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Through Integrated Weed Management



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Chaff Lining in Soybean Fields for Palmer Amaranth Management

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Summary

Herbicide-resistant weeds have resulted in the loss of effective herbicides and has forced farmers to seek alternative strategies. Australian farmers have developed harvest time weed seed control strategies targeting plants that survive weed control tactics used earlier in the growing season. Chaff lining is one of the lowest-cost, simplest approaches and consists of separating the chaff from the straw when harvesting the cash crop and leaving the chaff in a narrow row behind the combine. The chaff fraction contains most of the weed seeds. A chaff-lining chute, built at UD, was used to evaluate its effectiveness in soybeans. Chaff lining concentrated 87% of the Palmer amaranth seeds leaving the back of the combine in a 12-inch band. Additional research will focus on the implications of concentrating weed seeds rather than spreading them across the width of the field.

At harvest, you may discover that weeds have escaped your control efforts and are setting seeds. These escaped weeds can create an even bigger problem next year if they are allowed to add seeds to the soil weed seedbank.

Harvest weed seed control (HWSC) methods were developed in Australia to reduce the impact of weeds not controlled during the growing season. In particular, these efforts targeted herbicide-resistant weeds since the Australians had few effective herbicide options left. HWSC is not intended to replace herbicides or other integrated weed management strategies. Rather, HWSC is meant to provide one more opportunity to manage weeds before they have a chance to enter the soil seedbank.

Four different HWSC tactics have been developed, including chaff lining. Chaff lining is a strategy in which the weed seeds are placed in only a fraction of the area in a field by concentrating the seeds in narrow (12-inch) bands throughout the field.

During combining, three products leave the combine: crop grain (the majority of the material), larger pieces of straw and crop residues and the chaff fraction. The chaff contains all the small plant pieces as well as most of the weed seeds.

Since Palmer amaranth is one of the main weeds in soybean crops in the US, this demonstration focused on collecting the chaff fraction in rows behind the combine with a specially designed chute, to place the

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chaff and as many Palmer amaranth seeds as possible in narrow rows directly behind the combine. The straw and crop residue were spread across the width of the combine.

This demonstration was designed to measure how many of the weed seeds were kept in the chaff fraction and placed in the chaff lines.

METHODS

A chaff-lining chute was fabricated by University of Delaware Carvel Education and Research Center staff and installed in the rear of a John Deere 9500 combine with Australian guidance and advice. A soybean field with a natural infestation of Palmer amaranth was used to test chaff lining (Photo 1). The modified John Deere combine was run the length of the field (500 to 900 feet) (Photo 2). The combine's header was 20 ft. wide, and 10 strips were harvested using the modified equipment. Samples were collected at six locations within the field, with each sampling location selected because of its high density of Palmer amaranth. Prior to the combine passing through a location, three trays (20 inches x 12 inches x 2 inches) were placed on the ground to collect chaff and weed seeds. Two trays were placed three feet from the outer edges of the header, and one in the center of the header (directly under the chaff chute). The two trays near the outer edges collected seeds that were lost at the combine header and/or seeds spread with the straw fraction.

After the combine passed through a location, everything within the trays was collected, bagged, and returned to the lab. Weed seeds were separated from chaff and counted.

After counting weed seeds in each location, results were expressed as percentage of captured seeds in the chaff line and outside the chaff line. Percentages were averaged across the different locations within the farm.

RESULTS

Across the six locations, 87% of Palmer amaranth seeds were collected in the chaff lines (Table 1). This ranged from 64 to 99% of all the Palmer amaranth seeds collected. Across the six locations, the average number of seeds per square foot was 4,972 seeds in the chaff line compared to 549 seeds for the remainder of the combine header width. In this demonstration, we did not evaluate whether the Palmer amaranth seed presence was a result of seeds shattering at the header intake or if the seeds left the combine in the straw fraction.

CONCLUSIONS

The chaff-lining chute proved to be an efficient method of HWSC, collecting 87% of the Palmer amaranth seeds exiting the back of the combine. This approach required only minor modifications to the combine (although rotary combines require a baffle to separate chaff fraction from the straw), required no additional horsepower, and did not interfere with the combining operation. Confining weed seeds to only 5% of the area of the field enables additional management options for the following season. Ongoing research is examining management strategies for controlling weeds in the chaff lines. Future efforts should focus on larger combine headers and determine if weed seed loss occurs at the combine header or when leaving the combine with the straw fraction.



Photo 1. Demonstration field before combining.
Credit: Claudio Rubione, University of Delaware.



Photo 2. A chaff-lining chute concentrating weeds seeds in a narrow row during harvest, while spreading the straw and large plant residue pieces in the width of the combine header. Credit: Claudio Rubione, University of Delaware.

Table 1: Palmer amaranth seed collected at six different locations in the demonstration field. Seed samples were collected in the chaff line (directly under the chaff chute) and outside of the chaff line. Collected seeds are expressed as percentage of seeds in the chaff line or outside the chaff line compared to all seeds recovered from collection trays.

	Location within demonstration field						Average
	1	2	3	4	5	6	
	----- % of collected Palmer amaranth seeds -----						
In the chaff line	64	99	88	79	97	96	87
Outside of the chaff line	36	1	12	21	3	4	13



Photo 3. Combining soybeans, note the already-formed chaff lines next to the combine made with a fabricated chute. Credit: Claudio Rubione, University of Delaware.

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