

# Impact of Cereal Rye and Red Clover on Weed Seed Mortality

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## Introduction

- Cover crops with varying C:N ratios may influence weed dynamics, specifically weed seed mortality (Davis et al. 2006, De Cauwer et al. 2011, Gomez et al. 2013).
- In 2011 a collaborative experiment was designed by the North Eastern region (NE-1047) to examine the following objective and test the following hypothesis:
- **Objective:** Determine the influence of cover crops on weed seed mortality
- **Hypothesis:** Cover crops with low C:N ratios, such as legumes, will enhance seed mortality through increased microbial activity (leading to seed decay) and germination stimulation due to nitrate availability (fatal germination).
- **\*\* Our Michigan site looked at high cover crop rates (22 times higher than the other states) to test 'hot spot' conditions where N availability is very high or very low.**

## Materials & Methods

- Location: East Lansing, MI (MSU Agronomy farm)
- Cover crops accessed:
  - Medium red clover 'Marathon'
  - Rye 'Wheeler'
  - No cover
- Weed species examined:
  - Common lambsquarters (*Chenopodium album*)
  - Giant foxtail (*Setaria faberi*)
  - Velvetleaf (*Abutilon theophrasti*)
- Weed seeds (200) were buried at 15cm in mesh bags filled with silica sand (100 g) in the fall of 2011 and 2012, after cover crops were established.
- At the time of cover crop incorporations in the spring:
  - Seed bags were retrieved (Figure 1)
  - A high rate of fresh, chopped shoot and root cover crop material was added to each bag (equivalent to 6.2g dry weight). No material was added to the no cover treatment (Figure 1)
  - Bags were reburied in the original cover crop plots (Figure 4)
- Sample removal times = 0, 1, 2, 4, 6, & 12 months after cover crop incorporation (MAI).
- Seed mortality rates were calculated by determining the number of viable seeds remaining through a combination of germination and tetrazolium chloride testing.



Figure 1. Seed bag upon retrieval from overwintering (left), chopping of rye shoots and roots (center) and bag prior to reburial (right).

## Results- Seed mortality over time

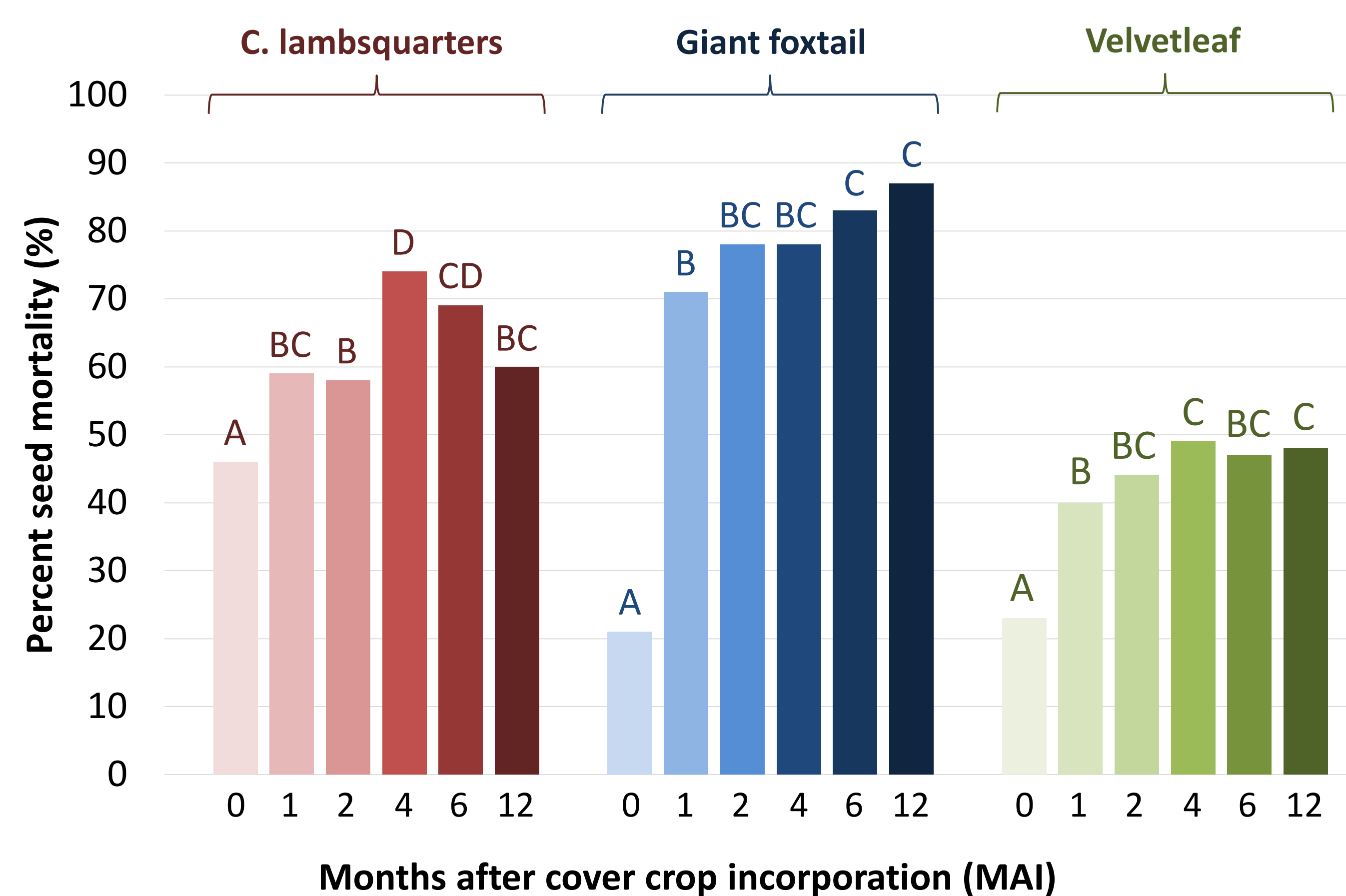


Figure 2. Seed mortality over time, 2012 only. Different letters indicate differences within a species ( $p \leq 0.05$ ).

- There was no interaction between cover crop and time of seed bag retrieval, therefore main effects are presented separately.
- In 2012 and 2013 weed seed mortality over the winter months (prior to cover crop incorporation) ranged from 4-46%, depending on the year and species, except in 2013 where giant foxtail over winter mortality was 72%.
- Once cover crop amendments were added (0 MAI), seed mortality significantly increased (Figure 2).
- These same trends have been observed for the 0-4 MAI sampling times from 2013 (data not shown); 6 & 12 MAI samples are still in the field.

## Results- Cover crop influence on seed mortality

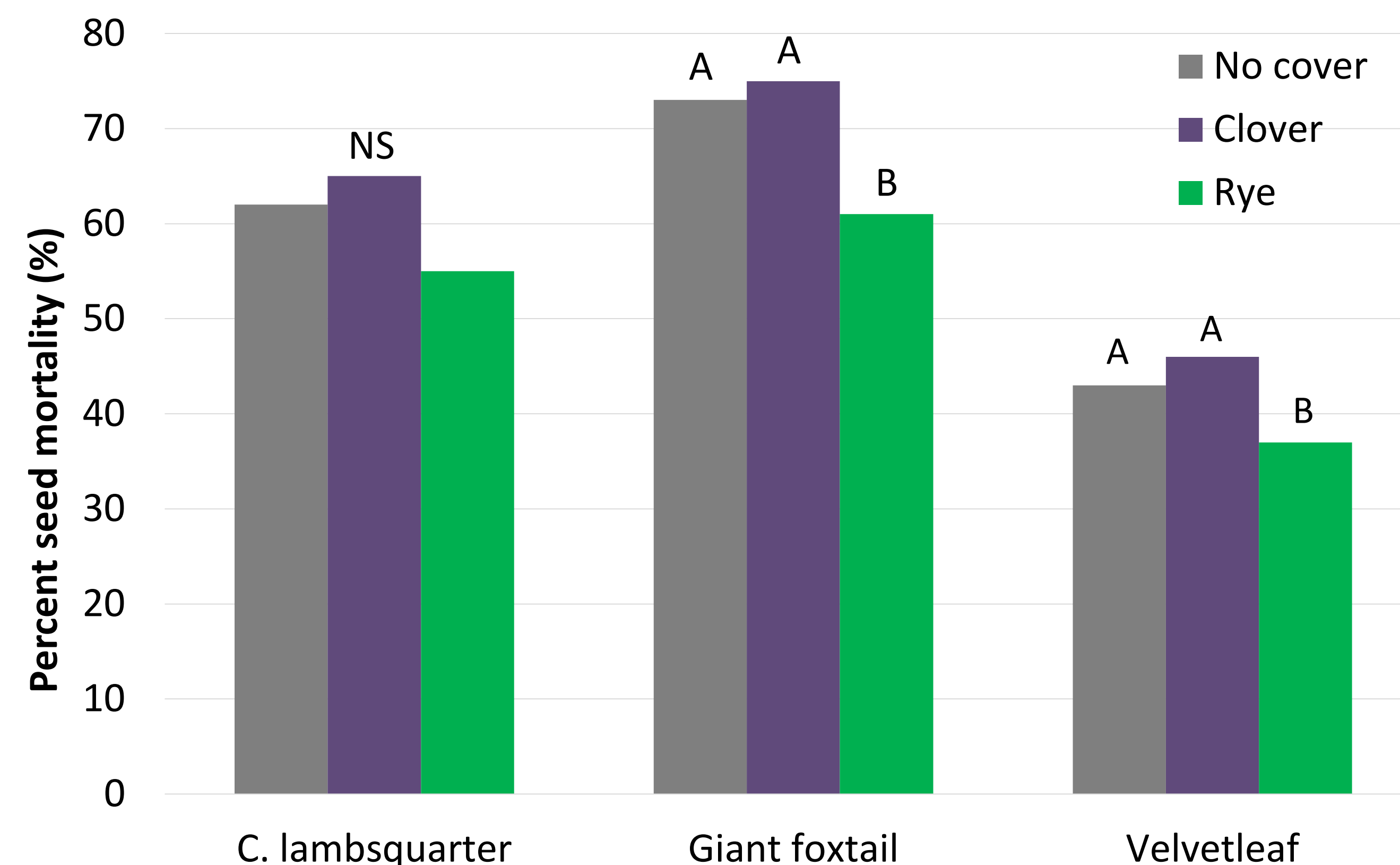


Figure 3. Seed mortality as influenced by a high rate of cover crop; 2012 only. Different letters indicate differences within a species ( $p \leq 0.05$ ).

- For common lambsquarters cover crop did not influence seed mortality in 2012 (Figure 3).
- For giant foxtail and velvetleaf in 2012:
  - Clover increased weed seed mortality compared to rye, but not compared to no cover (Figure 3).
  - Rye increased weed seed persistence by ~12% for both species when compared with the no cover treatment (Figure 3).



Figure 4. Repackaged seed bags were reburied following the inclusion of the cover crop biomass. Soil cores, 15 cm deep, were removed with a golf cup cutter, bags were placed in the hole (left), and the soil core was replaced (right).



## Conclusions

- Legume cover crops did not increase weed seed mortality compared to the no cover crop treatment.
- High rates of rye (which may be realistic in certain micro-sites) appeared to increase weed seed persistence.
- Completion of 2013 data analysis in MI and other states in the NE-1047 project will further elucidate the effect of cover crop species residues on weed seed mortality.

**Literature cited:**  
 Davis, AS, KI Anderson, SG Hallett, and KA Renner. 2006. Weed seed mortality in soils with contrasting agricultural management histories. *Weed Sci.* 54:291-297.  
 De Cauwer, B, T D'Hose, M Cougnon, B Leroy, R Bulcke, and D Reheul. 2011. Impact of the quality of organic amendments on size and composition of the weed seed bank. *Weed Res.* 51:250-260.  
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