

# Comparison of Seed Mortality of Palmer amaranth and Powell amaranth in Michigan



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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.
- Michigan Palmer amaranth populations have been confirmed resistant to glyphosate- and ALS-inhibiting herbicides.
- Palmer amaranth found in Michigan have produced seed that has survived Michigan's colder climate and have germinated the following spring.
- Little is known about the seed mortality of Palmer amaranth in northern conditions.

## Objectives

- Compare Palmer amaranth seed mortality to the native Michigan pigweed species, Powell amaranth
- Determine if seed placement in the soil impacts Palmer amaranth seed mortality.

## Materials and Methods

- Powell amaranth seed and multiple-resistant Palmer amaranth seed was collected from different farm fields in the fall of 2011 and 2012
- 100 seeds of Palmer amaranth and Powell amaranth placed in separate 10x10 cm mesh bags with 100 g Capac loam soil
  - Seed bags were double contained in 13x13 mesh bags
- Seed bags were placed at depths of 0, 2.5 and 10 cm in the soil in November - wire cages were placed over the bags to protect seed from rodents
- Seed bags were retrieved at 1, 6, and 12 months after burial
  - Four replications per retrieval time at each burial depth for both pigweed species
  - Experiment replicated two seasons
- Seed bags stored at -18 C until processing
- Seed bag processing:
  - Seeds sieved from soil, counted and germinated in dark at 20 C for 1 wk
  - Non-germinated seeds were tested with tetrazolium chloride (TZ) for viability (Figure 1)
- 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

- Significant interactions occurred for species by retrieval time and depth by retrieval time in 2012; only the main effects of species and retrieval time were significant in 2013 (Table 1).
- Delaying retrieval time increased seed mortality for both species in 2012 (Figure 2). Palmer amaranth seed mortality was greater than Powell amaranth seed at every retrieval time.
- Differences in seed mortality for the different burial depths was observed at the 6 month retrieval time; seed mortality was greater when seed was buried at 2.5 and 10 cm compared to seed placed on the soil surface (Figure 3).
- Palmer amaranth seed mortality was 9% greater than Powell amaranth seed mortality in 2013 (Figure 4). Delaying retrieval time until 12 months increased seed mortality 25 and 22% compared with the 1 and 6 month retrieval time (Figure 5).



Figure 1. Tetrazolium chloride (TZ) testing of remaining non-germinated Palmer amaranth seed.

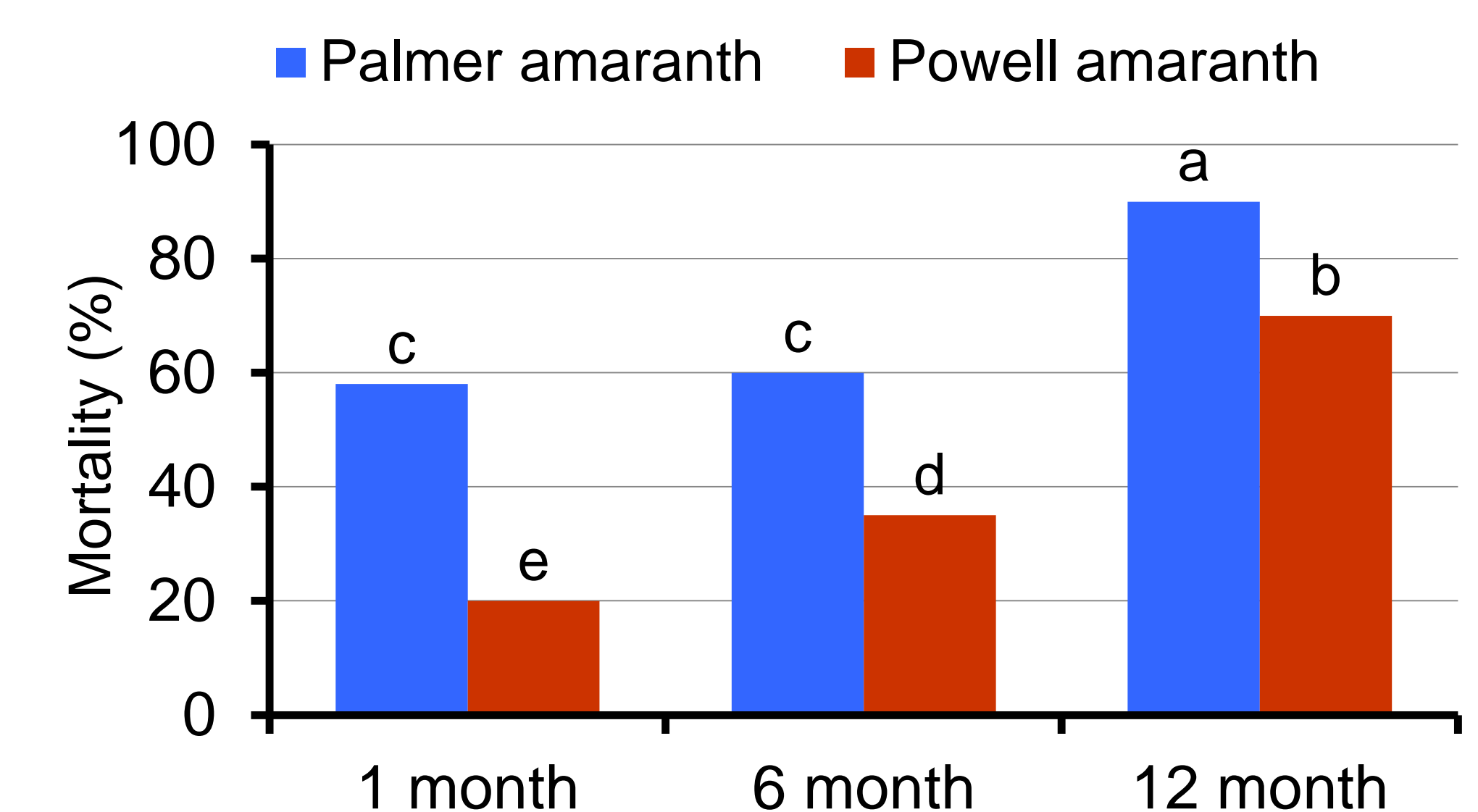


Figure 2. Effect of retrieval time on Palmer amaranth and Powell amaranth seed mortality in 2012.

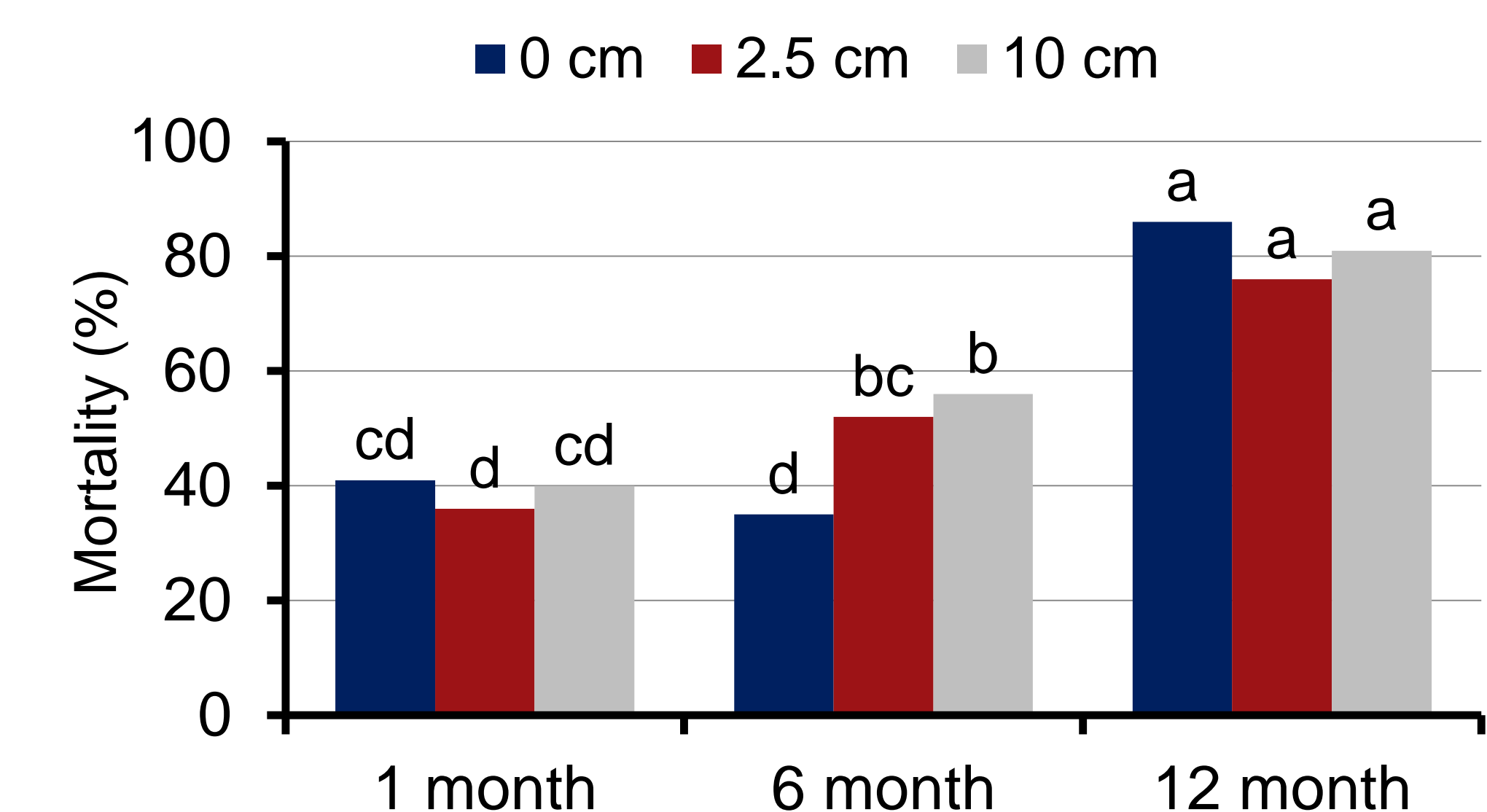


Figure 3. Effect of burial depth and retrieval time on seed mortality of both species in 2012.

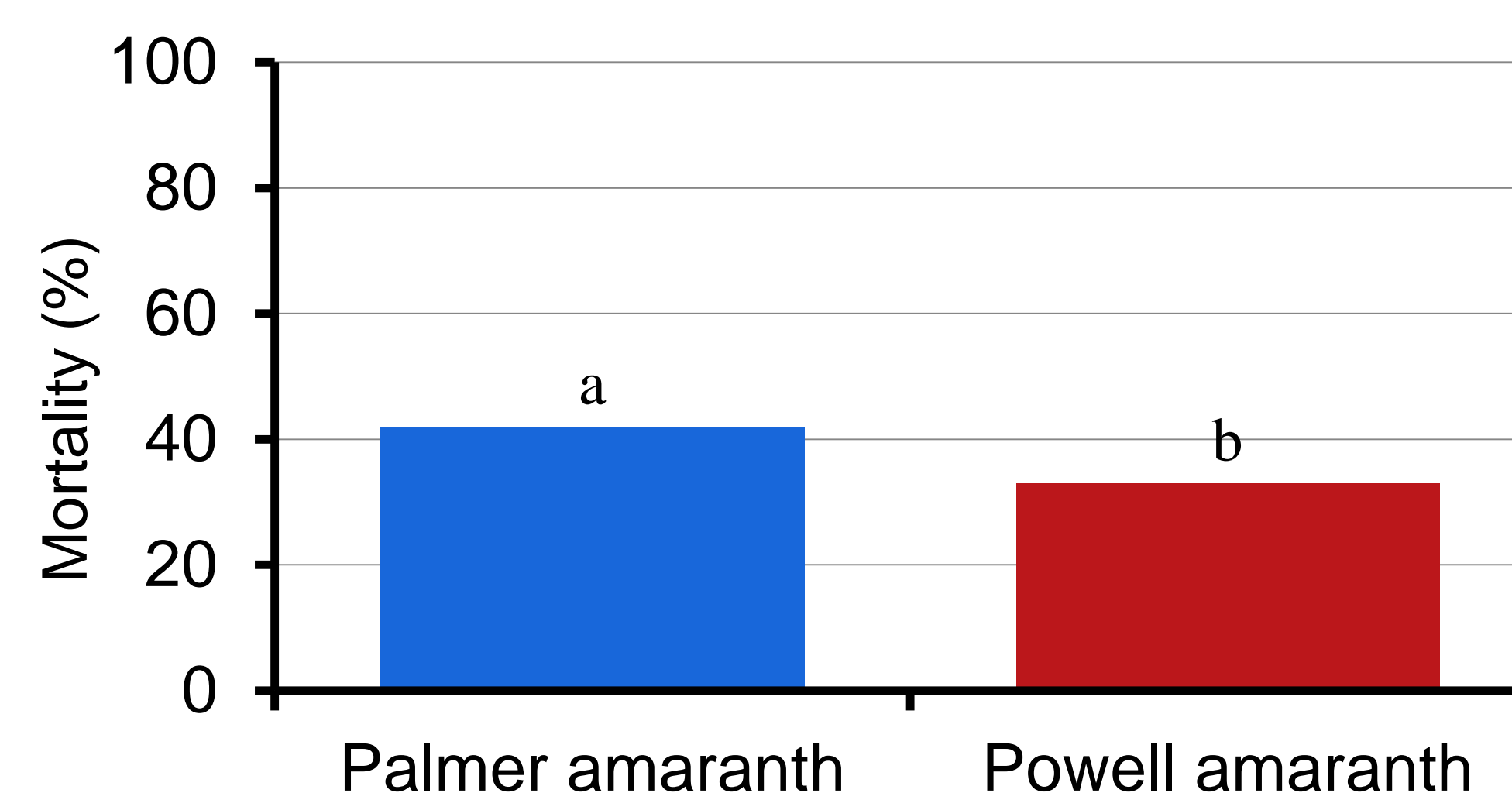


Figure 4. Effect of pigweed species on seed mortality in 2013.

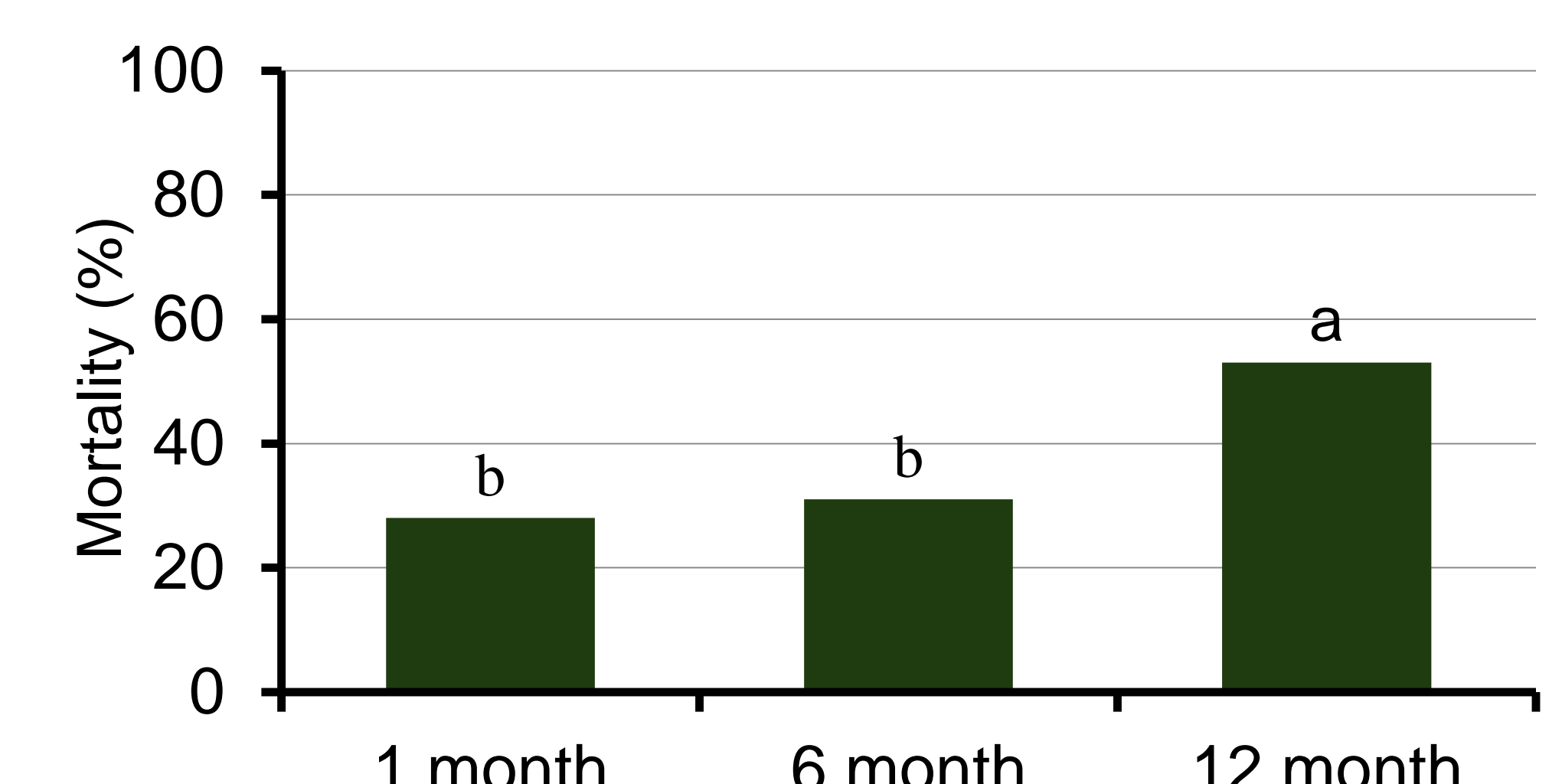


Figure 5. Effect of retrieval time on seed mortality of both species in 2013.

Table 1. Main effects and interactions for Palmer amaranth and Powell amaranth seed mortality.

Effects	2012	2013
	p-value	
Species	<0.0001	0.0202
Depth	0.2954	0.3638
Retrieval time (RT)	<0.0001	<0.0001
Species*depth	0.8907	0.9857
Species*RT	0.0227	0.4021
Depth*RT	0.0148	0.0536
Species*depth*RT	0.8056	0.0893

## Conclusions

- Palmer amaranth seed mortality was greater than mortality of Powell amaranth in both years.
- While burial depth had little influence on seed mortality for either species, seed mortality increased the longer the seed was buried in the soil.
- Eliminating additional Palmer amaranth seed rain for a single season may decrease viable seed in the soil seedbank by more than 50%.