

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 ($p \leq 0.05$)

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.

Figure 2. Tetrazolium chloride (TZ) testing of remaining non-germinated Palmer amaranth seed.

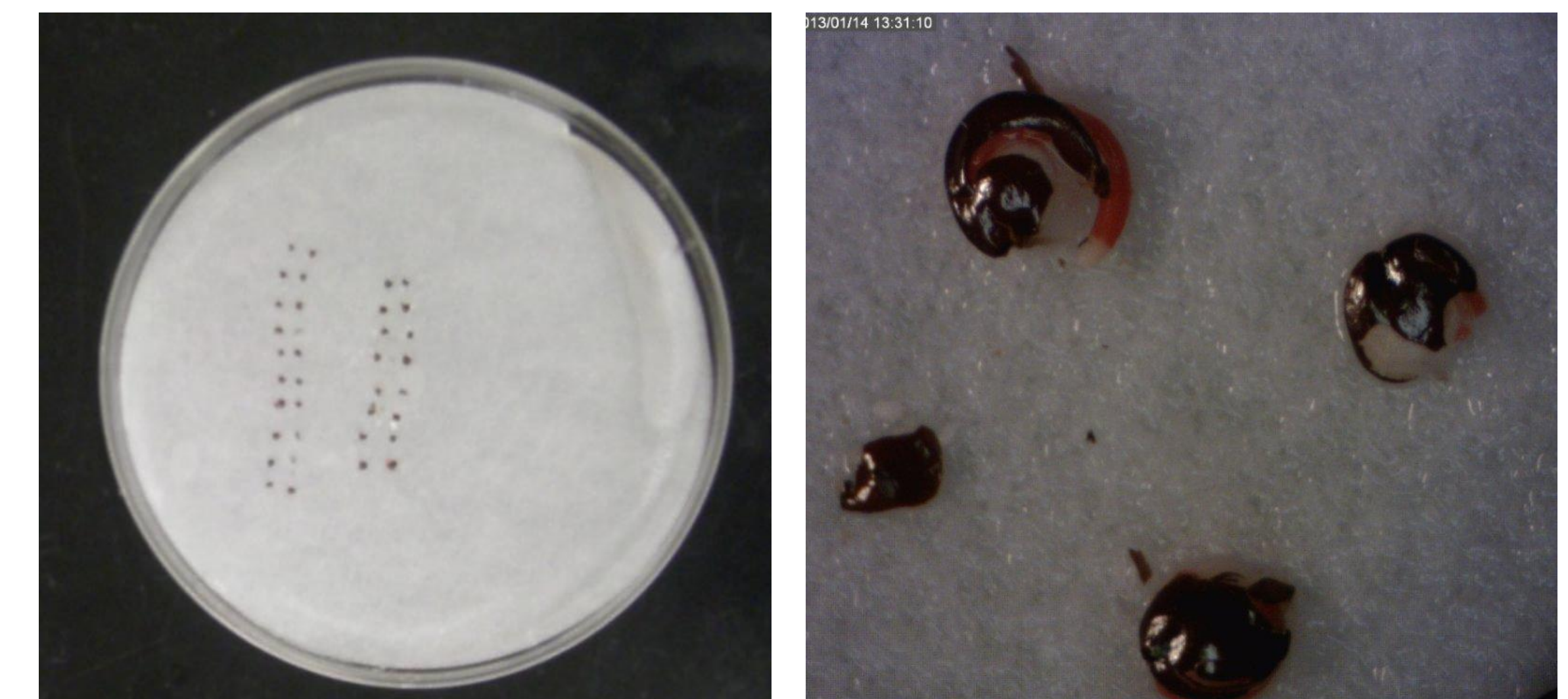


Figure 1. Concentration of soil amendments mixed in each mesh bag.

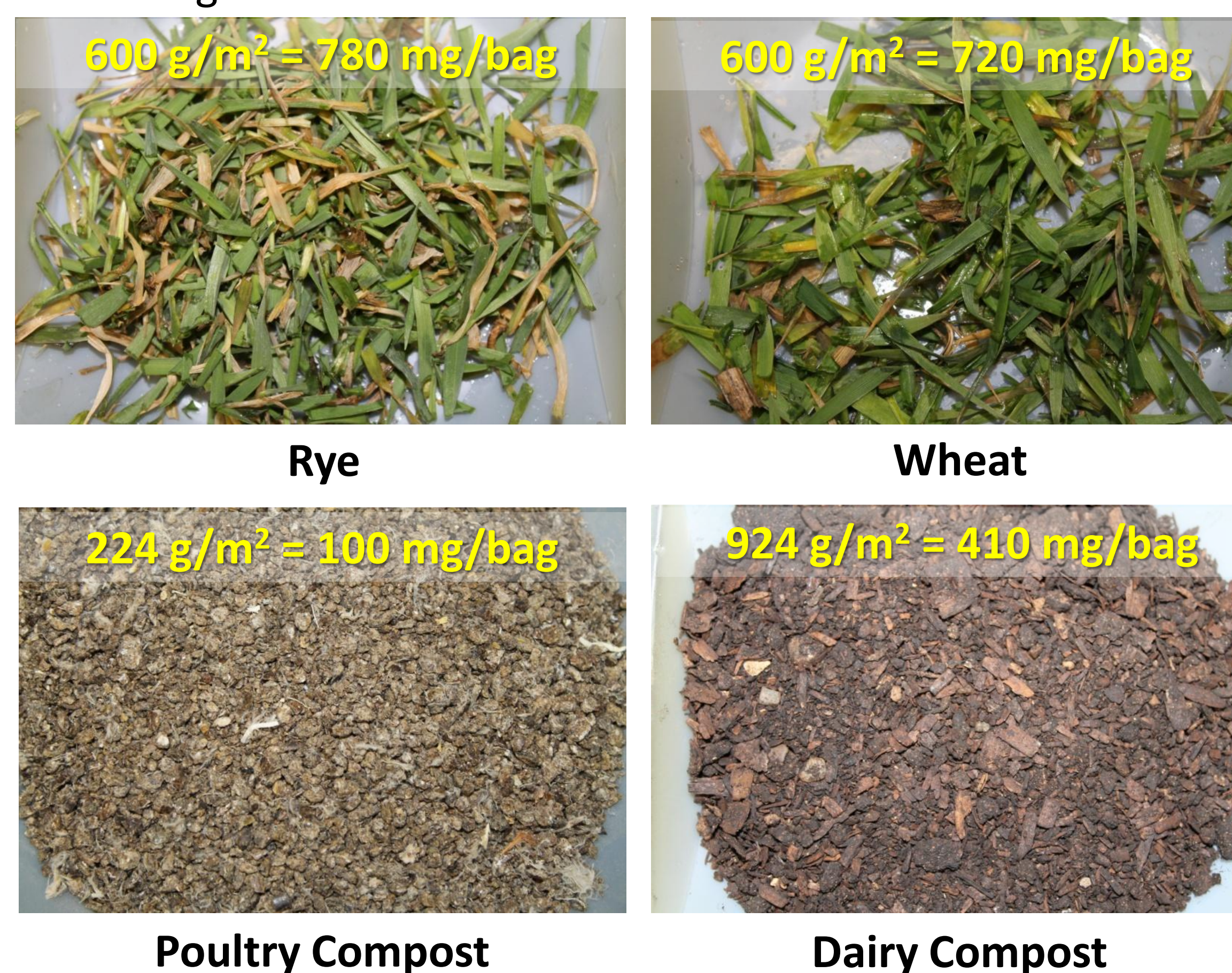


Figure 3. Effect of exposure time on Palmer amaranth seed mortality combined across all soil amendments.

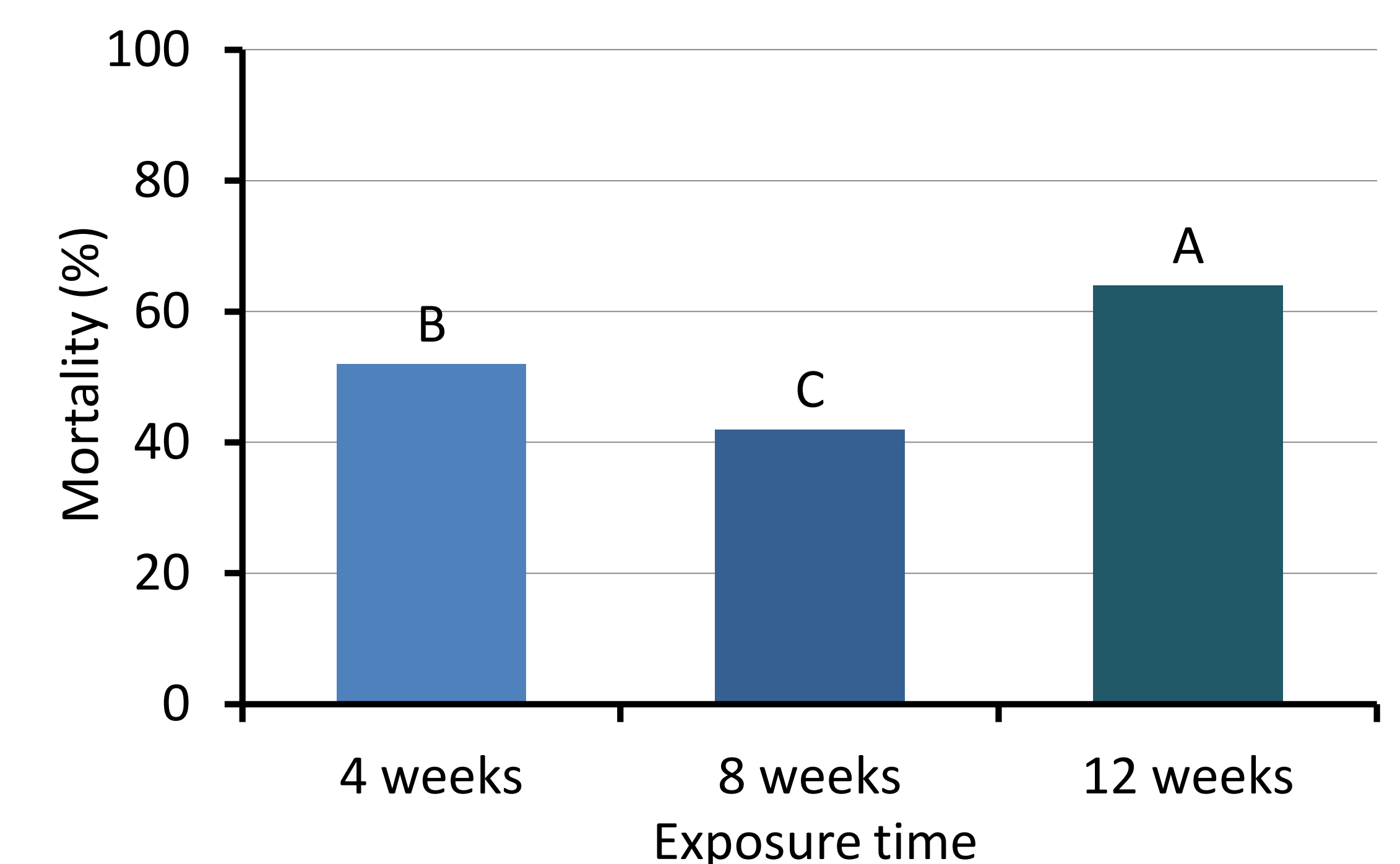


Figure 4. Effect of soil amendment on Palmer amaranth seed mortality combined across all exposure times.

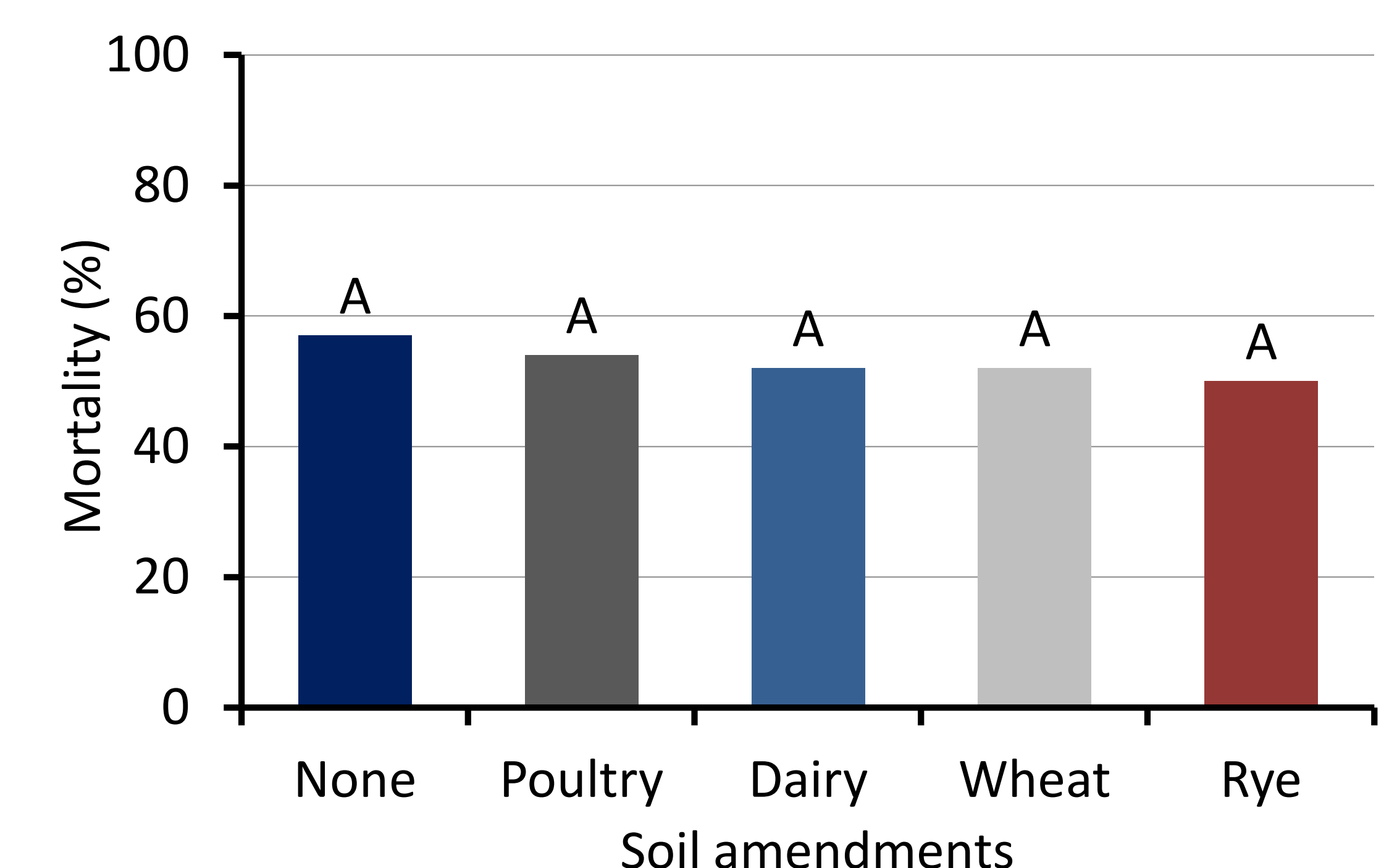


Table 1. Main effects of exposure time, amendment, and the interaction of exposure time and amendment.

Factor	Pr > F
Exposure time	0.0001
Amendment	0.8376
Exposure time*Amendment	0.7895

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.