

Cropping system effects on weed seed mortality

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Introduction

Weed management in arable fields involves all practices that have an effect on weeds above and below the soil surface. Because the soil seedbank is the main source for future weed infestations, developing effective strategies to deplete it is particularly important. Various greenhouse studies have shown that weed seed decay is closely related to soil management history and microbial community composition, but similar field experiments, due to their complexity, are not common.

We conducted an experiment to test the hypothesis that a more diverse crop rotation has a greater effect on weed seed mortality in the soil compared to a conventional corn-soybean rotation.



Marsden Farm cropping systems experiment

Methods

The study was conducted at Iowa State University's Marsden Farm, in Boone, IA. At this site, a multiyear, 9-ha field experiment that includes three cropping systems was established in 2002. **In the present experiment we evaluated a 2-year corn/soybean rotation and a 4-year corn/soybean/oat+alfalfa/alfalfa rotation.** Each crop phase of each rotation was present every year; evaluations were conducted in the corn phase.

In spring of 2008 and 2009 we buried sets of mesh bags containing seeds of giant foxtail (*Setaria faberi*) and velvetleaf (*Abutilon theophrasti*) mixed separately with soil at 2 cm and 20 cm. We exhumed the bags at ten different times during the season. The recovered seeds were classified as germinated, decayed or dormant.

Other evaluations in this study, not reported here, included determination of microorganisms colonizing the seeds, correlation between the occurrence of some of those microorganisms and seed decay, and the rotation effect on seed mortality of weed seed lots harvested in different years.



Burial of bags containing seeds and soil

Results

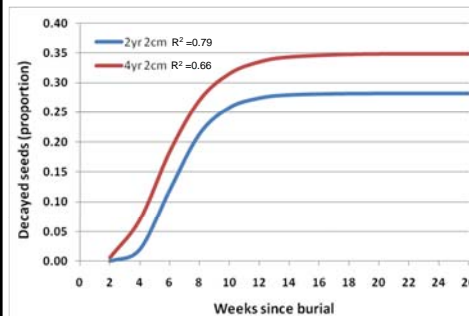


Fig. 1. Gompertz function fitted to the proportion of decayed giant foxtail seeds recovered in 2008 from bags buried at 2 cm in the 2- and 4-year rotations. No seed decay was detected in 2009 when a different seed lot was evaluated.

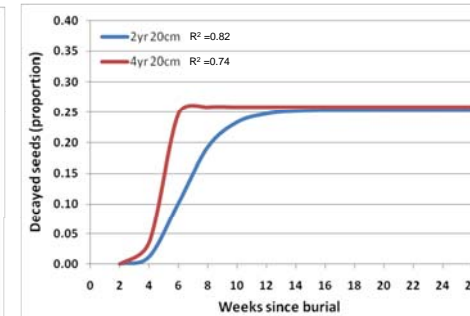


Fig. 2. Proportion of decayed giant foxtail seeds recovered in 2008 from bags buried at 20 cm in the 2- and 4-year rotations. No seed decay was detected in 2009.

- ✦ 2008 results show higher giant foxtail seed decay in the 4-year rotation compared to the 2-yr rotation ($p < 0.0150$), and greater seed mortality in the first 2 cm of the soil compared to 20 cm depth ($p = 0.0506$).
- ✦ Giant foxtail seed decay in the first 2 cm of the 4-yr rotation was, in 2008, an important seedbank output (35%), along with germination (33%).
- ✦ No significant differences were found on the effect of cropping system ($p = 0.6314$) or burial depth ($p = 0.1051$) on velvetleaf seed mortality. Velvetleaf seeds remained mostly dormant.
- ✦ These results demonstrate the importance of diversified cropping systems for enhancing seed decay of certain weed species, and therefore seedbank depletion.
- ✦ Results from related field studies suggest that the rotation effect can vary depending on the seed lot evaluated, which could explain the low seed mortality detected in 2009.