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A collaboration between Penn State and University of Maine

Introduction

Crop-weed competition causes an overall crop yield loss of about 12%, costing farmers around \$4 billion annually. As a result, farmers are looking for additional weed management opportunities. This project assesses the effect of increasing cover cropping intensity on weed seedbank dynamics. There are two components to this research 1) creating different management strategies that integrate tillage and multiple cropping practices (w/cover crops), and 2) evaluating weed seed predation by ground beetles. This project focuses on *Harpalus* species, granivorous ground beetles that are common to Pennsylvania and the Northeast.

Objectives

Determine the effect of increasing cover cropping system intensity on:

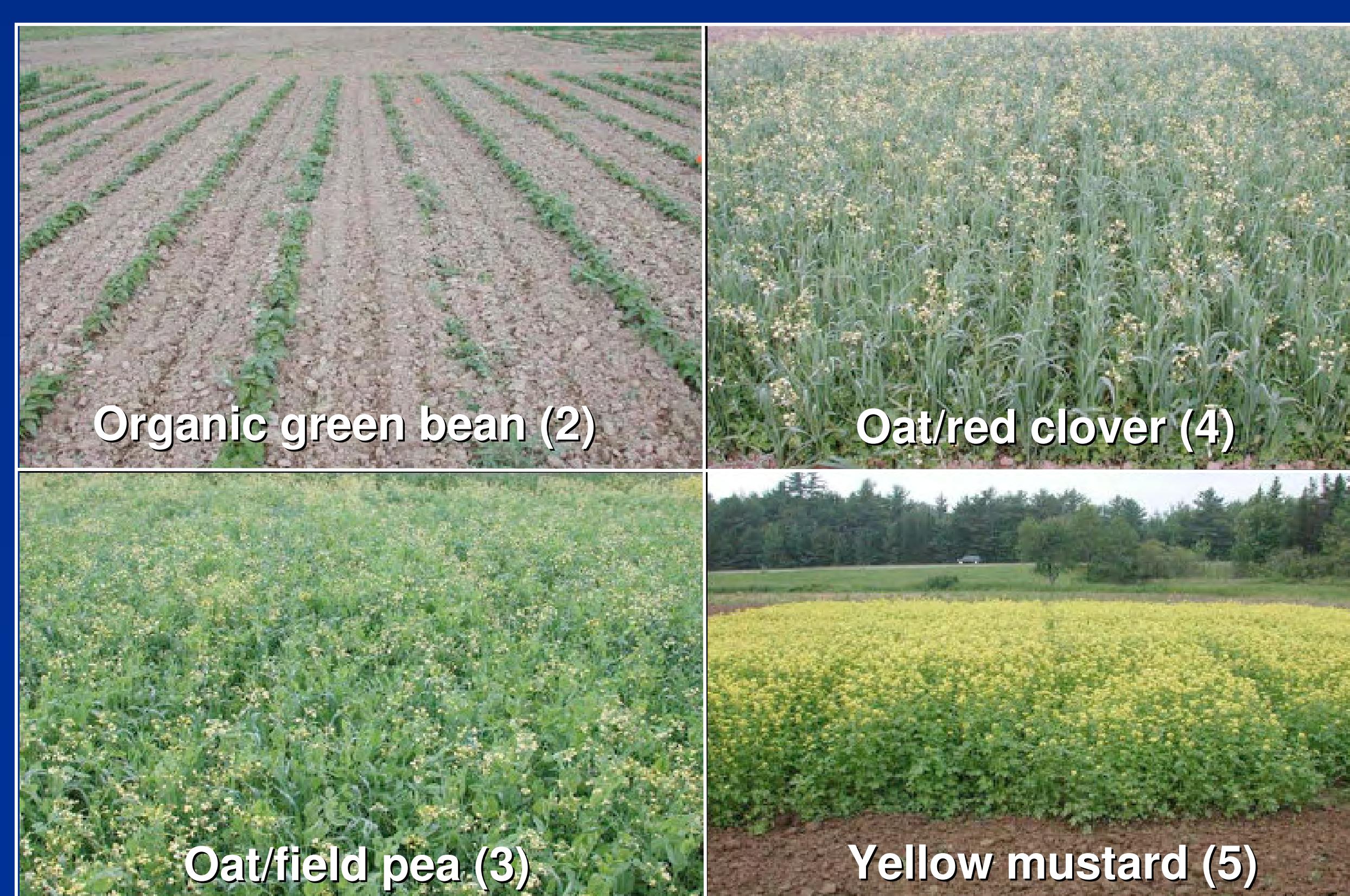
- Weed seedbank dynamics
- Ground beetle activity density

Methods

- Five or six cropping systems – all rotated to sweet corn
- Conducted in both Pennsylvania and Maine (#6 in PA only).

Six cropping systems

	# Disturb.	Subseq. crop
System 1	Fallow (4)	Sweet Corn
System 2	Green Bean or Oat Rye/Vetch (2)	Sweet Corn
System 3	Oat/Pea Rye/Vetch (2)	Sweet Corn
System 4	Oat/Red Clover (1)	Sweet Corn
System 5	Brassica Buckwheat Brassica (3)	Sweet Corn
System 6	Organic Soybean (1)	Sweet Corn



Weed Recruitment and Decline

- Synthetic weed seed bank established:
 - Common lambsquarters (*Chenopodium album*)
 - Giant foxtail (PA) and Yellow foxtail (ME) (*Setaria* spp.)
 - Velvetleaf (*Abutilon theophrasti*)

Methods (cont.)

- Seedling emergence (recruitment) monitored after disturbance events throughout summer.
- Seedbank decline estimated by change in the germinable seedbank over 12 mo. Period.

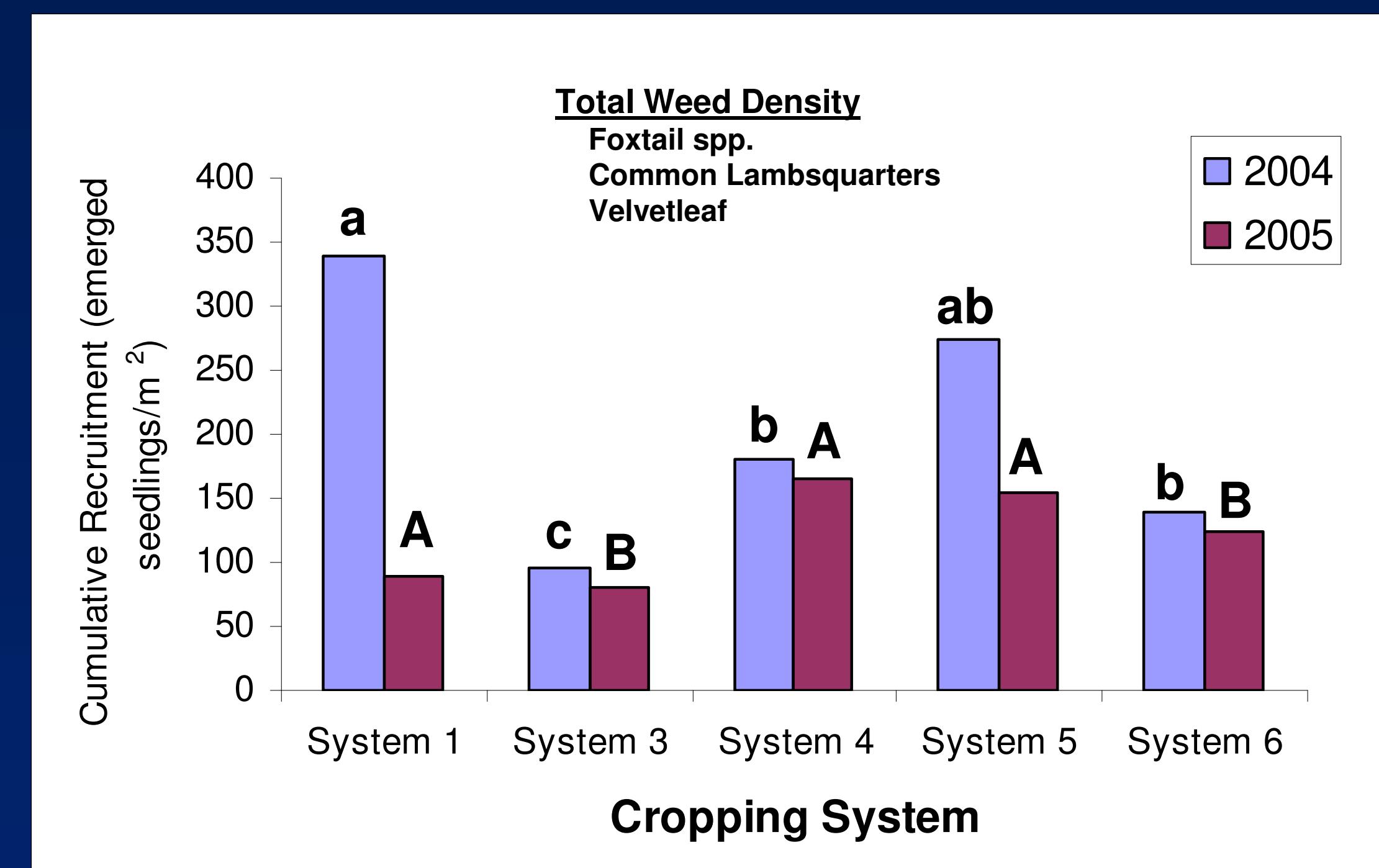


Figure 1. Cumulative recruitment across cropping systems

Results: (Preliminary)

Recruitment and survival (PA) - Figure 1

- The Fallow (1) and Brassica/Buckwheat/Brassica (BWB) or (5) had the highest amount of recruitment and Oat/Pea (3) had the lowest.
- In general, higher disturbance frequency resulted in greater weed emergence.
- Only the oat/red clover (4) and soybean (6) systems allowed successful seed production.

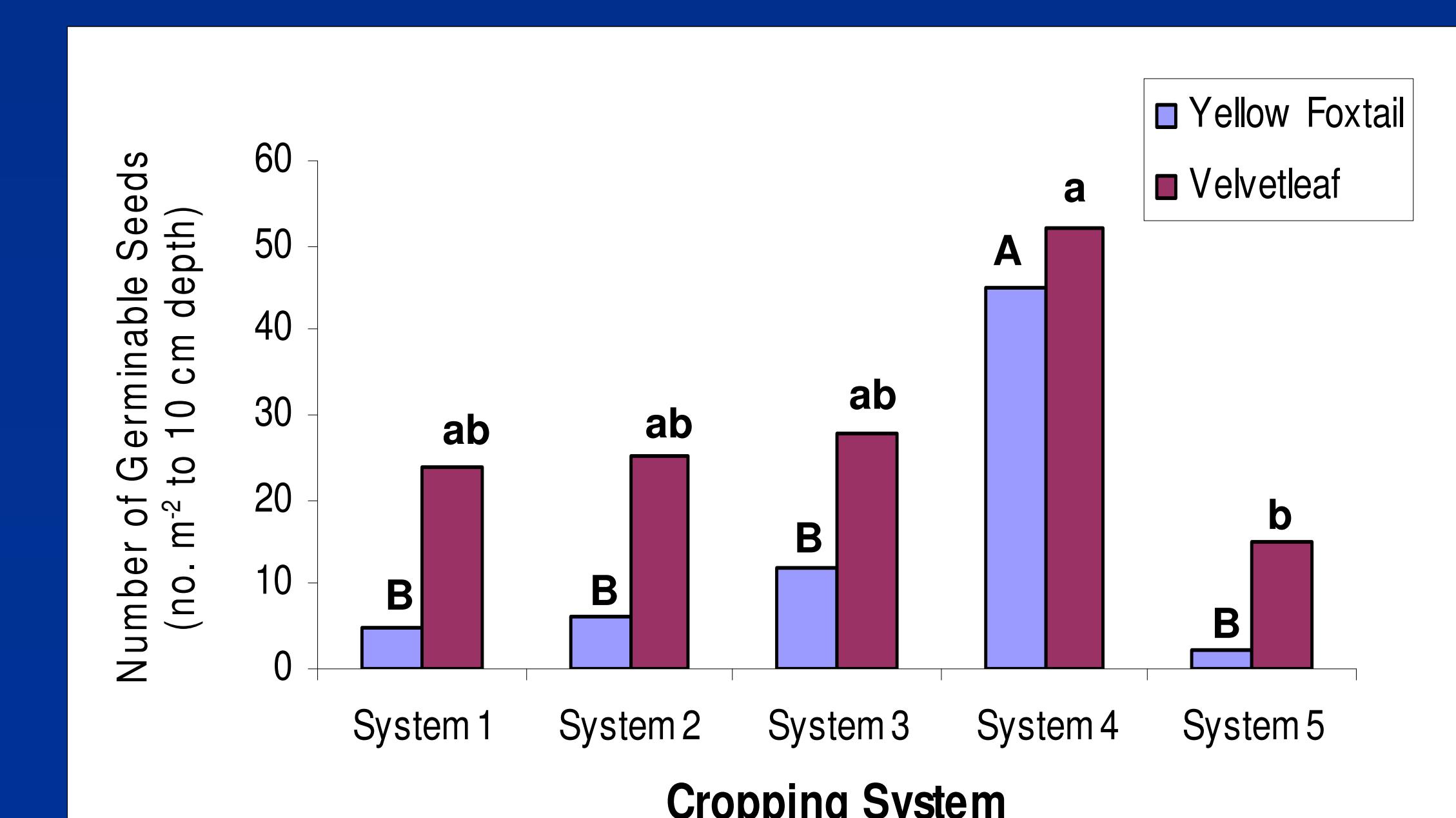


Figure 2. Weed seedbank year following system treatments

Seedbank Decline (ME) - Figure 2

- Yellow foxtail and velvetleaf seed densities were greatest in oat/red clover (4), with one disturbance event.
- Velvetleaf seed density was the lowest in BWB (5), with three disturbance events.

Methods: *Harpalus pensylvanicus* Activity Density

- Pitfall traps: used to collect insects within different systems
- Pitfalls left open 72 hours to determine beetle activity density
- Activity-density monitored June-September

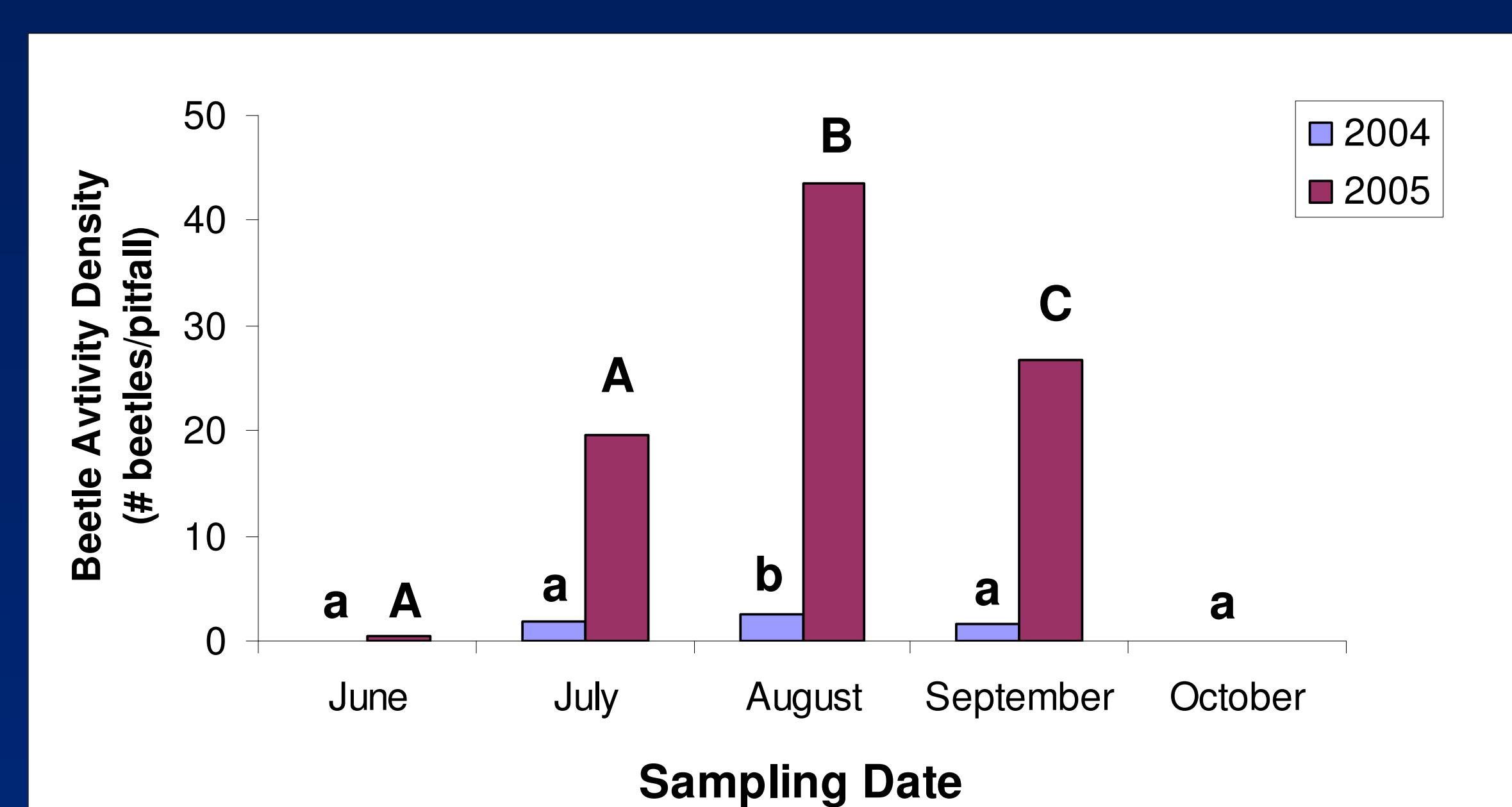


Figure 3. *H. pensylvanicus* activity density pooled across systems

Results: Activity density research – Figure 3

- Inconsistent differences due to cropping system, but greater beetle density in 2005 than 2004.
- Peak activity density in 2004 and 2005 occurred in the beginning of August decreasing in September.

Summary

- Differences in cumulative recruitment and seed germinability between cropping systems attributed to disturbance frequency.
 - Cumulative recruitment - higher disturbance frequency can result in higher weed emergence.
 - Seed germinability - higher seedling density (larger seedbank) with fewer disturbance events.
- H. pensylvanicus* had peak activity density in early August both years.
- Differences in beetle activity density between cropping systems inconsistent.

Other Activities

- Complimentary on-farm demonstrations accompany experiment station projects.
- Outreach activities include field days and other educational events.
- Future research should focus more on food preference by seed predators that could impact the summer annual weed seed bank and how timing of disturbance influences activity density.

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