



ISRC Project Report

1) About the project

- **Project Title:** Enhancing implementation and adoption of non-chemical tactics for integrated weed management in soybean
- **Lead PI:** Prashant Jha, Dept. of Agronomy
 - **Co-PIs:** None
- **Projects year(s):** 2021-2023
- **Total amount of funding:** \$100,000
- **Leveraged/Additional Funding, including federal or private organizations:** Additional funding from USDA-NIFA CPPM program, totaling ~\$620,000, was leveraged with multi-state (IA, AR, KS, IL) collaborations.

2) Project Summary

- **Objectives:**
 - Integrate ecologically-based integrated weed management (IWM) strategies, namely, cover crop and harvest weed seed control (HWSC), for managing herbicide-resistant waterhemp seed banks in soybean.
- **Deliverables:** Soybean producers in Iowa have demonstrated increasing interest in the two new harvest weed seed control technologies, namely chaff lining and weed seed destructor to manage herbicide-resistant weeds on their farm fields.
 - A Redekop Weed Seed Destructor attached to a JD S680 combine was demonstrated at the Farm Progress Show in Boone, IA in 2022, participants: >500
 - Information and data from harvest weed seed control technology in soybean was presented at the ICM conference, statewide Crop Advantage Series meetings, and industry-sponsored events held in Iowa in 2021/2022, total participants ~5000.
 - The project concept and results were presented by the PI at North Central Weed Science Society and Weed Science Society of America annual meetings held in 2022/2023.
 - ICM blog articles on IWM strategies in soybean were posted.

- **Benefit to Soybean Farmers:** This project seeks to increase successful adoption of IWM strategies for mitigating herbicide resistance as a component of sustainable soybean production in Iowa and the Midwestern region. The involvement of the Iowa producers in this project has proven to be an effective mechanism to leverage partnerships and enhance the implementation and adoption of cover crops and harvest weed seed control technology in Iowa.
 - A minimum of 30% of the corn and soybean farmers who receive information from this on-farm research are expected to integrate HWSC methods (chaff lining, seed destructor) and cover crops as effective IWM strategies for herbicide-resistant weed management.
 - Recommendations based on this research will be incorporated into the “Take Action” outreach materials to almost 500 soybean growers.
 - Web-based videos on practical weed management tips generated from this research will be viewed by ~200 weed management practitioners per year.
 - Results from this research was presented by Dr. Jha (PI) at numerous statewide and regional extension meetings/field days.
 - These metrics will be measured by conducting follow up grower surveys in Iowa through active participation of ISU ANR Crops Team, Extension Field Agronomists, and ISA On-Farm Network.
 - Augmenting current weed control practices with sustainable IWM-based approaches highlighted in this project will greatly improve the profitability and sustainability of soybean-based cropping systems of Iowa, currently threatened by multiple herbicide-resistant pigweeds. Ultimately, this project will reduce potential environmental impacts associated with increased pesticide use.

3) **Final Report:** Field experiments were conducted at ISU Research Farm and in grower fields in Iowa in the fall of 2021, with planting of cereal rye cover crop. The field sites had a natural uniform infestation of glyphosate-resistant waterhemp. A strip-split-plot randomized complete block design with four replications was used. The cereal rye cover crop was terminated (anthesis stage) after soybean planting in May of 2022. Herbicide treatments (PRE only vs. PRE followed by POST) were implemented in soybean in the 2022 growing season. Data on pigweed emergence was monitored in four 0.5 m² quadrants at a biweekly basis with a final density count before soybean harvest. Data on waterhemp seed production/retention at soybean harvest was recorded in each plot. The harvest weed seed control (seed destructor on vs. off) was implemented in fall of 2022 at soybean harvest.

A cereal rye cover crop (3-4 feet tall, with biomass of at least 4000 lbs/acre), when terminated at soybean planting, was very effective in reducing waterhemp density (by 35-40%) and seed production (up to 90%) compared with the no cover crop treatment. Waterhemp plants retained greater than 70% of seeds at the typical harvest dates of soybean in Iowa. Header loss accounted for 30% of waterhemp seed losses at soybean harvest and additional 10-15% losses occurred at the grain tank and from seeds escaping through the combine thresher (chopper). The Redekop™ Seed destructor unit physically destroyed greater than 90% of waterhemp seeds that entered the combine at soybean harvest. Those seeds were mostly non-viable and failed to germinate. Thus,

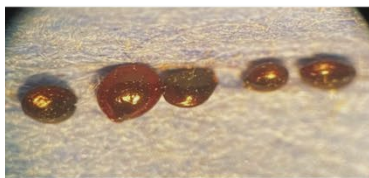
cover crops and weed seed destruction are effective integrated weed management tactics to mitigate herbicide-resistant waterhemp seedbanks in Iowa soybean production systems. These non-chemical tactics can reduce reliance on herbicides and preserve the utility of existing herbicide tools in soybean. In addition, my program successfully implemented the seed destructor technology at corn harvest in Iowa in 2022, indicating that growers can use this harvest weed seed control method in both corn and soybean phases of the rotation for a faster decline in weed seed banks.

4) Supporting attachments:

- *Photos/graphs/other graphics*



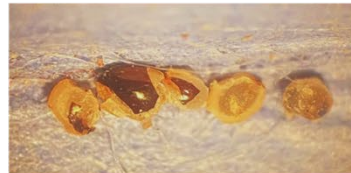
Measuring header, grain tank, and thresher loss of waterhemp seeds, Dayton, IA 2022



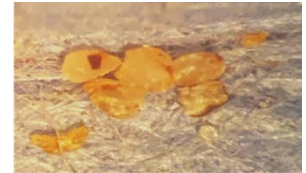
Fully intact



Slightly cracked



Moderately cracked



Severely cracked

Different levels of physical damage of pigweed seeds after passing through the Redekop seed destructor (high impact mill).

Acknowledgement: Support from ISRC and ISA to test harvest weed seed control technology for the first time in Iowa (by my program) is greatly appreciated.