

# No-Till Establishment of Alfalfa and Canola and Slug Herbivory

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## Introduction

No-till establishment of small seeded crops can be challenging due to slugs and seed placement issues, particularly in residue. We observed significant challenges with late summer/early fall planted no-till alfalfa and canola in the NESARE Sustainable Dairy Cropping Systems Trial where both alfalfa and canola are planted with different management practices.



The common gray garden slug (*Deroceras reticulatum*) is one of three slug species identified. Feeding damage varies from leaves with some holes to complete defoliation & plant death.

## Objectives:

- Monitor Slug seasonal activity & identify possible practices to establish No-Till Alfalfa & Canola
- Test if Canola and Alfalfa establishment strategies designed to reduce herbicide also reduce slug damage and improve crop establishment and yield.

## Methods

Alfalfa and Canola are integrated in two dairy crop rotations that are primarily no-till in the NESARE Dairy Cropping Systems project at the Penn State Agronomy Farm. Each crop entry is planted every year in 36.6 m x 27.4 m plots with farm-scale equipment.

**Experimental Design:** Nested split plot design, replicated four times.

### Treatments:

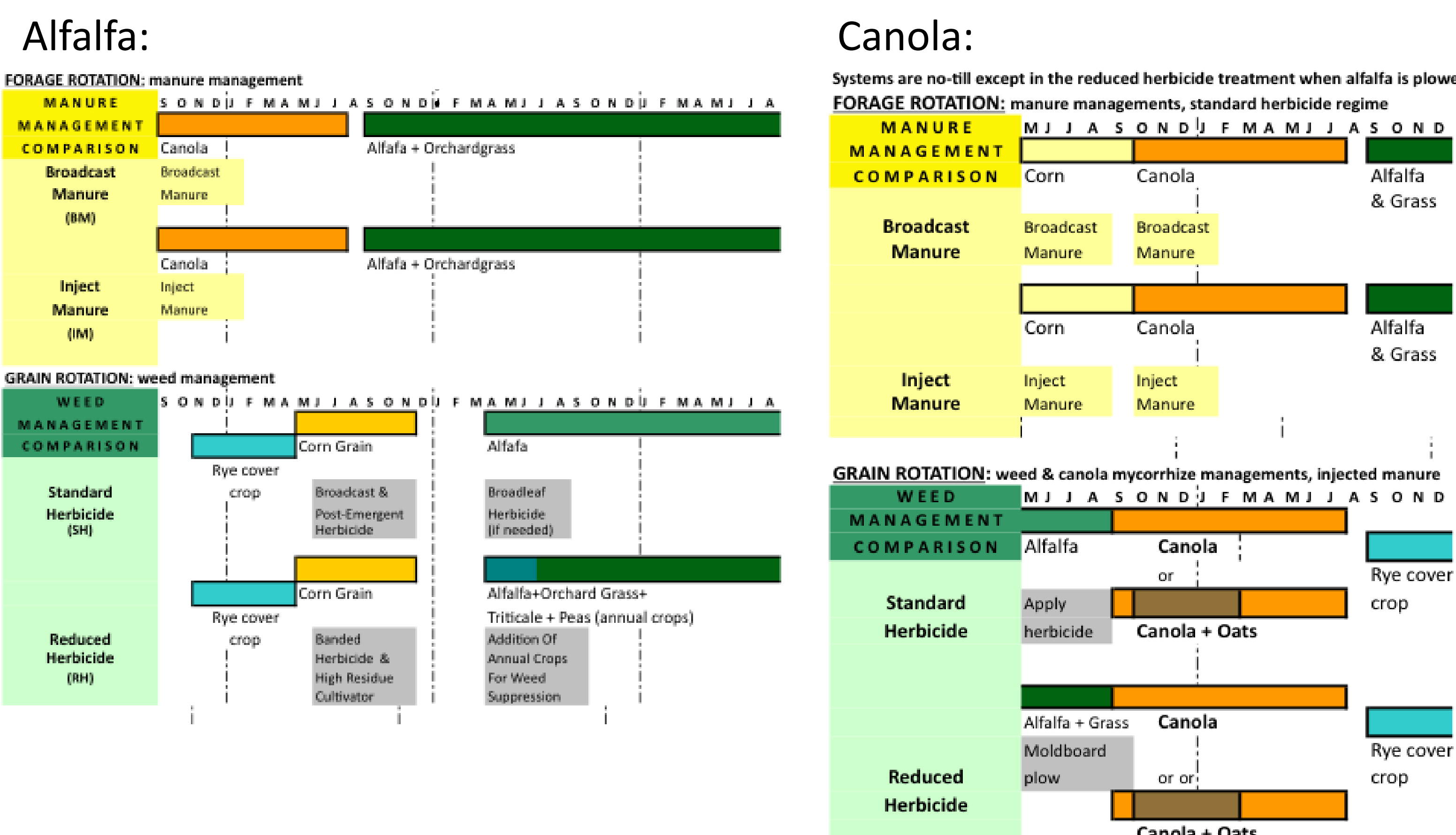
- **Alfalfa + Orchardgrass planted in Late Summer (late August) after Canola**
- **Alfalfa versus Alfalfa + Orchardgrass with Triticale and Peas Companion Crops in Spring**  
Compares establishment method that reduces herbicide use, planted in Spring (April)
- **Winter canola planted after Alfalfa in the 'Forage Rotation'**  
Compares shallow disk manure injection & surface application
- **Winter canola planted after Corn silage in the 'Grain Rotation'**  
Compares strategies to reduce herbicide use, includes terminating alfalfa before canola with plowing versus herbicides.

**Slug** (*Deroceras reticulatum*, *D. laeve*, and *Arion fasciatus*) activity density was monitored weekly in 10 x 30-m plots of alfalfa and canola using two shelter trap (white roofing shingles, 0.093 m<sup>2</sup>).

**Seedling establishment** and slug herbivory damage assessed 40 days post planting by counting the number of plants present and the number damaged by slugs in five 0.4 m row-sections (alfalfa) or eight 1m row sections (canola).

**Data Analysis** for each year was conducted with PROC MIXED of SAS with rotations and treatment as fixed effects, block as random. Repeated Measures Analysis for Slug Activity Density with plots as subject. Least squares means were compared with Tukey's test at p < 0.05.

## Two Dairy Crop Rotations



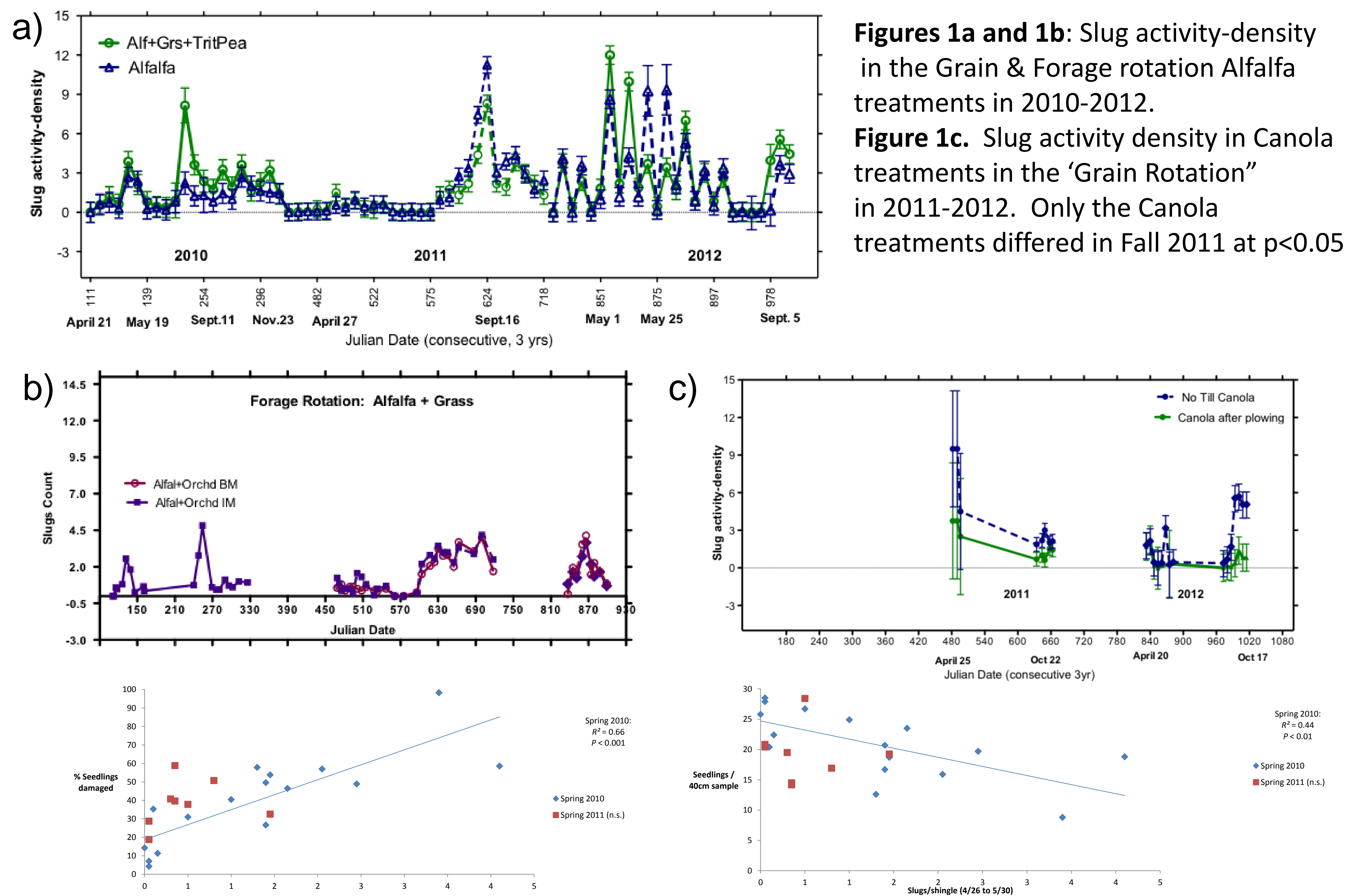
**Acknowledgements:** Special thanks for research assistance from Andrew Aschwanden, Stephanie Bailey, Dianna Durán Castro, Justin Dillion, Marissa Keys, Heidi Musshafen, Brian Gray, Scott Harkcom, Andrew Kirk, Erika Samian, Elina Snyder, Andrew Puglia, and Joshua Walker.

Funding:



## Results and Discussion

Slug activity-density in general increased in mid-May, declined in mid-summer, and increased again in mid-September when slugs approached full size (Figures 1a-1c). In spring 2012, slug activity density was high after a mild winter in early spring alfalfa (Fig. 1a) when temperatures were unusually warm. Slug activity was lower only in canola that was planted after plowing in fall 2011 (Fig. 1c).



**Figures 1a and 1b:** Slug activity-density in the Grain & Forage rotation Alfalfa treatments in 2010-2012.  
**Figure 1c.** Slug activity density in Canola treatments in the 'Grain Rotation' in 2011-2012. Only the Canola treatments differed in Fall 2011 at p<0.05

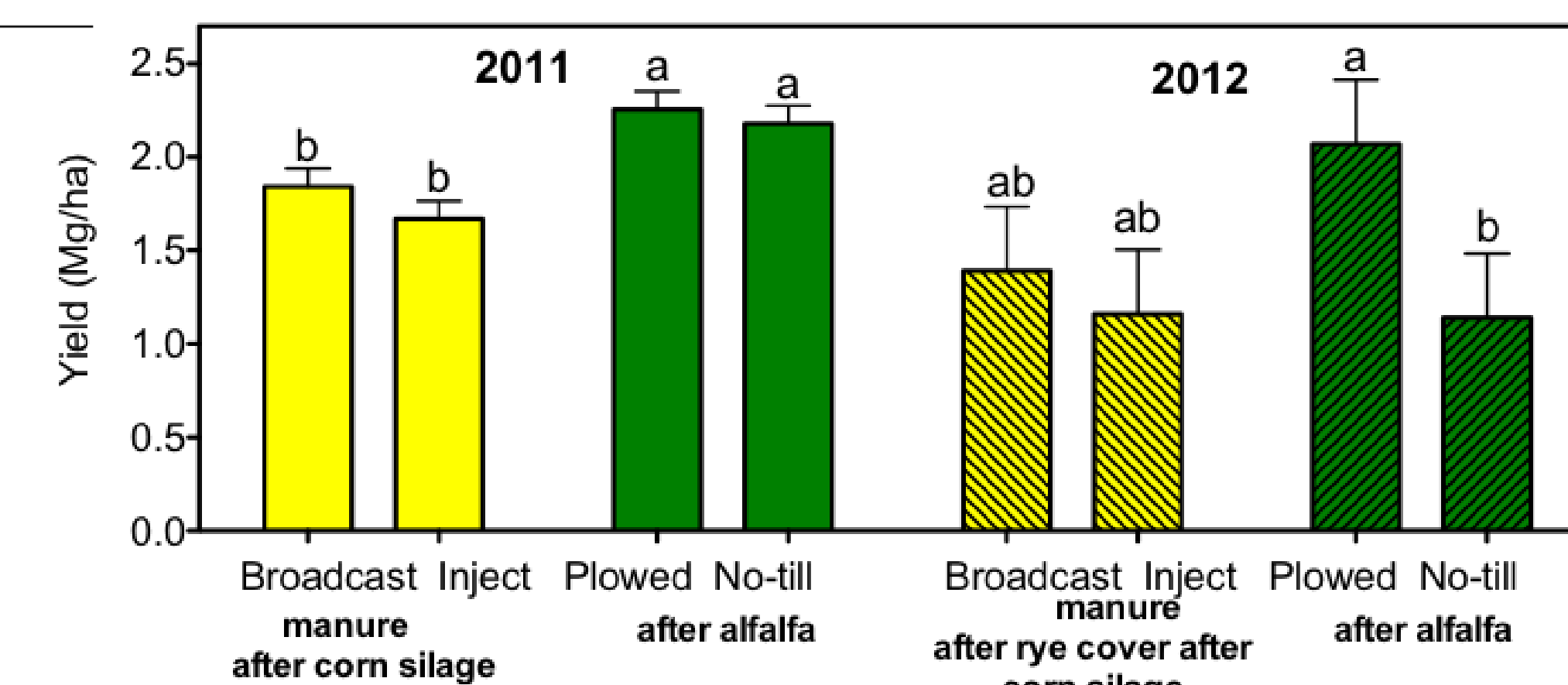
**Figure 2a and b:** Percentage of Alfalfa seedlings Damaged (a) and Number of Seedling established (b) versus Average Spring Slug Activity Density in 2010 and 2011. In Spring 2010, the linear regression was significant at p<0.05, but not in Spring 2011.

**Table 1: Crop Population Density in Fall, 40 days post planting**

	2010	2011	2012
<b>Canola</b>	Not Diff	No-Till 41% < Plowed, Half stands failed	No-Till 30 % < Plowed
<b>Alfalfa</b>	Half stands replanted Spring 2011	Failed, replanted Spring 2012, failed in spring	Delayed until Spring 2013

Fall planted canola plant populations were higher when planted after plowing than when planted without tillage. Fall alfalfa plant establishment in 2010 and 2011 was so poor that alfalfa was replanted in spring & delayed until spring in fall 2013 (Table 1). Alfalfa planted in spring in the grain rotation after corn silage established successfully in 2011, 2012 and 2012.

**Figure 3:** Canola yield in 2011 & 2012 when planted after corn silage or alfalfa (2011) by treatment. In 2012, spring canola was planted after a rye cover crop after corn silage. Different letters indicate treatments that differed within year at p<0.05.



**Summary:** High fall slug-activity density appears to have contributed to failure and poor stand establishment of late summer-planted alfalfa, although seed placement and canola residue allelopathy may also have contributed. Only in spring 2012, when slug activity was high & weather conditions were limiting did spring alfalfa after canola fail. Alfalfa planted in spring after corn (grain rotation) established successfully all 3 years. *These results suggest that planting no-till alfalfa in spring will be more successful than late-summer, as slug activity tends to be lower in spring than fall and weather conditions for plant growth tend to improve with time in spring.*

High slug activity density in fall 2011 and 2012 also appears to have limited no-till canola establishment. In fall 2011, half of the no-till canola stands failed, and yield (2012) was 45% less yield than canola planted after plowing (Fig. 3). Planting canola after some tillage will likely improve establishment, particularly in fall. Alternatively, no-till canola establishment may be more successful if planted in mid-August prior to peak fall slug activity or in spring.