Cover Crop Termination Timing Effect on Soil and Water Conservation, Slugs, and Yield in Pennsylvania No-till Soybean and Corn.

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Introduction

No-till farmers in PA face several challenges, such as:
- Balancing soil conservation and profitability
- Soil moisture management at planting and beyond
- Slug management

Typical practice = terminate cover crop 1-2 weeks before planting cash crop

Some farmers are delay termination until planting or later for soil conservation, soil moisture management, and possible slug management benefits, **"planting green"**

<u>HYPOTHESIS:</u> Delaying termination time until planting rather than earlier will improve seedbed conditions for planting; extend soil water conservation benefits of cover crops; and reduce slug damage to the subsequent corn or soybean crop.

Methods

Two research stations and three farmer cooperator locations included a range of environments from central and southeastern PA

Farmer-Cooperators
- Long-term no-till, typically "plant green"
- Managed fields as usual, with added early terminated treatment
- All treatments were replicated 4 times.

Measurements
- Rye (*Secale cereale* L.) biomass at early termination and planting
- Cash crop stand counts
- Soil moisture and temperature (top 8 cm.), repeated throughout the growing season
- Slug population, repeated throughout the growing season
- Soil cover, beneficial insect populations and predation, weed biomass and community composition (data not shown)

Management Table

Site	Rye Planting Date	Rye Seeding Rate	Early Termination Date	Late Termination Date	Cash Crop Planting Date
Centre Co.	28-Oct	41 kg ha^{-1}	4-May	9-May	9-May
Clinton Co.	31-Oct	54 kg ha^{-1}	18-May	7-Jun	27-May
Lancaster Co.	20-Oct	41 kg ha^{-1}	2-May	13-May	11-May
Rock Springs	30-Sep	14, 27 or 54 kg ha^{-1}	8-May	18-May	14-May
Southeast	30-Sep	14, 27 or 54 kg ha^{-1}	5-May	29-May*, 21-May	19-May

*Penn State Research Centers are indicated in **bold** text. *Indicates the date for the corn experiment only.*
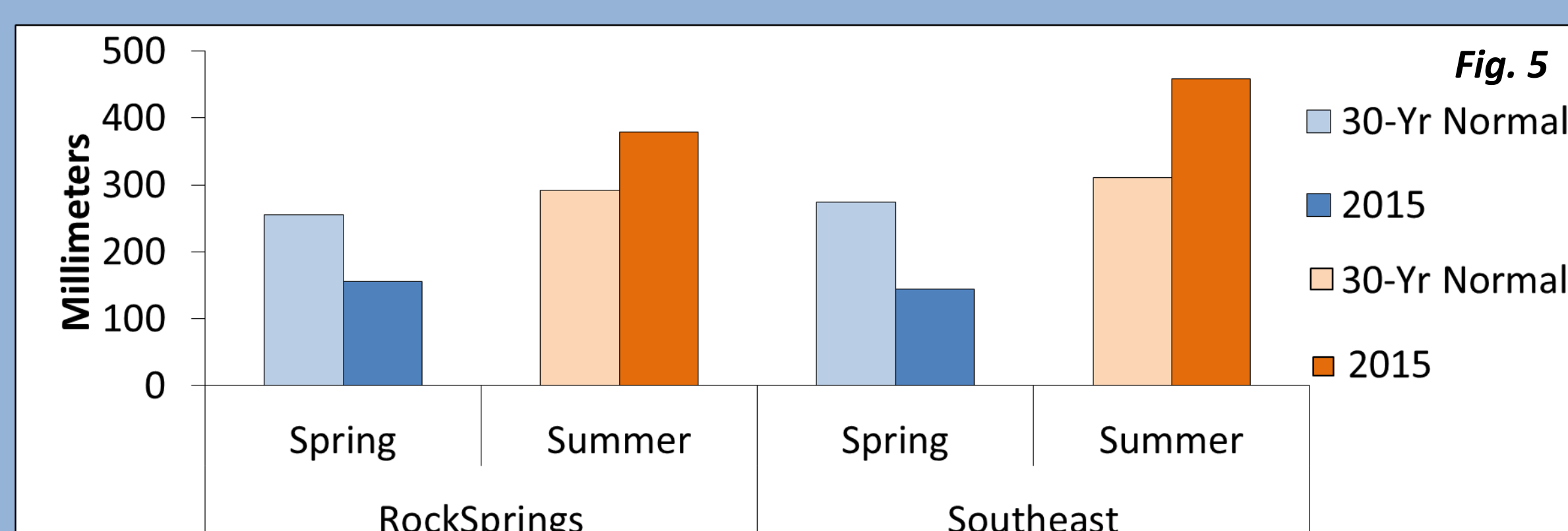
Figure 5. Thirty-year normal (1980-2010) precipitation at Landisville and Rock Springs, PA. Spring includes March, April and May; summer includes June, July and August.


Figure 1: Grey garden slugs (Deroceras reticulatum) cause yield losses for PA farmers. Figure 2: Planting into a standing green rye cover crop at anthesis.

Figure 3: Soybean trial ready to be planted into early terminated (left) and standing green (right) rye at a farmer cooperator's in east-central PA. Figure 4: A digital thermometer and moisture meter were used to measure soil temperature and volumetric water content in the top 8 cm. of soil multiple times throughout the growing season.

Results

### Delaying Rye Termination in Soybeans:
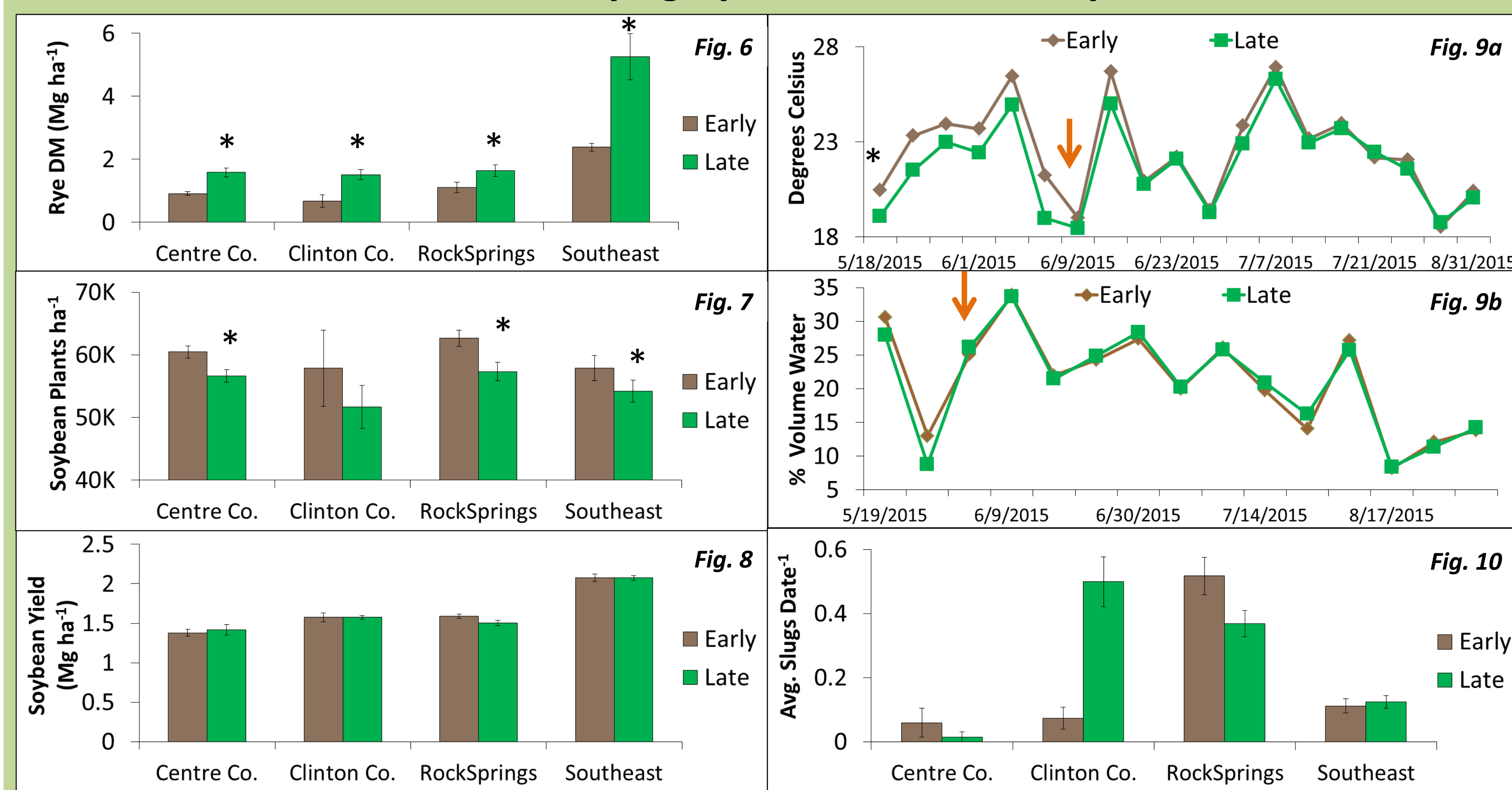
Figure 6: Rye biomass was significantly higher at late termination compared to early termination at all locations, and biomass nearly doubled at 3 of the 4 locations.
Figure 7: Soybean populations were reduced by an average of 7% in late-terminated plots in 3 of 4 locations.
Figure 8: Soybean yield was not affected by rye termination time at any of the 4 locations.
Figure 9: (Data from Research Stations only) – 9a) Soil temperature in the top 8 cm was typically lower in late-terminated plots, though the difference decreased as the growing season progressed (orange arrow). 9b) Soil moisture was numerically reduced by delaying rye termination, until early June (orange arrow).
Figure 10: Slug populations were not significantly affected by rye termination timing.

Figure 11a: Soybeans at V4 in an early-terminated plot at the Southeast Agricultural Research Station. Figure 11b: Soybeans on the same day in a late-terminated plot.

* *Indicates significant difference between termination times @ p <0.05*

Delaying Rye Termination in Corn:
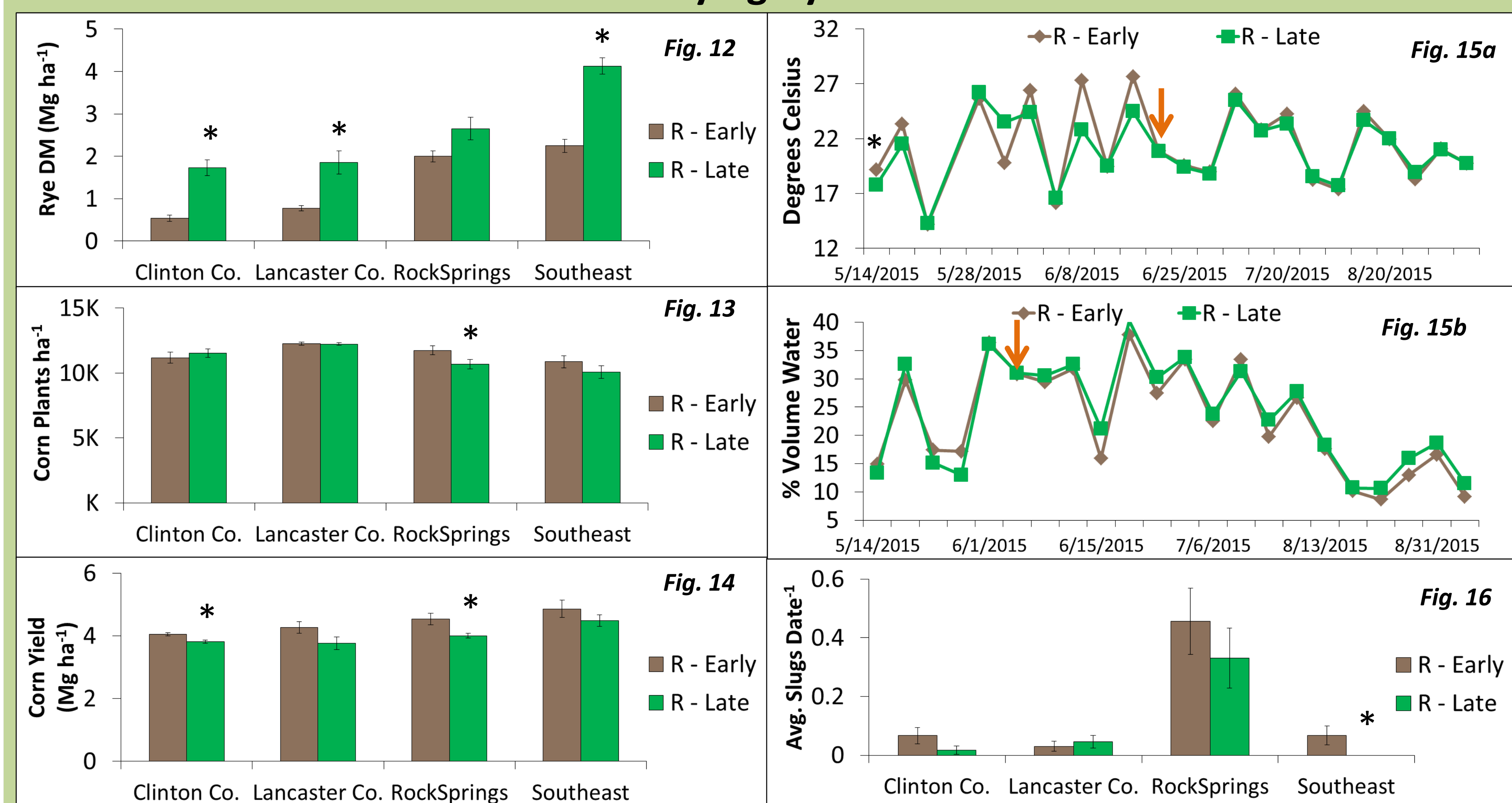
Figure 12: Rye biomass nearly doubled by delaying termination at 3 of 4 sites, but was not significantly different between termination times at Rock Springs research center.
Figure 13: Corn populations were significantly reduced in late-terminated plots in 1 of 4 locations.
Figure 14: Corn yield was lower in late-terminated plots at half the locations.
Figure 15: (Data from Penn State Research Stations only) – 15a) Soil temperature in the top 8 cm was typically lower in late-terminated plots from planting through June (orange arrow), though the difference decreased as the growing season progressed. 15b) Soil moisture in the top 8 cm was numerically reduced by delaying rye termination, until early June, when soil moisture was generally higher in late-terminated plots (orange arrow).
Figure 16: Slug populations were significantly reduced in late-terminated plots at 1 of 4 locations; however, only 6 slugs total were found at this location for the year.

Figure 17a: Corn at V3 in early terminated (left) and late terminated (right) plots at the Southeast Research Station. Figure 17b: Corn in early (left) and late (right) terminated plots showed differences in maturity throughout the growing season.

Conclusions/ Implications:

> **Delaying cover crop termination until planting used more moisture in the spring, and conserved moisture later in the growing season compared to terminating 10-14 days prior to crop planting**

> Soybeans responded better to delayed cover crop termination than corn in this very dry spring when planting was delayed due to lack of moisture

> **Managing nitrogen in corn is essential when rye termination time is delayed to obtain optimum yields**

> Slug populations were insufficient to draw strong conclusions. This study will be repeated for 2 more years, to see the impacts of delaying cover crop termination timing in a variety of climatic conditions in different regions of PA