Soil amendment effects on Palmer amaranth seed mortality in a Northern climate

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Introduction

- Palmer amaranth, typically a Southern weed, has been found in nine Michigan counties, with the first confirmation in the fall of 2010.
- These Palmer amaranth populations have been confirmed resistant to glyphosate- and ALS-inhibiting herbicides.
- Palmer amaranth seed produced from these populations have overwintered in Michigan’s colder climate and have germinated the following spring.
- Amendments incorporated into the soil can change the microbial community, which may affect fatal germination and seed decay, both components of weed seed mortality.
- Currently, no research has been conducted examining the effects of various soil amendments on Palmer amaranth seed mortality.

Objectives

- Evaluate the effects of four soil amendments over time on Palmer amaranth seed mortality in a Northern climate.

Materials and Methods

- Multiple-resistant Palmer amaranth seed was collected from a field in St. Joseph Co., Michigan in fall 2011
  - Intact seed overwintered outside in mesh bags
- Soil amendments (4 amendments):
  - Wheat and rye planted fall 2011 at 100 kg/ha
  - Wheat and rye sampled and maximum biomass determined in spring
- Poultry and dairy compost applied to plots in spring at 2241 and 9234 kg/ha, respectively
- All amendments incorporated to a 15 cm depth in spring
- Seed bags:
  - Overwintered Palmer amaranth seed (100) placed in mesh bags with 100 g sand and soil amendment
  - Soil amendment concentrations determined from the maximum amount per area at a 15 cm incorporation depth (Figure 1)
- Amended seed bags buried 15 cm deep in respective amendment plots in May 2012
- 4 replications per amendment were retrieved after 4, 8, 12, and 24 wks of exposure
- Seed bags stored at -18 C until processing
- Seed bag processing:
  - Seeds sieved from sand, counted and germinated in dark at 20 C for 1 wk
  - Non-germinated seeds tetrazolium chloride (TZ) tested for viability (Figure 2)
- Mortality = 100 – (germinated + TZ positive)
- Data were analyzed using PROC MIXED in SAS, mean separation by Fisher’s protected LSD (p<0.05)

Results and Discussion

- There was not an exposure time by soil amendment interaction for Palmer amaranth seed mortality, so the main effects of exposure time and amendment were examined (Table 1).
  - Averaged over all amendments, Palmer amaranth seed mortality was 52% after 4 wks of exposure. By 12 wks of exposure, seed mortality increased to 64% (Figure 3).
  - Averaged over all exposure times, soil amendments did not affect Palmer amaranth seed mortality. Seed mortality ranged from 50 to 57% (Figure 4).
- Samples are currently being processed for the seed bags retrieved after 24 wks of exposure.

Conclusions

- Palmer amaranth seed mortality increased the longer the seed was buried in the soil.
- The incorporation of poultry or dairy compost, or the use of rye or wheat as a cover crop, did not affect Palmer amaranth seed mortality within the first 12 weeks of exposure to these amendments during the summer months.
- We are repeating this research in 2012-2013.