth population to at least five modes of actions of herbicides: Microtubule-, PS II-, ALS-, EPSPS-, and HPPD-inhibitors.
- Palmer amaranth biotype was confirmed resistant to atrazine and HPPD-inhibitor herbicides in a seed corn production field in Fillmore County Nebraska in 2014.
- Dose response studies conducted under greenhouse conditions showed 4- to 23- fold level of resistance to HPPD-inhibitors and 9- to 14- fold level resistance to atrazine applied POST.



Atrazine- and HPPD- Resistant Palmer amaranth in Fillmore County, Nebraska

Objective

To develop herbicide programs for control of atrazine- and HPPD inhibitors-resistant Palmer amaranth population using different PRE herbicides followed by glufosinate in glufosinate-resistant corn.

Materials & Methods

- Field study was conducted on a grower's farm infested with atrazine- and HPPD inhibitors-resistant Palmer amaranth in Fillmore County near Shickley, Nebraska in 2015.
- Study was laid out in a randomized complete block design with four replications.
- Each plot was 3.0 m wide and 9.0 m long and consisted of four rows of glufosinate-resistant corn "Mycogen 2V717d" spaced 0.76 m apart.
- PRE herbicide application was made one day after planting, except for Fierce applied ten days before planting, followed by POST herbicide application at 29 d after planting using a CO₂ pressurized backpack sprayer at a spray volume of 15 gallons acre⁻¹.
- Visual control estimates of Palmer amaranth were collected 14, 21, 28, 56, and 70 d after herbicide applications on a scale of 0 to 100% with 0% meaning no control and 100% meaning complete death of weed.
- Above-ground biomass of Palmer amaranth was harvested from 0.5 m² quadrants at 28 d after POST and dry weight was recorded. Dry weight was converted to percent biomass reduction compared to nontreated control and presented.
- Data were analyzed in SAS (9.3) using Proc GLIMMIX model.

PRE Herbicide Treatments

Chemical Name	Trade Name	Rate (ai/ae ha ⁻¹)	Modes of Action
Callisto + Dual II Magnum + Atrazine	Lumax EZ	2780	27 + 15 + 4
Flumioxazin + Pyroxasulfone	Fierce	160	14 + 15
Acetochlor + Clopyralid + Flumetsulam	Surestart II	1190	15 + 4 + 2
Saflufenacil + Dimethanamid-P	Verdict	780	14 + 15
Pyroxasulfone + Fluthiacet-ethyl + Atrazine	Anthem ATZ	1580	15 + 4 + 5

POST Herbicide Treatments

Glufosinate	Liberty 280	595	10
Glufosinate + Dicamba	Liberty 280 + Diflexx	595 + 280	10 + 4

Results

Figure 1. Control of resistant Palmer amaranth at 21 d after PRE

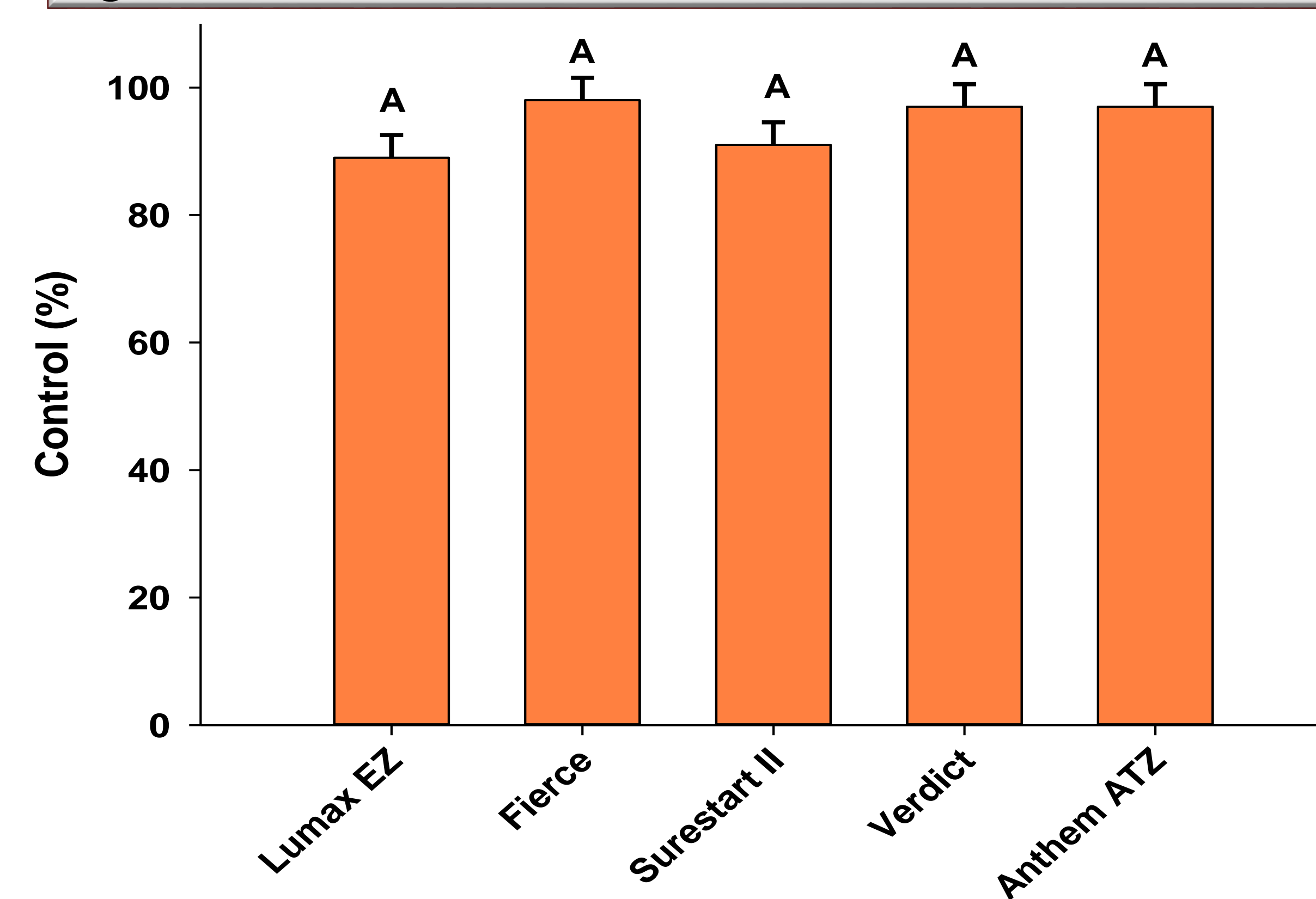


Figure 2. Control of resistant Palmer amaranth at 28 d after POST

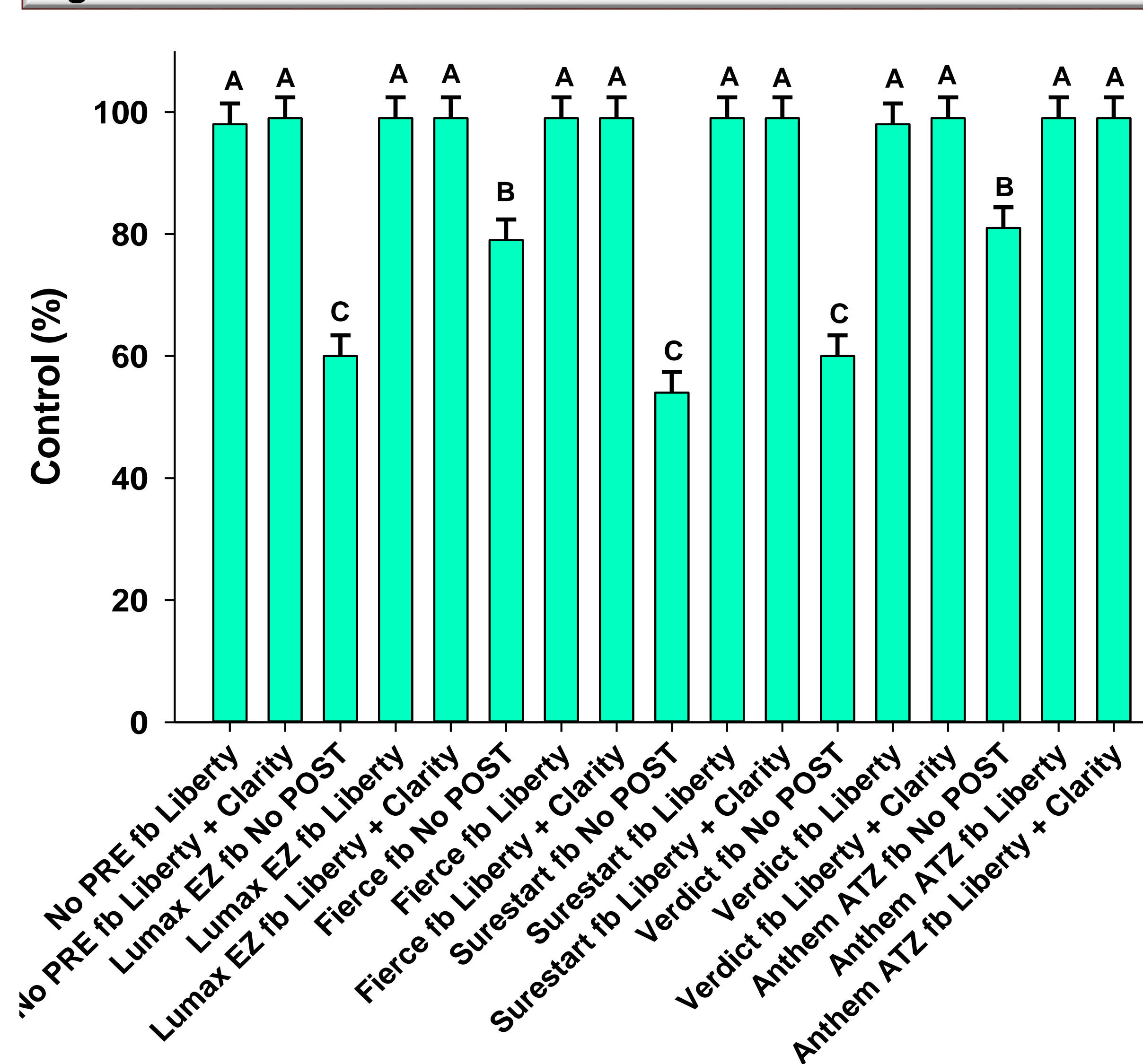
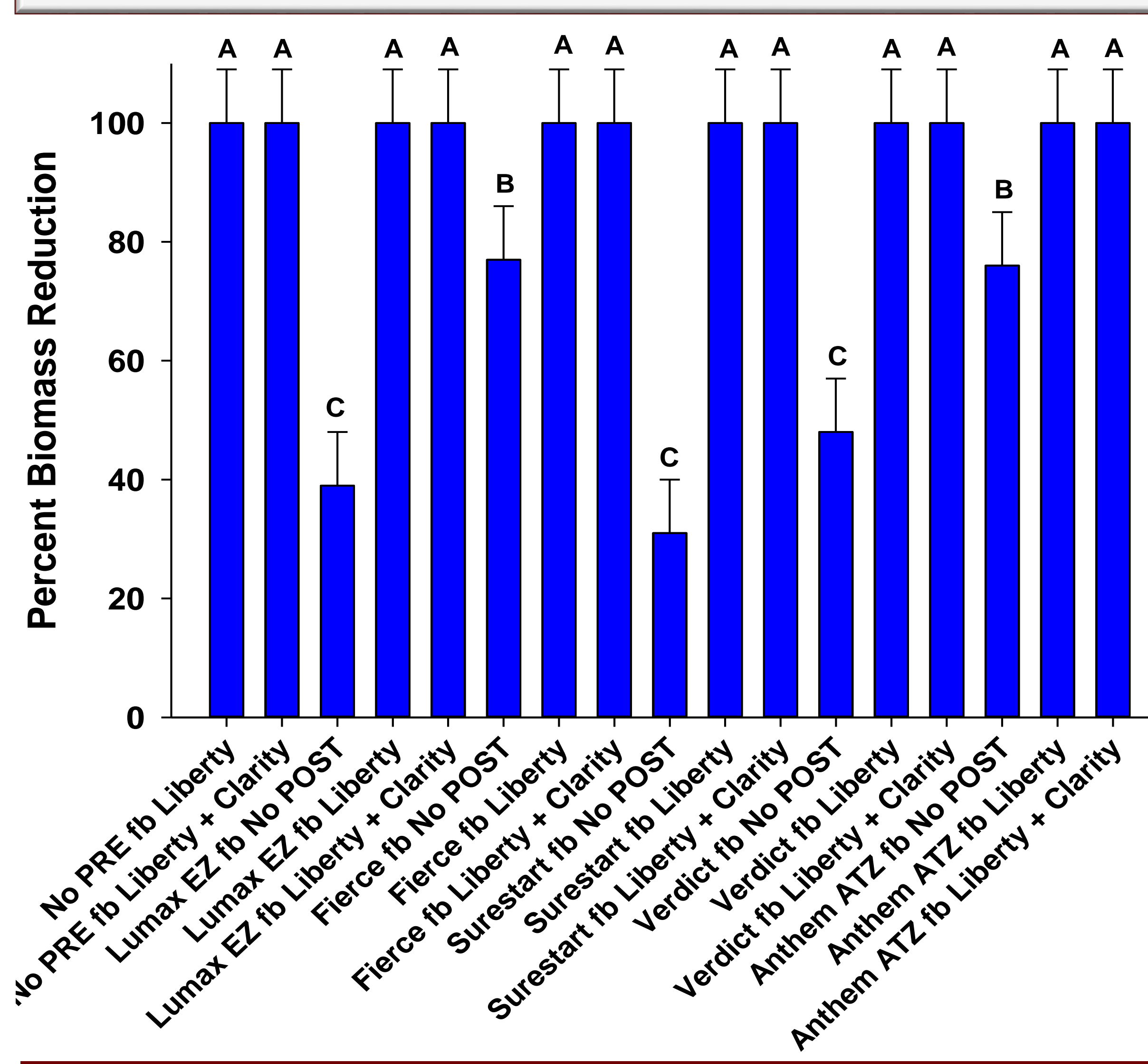


Figure 3. Percent biomass reduction of Palmer amaranth at 28 d after POST



Discussion

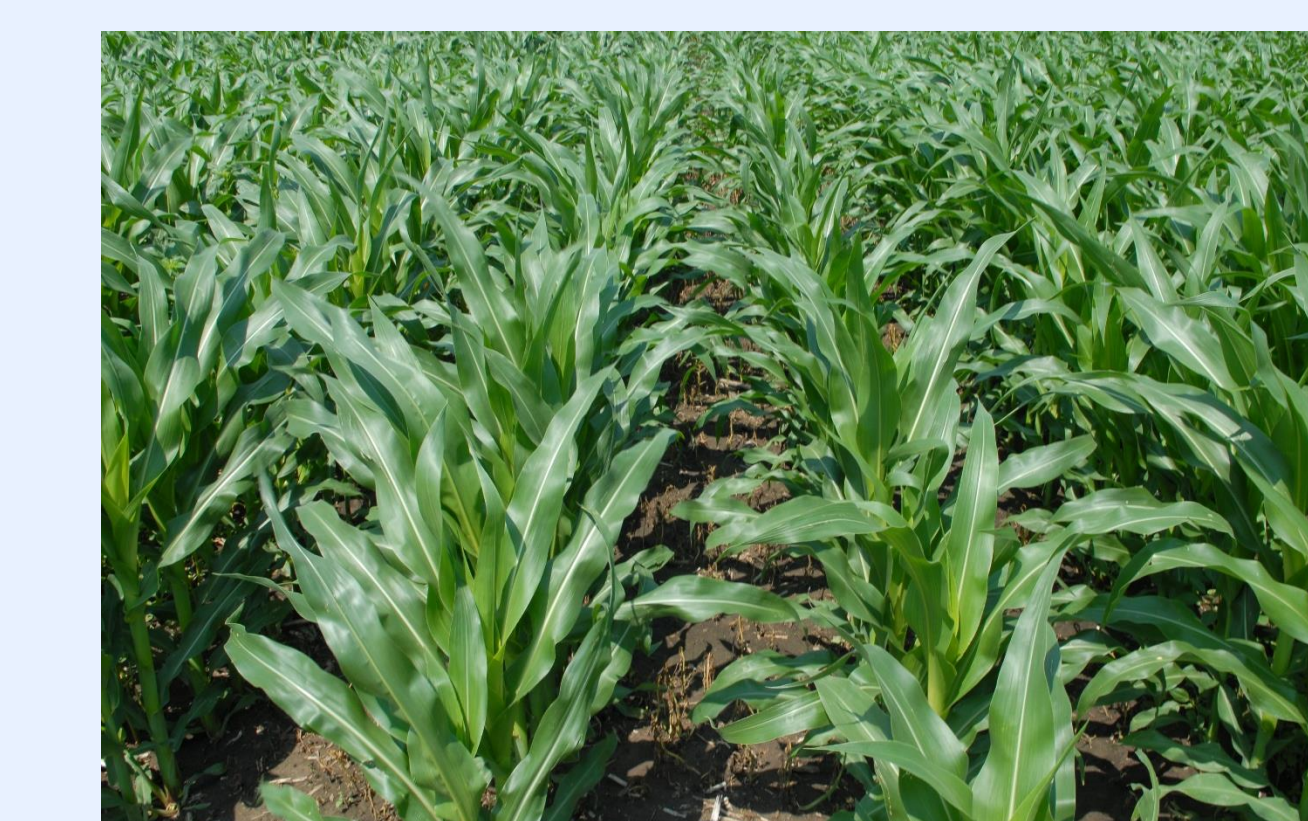
- At 21 d after PRE application, Palmer amaranth was controlled > 85% with all the PRE herbicides used in this study.
- At 28 d after POST or 49 d after PRE application, all the PRE fb POST and POST only herbicide treatments controlled Palmer amaranth > 95% compared to < 80% control with PRE only herbicide treatments.
- No crop injury was observed with the PRE and POST herbicide applications.
- Percent shoot biomass reduction and visual control estimates of Palmer amaranth were usually similar at 28 d after POST application.
- All herbicide treatments provided higher corn yield (>14550 kg ha⁻¹) compared with nontreated control.



Nontreated Control



No PRE fb Liberty



No PRE fb Liberty + Clarity



Lumax EZ (PRE only)



Lumax EZ fb Liberty



Lumax EZ fb Liberty + Clarity

Conclusions & Implications

- Application of soil-residual herbicides tested in this study followed by POST herbicides provided effective control of Palmer amaranth.
- Tank mix application of glufosinate and dicamba as POST herbicides will tend to impose less selection pressure on Palmer amaranth or other weeds compared to POST application of glufosinate alone.
- PRE followed by POST treatments should include multiple sites-of-action herbicides in order to reduce the chances of further evolution of resistance in weeds.
- Palmer amaranth has developed resistance to different sites-of-action herbicides in the United States; therefore, integrated weed management strategies including crop rotation, tillage, and use of residual followed by POST herbicides with different sites-of-action should be followed.