

A multi-state effort to evaluate if alfalfa can eliminate herbicide resistant *Amaranthus* weed seed production and reduce the seedbank to near zero



Sara Kezar¹, John Wallace², Mark Marsalis³, Leslie Beck³ & Mark Renz¹

¹ University of Wisconsin – Madison; ² Penn State University; ³ New Mexico State University



Introduction

- Herbicide resistance is a major obstacle in crop production particularly *Amaranthus* weeds (e.g. waterhemp & Palmer amaranth).
- Alfalfa shows promise to prevent seed production of resistant populations.
- As *Amaranthus* seed has a short longevity in the soil (4-6 years), we expect *Amaranthus* seedbanks to be severely reduced during alfalfa production.

OBJECTIVE

- Evaluate if alfalfa can reduce the weed seedbank of *Amaranthus* species across three distinct alfalfa production regions in the United States

EXPERIMENTS WILL QUANTIFY

1. Reduction of the *Amaranthus* seedbank over two years
2. If different weed management tactics in the establishment year can enhance reduction
 - What is the impact of management on alfalfa yield and stand establishment
3. If weed seedbank reduction in small scale research plots is scalable to the farm level

Methods

- Experiments were established in spring 2026 in Wisconsin (Lancaster), Pennsylvania (Rock Springs) and New Mexico (Los Lunas) in spring 2026.
- Three common weed management approaches were selected that are effective at controlling *Amaranthus* spp. weeds and compared to a non-treated control. Glyphosate and ALS herbicides were not included due to the widespread resistance
 - Acetochlor (Warrant) applied at alfalfa emergence
 - 2,4-DB (Butyrac) applied when *Amaranthus* spp were 2 inches tall and alfalfa had 2 trifoliate leaves
 - 2,4-DB (Butyrac) + pendimethalin (Prowl H20) applied when *Amaranthus* spp were 2 inches tall and alfalfa had 2 trifoliate leaves
 - Non-treated control
- An additional treatment will be applied in August to *Amaranthus* spp that are producing pollen. This treatment (gametocide) is a dilute concentration of imazethapyr (Pursuit). Previous research had shown this is able to prevent viable pollen production, even in resistant populations.

MEASUREMENTS

- Soil cores were taken prior to planting and will be taken in two subsequent years.
- Weed control and injury will be visually observed as well as yield (weed and alfalfa) at each harvest.
- Density of *Amaranthus* spp. that are flowering and alfalfa stand density will be counted in the fall of each year.

Establishment of Research Plots



Soil cores for seedbank estimates taken from field prior to planting alfalfa. Cores were placed in trays in greenhouse, watered and germinable *Amaranthus* spp counted to estimate initial seedbank. Current estimate is > 3 seeds per cm² at Wisconsin site, other locations have not been summarized.

Initial results



Images from June 18, 2026 (Wisconsin) highlights differences from herbicide applications (49 days after Warrant application; 25 days after Butyrac applications). Note poor control from Warrant was due to lack of activating rainfall needed for herbicide for 14 days after application.

Table 1: Waterhemp control prior to 1st cut*

treatment	6/9	6/18	7/2	
NTC	0 c	0 c	0c	
Warrant	28 b	35 b	38b	
Butyrac	69 a	84 a	85a	
Butyrac +				
Prowl	69 a	83 a	85a	
P value	<0.001	<0.001	<0.001	

Table 2: Alfalfa cover prior to 1st cut*

treatment	6/9	6/18	7/2	
NTC	33	34 c	40c	
Warrant	43	55 b	60b	
Butyrac	41	68 a	83a	
Butyrac +				
Prowl	41	67 a	85a	
P value	0.124	<0.001	<0.001	

* Results only from Wisconsin; data from other locations but is yet to be summarized

Future Efforts

- Gametocide (Pursuit) applications will be made in August.
- Measurements will continue in 2026, 2027 and 2028. Biomass, alfalfa density, seedbank
- Results will be compared to on-farm seedbank estimates in alfalfa fields.

Acknowledgments

- Funding for this research was provided by the US Alfalfa Farmer Initiative.
- Thanks to Travis Wilson, Milos Viric, and students for collecting data.