2018 SOYBEAN MANAGEMENT FIELD DAYS

RESEARCH UPDATE

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University of Nebraska–Lincoln

UNIVERSITY OF NEBRASKA–LINCOLN INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES

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Cultural Practices

	Plant	Harvest	Soil	Herbicide		Site Average Yield
	5/31/2018	10/17/2018	Clay Loam	Date	Chem/Rate	62 bu/ac
Albion	Termination 1			5/17/2018	Roundup Powermaxx 32oz	
	Termination 2			5/31/2018	AMS 12 lb/100 gal.	
	Pre			5/31/2018	Valor 3oz	
	Post			6/23/2018	Roundup Powermaxx 32oz AMS 12 lb/100 Fomesafen 1pt NIS @ 1% v/v	
	5/24/2018	10/3/2018	Silty Clay Loam	Date	Chem/Rate	65 bu/ac
Cedar Bluffs	Termination 1			5/1/2018	Roundup Powermaxx 32oz	
	Termination 2			5/24/2018	AMS 12 lb/100 gal.	
	Pre			5/24/2018	Valor 3oz	
	Post			6/23/2018	Roundup Powermaxx 32oz AMS 12 lb/100 Fomesafen 1pt NIS @ 1% v/v	
	5/29/2018	7/18/2018*	Silty Clay Loam	Date	Chem/Rate	NA
Hartington	Termination 1			5/1/2018	Roundup Powermaxx 32oz	
	Termination 2			5/29/2018	AMS 12 lb/100 gal.	
	Pre			5/29/2018	Valor 3oz	
	Post			6/28/2018	Roundup Powermaxx 32oz AMS 12 lb/100 Fomesafen 1pt NIS @ 1% v/v	
	6/1/2018	10/18/2018	Clay Loam	Date	Chem/Rate	63 bu/ac
Kenesaw	Termination 1			5/8/2018	Roundup Powermaxx 32oz	
	Termination 2			6/1/2018	AMS 12 lb/100 gal.	
	Pre			6/1/2018	Valor 3oz	
	Post			6/19/2018	Roundup Powermaxx 32oz AMS 12 lb/100 Fomesafen 1pt NIS @ 1% v/v	

Soybean Management Field Days On-Farm Research

Introduction

Keith Glewen,
Nebraska Extension Educator

The 2018 growing season represented the eighth year replicated on-farm research was conducted at Soybean Management Field Day locations. The foundation of our research effort this year focused on cover crops and their impact on soybean yield. Our effort started with planting replicated strips of cereal rye, winter wheat in the fall of 2017. As a grower you may have questions concerning the impact cover crop residue has on weed pressure, insects – good and bad, soil water use, fertility and how all of this eventually impacts soybean yield. In addition, we continued a two year study looking at conventional versus traited soybean performance.

As growers, you are increasingly challenged to grow soybeans more responsibly and to document sustainability. We are confident the results reported in this research update and the information provided at the Soybean Management Field Days this past August will be useful. Faculty and staff representing the University of Nebraska-Lincoln greatly appreciate the financial investment you, the soybean growers of Nebraska, have made through your Checkoff contribution in supporting the research undertaken in this project. We would also like to thank the Nebraska Soybean Board for their part in support and management of this effort. Their input into the selection of research topics and, in some cases, treatments was most helpful.

We would also like to thank each of the four collaborating soybean growers who provided their farm as a research location. The names and locations of these operators are noted on the following pages.

After reviewing the report, if you have additional questions, we encourage you to contact researchers associated with the study. Their names appear in the write up of each study and their contact information is listed on the back cover. ***We are committed to work for you, the soybean growers of Nebraska.***

2017 & 2018 SMFD SOYBEAN VARIETY PRODUCTION STUDY

Rodrigo Werle (UW-Madison Weed Specialist), Keith Glewen (UNL Cropping Systems Extension Educator), Nick Arneson (UNL Plant Pathology Research Technologist), Chris Proctor (UNL Weed Science Extension Educator) and Roger Elmore (UNL Cropping Systems Specialist)
Researchers: Steven Spicka (UNL Ag Research Technician) & Ben Dement (UNL Research Assistant)

TAKE HOME POINTS:

- Narrow row spacing (15-inch) resulted in similar or higher grain yields when compared to 30-inch row spacing.
- Under adequate weed control with conventional herbicides (no glyphosate or dicamba POST-emergence), the conventional varieties yielded similarly as RR2 and RR2Xtend varieties.
- Early maturity soybean varieties (RM=2.2-2.4) yielded similarly when compared to the late season varieties (RM = 3.2).
- Narrow row spacing in combination with early maturity varieties can provide Nebraska growers with an opportunity to increase yield and the window for fall cover crop establishment. Moreover, conventional varieties can be associated with premiums thus become more profitable in fields where satisfactory weed control can be achieved with conventional herbicides.

INTRODUCTION

In 2017, Xtend soybean (RR2Xtend) and approved formulations for over-the-top dicamba application technology package became available to soybean producers in the United States, providing them with another tool for weed management in soybeans and a set of new genetics to choose from. Because of the higher seed prices of herbicide-tolerant soybean varieties (e.g., RR2 and RR2Xtend) when compared to conventional varieties, widespread occurrence of glyphosate-resistant weeds in Nebraska (e.g., common waterhemp, Palmer amaranth, marestail, kochia, giant ragweed, and common ragweed), concerns with dicamba off-target movement when spraying RR2Xtend acres, and premiums paid for non-GMO soybeans, some growers have considered including conventional soybean varieties as part of their cropping systems. Some of the challenges associated with growing conventional soybeans are: i) seed availability and variety selection may be limited, ii) misapplication and drift of glyphosate and/or dicamba can severely impact non-tolerant varieties, iii) inability to use glyphosate post-emergence for managing weeds (which most of us have become accustomed to), and iv) need for more intensive scouting and timely spray applications for adequate weed control. Moreover, a common question amongst producers is whether conventional varieties can yield similar to RR2 and RR2Xtend varieties, which dominate the market and have been the main focus of current breeding programs.

According to a recent survey, 30-inch row spacing has been the standard for most growers across Nebraska; however; research has shown a potential yield increase when soybeans are planted on 15-inch row spacing. Moreover, narrow-row spacing has been reported to reduce the likelihood of weed resurgence in soybeans due to the faster rate of canopy closure compared with wider row-spacing. The survey highlighted that cover crops have increased in popularity with Nebraska growers who indicated lower weed pressure where cover crops have been adopted. One of the challenges with cover crops in Nebraska is the relatively short growing season following soybean or corn harvest. Selecting soybean varieties with shorter relative maturity could allow for earlier planting of cover crops in the fall, thereby enhancing cover crop biomass production, soil health, and weed suppression. Thus, herbicide tolerance trait, row spacing, maturity group, and cover crops are all strategies that growers could better explore to maximize soybean yield potential and/or profitability while enhancing weed management. The objective of this study was to explore the impact of herbicide-tolerance trait selection, maturity group and row spacing on soybean yield across six site-years in Nebraska.

Research Questions?

- When treated the same, can conventional, RR2, and RR2Xtend varieties yield similarly?
- How do these varieties respond to different row spacing?
- What effect does maturity group have on yield?

METHODS

To investigate these research questions, a study was established at six Soybean Management Field Days locations in 2017 (Auburn, Ord and Tekamah) and 2018 (Albion, Cedar Bluffs and Kenesaw). The study was conducted as a 2x2x3 factorial with a total of 12 treatments replicated 4 times arranged in a randomized complete block design. Plots were 10 ft wide and 30 ft long. Treatments consisted of: i) row spacing, ii) maturity group, and iii) herbicide-tolerance trait (Table 1). All soybean varieties evaluated herein were managed as conventional for weed management (i.e., no glyphosate or dicamba sprayed POST-emergence).

Table 1. Row spacing, maturity group, and soybean variety treatments at six Soybean Management Field Day locations[1]

Row Spacing[2]	Maturity Group	Herbicide Tolerance Trait[3]
15-inch	Early (2.2-2.4)	Conventional (U11-920017 & AG3253)
30-inch	Late (3.2)	RR2 (AG2431R2Y & AG3231)
		RR2 Xtend (AG24X7 & AG32X7)

[1]The study was conducted across six Site-Years: Auburn-2017, Ord-2017, Tekamah-2017, Albion-2018, Cedar Bluffs-2018, and Kenesaw-2018.
[2]125,000 seeds per acre planted for the 15-inch and 30-inch row spacing treatments.
[3] RR2 = glyphosate-tolerant varieties and RR2Xtend = glyphosate and dicamba-tolerant varieties. No glyphosate or dicamba were sprayed POST-emergence in this trial.

Grain yield data. Soybean grain yield was determined with a small plot combine by harvesting the center-two rows of each plot. Yields were adjusted to 13% grain moisture for final reported values.

Statistical analysis. Experimental data were analyzed to evaluate treatment effects on yield. Because the study was conducted at different sites each year, each individual site and year were combined into Site-Year and treated as a single fixed factor. Significant differences were determined based on a probability of 0.95. Treatment means where statistical differences ($P<0.05$) were detected are shown in Tables 2, 3, 4 and 5.

RESULTS AND DISCUSSION

According to the statistical analysis, the four-way interaction (Site-Year by Row-Spacing by Maturity Group by Herbicide Tolerance Trait) and all possible 3-way interactions were not significant ($P>0.05$). The following 2-way interactions were significant ($P<0.05$) and are discussed herein: i) Site-Year by Herbicide Tolerance Trait, ii) Site-Year by Row Spacing, iii)

Site-Year by Maturity Group, and iv) Row Spacing by Maturity Group.

i. **Study Site-Year and Herbicide Tolerance Trait.** No significant yield difference was detected across herbicide tolerance **Traits** (conventional, RR2, RR2Xtend) within four out of six **Site-Years**; (Table 2). For the two site-years where yield differences were detected, the RR2Xtend trait yielded highest at Tekamah-2017 whereas the conventional trait was highest at Kenesaw-2018. These results indicate that in fields where conventional herbicides provide adequate levels of weed control, there may not be yield benefit from herbicide-tolerant varieties compared with conventional varieties.

ii. **Study Site-Year and Row Spacing.** Significantly higher soybean yields were detected in the **15-inch** versus **30-inch** row spacing within three out of six **site-years** (Auburn-2017, Albion-2018, Cedar Bluffs-2018; Table 3). No significant yield difference between **15-inch** and **30-inch** row spacing was detected at Ord-2017, Tekamah-2017 and Kenesaw-2018. Higher yields in narrow-row spacing are likely due to faster canopy closure and higher light interception (e.g., plants "harvesting" more light for photosynthesis) due to a more even plant distribution in the field, which can also enhance late-season weed suppression.

iii. **Study Site-Year and Maturity Group.** The **Early** maturity varieties (RM 2.2-2.4) yielded the same as the **Late** maturity varieties (RM 3.2) within five **site-years** (Auburn-2017, Ord-2017, Tekamah-2017, Albion-2018, Cedar Bluffs-2018); and at Kenesaw-2018, **Early** varieties yielded more than **Late** varieties (Table 4). Thus, growers interested in fall-seeded cover crops as part of their cropping systems could potentially benefit from adopting **Early** maturity soybean varieties recommended for their regions to allow a wider window for cover crop establishment in the fall without sacrificing soybean yield.

iv. **Row Spacing and Maturity Group.** The combination of narrow row spacing (**15-inch**) and **Early** maturity varieties resulted in the highest yield followed by **15-inch** and **Late** maturity (Table 5). The **30-inch** row spacing combined with either **Early** or **Late** varieties presented the lowest yields. Thus, yield was maximized with narrow row spacing in combination with **Early** maturity varieties.

SUMMARY

This study was conducted at six site-years across Nebraska during the 2017 and 2018 growing seasons. Fifteen-inch row spacing yielded the same or more than the standard 30-inch row spacing. The results of this study do not indicate an yield advantage of RR2 and RR2Xtend soybean varieties when compared to conventional soybeans (under weed-free conditions). The Late maturity group tested in this study (RM3.2) did not have an yield advantage when compared to the Early maturity group (RM2.2-2.4). For Early maturity group varieties, yield was maximized in combination with narrow (15-inch) row spacing.

ACKNOWLEDGEMENTS

The authors would like to thank the students and technicians involved with the Soybean Management Field Day for their support with plot establishment and maintenance, and data collection. The Nebraska Soybean Board funded this program. Thanks to the growers who allowed us to establish this study on their farms.

Table 2. Average soybean yield response across Site-Years and herbicide tolerance Traits.

Site-Year x Trait	Avg Yield (bu/acre) [1]
Auburn-2017 x Conventional	77.5 *ab*
Auburn-2017 x RR2	77.7 *a*
Auburn-2017 x RR2Xtend	79.6 *a*
Ord-2017 x Conventional	64.2 *de*
Ord-2017 x RR2	64.7 *de*
Ord-2017 x RR2Xtend	63.0 *de*
Tekamah-2017 x Conventional	69.1 *cd*
Tekamah-2017 x RR2	71.6 *bc*
Tekama-2017 x RR2Xtend	75.5 *ab*
Albion-2018 x Conventional	62.5 *e*
Albion-2018 x RR2	63.4 *de*
Albion-2018 x RR2Xtend	61.8 *e*
Cedar Bluffs-2018 x Conventional	76.2 *ab*
Cedar Bluffs-2018 x RR2	74.9 *abc*
Cedar Bluffs-2018 x RR2Xtend	76.3 *ab*
Kenesaw-2018 x Conventional	69.1 *cd*
Kenesaw-2018 x RR2	61.2 *e*
Kenesaw-2018 x RR2Xtend	60.4 *e*
	P = 0.0253

[1] Treatments that do not share the same letter are significantly different ($P<0.05$). Letters, in alphabetic order, represent highest to lowest average treatment yields.

Table 3. Average soybean yield response across Site-Years and Row Spacing.

Site-Year x Row Spacing	Avg Yield (bu/acre) [1]
Auburn-2017 x 15-inch	83.2 *a*
Auburn-2017 x 30-inch	73.3 *b*
Ord-2017 x 15-inch	65.2 *d*
Ord-2017 x 30-inch	62.7 *de*
Tekamah-2017 x 15-inch	73.1 *b*
Tekamah-2017 x 30-inch	71.1 *bc*
Albion-2018 x 15-inch	66.0 *cd*
Albion-2018 x 30-inch	59.1 *e*
Cedar Bluffs-2018 x 15-inch	80.4 *a*
Cedar Bluffs-2018 x 30-inch	71.2 *b*
Kenesaw-2018 x 15-inch	65.2 *d*
Kenesaw-2018 x 30-inch	61.9 *de*
	P = 0.0168

[1] Treatments that do not share the same letter are significantly different ($P<0.05$). Letters, in alphabetic order, represent highest to lowest average treatment yields.

Table 4. Average soybean yield response across Site-Years and Maturity Group.

Site-Year x Maturity Group[1]	Avg Yield (bu/acre) [2]
Auburn-2017 x Early	79.4 *a*
Auburn-2017 x Late	77.1 *ab*
Ord-2017 x Early	65.5 *ef*
Ord-2017 x Late	62.4 *efg*
Tekamah-2017 x Early	72.7 *bc*
Tekamah-2017 x Late	71.5 *cd*
Albion-2018 x Early	61.6 *fg*
Albion-2018 x Late	63.6 *efg*
Cedar Bluffs-2018 x Early	75.8 *abc*
Cedar Bluffs-2018 x Late	75.8 *abc*
Kenesaw-2018 x Early	67.1 *de*
Kenesaw-2018 x Late	60.0 *g*
	P = 0.0352

[1] Relative maturity group: Early = RM2.2-2.4; Late = RM3.2.
[2] Treatments that do not share the same letter are significantly different ($P<0.05$). Letters, in alphabetic order, represent highest to lowest average treatment yields.

Table 5. Average soybean yield response across Row Spacing and Maturity Group.

Row Spacing x Maturity Group[1]	Avg Yield (bu/acre)[2]
15-inch x Early	74.0 *a*
15-inch x Late	70.4 *b*
30-inch x Early	66.7 *c*
30-inch x Late	66.4 *c*
	P = 0.0509

[1] Relative maturity group: Early = RM2.2-2.4; Late = RM3.2.
[2] Treatments that do not share the same letter are significantly different ($P<0.05$). Letters, in alphabetic order, represent highest to lowest average treatment yields.

IMPACT OF COVER CROP SPECIES, TERMINATION TIMING, HERBICIDE PROGRAM AND FUNGICIDE SEED TREATMENT ON WEED SUPPRESSION AND SOYBEAN YIELDS

Authors: Nick Arneson (UNL Plant Pathology Research Technologist), Chris Proctor (Nebraska Weed Science Extension Educator), Rodrigo Werle (UW-Madison Weed Specialist), Keith Glewen (Nebraska Cropping Systems Extension Educator), Loren Geisler (UNL Extension Plant Pathologist)
Researchers: Steven Spicka (UNL Ag Research Technician) and Ben Dement (UNL Research Assistant)

TAKE HOME POINTS:

- Late termination produced more cover crop biomass than early termination and rye generally produced more biomass than wheat.
- Inconsistent and low weed pressure across research locations led to no treatment difference for weed suppression across treatments.
- Soybean yield were not affected by cover crop treatment with an exception where late-terminated rye and wheat reduced yield at one location.

INTRODUCTION

The adoption of cover crop continues to increase across the Nebraska landscape. Most farmers have interest in cover crops for the potential benefits of reducing soil erosion, increasing soil organic matter, capturing excess nutrients, weed suppression, and as a forage. With the short window following harvest to establish cover crops there is opportunity to increase spring biomass by delaying termination, but later termination may reduce yield potential of the subsequent crop. Thus, finding a balance between cover crop biomass production in the spring while minimizing impact on the subsequent crop is important. **The objective of this study was to evaluate the impact of cover crop species (wheat and cereal rye) and biomass (termination timing; early and late?) on weed control and soybean yield when paired with different seed treatments and herbicides application timings.**

METHODS

Experiments were conducted at each of the 2018 Soybean Management Field Day sites. These sites were located near Albion, Cedar Bluffs, Hartington, and Kenesaw. At each site there 24 treatments (three cover crop treatments x two cover crop termination dates x 2 herbicide applications x 2 fungicide/insecticide? seed treatments). Cover crop treatments consisted of wheat ("Ruth" variety at 63 lbs/acre), rye ("VNS" variety at 59 lbs/acre) and no cover crop. Cover crops were planted in early- to mid- November (Table 6). These cover crops were terminated at two separate times during the spring with glyphosate (32 oz/acre) and 12lb/100 gallons of AMS at 15 gallons per acre (Table 6). Early termination treatments were made after extended leaf height of the cover crops reached 6-8 inches, which is defined as the minimum growth required for erosion control (NRCS Code 340). In many cases, extended leaf heights were at or above 12 inches. Late terminations occurred approximately 2-3 weeks after the first termination application and coincided with soybean planting (Table 1). The full herbicide treatment was flumioxazin (3 oz/A) applied with later termination followed by fomesafen (1 pt/A) + glyphosate (32 fl oz/A) (Table 1). The postemergence only herbicide treatment was fomesafen (1 pt/A) + glyphosate (32 fl oz/A) when soybean was V3 growth stage (Table 6). Seed treatments included a no seed treatment check and a base fungicide seed treatment consisting of Apron XL (mefenoxam, 0.64 mg a.i./seed) + Maxim 4FS (fludioxonil, 0.0076 mg a.i./seed) + Vibrance (sedaxane, 0.0076 mg a.i./seed). The selection of the chemistry tested in this study is not an indication that this is the best product; it is intended to be representative of a product group. This study was conducted as a randomized complete block design with four replications at each site. Each experimental unit was 10 ft wide (4 rows X 30 in. per row) and 30 ft long.

Table 6. Planting, application and data collection dates at each of the Soybean Management Field Day sites in 2017 and 2018.

Site	Cover Crop			Soybean Planted	Herbicide		Weed Density	Weed Biomass
	Planted (Yr. 2017)	Termination 1	Termination 2		PRE	POST		
Albion	Nov. 16th	May 17th	May 31st	May 31st	May 31st	June 23rd	June 12th	July 25th
Cedar Bluffs	Nov. 6th	May 10th	May 24th	May 24th	May 24th	June 23rd	June 19th	July 23rd
Hartington	Nov. 9th	May 17th	May 29th	May 29th	May 29th	June 28th	June 12th	-
Kenesaw	Nov. 10th	May 8th	June 1st	June 1st	June 1st	June 19th	June 19th	July 31st

DATA COLLECTION

Cover crop biomass: Samples and measurements were taken on each plot prior to each termination date. Biomass samples were collected by cutting rye or wheat plants at ground level from 1 ft x 2 ft area with 10 samples for each cover crop species and study location. Plant samples were dried in an oven prior to being weighed.

Weed density and biomass: Weed numbers were counted twice within each plot by randomly placing a 12” x 12” sampling square. Weeds were then cut at ground level, bagged, and dried prior to being weighed

Yield: Soybean yields were taken using a small plot combine by harvesting the center two rows of each plot. Alleys were cut just prior to harvest and recorded to determine total plot length. All yields were adjusted to 13% moisture prior to the statistical analysis.

RESULTS

Cover Crop biomass: Overall, biomass varied across locations (Fig. 1) with the greatest biomass occurring at Hartington, followed by Albion, Kenesaw, and Cedar Bluffs. Rye consistently produced more biomass than wheat. Termination timing also had a significant effect on biomass with the late termination having over five times the biomass of the early termination.

Weed Density: There were no significant differences in weed density across treatments and locations (Table 7).

Weed Biomass: Given the inconsistent weed pressure within and across locations, statistical analysis was not possible to generate adequate estimates.

Table 7. Mean weed density for cover crop species, termination date, and herbicide at each site.

	Rye				Wheat				No-Cover			
Albion	Early		Late		Early		Late		Early		Late	
	PRE + POST	POST	PRE + POST	POST	PRE + POST	POST	PRE + POST	POST	PRE + POST	POST	PRE + POST	POST
	Density (weeds/ft^2)											
	0	4.25	0	0	0	5.5	0	0	0	0	6.25	1.25
Cedar Bluffs	**Rye**				**Wheat**				**No-Cover**			
	Early		Late		Early		Late		Early		Late	
	PRE + POST	POST	PRE + POST	POST	PRE + POST	POST	PRE + POST	POST	PRE + POST	POST	PRE + POST	POST
	Density (weeds/ft^2)											
	0	2	0	0	0	0	0	0	.25	.75	0	0
Hartington	**Rye**				**Wheat**				**No-Cover**			
	Early		Late		Early		Late		Early		Late	
	PRE + POST	POST	PRE + POST	POST	PRE + POST	POST	PRE + POST	POST	PRE + POST	POST	PRE + POST	POST
	Density (weeds/ft^2)											
	1.75	.25	3.75	.75	0	.25	6	1.25	0	.25	1	2
Kenesaw	**Rye**				**Wheat**				**No-Cover**			
	Early		Late		Early		Late		Early		Late	
	PRE + POST	POST	PRE + POST	POST	PRE + POST	POST	PRE + POST	POST	PRE + POST	POST	PRE + POST	POST
	Density (weeds/ft^2)											
	1	.01	0	.25	0	.01	0	0	.19	.01	0	1

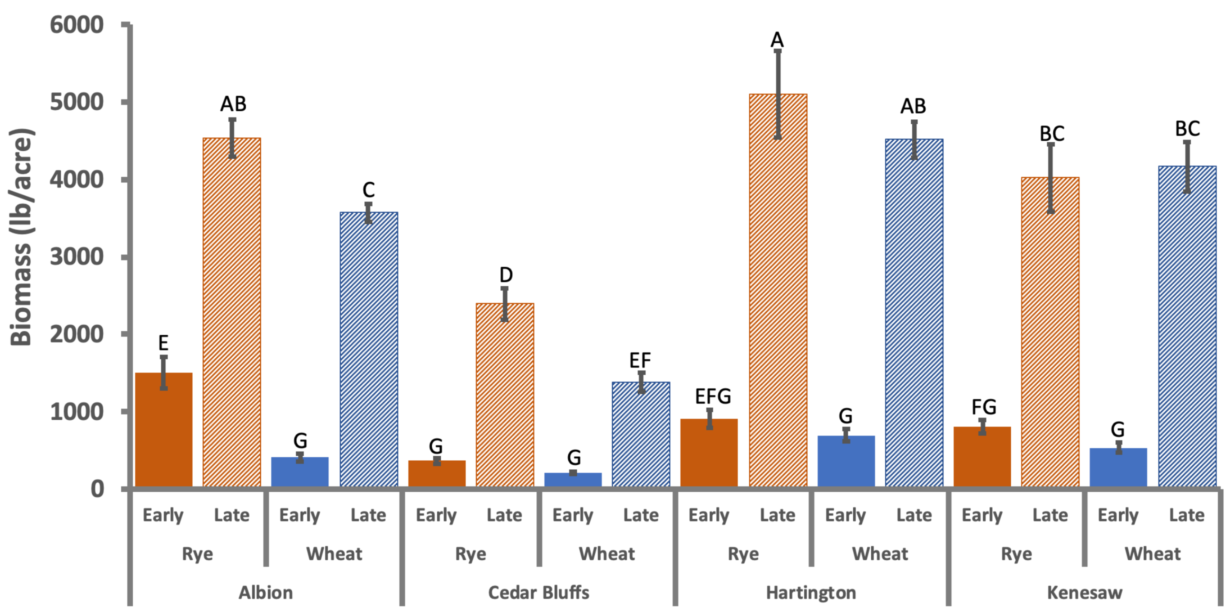

Figure 1. Cover crop biomass (lbs/acre) taken prior to early and late termination for cereal rye and wheat cover crops at each of the four SMFD sites. Letters indicate significant differences between treatments at P<0.05.

Yield:

- At the Cedar Bluffs location, there was a significant reduction in soybean yield with the late termination treatments of both cover crop species and regardless of herbicide program (Fig. 3).
- Yield was lower for the early termination POST only herbicide on wheat when compared with the late termination POST only herbicide on Rye at the Albion location, however all other treatments yielded the same (Fig. 2).
- No significant differences occurred between cover crops, terminations or herbicide program for the Kenesaw location (Fig 4).
- There were no significant effects of seed treatment alone on yield at any of the three locations.
    - At Cedar Bluffs, fungicide seed treatment at the early termination with the POST only herbicide yielded higher than no seed treatment at the late termination with the full herbicide treatment.
    - At Kenesaw, no seed treatment at the late termination with the full herbicide treatment yielded higher than fungicide seed treatment at the early termination with the POST only herbicide treatment.
    - **No yield was taken at Hartington due to a hailstorm on July 18th.**

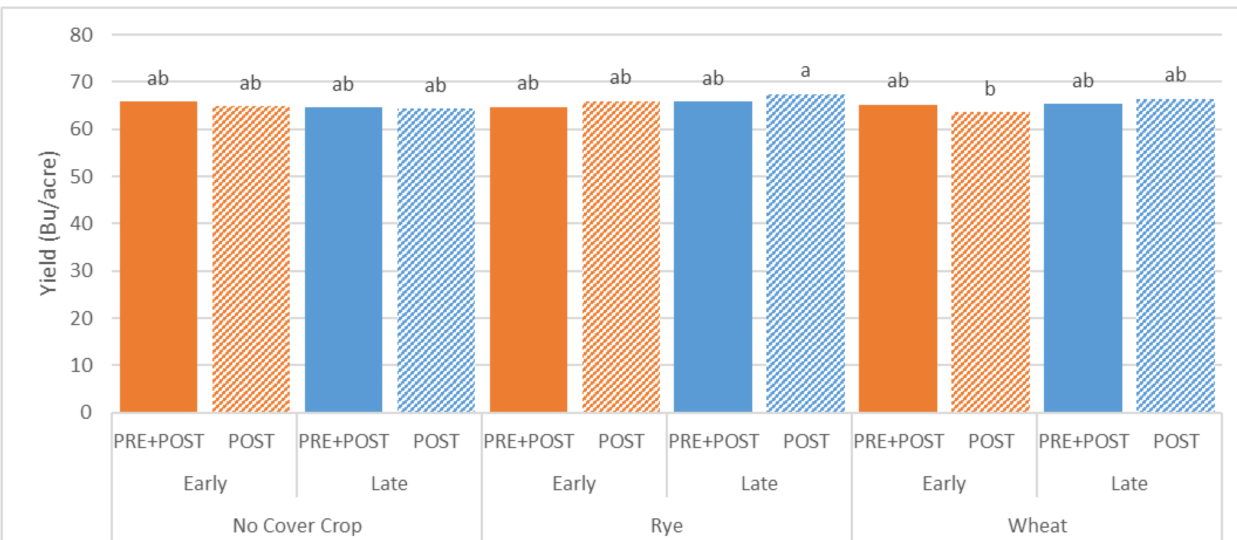

Figure 2. Soybean grain yield (bu/acre) by cover crop species, termination timing, and herbicide treatments at the Albion location. Letters indicate significant differences between treatments at P<0.05.

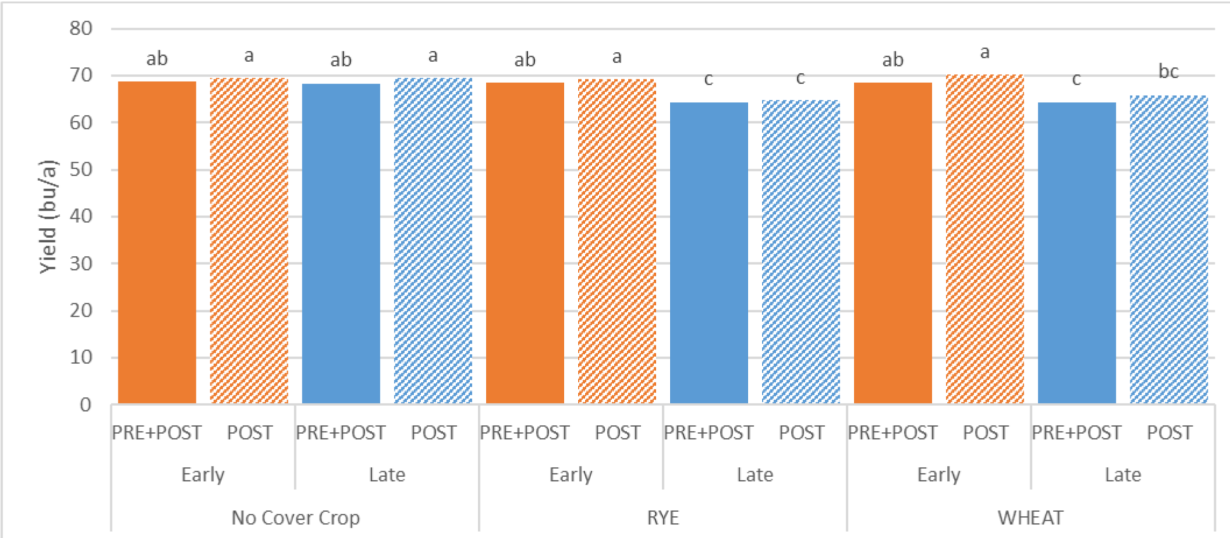

Figure 3. Soybean grain yield (bu/acre) by cover crop species, termination timing, and herbicide treatments at the Cedar Bluffs location. Letters indicate significant differences between treatments at P<0.05.

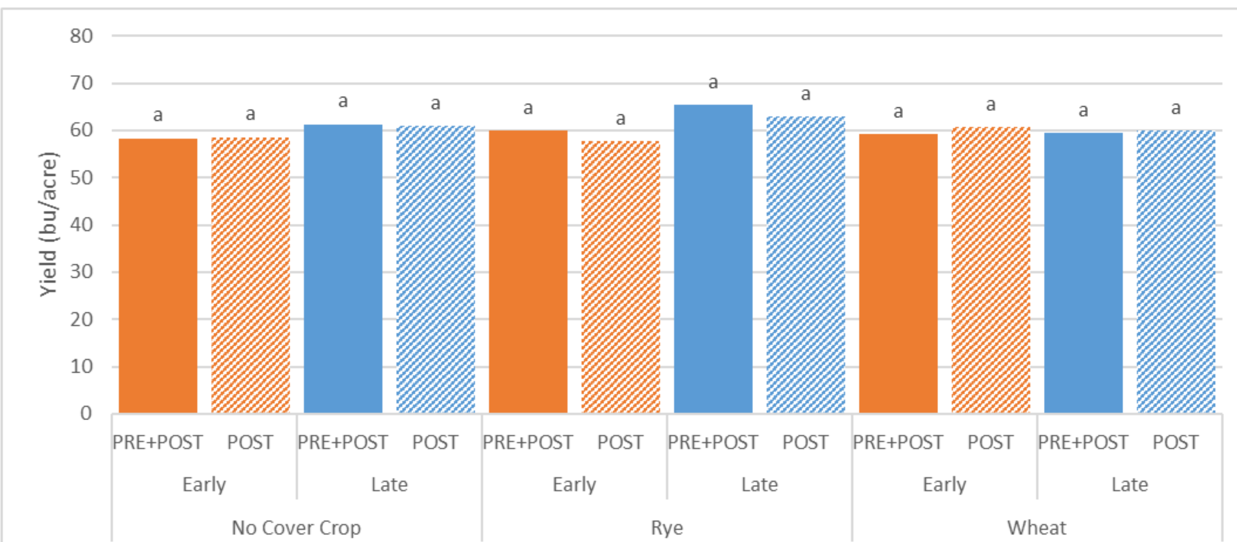

Figure 4. Soybean grain yield (bu/acre) by cover crop species, termination timing, and herbicide treatments at the Kenesaw location. Letters indicate significant differences between treatments at P<0.05.

DISCUSSION

Cover crop species selection significantly influenced spring biomass production at two sites. Late termination significantly increased cover crop biomass compared to early termination at all the sites. It was hypothesized that additional biomass at the late termination might have a negative effect on soybean yield, since this was not the case we expect that irrigation and soybean's ability to adapt to early season stress may have contributed to the yields recorded. Given the higher biomass produced by the late termination, it was expected that differences in weed suppression would be evident. That was not evident because of the low and inconsistent weed pressure within and across locations. In the future larger sample sizes and more frequent data collection may help better understand the effects of cover crops on weed suppression as well as selection of locations with higher, more uniform weed pressure. Fungicide seed treatment did not have consistent effects on yield at any of the locations. There were no observable differences between treatments in terms of seedling disease (seedling disease pressure appeared to be low at all locations). More research investigating the effects of cover crops on incidence of seedling diseases in soybean is needed. Even though the weed suppression benefits of cover crops were not obvious in this study, it is important to note that cover crops did not have a negative impact on the soybean crop which suggests the integration of cover crops into a soybean-corn rotation has potential for success in Nebraska.

IMPACT OF COVER CROP SPECIES AND TERMINATION TIMING ON ARTHROPOD ACTIVITY AND SOYBEAN YIELDS

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Researchers: Elliot Knoell (Research Project Coordinator), Steven Spicka UNL Ag Research Technician), and Keith Glewen (Nebraska Extension Educator)

TAKE HOME POINTS:

- Large differences in cover crop biomass and extended leaf height were observed between cover crop species, termination dates and sites
- Cover crop species and termination date had a significant impact on arthropod activity with many representing beneficial arthropods such as predators or fungal feeders
- Little to no damage was observed on soybean across any of the cover crop treatments or sites
- No differences in soybean yield were observed between cover crops or termination treatments at any of the field study sites

INTRODUCTION

Cover crop adoption has been increasing as a means of reducing soil erosion, increasing soil organic matter, soil tilth, water infiltration, nutrient capture, and weed control. Despite these benefits, producers still face a number of production challenges. Of these challenges, spring termination of cover crops is a primary concern, second only to fall establishment (Butts and Werle 2016). A national survey of growers found 39% "planted green" into a cover crop with 69% of those producers planting soybeans as the subsequent cash crop (CTIC 2017). While some producers are motivated to plant green, others are forced to as a result of poor spring weather conditions or a lack of herbicide control. Currently, limited information is available on the risk of increased pests or disease for timing of termination of a cover crop relative to the cash crop planting.

Cover crops can attract both pest and beneficial arthropods. Damage from insect pests is based on a number of different factors such as, timing of cover crop establishment or termination method, number of years with a cover crop, weather conditions, and the interval between termination and planting as well as the subsequent cash crop species. Studies and field observations have shown significant risks from pests such as black cutworm, wireworm, Japanese beetle, green cloverworm, southern corn rootworm, seed corn maggot, stinkbugs, and bean leaf beetle and slugs with rye cover crops (Smith et al. 1988). In contrast, Koch et al. 2012 reported reduced aphid and bean leaf beetle population with a rye cover crop. Methods of termination varied considerably between studies (plowing, paraquat, or mowing). In addition, termination dates were not utilized in a way to evaluate their impact on insect populations. Such studies have demonstrated the risk with each of these pests, but no studies have been conducted to determine how management practices such as the timing of termination might influence this relationship.

METHODS

Experiments were conducted at each of the Soybean Management Field Day sites. These sites were located near Albion, Cedar Bluffs, Hartington, and Kenesaw. At each site there 6 treatments (three cover crop treatments x two cover crop termination dates). Cover crop treatments consisted of wheat, rye and no cover crop. ‘VNS’ rye and ‘Ruth’ wheat were planted at 59 and 63 lb/acre, respectively. Cover crops were planted in early- to mid-November (Table 1). These cover crops were terminated at two separate times during the spring with glyphosate (32 oz/acre) and 12lb/100 gallons of AMS at 15 gallons per acre (Table 8). Early termination treatments were made after extended leaf height of the cover crops reached 6-8 inches, which is defined as the minimum growth required for erosion control (NRCS Code 340). In many cases, extended leaf heights were at or above 12 inches. This height is considered optimal for erosion control. Late terminations occurred approximately 2-3 weeks after the first herbicide application coinciding with soybean planting (Table 8). This study was conducted as a randomized complete block design with four replications at each site. Each experimental unit was 30 ft wide (12 rows X 30 in. per row) and 30 ft long.

Table 8. Planting, application and data collection dates at each of the Soybean Management Field Day sites in 2017 and 2018.

Site	Cover Crop			Soybean Planted	Pitfall Trap	Soybean Damage Assessment
	Planted (Yr. 2017)	Termination 1	Termination 2			
Albion	Nov. 16th	May 17th	May 31st	May 31st	June 14th-18th	June 18th
Cedar Bluffs	Nov. 6th	May 10th	May 24th	May 24th	June 7th-12th	June 12th
Hartington	Nov. 9th	May 17th	May 29th	May 29th	June 13th-18th	June 18th
Kenesaw	Nov. 10th	May 8th	June 1st	June 1st	June 14th-19th	June 19th

DATA COLLECTION

Cover crop biomass and extended leaf height: Samples and measurements were taken on each plot prior to each termination date. Biomass samples were collected by cutting rye or wheat plants at ground level from 1 ft x 2 ft area at a minimum of 10 sites for each cover crop species and location. Plant samples were dried in an oven prior to being weighed. Extended leaf heights were determined by pulling a handful of wheat or rye plants to an upright position and measured from the soil surface to the tip of a leaf.

Arthropod activity: Pitfall traps were placed in each plot (photo to the right) to capture arthropods moving across the soil surface. Traps were set up approximately two weeks after planting for a period of 4-5 days. All arthropods were identified to family.

Pest damage assessment: Insect damage to soybeans was assessed through visual evaluation for frequency and severity at the V2-V3 stage.

Soybean Yield: Yields were taken using a small plot combine by harvesting the center two rows of each plot. Alleys were cut just prior to harvest and recorded to determine total plot length. All yields were adjusted to 13% moisture prior to the statistical analysis.

RESULTS

Cover Crop biomass and extended leaf height: Overall, biomass and extended leaf height varied between sites (Table 9) with the greatest **biomass** occurring at Hartington, followed by Albion, Kenesaw, and Cedar Bluffs. In contrast, the greatest **heights** occurred at Albion, followed by Hartington, Kenesaw, and Cedar Bluffs. Cover crop treatment had a significant impact on biomass (Table 10) with the greatest biomass and extended leaf height occurring for rye when compared to wheat. Termination treatments (Table 3) also had a significant effect on biomass and extended leaf height with over five times the biomass in late terminations and double the height. Depending on the site there were also significant differences in biomass (Figure 5) with cover crop species ($P=0.0420$) and termination date ($P<0.0001$) treatments. Significant differences in cover crop treatments occurred at Albion and Cedar Bluffs. Termination data was significant at all sites, however, the magnitude of these differences varied between sites (Figure 5).

Extended leaf height (Figure 6) also had a significant interaction between site, cover crop and termination ($P<0.0001$). Extended leaf height was similar between all sites with the exception of Cedar Bluffs at 3-4 inches shorter (Table 9). Larger differences were observed between early and late terminations for rye when compared to wheat across the same treatment combination.

Table 9. Mean biomass and extended leaf height for both cover crop species at each site. Letters indicate significant differences at $P<0.05$.

Site	Cover Crop	
	Biomass (lbs/acre)	Extended Leaf Height (inches)
Albion	2,505 AB	21.2 A
Cedar Bluffs	1,086 C	17.2 B
Hartington	2,803 A	20.8 A
Kenesaw	2,381 B	20.4 A

Table 10. Mean biomass and extended leaf height for cover crop species and termination date across all sites. Letters indicate significant differences at P<0.05.

Treatment		Cover Crop	
		Biomass (lbs/acre)	Extended Leaf Height (inches)
Cover Crop Species	Rye	2,453 A	24.5 A
	Wheat	1,935 B	15.2 B
Termination Date	Early	678 B	13.3 B
	Late	3,709 A	26.5 A

Figure 5. Cover crop biomass (lbs/acre) taken prior to early and late termination for cereal rye and wheat cover crops at each of the four SMFD sites. Letters indicate significant differences between treatments at P<0.05.

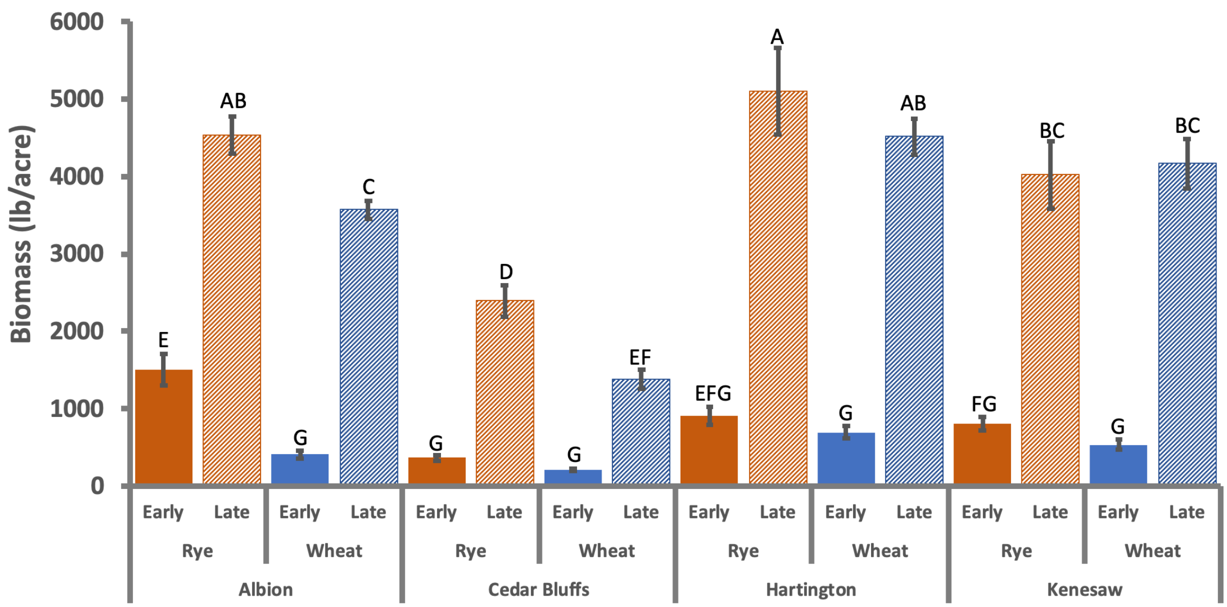
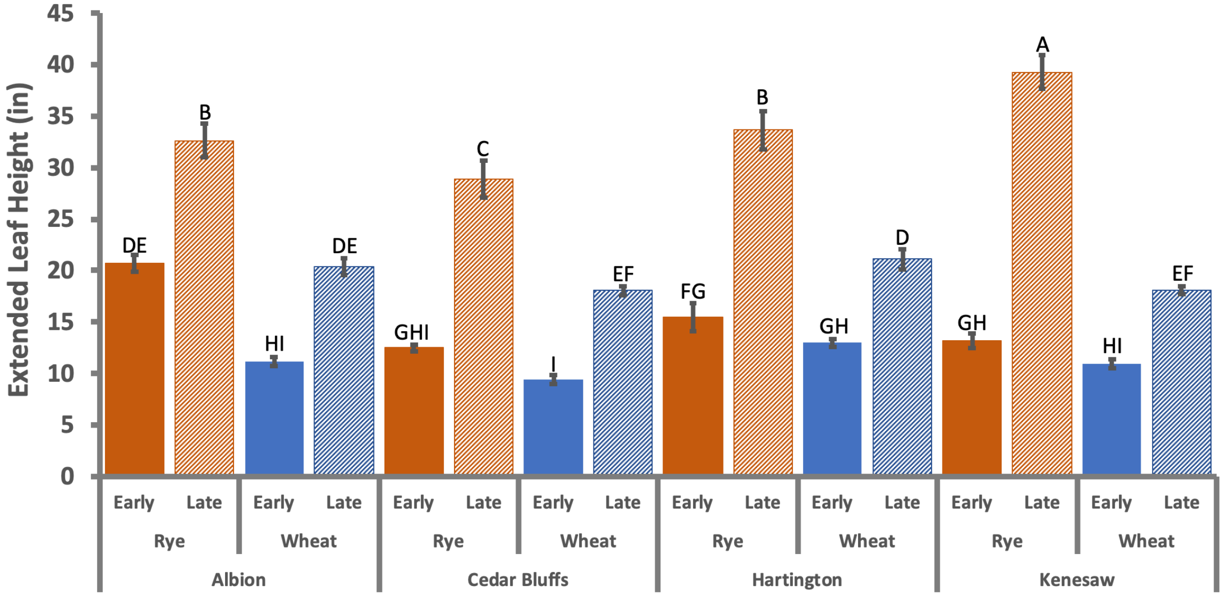
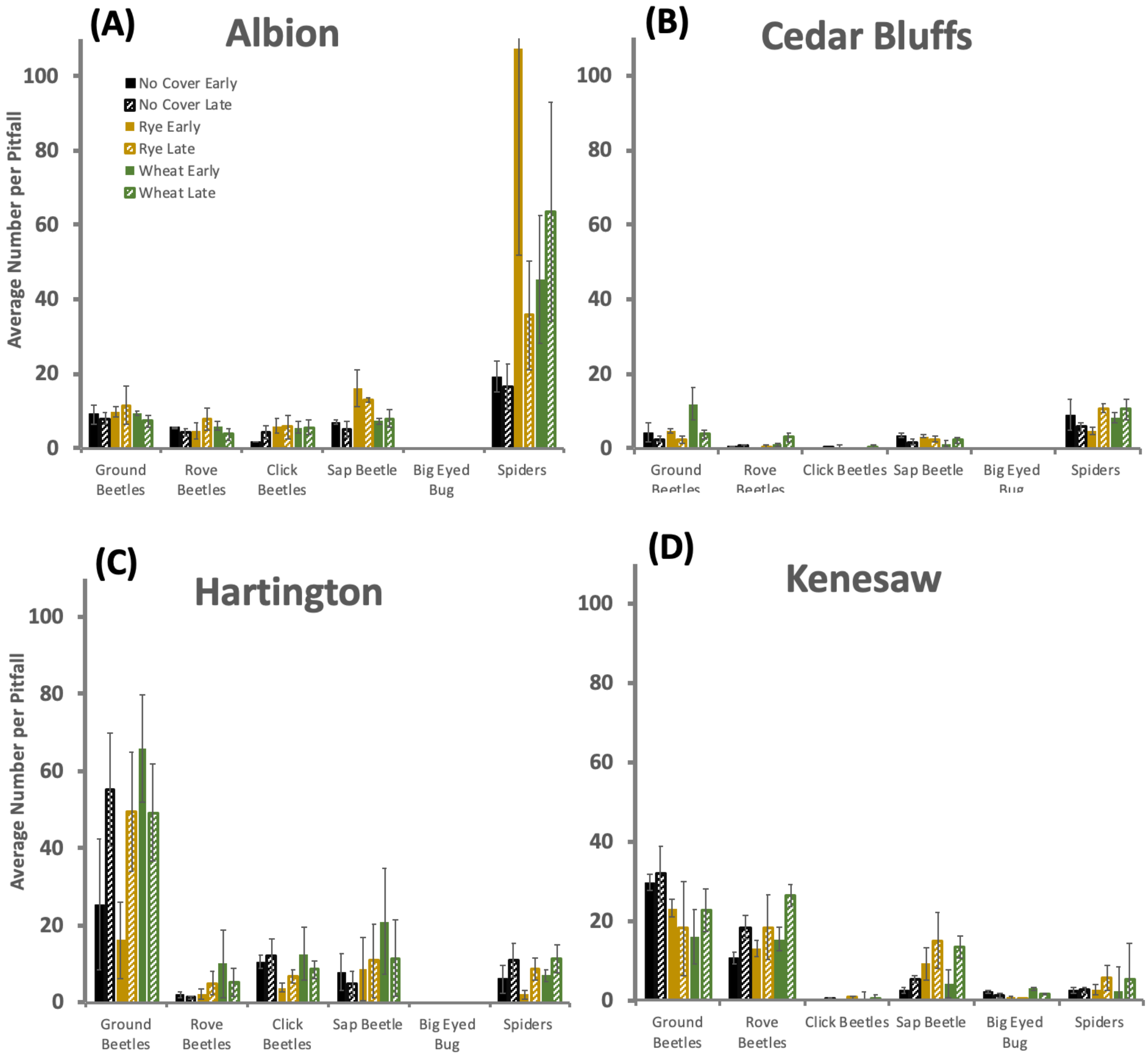


Figure 6. Extended leaf height (inches) taken prior to early and late termination for cereal rye and wheat cover crops at each of the four SMFD sites. Letters indicate significant differences between treatments at P<0.05.



Arthropod activity: Total arthropod activity had a significant interaction between site, cover crop and termination (P<0.0001). The greatest differences were observed between sites with Albion (4.3) and Hartington (4.3) having significant more arthropods per pitfall trap compared to Kenesaw (4.0). Significantly fewer arthropods were collected from pitall traps at Cedar Bluffs (2.8). For cover crop species, significantly more arthropods were found in wheat (4.0) compared to rye (3.8) or no cover crop (3.7). In addition, late terminated cover crops (3.9) collected more arthropods compared to early termination (3.8). Figure 3 shows the arthropods with greater than 5% occurrence and their average numbers per pitfall trap for Albion (A), Cedar Bluffs (B), Hartington (C), and Kenesaw (D).

Figure 7. Average number of arthropods (>5% of samples) recovered from pitfall traps for early and late terminations across three cover crops (none, rye and wheat) at each site (Albion (A), Cedar Bluffs (B), Hartington (C), and Kenesaw (D) over a 5-day period being at the V2-V3 stage in soybean.



Pest damage assessment: Percentage of defoliated plants was averaged less than 5% across all treatments and sites. In addition, incidence or the number of plants with visible damage was less than 5%. The most common defoliators were alfalfa caterpillar, leaf miners, and slugs.

Figure 8. Percent defoliation and incidence (number of plants with damage) across all sites compared to the economic threshold of 30% for vegetative stage soybeans.

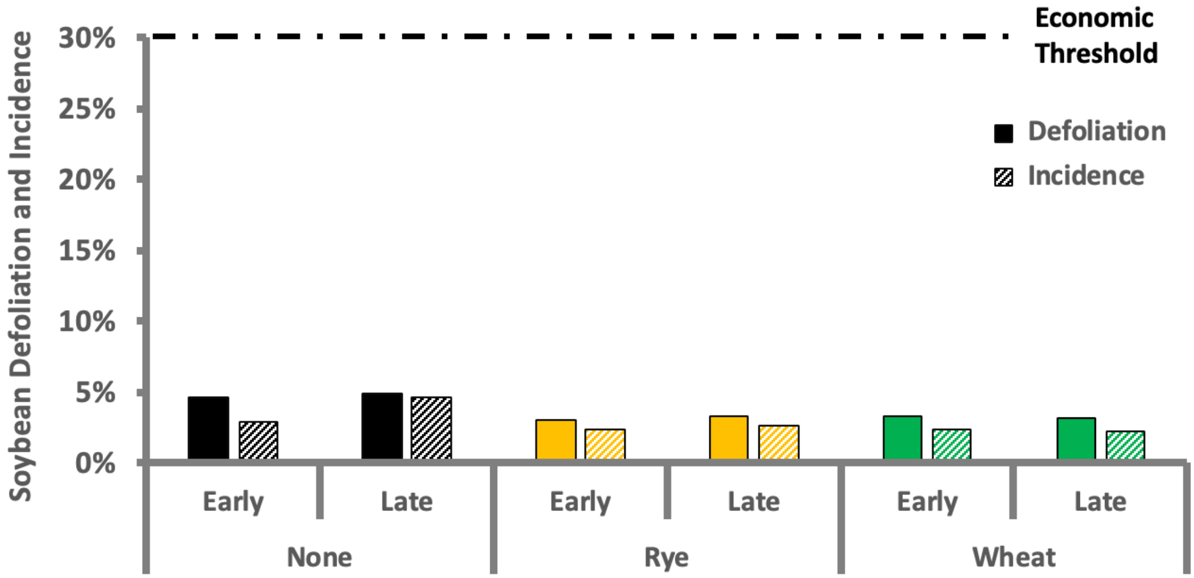
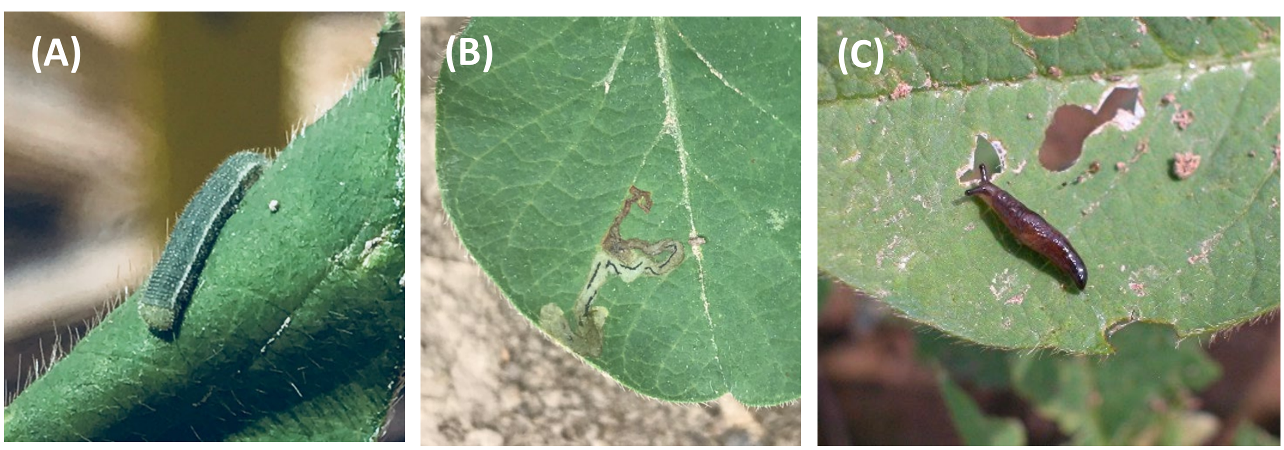


Figure 9. Defoliators (A) alfalfa caterpillar, (B) leaf miner, and (C) slug that were most commonly found on soybean across all treatments.



Yield: No significant differences occurred between cover crops, terminations or their combination across all sites. Significant differences occurred between sites with the greatest yield occurring at Cedar Bluffs (68.6 bu/acre), followed by Albion (67.3 bu/acre) and Kenesaw (65.8 bu/acre). **No yield was taken at Hartington due to a hailstorm on July 18th.**

DISCUSSION

Cover crops and termination date had a significant impact on arthropod activity. These differences varied between sites. A comparison between cover crop biomass at each site and total arthropod activity indicates that there is a positive correlation with greater arthropod activity with increasing biomass of the cover crop. Other factors such as previous crop, cover crop history, residue management, and environmental conditions can influence these results. Additional data are needed to confirm this result. Of the arthropods collected from pitfall traps, ground beetles, rove beetles, and spiders are considered to be generalist predators feeding on other insects. Sap beetles are typically found feeding on decaying fruit and fungi and are not considered to be a threat to vegetative stage soybeans. Click beetles were found in significant numbers at Albion and Hartington. The immature form of this insect is the wireworm which can cause significant damage to seedlings early in the growing season under cool conditions that slow plant growth.

Plant damage was very low on all treatments across all sites. These low levels of damage could be due to a later planting date decreasing the likelihood of significant infestation from early defoliators. Of the defoliators observed, slugs are the only pest that has been observed in the past to be associated with cover crops.

2018 SMFD – PREVIOUS COVER CROP AND FERTILIZER APPLICATION HAVE LITTLE EFFECT ON SOYBEAN YIELD UNDER FERTILE SOILS IN NEBRASKA

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TAKE HOME POINTS:

- Cover crops (CC) may compete with soybeans for water and nutrients like phosphorus (P), potassium (K) and sulfur (S), especially when soil test indicates nutrient concentrations below the critical level for a nutrient.
- Cover crop had no effect on soybean grain yield (~1 bu/ac difference) over all sites.
- Fertilizer application had a significant yet small effect on soybean grain yield (0.7 bu/ac more from applying P+K) over all sites.
- There was a significant negative effect of S application on grain yield (0.7 bu/ac less with S as compared to no S).
- Grain yield response to fertilizer is very unlikely when soil test P is greater than 12 ppm and K is greater than 124 ppm (Mehlich-3 or Bray-P).
- The application of P, K, and S was agronomically and economically unwarranted at these three sites, agreeing with UNL recommended soil critical levels of 124 ppm for K, and 12 ppm for P on for soybeans.

INTRODUCTION

The inclusion of a cover crop (CC) into existing cropping systems has been promoted due to its many potential benefits. For example, CCs can protect topsoil from erosion, increase soil organic matter and cation exchange capacity, alter nutrient loss dynamics, promote soil aggregation and improve water infiltration. On the other hand, CCs may compete for different resources, like water and nutrients, with the following cash crop, in spite of being grown at different times.

Furthermore, it has been observed that often farmers, crop consultants and fertilizer dealers use/recommend potassium (K) and phosphorus (P) fertilizer application when soil tests for these nutrients are above the critical levels established by University of Nebraska soil science research studies. Current UNL-recommended critical levels for P and K for soybean are 12 and 124 ppm (Bray-1 or Mehlich-3). Soybeans are very tolerant to low soil sulfur (S) levels and unlikely to respond to S application. However, in previous Soybean Management Field Day (SMFD) studies, soybean yield response to S was observed on a silt loam site testing 13 ppm sulfate-S. Therefore, the objectives of these studies were to:

1. Assess the effect of previous CC on nutrient availability to soybeans.

2. Assess soybean yield response at different levels of P, K and S fertilizer application and evaluate their agreement with UNL nutrient critical level recommendations.

METHODS

The 2018 SMFD was conducted at four locations in Nebraska: Kenesaw, Albion, Hartington and Cedar Bluffs. Corn was the previous crop at all sites. Sites were center-pivot irrigated. Soil attributes for the 0-8 inch layer for each site are listed on Table 1. In general, all sites have P, K and S soil levels above the UNL-recommended critical level for soybeans.

Table 11. Soil properties for all four sites.

Attribute	Cedar Bluffs	Albion	Hartington	Kenesaw
Clay (%)	32	28	32	29
Sand (%)	13	27	19	20
Texture	Silty Clay Loam	Clay Loam	Silty Clay Loam	Clay Loam
Water pH	5.9	6.8	7.0	6.7
CEC (me/100g)	21.0	18.4	22.8	16.4
Organic Matter (%)	3.1	2.9	4.6	2.6
Nitrate (lbs N/ac)	19	28	53	40
M3-Phosphorus (ppm P)	15	65	107	123
Potassium (ppm K)	316	533	422	635
Sulfate (ppm S)	7.6	11.3	15.6	6.8
Magnesium (ppm Mg)	334	425	525	386
Zinc (ppm Zn)	1.4	2.8	4.0	3.2
Iron (ppm Fe)	63.5	59.2	25.5	27.6
Manganese (ppm Mn)	17.6	9.0	5.3	4.3
Copper (ppm Cu)	1.1	0.5	1.0	0.9
Calcium (pppm Ca)	2358	2678	3436	2273
Sodium (ppm Na)	20	18	40	36
Boron (ppm B)	1.3	0.8	1.1	0.8

CEC= cation exchange capacity.

The studies were conducted as a split-plot on a randomized complete block design with four replicates. Cover crop was the main plot treatment factor and fertility was the split-plot treatment factor. Cover and cash crop management dates are shown on Table 2. Wheat and rye were drilled from 6th to 16th October at a rate of 59 and 63 lbs seed/ac, respectively. Cover crops were chemically terminated from 24th May to 1st June, and soybeans were planted shortly after. Fertility treatments were applied from 15th June to 11th July.

Table 12. Cover crop and soybean management dates.

	Albion	Cedar Bluffs	Hartington	Kenesaw
CC drilling	11/16/17	11/6/17	11/9/17	11/10/17
CC termination and soybean planting	5/31/18	5/24/18	5/29/17	6/1/17
Fertilizer application	6/18/18	6/15/18	7/11/18	6/18/18
Harvest	10/17/18	10/3/18	NA	10/18/18

Fertility treatments were comprised of all combinations between two P rates (0 and 30 lbs P2O5/ac), two K rates (0 and 40 lbs K2O/ac) and two S rates (0 and 20 lbs S/ac), for a total of 8 fertility treatment combinations (Table 2). These treatments were superimposed on a previously-established CC study with treatments being rye, wheat and no cover crop.

Table 13. Description of each fertility treatment, including phosphorus (P), potassium (K), and sulfur (S) rates, in lbs/ac.

Number	Treatment	P Rate (lbs P_2O_5/ac)	K Rate (lbs K_2O/ac)	S Rate (lbs S/ac)
1	0P/0K/0S	0	0	0
2	0P/0K/20S	0	0	20
3	0P/40K/0S	0	40	0
4	0P/40K/20S	0	40	20
5	30P/0K/0S	30	0	0
6	30P/0K/20S	30	0	20
7	30P/40K/0S	30	40	0
8	30P/40K/20S	30	40	20

The fertilizer sources applied in order to supply P, K and S were ammonium polyphosphate (10-34-0), urea+potassium acetate (2-0-25, Lokomotive) and ammonium thiosulfate (12-0-0, 26% Sulfur), respectively. All three sources were in the liquid form and injected into the soil. Given that all three sources have N in their formulation, appropriate rates of N fertilizer were applied as urea-ammonium nitrate (UAN) 28% in order to counter the N deficit in a given treatment formulation, with all treatments receiving a total of 30 lbs N/ac. Grain yield was measured by combine-harvesting the middle two rows of each plot. Grain moisture was adjusted to 13% and expressed as both bu/ac and Mg/ha.

RESULTS

Soybean Grain Yield

The study at Hartington was not taken to yield due to near-complete crop destruction after a hailstorm on July 18th. Therefore, soybean yield data is shown only for the Albion, Cedar Bluffs, and Kenesaw site studies. Soybean grain yield was only affected by i) site; ii) the interaction between site, CC and P; and iii) and the interaction between P, K, and S.

Although non-significant, soybean yield averages (n=4), in bu/ac, for each site, CC and fertility treatment combination are shown on Figure 10. Higher yields have a green background and lower yields have a orange background. Overall, soybean yield was high at all sites, varying from 67.4 to 77.5 bu/ac. Interestingly, the lowest numerical yields at each site were never observed under the no fertilizer treatment (0P/0K/0S).

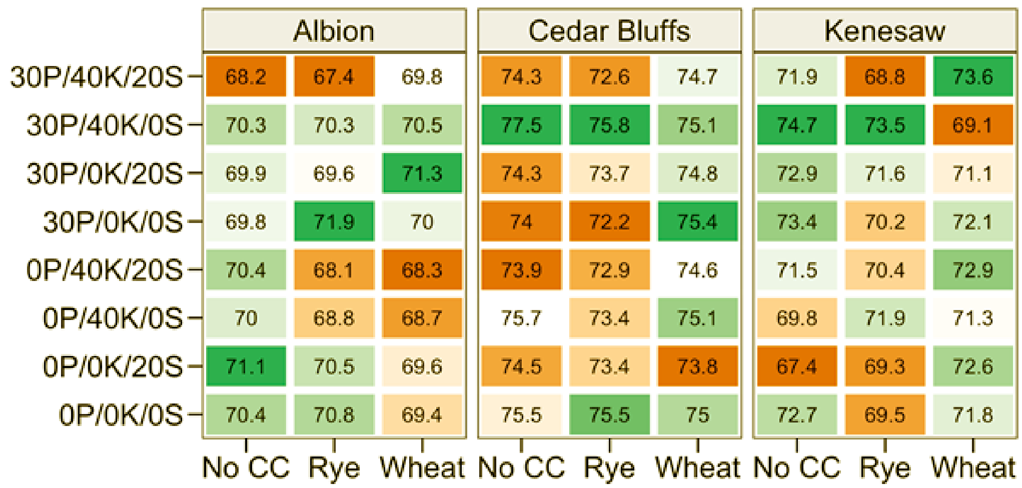

Figure 10. Soybean grain yield (bu/ac) for each site, fertility (y axis) and cover crop (x axis) treatment combination. Yield values are color-coded and range from green (highest yield within a given site and cover crop treatment) to red (lowest yield).

At Albion, the highest numerical yield was observed when soybeans followed rye and received P fertilizer (71.9 bu/ac). At this same site, the lowest numerical yield was observed when soybeans followed rye and received P, K, and S fertilizer (67.4 bu/ac). At Cedar Bluffs, the highest numerical yield was observed when soybeans followed No CC and received P and K fertilizer (77.5 bu/ac). At this same site, the lowest numerical yield was observed when soybeans followed rye and received P fertilizer (72.2 bu/ac). At Kenesaw, the highest numerical yield was observed when soybeans followed No CC and received P and K fertilizer (74.7 bu/ac). At this same site, the lowest numerical yield was observed when soybeans followed No CC and received S fertilizer (67.4 bu/ac).

Site

The main effect of site significantly affected soybeans yield. When averaged over CC and fertility treatments, yield was significantly higher at Cedar Bluffs (74.5 bu/ac) as compared to Albion (69.8 bu/ac) and Kenesaw (71.4 bu/ac).

This may have been due to differences in soybeans planting date, soil properties and weather among sites affected average yield. For instance, Cedar Bluffs was the first site planted, 5 and 7 days earlier as compared to Albion and Kenesaw, respectively.

Interaction of Site, Cover Crop, and P

Grain yield was significantly affected by the interaction between site, CC and P fertilizer (Figure 11). This interaction was significant because the application of P at Kenesaw produced 3 bu/ac more when soybeans followed No CC as compared to not applying P. However, at the other sites, applying P did not significantly increase soybean yield regardless of the previous CC. This response to P addition at Kenesaw is unexpected, given that soil P at this site was the highest among all studies (123 ppm Mehlich-3).

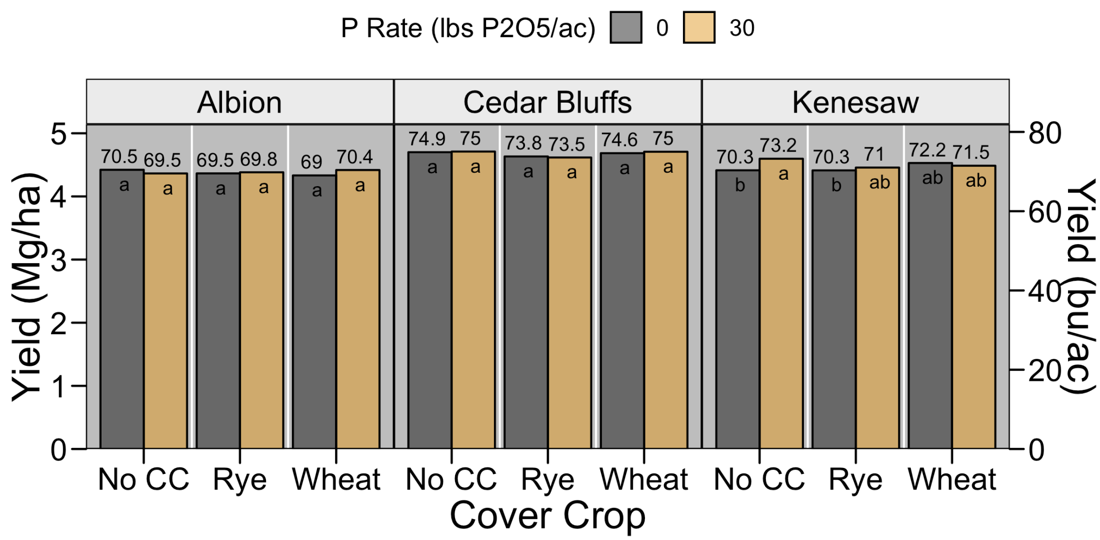

Figure 11. Soybean grain yield for each cover crop treatments within a site. Numbers on top of bars represent grain yield in bu/ac. Treatments sharing a common letter within a site are not statistically different at α=0.05.

Given that the response was only observed when soybeans followed No CC, it is possible that the presence of CC residue influenced P availability and/or mobility. For example, more residue on the soil surface can limit water evaporation and increase soil moisture as compared to No CC. In this case, plant roots could have explored a larger soil volume as compared to drier soil conditions.

Nutrient Interactions: P x K x S

Grain yield was significantly affected by P, K, and S fertilizer rate (Figure 12). When averaged over sites and CC treatments, soybean grain yield was highest with P and K fertilizer (73 bu/ac), and lowest with P, K and S fertilizer (71.2). Although this difference is very small and not agronomically practical, it indicates a possible negative effect from applying S mixed with P and K.

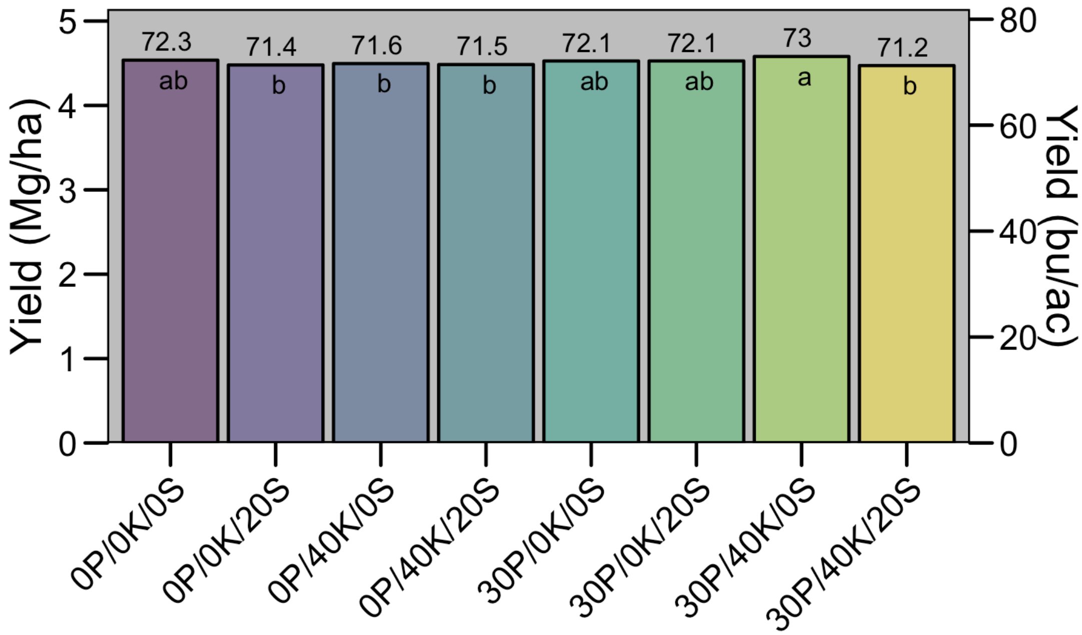

Figure 12. Soybean grain yield for each fertility treatment, averaged over sites and cover crop treatments. Numbers on top of bars represent grain yield in bu/ac. Treatments sharing a common letter are not statistically different at α=0.05.

All sites had soil P, K, and S levels that were above the UNL-established critical levels. In spite of that, based on yield data from these studies, a statistical response to P and K fertilization existed. However, the magnitude of the response (0.7 bu/ac more with P+K as compared to no fertilizer) was small. In order for P and K application to be economically feasible at these sites, the combined fertilizer and application cost would have to be less than US$ 5.7/ac (assuming a soybean price of $US 8.1/bu). Furthermore, the application of S decreased soybean yield as compared to no S (0.7 bu/ac less with S), indicating a possible negative effect of S when applied with other nutrients. Therefore, the application of P, K, and S was agronomically and economically unwarranted at these three sites, agreeing with what would have been recommended based on UNL nutrient critical levels for soybeans.

ACKNOWLEDGEMENTS

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SOIL WATER DIFFERENCES BETWEEN RYE COVER CROP AND NO COVER CROP ON IRRIGATED FIELDS

Authors: Aaron Nygren (Nebraska Extension Educator Crops and Water) and
Steve Melvin (Nebraska Extension Educator Crops and Water)

TAKE HOME POINTS:

- Significant differences in soil water content existed between a rye cover crop and no cover crop at planting time.
- After planting, early season rainfall exceeded crop water use and refilled the soil profile, resulting in little to no differences in soil water content between a rye cover crop and no cover crop.
- When growing cover crops that will be terminated just before planting soybeans, it is always important to make sure the pivot is ready to apply water before the crop is planted in case the soils are dry.

INTRODUCTION

Interest in establishing cover crops has grown across Nebraska in recent years. Cover crops offer many potential benefits for farmers, such as reduced soil erosion, increased soil organic matter, soil health, soil structure, nutrient cycling, and weed control. While the potential benefits are numerous, one cost often associated with cover crops is the use of stored soil water. If cover crops reduce the amount of stored soil water in the profile, this could potentially decrease the yields of the subsequent cash crop. The actual amount of water stored in the soil profile for the subsequent crop is actually dependent on many different factors in addition to cover crops, including the water use of the previous crop, off-season precipitation, early-season precipitation, soil texture, and irrigation management. With 2.805 million acres (USDA-NASS) of Nebraska's soybean crop grown with irrigation, 48% of the total, it is worth exploring differences in cover crops and irrigation management on soil water content.

METHODS

Plots with a rye cover crop established in the fall of 2017 were compared to a plots with no cover crop. While cover crop plots with wheat were also available, the rye plots were focused on given the expectation of greater biomass growth compared to wheat and to simplify the experimental design. This study was conducted as a randomized complete block design with four replications at each site. To measure soil water content differences, Irrometer® Watermark granular matrix sensors attached to CPCV pipe were installed at depths of 6", 18" and 30". Sensors were installed into the plots initially the last week of April. Sensors were then pulled right before planting and reinstalled in the soybean row in the following days. Sensor readings were taken with a data logger every 2 hours during the growing season. Rye was terminated at the same dates as the late termination treatments as shown in Table 14. All plots received the same amount of irrigation water.

RESULTS

Soil water content results from Hartington are not presented due to equipment failure and the near-complete crop destruction after a hailstorm on July 18th. Therefore, soil water data is only shown for the Albion, Cedar Bluffs, and Kenesaw sites.

Soil water contents at three main points during the growing season were looked at: planting time, wettest day (highest soil water content) of the summer after planting, and driest day (lowest soil water content) of the year after planting.

Planting Time: There were significant differences in Watermark sensor readings at all three sites at planting time with the no cover crop plots having lower readings (Figure 13 (A)). When these values are converted to soil water content in inches, the differences in soil water content for the entire three foot soil profile between plots ranged from 1.15 inches at Albion to 2.44 inches for Cedar Bluffs (Table 12). While differences existed in total water content, soils for both rye and no cover crop plots at Albion and Cedar Bluffs were above field capacity. At Kenesaw the soil water content for the rye cover crop was below field capacity while the no cover crop plot was above field capacity.

Wettest Day of the Summer after Planting: The Cedar Bluffs site had a significant difference in Watermark sensor readings (Figure 13 (B)), with the no-cover crops plot having slightly lower readings. When converted to soil water content, this resulted in a difference of .35 inches between the rye cover crop and the no cover crop. However, both treatments were still above field capacity. Albion and Kenesaw had no significant differences in Watermark sensor values.

Driest Day of the Summer after Planting: There were no significant differences in Watermark sensor readings at any of the three sites (Figure 13 - C).

DISCUSSION

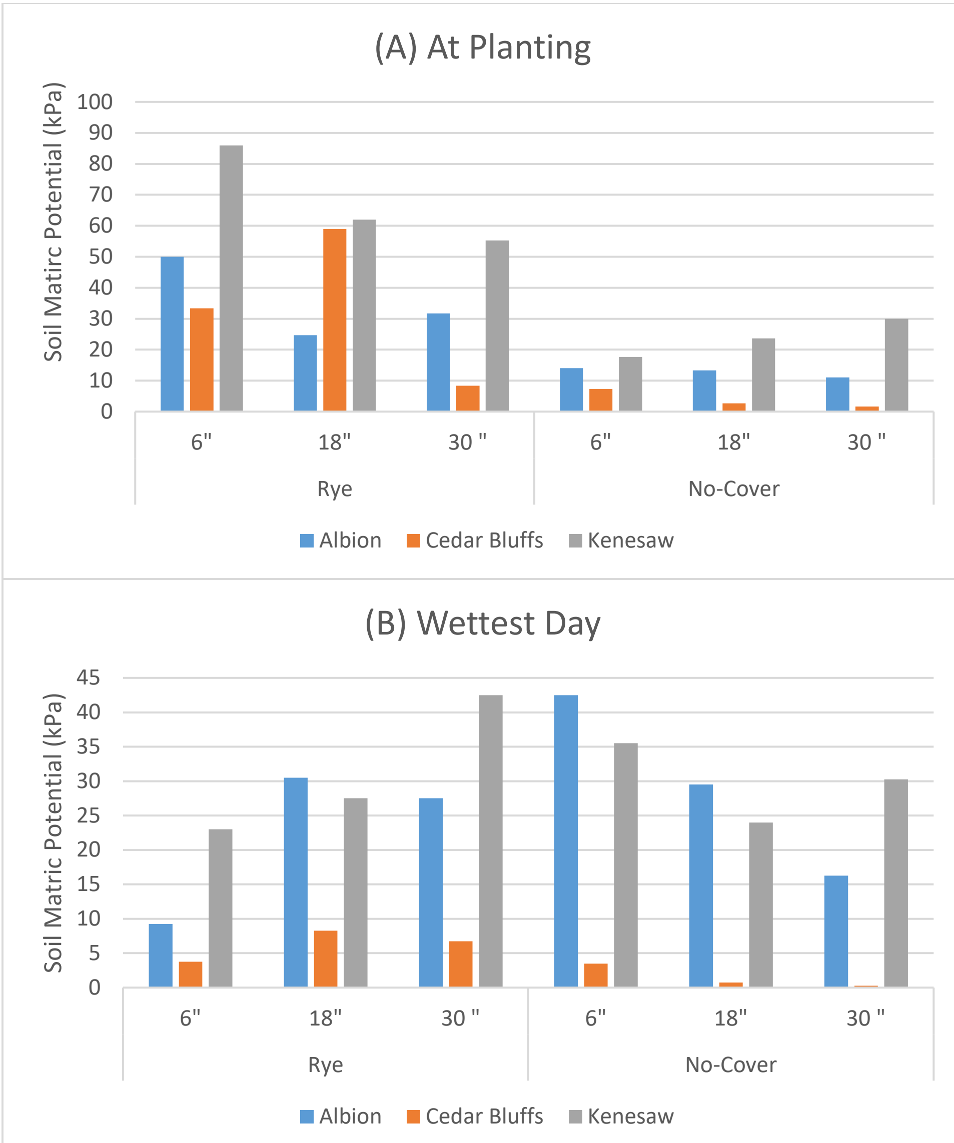
Cover crops had a significant impact on soil water content at the time of planting but differences diminished or disappeared over the course of the growing season. The range of these differences varied between sites. The largest differences in soil water content at planting were seen in the top 6 inches of soil. Reductions in soil water content have the potential to affect soybean germination and growth after planting. One site experienced soil water contents below field capacity at planting, which has the potential to negatively affect emergence and growth. At this site, rye cover crop plots were being managed with a pre-determined later termination date, resulting in additional biomass growth even with dry weather conditions. Farmers in a similar situation could manage this by using either earlier termination of the cover crop or by the use of irrigation, if available. This is why it is recommended that pre-season maintenance is performed on irrigation systems before planting time to ensure that they are ready to apply water when needed.

Two sites had soil water contents for the rye plots that were closer to field capacity while the no cover plots had excess water in the profile. In wet conditions, this may result in better planting conditions with the use of cover crops. Additionally, soils that are above field capacity are deep percolating a significant amount of soil water which will take nitrates with it and will be lost if not used by the cover crop.

It is important to note the experiment was conducted on irrigated fields that are usually wetter after harvest and only require a few inches of precipitation to refill the soil profile. Non-irrigated fields or land in the pivot corners may be drier resulting in different results.

After planting, rainfall exceeded crop water use amounts (which happens most years) and refilled the profile to either near or above field capacity. This is important as the most critical water period for soybeans is later in the season beginning at R3.

Figure 13. Average Watermark sensor readings for three sites at (A) planting time, (B) wettest day of the growing season, and (C) driest day of the growing season.



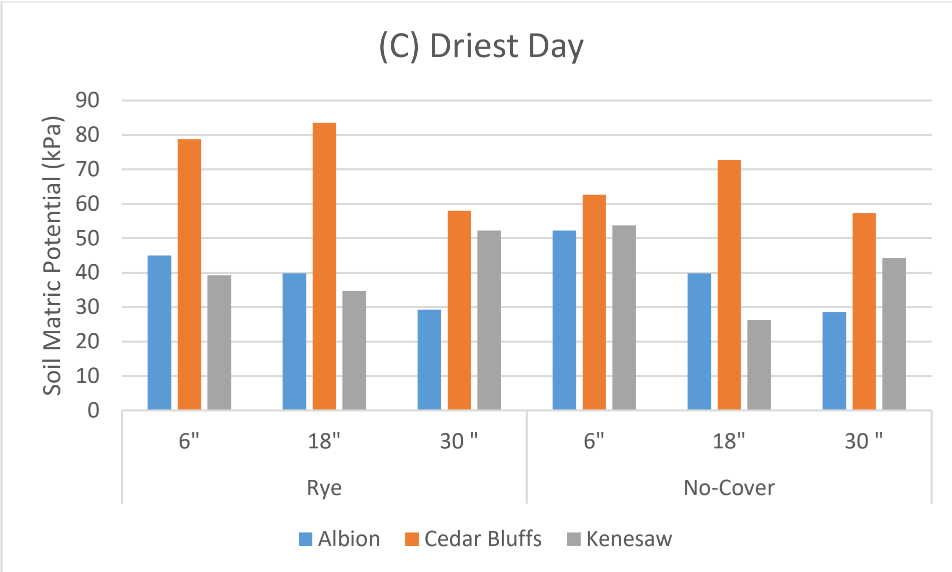


Table 14. Soil water content above or below field capacity and differences between plots. Treatments sharing a common letter are not statistically different at P<.05. The "+" numbers show soils that are above field capacity and a high level of deep percolation of soil water is occurring.

Site		Albion			Cedar Bluffs			Kenesaw		
Treatment		At Planting	Wettest Day	Driest Day	At Planting	Wettest Day	Driest Day	At Planting	Wettest Day	Driest Day
Soil Water Content Above (+) or Below (-) Field Capacity in Inches	No Cover	+1.57 a	+.39 a	-0.82 a	+3.08 a	+3.14 a	-1.21 a	+0.67 a	+0.04 a	-0.67 a
	Rye	+0.06 b	+1.13 a	-0.58 a	+0.64 b	+2.79 b	-1.29 a	-1.68 b	-0.14 a	-0.83 a
Differences in Soil Water Content of Rye versus Cover in Inches		-1.15	+.75	+0.24	-2.44	-0.35	-0.08	-2.35	-0.18	-0.16

2018 SOYBEAN MANAGEMENT FIELD DAYS RESEARCH UPDATE

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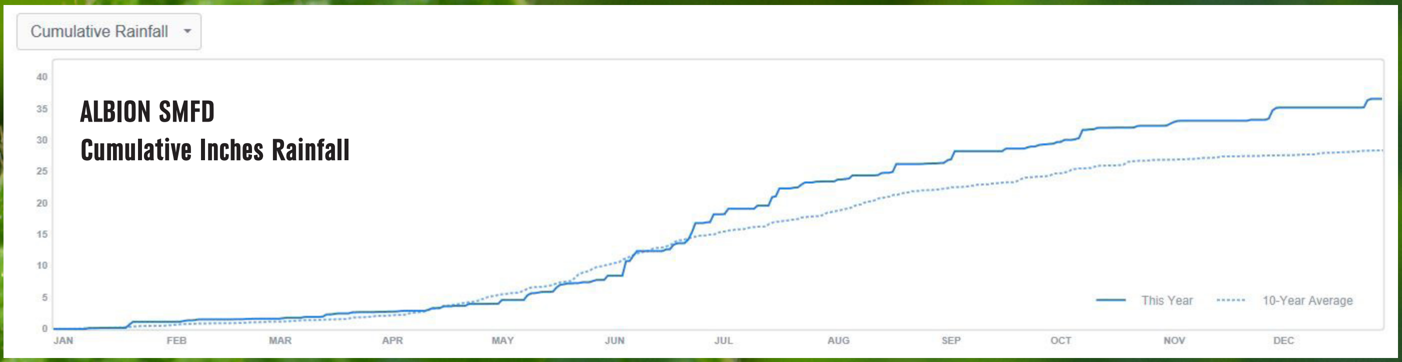
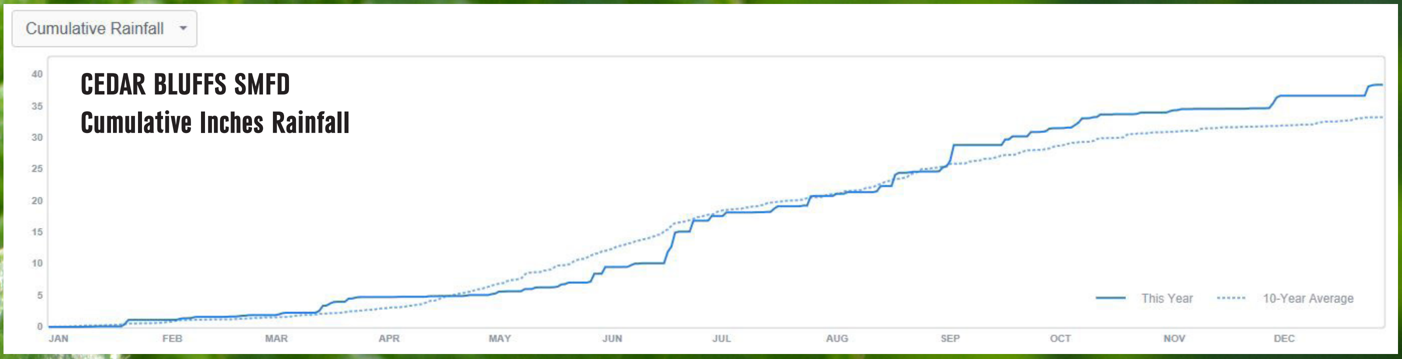
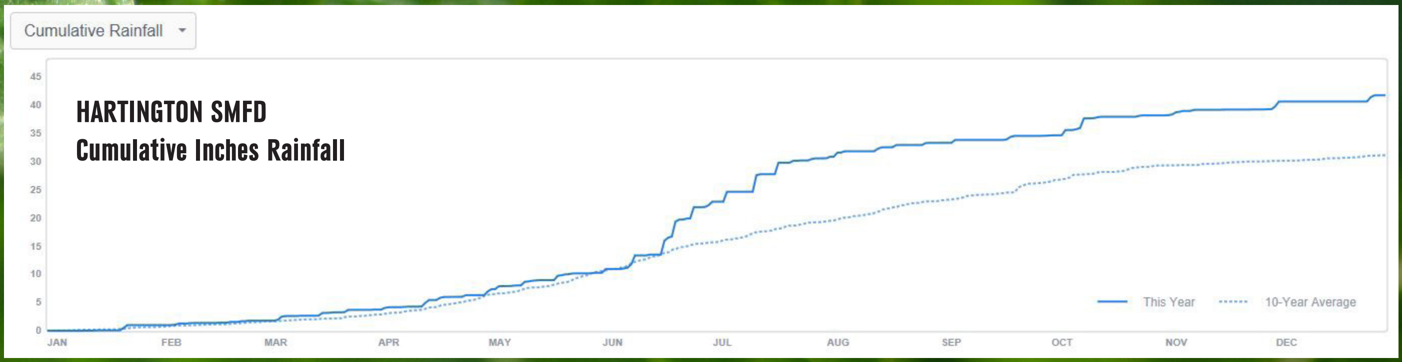
2018 SOYBEAN MANAGEMENT FIELD DAYS

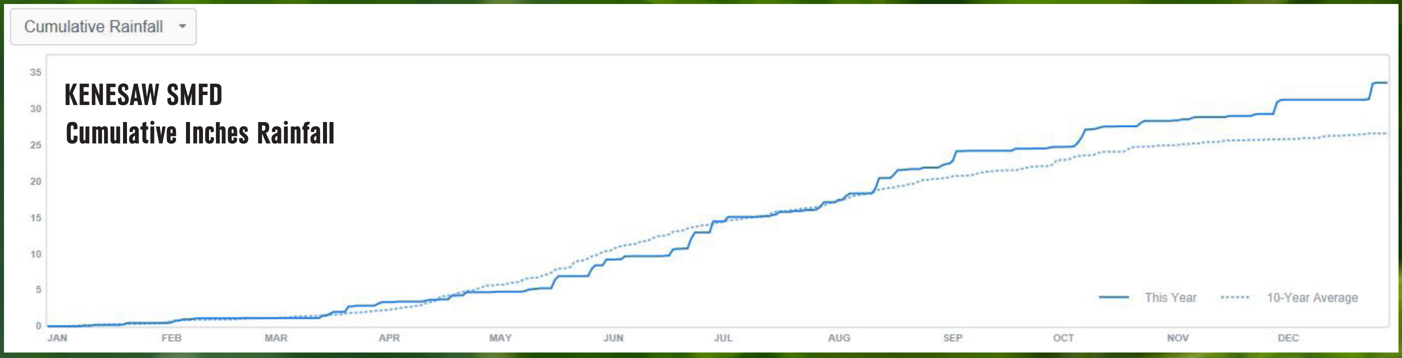
RESEARCH UPDATE

Cumulative Rainfall Totals









2018 Soybean Management Field Days Research Locations:

David and Dean Jacobitz Farm - KENESAW, NE * John and Mike Frey Farm - ALBION, NE

Ed Lammers Farm - HARTINGTON, NE * Ray Jr. & Kevin Kucera Farm - CEDAR BLUFFS, NE

For more information, contact the Nebraska Soybean Checkoff Board at (800)852-BEAN or Nebraska Extension at (800)529-8030.