How important is cleaning your equipment? A tale of two pigweeds

Weeds are troublesome to farmers. They directly compete with crops for water, nutrients, and light, impacting yield and quality. Weeds can also impede harvest or act as hosts for pests and pathogens. Weeds that have escaped control methods throughout the growing season can produce seed that can be spread within and between fields and farms. This becomes especially problematic if those weeds are resistant to herbicides.

(Photo 1)

Many annual weeds, species that germinate, flower, and die within the span of a growing season, can produce enormous amounts of seed. For example, dioecious pigweeds such as Palmer amaranth (*Amaranthus palmeri)* and waterhemp (*Amaranthus tuberculatus)* can produce, on average, tens of thousands to hundreds of thousands of seeds per female plant, even up to a million seeds in optimal conditions. Although most of the seed produced by these weeds will remain in the field where they are produced, the size of pigweed seeds (1.5-3mm) enables unintentional dissemination, through combines, on muddy tractor tires, or on cultivating equipment. Palmer amaranth and waterhemp are two species that have recently been identified in New York (in four and fourteen counties, respectively); populations across the United States and Canada have documented resistance to multiple sites of action. There is concern about their continued spread in the state and how crop production activities may be involved.

(Photo 2)

While it might not be feasible to thoroughly clean equipment between every field, removing as much plant and soil debris as possible is a critical strategy for reducing weed seed spread. Even small amounts of soil, as seen in Photo 2, can harbor seeds of species such as lambsquarters, purslane, pigweeds, and grasses. This also applies to any pre-owned or contracted equipment and can help prevent introduction of new weed species or herbicide resistant weed

seed to your farm. A grower in NY who purchased a used combine from the Midwest partnered with a Cornell Cooperative Extension Specialist to thoroughly clean their equipment. Approximately 97% of the weed seeds that they recovered were waterhemp, a new species on this farm. These were screened for resistance and the recovered waterhemp was found to be likely resistant to multiple modes of action, including resistances not yet documented in NY.

For example, results from preliminary 2021 greenhouse studies to document herbicide resistance in NY populations found Palmer amaranth (Steuben County) and waterhemp (Ontario County) survival following applications of glyphosate (as Roundup, WSSA 9), chlorimuron (as Classic, WSSA 2) and cloransulam (as FirstRate, WSSA 2) at 1, 2, and 4x soybean use rates. The novel waterhemp population from the Midwest combine was similarly resistant to the WSSA 9 (i.e., Roundup) and WSSA 2 (i.e., Pursuit) chemistries, but also had plants surviving treatments with WSSA 27 (i.e., Callisto) and WSSA 14 (i.e., Cobra) herbicides. Taking steps to prevent weed seed movement to new farms and between fields can have implications for future weed control costs and prevent the spread of novel resistance traits into new regions, as we monitor Palmer amaranth and waterhemp spread in NY.

(Photo 3)

In addition to taking precautions with pre-owned and moving equipment, there are other strategies to reduce the spread of weed seeds. Try to avoid traveling through dense weed patches in a field, especially if herbicide resistance is suspected. When planning harvest operations, try to make sure that the weediest fields are harvested last. Not only are these strategies useful in reducing the transport of new weed populations but removing soil from implements can reduce transmission of soil-borne pathogens, and removal of plant debris can prevent unnecessary wear-and-tear while helping to preserve equipment functionality.

Please see these additional online resources for more information:

NC-ANR Academy Harvest Helpline: Combine Clean-Out
Weed Seed Management at Crop Harvest
Weed Seed Movement via Combines: 2019-2022 Case Study

Sources:

Heap. I. The International Herbicide-Resistant Weed Database. Online. Thursday, September 22, 2022. Available www.weedscience.org

Loux, M (2019). Palmer Amaranth and Waterhemp Management: It's All About the Seed. Ohioline, Ohio State University Extension.

Mohler, C.L., Teasdale, J.R., DiTommaso, A. (2021). Manage weeds on your farm: a guide to ecological strategies. Sustainable Agriculture Research & Education (Program).

Schwartz, L., Norsworthy, J., Young, B., Bradley, K., Kruger, G., Davis, V., Steckel, L., Walsh, M. (2016). Tall Waterhemp (*Amaranthus tuberculatus*) and Palmer amaranth (*Amaranthus palmeri*) Seed Production and Retention at Soybean Maturity. Weed Technology, 30(1), 284-290. doi:10.1614/WT-D-15-00130.1

Images:

Photo 1: Palmer amaranth overtakes a corn field in Steuben County, NY. This is one of four NY counties with reported Palmer amaranth populations.

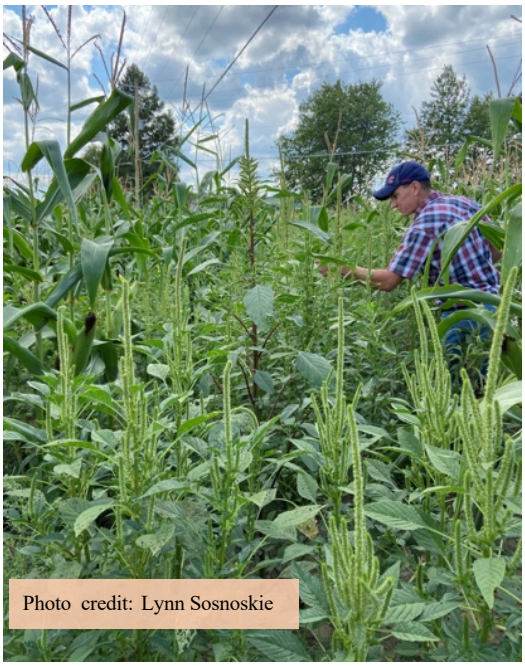
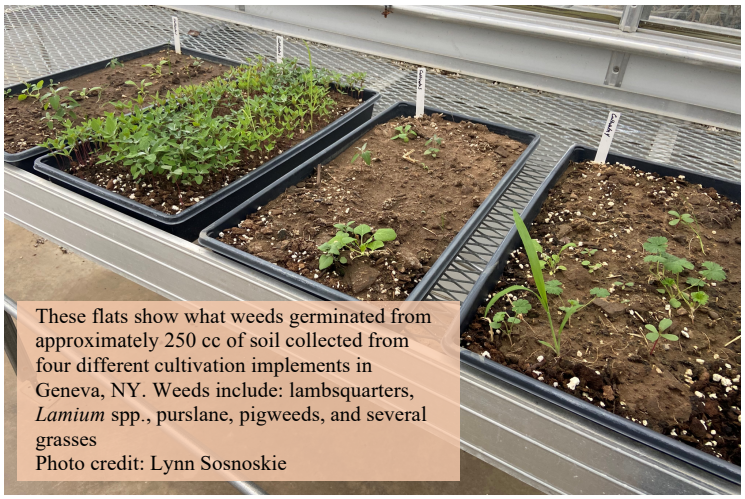


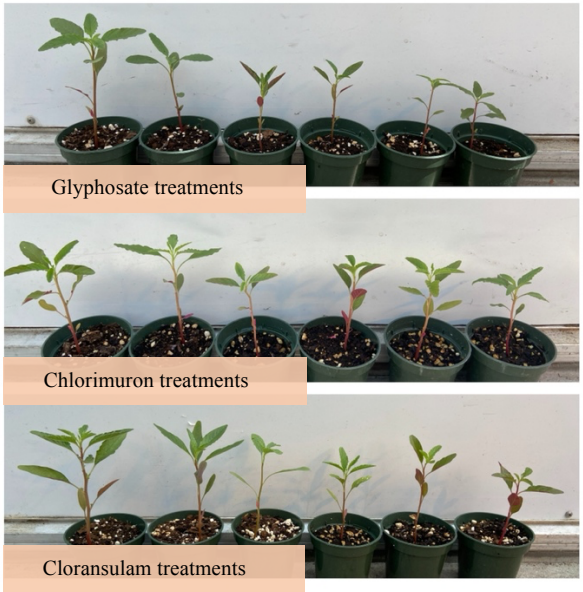
Photo credit: Lynn Sosnoskie

Photo 2: Germinated weeds recovered from 250 cc of soil recovered from four different farm implements at Cornell Agritech research farms in Geneva, NY. Weeds include: lambsquarters, *Lamium* spp., purslane, pigweeds, and several grasses. Number of emerged seedlings ranged from 4 to approximately 100 in each tray.



These flats show what weeds germinated from approximately 250 cc of soil collected from four different cultivation implements in Geneva, NY. Weeds include: lambsquarters, *Lamium* spp., purslane, pigweeds, and several grasses
Photo credit: Lynn Sosnoskie

Photo 3: Waterhemp survival after glyphosate, chlorimuron, and cloransulam treatments at 1, 2, and 4x soybean use rates (left to right) .



Glyphosate as Roundup; 1x rate = 0.87 kg ai/ha
Chlorimuron as Classic; 1x rate= 0.013 kg ai/ha
Cloransulam as FirstRate; 1x rate= 0.42 kg ai/ha
Applications with a cabinet sprayer w/ a single nozzle.
Boom set to deliver 187 L/ha.

Photo credit: Lynn Sosnoskie