EC3041

EXTENSION

On-Farm Research

2018 Growing Season Results

Post-Conference Publication March 2019

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Nebraska On-Farm Research Network

2019 Results Update Meetings

- Feb. 18 | GRAND ISLAND, Hall County Extension Office, College Park Campus
- Feb. 19 | NORFOLK, Lifelong Learning Center, Northeast Community College
- Feb. 26 | NORTH PLATTE, West Central Research and Extension Center
- Feb. 27 | ALLIANCE, Knight Museum & Sandhills Center
- Mar. 1 | BEATRICE, Valentino's Restaurant

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Nebraska On-Farm Research Network

Faculty, staff and students involved with the on-farm research projects listed in this report.

Nebraska Extension Educators

* **LAURA THOMPSON**
On-Farm Research Coordinator
1705 Stone St. * Falls City, NE 68355
(402)245-2224 * laura.thompson@unl.edu
*** Contact Laura Thompson for questions about this publication or the on-farm research network.**

KEITH GLEWEN
On-Farm Research Coordinator
1071 County Road G, Ithaca, NE 68033
(402)624-8030 * kglewen1@unl.edu

MELISSA BARTELS
451 N 5TH S., David City, NE 68632-1666
(402)367-7410 * mbartels6@unl.edu

TROY INGRAM
801 S St, Ord, NE 68862
(**308**)728-5071 * troy.ingram@unl.edu

BRIAN KRIENKE
362C Plant Sci Hall, Lincoln, NE 68583-0915
(402)472-5147 * krienke.brian@unl.edu

GARY LESOING
1824 N St Ste 102, Auburn, NE 68305
(402)274-4755 * gary.lesoing@unl.edu

STEVE MELVIN
1510 18th St , Central City, NE 68826
(308)-946-3843 * steve.melvin@unl.edu

NATHAN MUELLER
1206 W. 23rd St., Fremont, NE 68025-2504
(402)727-2775 * nathan.mueller@unl.edu

AARON NYGREN
PO Box 389, Schuyler, NE 68661
(402)352-3821 * anygren2@unl.edu

CHRIS PROCTOR
174 Keim Hall, Lincoln, NE 68583-0915
(402)472-5411 * caproctor@unl.edu

RANDY PRYOR
306 W 3rd St., Wilber, NE 68465-0978
(402)821-2151 * randy.pryor@unl.edu

JENNY REES
2345 Nebraska Avenue, York, NE 68467
(402)362-5508 * jrees2@unl.edu

RON SEYMOUR
515 W. 3rd St., Hastings, NE 68902-0030
(402)461-7209 * ron.seymour@unl.edu

MICHAEL SINDELAR
111 W Fairfield * Clay Center, NE 68933
(402)762-3644 * msindelar2@unl.edu

SARAH SIVITS
1002 Plum Creek Pkwy, Lexington, NE 68850-0757
(308)324-5501 * sarah.sivits@unl.edu

STRAHINJA STEPANOVIC
76025 Rd. 329, Grant, NE 69153
(308)352-4340 * strahinja.stepanovic@unl.edu

MEGAN TAYLOR
2715 13th St., Columbus, NE 68601-4916
(402)563-4901 * mtaylor42@unl.edu

JOHN THOMAS
415 Black Hills Ave, Alliance, NE 69301
(308)762-5616, * jthomas2@unl.edu

AMY TIMMERMAN
128 N 6th St., O'Neill, NE 68763-1616
(402)336-2760 * atimmerman2@unl.edu

Specialists

ANDREA BASCHE
Assistant Professor, Agronomy and Horticulture
279G PLSH * Lincoln NE 68583
(402)472-6413 * abasche2@unl.edu

HUMBERTO BLANCO
Associate Professor, Agronomy and Horticulture
261 PLSH, Lincoln, NE 68583-0915
(402)472-1510 * hblanco2@unl.edu

MARY DREWNOSKI
Assistant Professor, Beef Systems Specialist
ANSC C220F, Lincoln, NE 68583-0908
(402)472-6289 * mdrewnoski2@unl.edu

ROGER ELMORE
Nebraska Extension Cropping Systems Agronomist
165 Keim, Lincoln, NE 68583-0915
(402)472-1451 * roger.elmore@unl.edu

RICHARD FERGUSON
Nebraska Extension Soil Fertility Specialist
367 Keim, Lincoln, NE 68583-0915
(402)472-1144 * rferguson1@unl.edu

SUAT IRMAK
Nebraska Extension Water Resources Engineer
CHA 239, Lincoln, NE 68583-0726
(402)472-4865 * suat.irmak@unl.edu

JOE LUCK
Nebraska Extension Precision Ag Specialist
206 CHA, Lincoln, NE 68583-0726
(402)472-1488 * jluck2@unl.edu

JIM MACDONALD
Associate Professor, Animal Science
ANSC C220i, Lincoln, NE 68583-0908
(402) 472-6780 * jmacdonald2@unl.edu

JUSTIN MCMECHAN
Crop Protection and Cropping Systems Specialist
1071 County Road G, Ithaca, NE 68033
(402)624-8041; justin.mcmechan@unl.edu

TARO MIENO
Assistant Professor Ag Economics
208A FYH, Lincoln NE 68583-0922
(402)472-2386 * tmieno2@unl.edu

HUMESHKAR NEMALA
Research Assistant Professor
Biological Systems Engineering
229 CHA, Lincoln, NE 68583-0726
(402)472-4574 * hnemala2@unl.edu

CHARLES SHAPIRO
Emeritus Professor, Soil Scientist - Crop Nutrition
HAL 57905 866 Rd, Concord, NE 68728
(402)584-3803 * cshapiro@unl.edu

YEYIN SHI
Assist. Professor & Agricultural Information Systems
Biological Systems Engineering
206 CHA, Lincoln, NE 68583-0726
(402)472-2140 * yshi18@unl.edu

CHARLES WORTMANN
Nebraska Extension Soil and Nutrient Management Specialist
369 Keim, Lincoln NE 68583-0915
(402)472-2909 * cwortmann2@unl.edu

NILOVNA CHATTERJEE, Post-doctoral Associate
SABRINA RUIS, Post-doctoral Associate

Report, Program, and Research Assistance

RALPH ARNOLD
Research Database Technician
71565 652 Ave., Falls City, NE 68355
(402)883-2512 * ralph.arnold@unl.edu

CHERYL DUNBAR
Nebraska Extension Office Manager
1071 County Road G, Ithaca, NE 68033
(402)624-8030 * cdunbar2@unl.edu

AARON HIRD
USDA/NRCS State Soil Health Specialist
100 Cent.l Mall North Rm 152, Lincoln, NE 68508
(402)437-4053 * aaron.hird@ne.usda.gov

DEAN KRULL
Project SENSE
Demonstration Project Coordinator
Central Platte NRD, 215 N. Kaufman Ave.
Grand Island, NE 68803
(308)385-6282 * dkrull1@unl.edu

EMILY OESTMANN
On-Farm Video Production Intern

DELORIS PITTMAN
Marketing and Promotions Manager, Univ. of NE
Eastern NE Research & Extension Center
107 MUS Hall, Lincoln, NE 68583-0718
(402)472-3293 * dpittman1@unl.edu

TYLER SMITH
Project SENSE Technician
Biological Systems Engineering
138 CHA, Lincoln, NE 68583-0726
(402)472-6282 * tyler.smith@unl.edu

STEVE SPICKA
University of Nebraska Ag Research Technician,
Southeast Research and Extension Center
1071 County Road G, Ithaca, NE 68033
(402)624-8023 * sspicka2@unl.edu

JACKSON STANSELL
On-Farm Research Technician

Nebraska On-Farm Research Network

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Merlin Bartel
Don Batie
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Ken Herz
Leander Hopkins
Brandon Hunnicut
Andy Jobman
David Jobman
Russ Kavan
Joshua Keating
Joe Keithley
Jon Keithley
Nick Keller
Kevin Keller
Gene Kizzire
Kyle Korth
Justin Krafka
Korbin Kudera
Jason Lewis
Kevin Lostroh
Chris Lovitt
Ron Makovicka
Brad Makovicka
Mike McDonald
Galen Meeske
Karl Meeske
Brent Melliger
Brad and Patty Morner
Robert Mulliken
Jerry Mulliken
Michael Murren
Aaron Nelson
Dave Nielsen
Daryl Obermeyer
John Oehlerking
Loren Pestel
Mike Rupprecht
Chris Schiller
Scott Schmidt
Mark Schroeder
Noah Seim
Jerry Stahr
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that assisted with the research projects.

Nebraska On-Farm Research Network

In production ag it's what you think you know, that you really don't know, that can hurt you.

Nebraska Extension On-Farm Research Network Introduction

Laura Thompson, Keith Glewen
Nebraska Extension Educators and
On-Farm Research Network Coordinators

On-farm research can provide a great avenue to accelerate learning about topics that impact farm productivity and profitability. It is research that you do on your field, using your equipment, and with your production practices. This means the research is directly applicable to your operation. The Nebraska On-Farm Research Network approaches topics that are critical to farmer productivity, profitability, and sustainability. These topics include nutrient management, pest control, irrigation strategies, conservation programs, new technologies, soil amendments, cultural practices, and hybrid and variety selection. Research comparisons are identified and designed to answer producers' production questions. Projects' protocols are developed first and foremost to meet individual cooperator needs. Multiple year comparisons are encouraged.

We would like to thank all the cooperators who were involved in the valuable research studies contained in this report. Your efforts lead to new discovery and validate current production practices. We would also like to thank the Nebraska Corn Board, Nebraska Corn Growers Association, Nebraska Soybean Board, and Nebraska Dry Bean Commission for the financial support that makes this research, publication, and update meetings possible.

We invite you to become an on-farm research participant. To learn more or to discuss this report, please contact Nebraska Extension On-Farm Research Coordinators, Laura Thompson or Keith Glewen (contact information is on page 6), visit us online at http://cropwatch.unl.edu/on-farm-research, or find us on Facebook and Twitter.

Unless otherwise noted, data in this report were analyzed using Statistixs 10.0 Analytical Software and means were separated using Tukey's HSD (honest significant difference) test.

Statistics 101

Replication: In statistics, replication is the repetition of an experiment or observation in the same or similar conditions. Replication is important because it adds information about the reliability of the conclusions or estimates to be drawn from the data. The statistical methods that assess that reliability rely on replication.

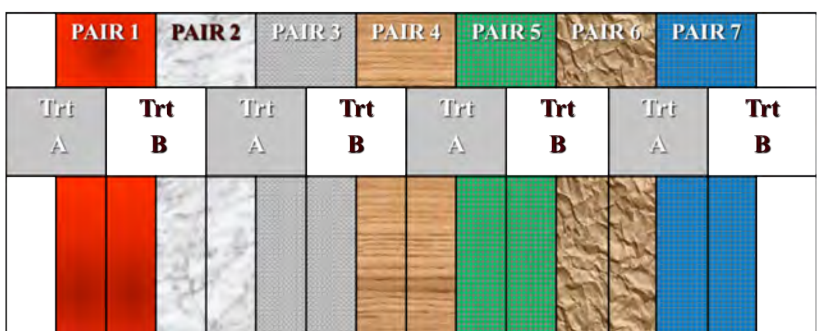
Randomization: Using random sampling as a method of selecting a sample from a population in which all the items in the population have an equal chance of being chosen in the sample. Randomization reduces the introduction of bias into the analysis. Two common designs that meet these criteria are shown below.

What is the P-Value? In field research studies we impose a *treatment* – this treatment may be a new product or practice that is being compared to a standard management. Both the **treatments** that we are testing and **random error** (such as field variability) influence research results (such as yield). You intuitively know that this error exists – for example, the average yield for each combine pass will not come out exactly the same, even if no treatments were applied. The P-Value reported for each study assists us in determining if the differences we detect are due to error or due to the treatment we have imposed.

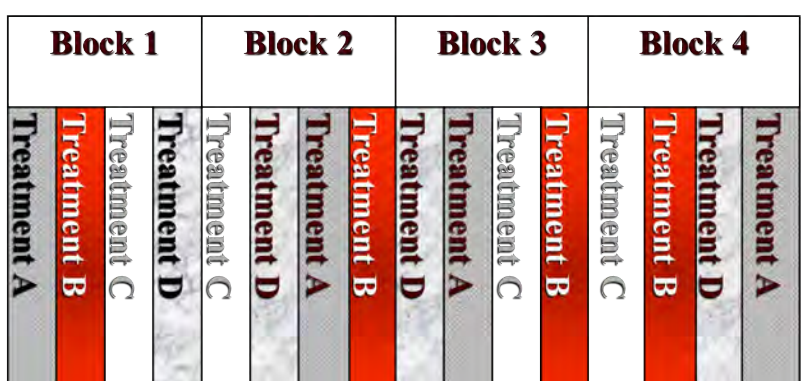
- As the P-Value decreases, the probability that differences are due to random chance decreases.
- As the P-Value increases, we are less able to distinguish if the difference is due to error or the treatment (hence, we have less confidence in the results being due to the treatment).

For these studies, we have chosen a cutoff P-Value of 0.1; therefore, if the P-Value is greater than 0.1 we declare that there are not statistically significant differences due to the treatments. If the value is less than 0.1, we declare that differences between treatments are statistically significant. When this is the case, we follow the yield values with different letters to show they are statistically different. The value of 0.1 is arbitrary – another cutoff could be chosen. However, as you increase your cutoff value, you increase the chance that you will declare that treatments are different when they really are not. Conversely, if you lower the P-Value, you are more likely to miss real treatment differences.

Paired comparison design



Randomized complete block design



Profit Calculation

Many of our studies include a net return calculation. It is difficult to make this figure applicable to every producer. In order to calculate revenue for our research plots we use input costs provided by the producer, application costs from Nebraska Extension's *2018 Nebraska Farm Custom Rates* (EC823 - revised June 2018), and an average commodity market price for 2018.

Average market commodity prices for the 2018 report are:

Corn	$3.23/bu
Soybeans	$7.40/bu
Wheat	$4.65/bu
Dry Edible Beans	$13.20/bu

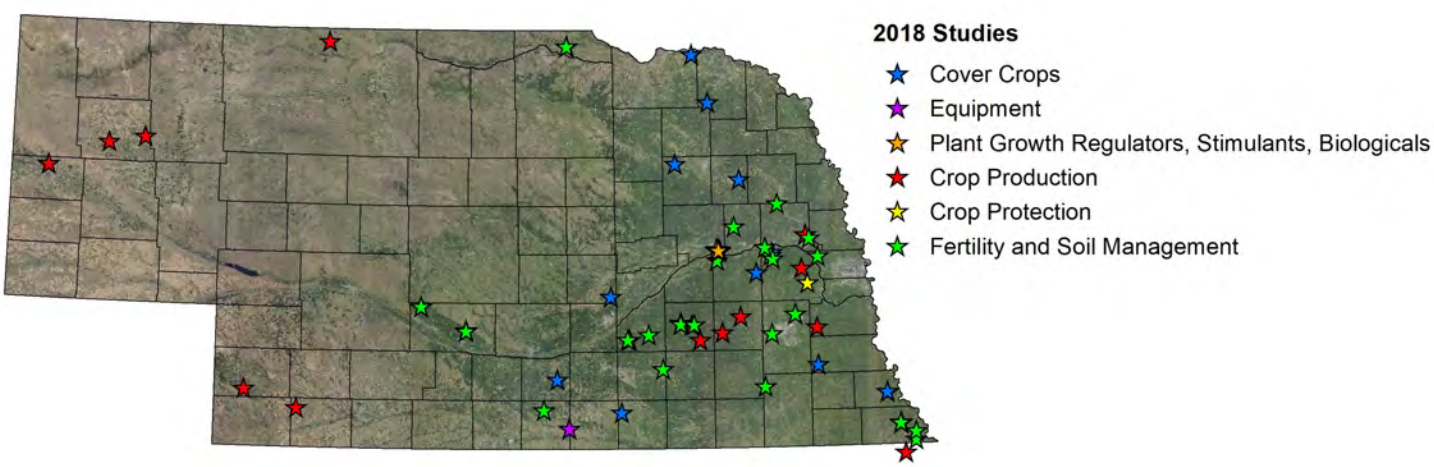
In order to make this information relevant to your operation, you may need to refigure return per acre with costs that you expect.

Rainfall Data

Rainfall data is provided for each study based on the field location. The rainfall graphs are developed using data from National Weather Service radar and ground stations that report rainfall for 1.2 x 1.2 mile grids.

FarmLogs https://farmlogs.com

2018 Study Locations



COVER CROPS

- Evaluating Corn Relative Maturity for Improving Cover Crop Establishment
- Evaluating Soybean Relative Maturity for Improving Cover Crop Establishment
- Corn Planted into Cereal Rye Cover Crop (4 sites)
- Corn Following Winter Terminated and Winter Hardy Cover Crops (NRCS Demo Farm site)
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- Integrating Cover Crops on Sandy Soils to Improve Water Quality and Soil Health
- Integrating Cover Crops on Sloping Soils to Improve Water Quality and Soil Health
- Grazed versus Non-grazed Cover Crop (NRCS Demo Farm)
- Effect of Grazing Cover Crops in a Three-year Non-irrigated Rotation

Evaluating Corn Relative Maturity for Improving Cover Crop Establishment

Study ID: 0701147201803
County: Richardson
Soil Type: Marshall silty clay loam 2-6% slopes; Pohocco silty clay loam 6-11% slopes, eroded; Geary silty clay loam 7-11% slopes, eroded
Planting Date: 5/7/18
Harvest Date: 9/24/18
Population: 27,500
Row Spacing (in): 30
Reps: 6
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** 8 oz/ac Banvel® and 6 oz/ac of 6# 2,4-D ***Post:*** 2.5 lb/ac generic mesotrione, 1 pt/ac Atrazine, and 12 oz/ac of 5.4 lb Roundup®

Fertilizer: 260 lb N/ac as 32% UAN
Irrigation: None
Rainfall (in):

Soil Test (Dec. 2018):

Soil pH 1:1	Buffer pH	CEC	OM	Bray P1 Weak Bray	Bray P2 Strong Bray	K	Mg	Ca	S	Zn	K	Mg	Ca	H
		mg/100g	*%*	*ppm*	*ppm*	-------------(*ppm*)-----------					----*% Base Saturation*---			
6.6	6.8	21.1	2.8	47	68	298	402	3130	7	4.8	3.6	15.9	74.2	6.3
6.9		19.7	2.9	28	43	267	364	3206	7	6.0	3.5	15.4	81.1	0.0

Introduction: Cover crops have the potential to provide several ecosystem services; therefore, many corn and soybean producers are looking for ways to better integrate them into their cropping systems. One of the primary limitations to fall planted cover crops in Nebraska is the limited growing window following corn and soybean harvest. One way to increase the growing window for cover crops following corn and soybean harvest is to plant earlier maturing corn and soybean varieties. Recent small plot research at the University of Nebraska found that shorter season comparative relative maturity (CRM) (95 CRM) corn hybrids had yields similar to longer season CRM hybrids (111 CRM). This research also showed the potential for greater cereal rye biomass accumulation following the shorter season hybrids. Two on-farm research studies in 2017 found that while the 95 day CRM was lower yielding, there were no yield differences between the 105, 111, and 115 day CRM. In this study, five different CRM corn hybrids were evaluated. Yield data from the yield monitor is displayed in Figure 1. Yield data reported in the table below is from weigh wagon measurements.

95 day CRM = Dekalb® DKC 45-65 RIB
99 day CRM = Channel 199-29STX RIB
105 day CRM = Dekalb® DKC 55-20 RIB
111 day CRM = Dekalb® DKC 61-54 RIB
114 day CRM = Dekalb® DKC 64-34 RIB

Results:

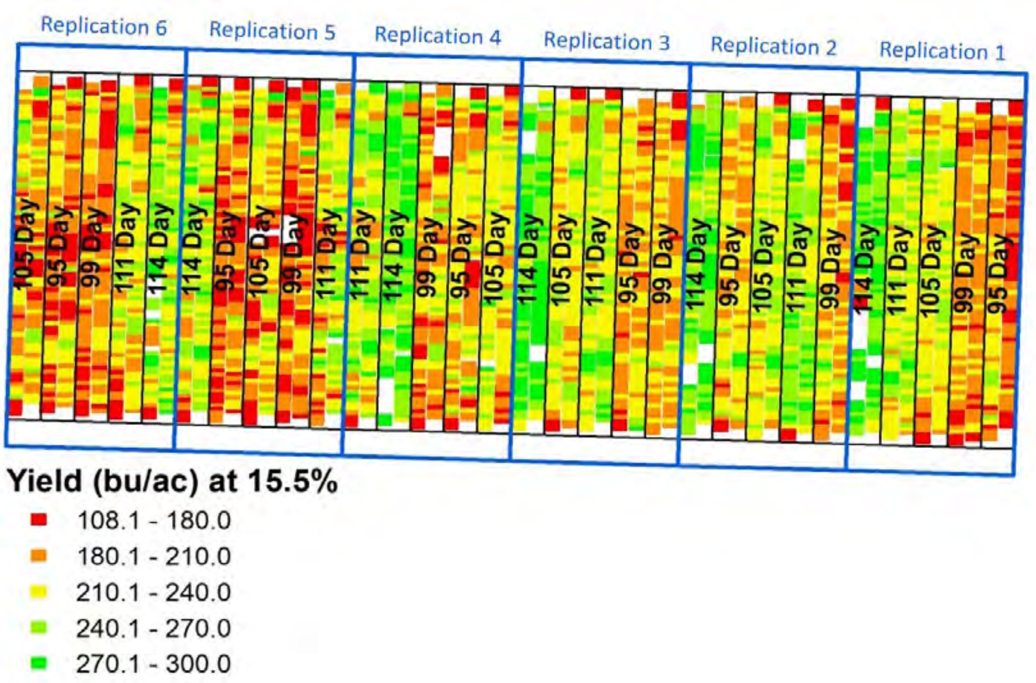


Figure 1. Yield from combine yield monitor for five corn hybrids evaluated.

	Harvest Stand Count (plants/ac)	Test Weight	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
95 Day CRM	26,466 A*	57 C	14.0 D	179 D	482.25 D
99 Day CRM	26,693 A	58 B	13.9 D	176 D	475.57 D
105 Day CRM	26,466 A	58 B	15.0 C	198 C	544.56 C
111 Day CRM	26,466 A	60 A	16.1 B	209 B	594.57 B
114 Day CRM	27,262 A	59 A	17.5 A	226 A	655.82 A
P-Value	0.881	<0.0001	<0.0001	<0.0001	<0.0001

*Values with the same letter are not significantly different at a 90% confidence level.

†Bushels per acre corrected to 15.5% moisture.

‡Marginal net return based on $3.23/bu corn, $250/unit DKC 45-65 RIB, $240/unit Channel 199-29STX RIB, $263/unit DKC 55-20 RIB, $250/unit DKC 61-54 RIB, and $272/ac DKC 64-34 RIB with 80,000 seeds/unit.

Summary:

- There were no differences in harvest stand counts between the five hybrids evaluated.
- Moisture and test weight were significantly different at harvest. The shorter season hybrids had lower test weight and were drier; the longer season hybrids had higher test weights and were wetter at the time of harvest.
- Yields were significantly lower for the 95 and 99 CRM and increased with increasing CRM. The highest yielding hybrid (114 CRM) was 47 bu/ac higher than the 95 day CRM.
- Net return also increased with increasing CRM.
- Due to the increase in yield and net return for increasing CRM, the results of this study do not align with the results from the 2017 on-farm research studies. The results of this study do not support the idea that an earlier maturing hybrid could be planted without sacrificing yield, allowing for earlier crop harvest and subsequent earlier cover crop establishment.

Evaluating Soybean Maturity for Improving Cover Crop Establishment

Study ID: 0701147201804
County: Richardson
Soil Type: Marshall silty clay loam 2-6% slopes
Planting Date: 5/21/18
Harvest Date: 9/24/18 and 11/16/18
Population: 180,000
Row Spacing (in): 15
Reps: 4
Previous Crop: Corn
Tillage: No-Till
Herbicides: ***Pre:*** 8 oz/ac dicamba and 6 oz/ac 6# 2,4-D. 1 qt/ac generic glyphosate, 1.25 pt/ac metolachlor, 9.3 oz/ac of 6# 2,4-D, 6 oz/ac Volunteer®, and 2 lb/ac AMS in April 2018 ***Post:*** 32 oz/ac Buccaneer® and 2 lb/ac AMS

Irrigation: None
Rainfall (in):

Soil Test (Dec. 2018):

Soil pH 1:1	Buffer pH	CEC	OM	Bray P1 Weak Bray	Bray P2 Strong Bray	K	Mg	Ca	S	Zn	K	Mg	Ca	H
		mg/100g	*%*	*ppm*	*ppm*	-------------*(ppm)*-----------					--*% Base Saturation*---			
5.2	6.1	15.2	2.4	11	13	115	214	1575	8	1.1	1.9	11.7	51.8	34.6
5.5	6.6	14.6	2.7	10	12	191	265	1620	7	1.5	3.4	15.1	55.5	26.0

Introduction: Cover crops have the potential to provide several ecosystem services; therefore, many corn and soybean producers are looking for ways to better integrate them into their cropping systems. One of the primary limitations to fall planted cover crops in Nebraska is the limited growing window following corn and soybean harvest. One way to increase the growing window for cover crops following corn and soybean harvest is to plant earlier maturing corn and soybean varieties. Recent small plot research at the University of Nebraska found that shorter season comparative relative maturity (CRM) corn hybrids had yields similar to longer season CRM hybrids. This research also showed the potential for greater cereal rye biomass accumulation following the shorter season hybrids. The objective of this study was to evaluate the same concept on soybeans. Four soybean maturity groups were evaluated. The group 1 and 2 soybeans were harvested on September 24 and the group 3 and 4 soybeans were harvested on November 16.

Group 1 (1.1 maturity) = Asgrow® 11X8
Group 2 (2.4 maturity) = Asgrow® 24X7
Group 3 (3.3 maturity) = Asgrow® 33X8
Group 4 (4.1 maturity) = Asgrow® 41X8

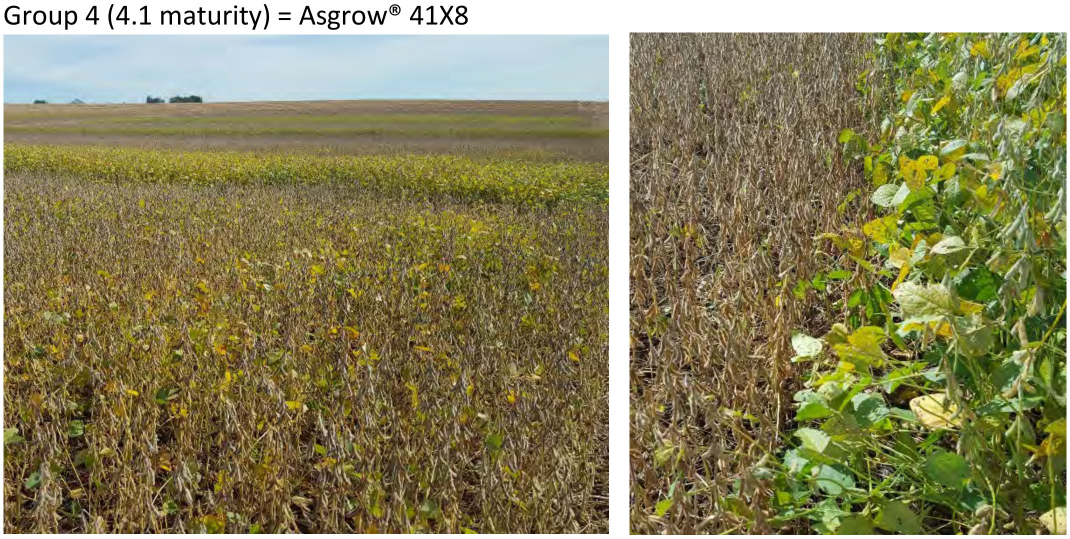


Figure 1. Images showing difference between group 3 and group 4 soybeans on September 26.

Results: Because of the variability in stand count, harvest stand count was included as a confounding variable (covariate) in the model so that test weight, moisture, yield, and net return can be evaluated for the soybean maturity groups without the complicating factor of stand count. The test weight, moisture, yield, and net return analysis was completed with the GLIMMIX procedure in SAS 9.4 (SAS Institute Inc., Cary, NC). Mean separation for test weight, moisture, yield, and net return was performed with Tukey's HSD.

	Harvest Stand Count (plants/ac)	**Test Weight**	**Moisture (%)**	**Yield† (bu/ac)**	**Marginal Net Return‡ ($/ac)**
Group 1 Soybean Maturity	190,503 A*	54 A	14.0 B	47 B	279.91 B
Group 2 Soybean Maturity	155,655 A	55 A	16.5 A	58 A	358.22 A
Group 3 Soybean Maturity	160,301 A	55 A	12.4 B	52 AB	309.34 AB
Group 4 Soybean Maturity	177,725 A	55 A	12.7 B	54 AB	326.02 AB
P-Value	0.110	0.116	0.001	0.067	0.057

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $7.40/bu soybean and seed costs of group 1 at $55/unit, group 2 at $53/unit, group 3 at $57/unit, and group 4 at $55/unit.

Summary:

- There were significant moisture differences with group 2 having a higher grain moisture at harvest.
- There was no difference in test weight between the four maturity groups.
- Yield and net return were higher for the group 2 soybeans when compared to the group 1 soybeans. Group 3 and group 4 soybeans were not different than group 1 or group 2. This study supports the idea that a group 2 maturity soybean could be planted without sacrificing yield, allowing for earlier crop harvest and subsequent earlier cover crop establishment.
- This study should be conducted in additional locations and years to determine if the conclusions from this study hold true in other growing conditions.

Corn Planted into Cereal Rye Cover Crop

Study ID: 0007155201801
County: Saunders
Soil Type: Yutan, eroded-Judson complex 6-11% slopes; Judson silt loam 2-6% slopes; Yutan, eroded-Aksarben silty clay loam 2-6% slopes
Planting Date: 4/29/18
Harvest Date: 10/28/18
Population: 35,000
Row Spacing (in): 15
Hybrid: Channel® 213-19 STX
Reps: 5
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** 4.5 oz/ac Corvus® and 1 lb/ac Atrazine on 5/5/18 ***Post:*** 24 oz/ac Buccaneer® 5, 3 oz/ac mesotrione, 8.5 lb/100 gal dry AMS, and 5 gal/1,200 gal crop oil concentrate
Seed Treatment: Basic Acceleron® 500
Foliar Fungicides: 13.7 oz/ac Trivapro® fungicide with 2 oz/ac WETCIT®
Fertilizer: 100 lb/ac N as anhydrous ammonia in the fall; 120 lb/ac N as 32% UAN and 1 gal/ac Humate with herbicide on 5/5/18; 7 gal/ac 6-24-6 and 1 pt/ac Zn in-furrow at planting
Irrigation: Pivot, Total: None
Rainfall (in):

Introduction: The objective of the study was to assess the impact of rye cover crop on subsequent crop yield. This is the third year this study has been conducted. The cereal rye cover crop was drilled following soybean harvest on October 20, 2017 in alternating strips with a no cover crop check. Cereal rye strips were terminated with herbicide on May 1, 2018. Rye was approximately 6" tall. Corn was planted into rye and check strips on April 29, 2018.

Results:

	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	16.3 A*	276 B	891.05 A
Cover Crop - Rye	16.2 A	282 A	875.11 B
P-Value	0.326	0.021	0.036

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and $20/ac rye seed and drilling costs, and $15/ac for rye termination.

To assess differences in soil loss and soil condition index (SCI) for the rye cover crop, the USDA-NRCS Revised Universal Soil Loss Equation 2 (RUSLE2) was used. The output on the following page is an estimated two year scenario evaluating the impact of rye cover crop.

Summary: Grain moisture did not differ between the no cover crop and cereal rye cover crop treatments. The rye cover crop treatment yielded 6 bu/ac more than the no cover crop check. The increased costs of seeding and termination for the rye cover crop treatment resulted in a $15.94/ac loss in marginal net return compared to the no cover crop check.

RUSLE2 Profile Erosion Calculation Record – Without Rye Cover Crop

Outputs:

Date	*Operation*	*Vegetation*	*Surf. residue cover after operation, %*
4/25/0	Planter, double disk opnr, 15" row spacing	Corn, grain, high yield	57
10/20/0	Harvest, killing crop 50pct standing stubble		87
5/10/1	Planter, double disk opnr, 15" inch row spacing	Soybean, 15 - 20 in rows	75
10/10/1	Harvest, killing crop 20pct standing stubble		91

Soil loss for cons. plan: **2.0 t/ac/yr** Sediment delivery: 2.0 t/ac/yr T value: 5.0 t/ac/yr
Soil conditioning index (SCI): **0.742**
Avg. annual slope STIR: 5.03

RUSLE2 Profile Erosion Calculation Record – With Rye Cover Crop

Outputs:

Date	*Operation*	*Vegetation*	*Surf. residue cover after operation, %*
4/18/0	**Sprayer, kill crop**		**63**
4/25/0	Planter, double disk opnr, 15" row spacing	Corn, grain, high yield	51
10/23/0	Harvest, killing crop 50pct standing stubble		88
5/10/1	Planter, double disk opnr, 15" row spacing	Soybean, 15 - 20 in rows	76
10/10/1	Harvest, killing crop 20pct standing stubble		91
10/15/1	**Drill or air seeder single disk openers 7-10 in spac.**	**Rye, winter cover**	**80**

Soil loss for cons. plan: **2.0 t/ac/yr** Sediment delivery: 2.0 t/ac/yr T value: 5.0 t/ac/yr
Soil conditioning index (SCI): **0.781**
Avg. annual slope STIR: 6.32

NRCS RUSLE2 Inputs:
Location: Saunders County
Soil: Yutan, eroded-Judson complex, 6 to 11 percent slopes/Yutan Silty clay loam eroded 64%
Slope length (along slope): 150 ft
Avg. slope steepness: 9.0 %
Yield values used: 215 bu/acre corn, 60 bu/acre soybean, and 3,360 lb/acre rye
Contouring: default
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Adjust res. burial level: bury 30% more than normal

Summary of Previous Years (Year 1 and 2)

In year one (2016), cover crops were drilled on October 15, 2015. Rye was terminated with 32 oz/ac Roundup and 1.5 gal/100 gal of liquid AMS on April 16, 2016. Rye was approximately 16” in height. Corn was planted on April 25, 2016.

2016 Results:

	Moisture (%)	Corn Yield (bu/ac)†	Marginal Net Return‡ ($/ac)
Check	15.9 A	229 A*	698.45
Cover Crop - Rye	15.9 A	229 A	666.45
P-Value	0.1019	0.6735	-

†Bushels per acre corrected to 15.5% moisture.
*Values with the same letter are not significantly different at a 90% confidence level.
‡Marginal net return based on $3.05/bu corn, $12/ac cover crop seed and chemical to kill rye, and $20/ac for the drilling and spraying operations.

In year two (2017), cover crops were drilled on November 5, 2016. Rye was terminated with 32 oz/ac Roundup, 3 oz/ac Valor XLT, 0.5 pt/ac of 2,4-D 6# Ester, and 1.5 gal/100 gal of liquid AMS on April 17, 2017. Rye was approximately 6” in height. Soybeans were planted on April 26, 2017.

2017 Results:

	Soybean Stand Count at Harvest	Soybean Moisture (%)	Soybean Yield (bu/acre)†	Marginal Net Return‡ ($/ac)
Check	108,647 A*	8.3 A	63 A	561.50 A
Cover Crop - Rye	100,353 A	8.2 A	61 A	509.42 B
P-Value	0.166	0.415	0.511	0.084

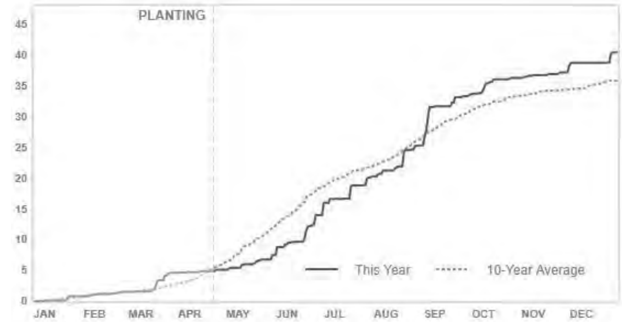
*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $8.90/bu soybean, $20/ac rye seed and drilling cost, and $15/ac for rye termination.

In years one and two, there were no differences in grain yield between the no cover crop and cereal rye cover crop treatments.

Corn Planted into Cereal Rye Cover Crop

Study ID: 0136109201802
County: Lancaster
Soil Type: silty clay loam; silt loam
Planting Date: 4/23/18
Harvest Date: 10/3/18
Population: 30,000
Hybrid: Dekalb® DKC 62-98
Reps: 8
Tillage: No-Till
Herbicides: ***Pre:*** Bicep II Magnum® ***Post:*** Roundup® and Callisto®
Foliar Insecticides: None
Foliar Fungicides: None

Fertilizer: 170 lb/ac NH3 fall applied and 5 gal/ac 10-34-0 starter with planting
Irrigation: None
Rainfall (in):



Introduction: The purpose of this study was to evaluate the impact of a rye cover crop on subsequent corn yield. There are two treatments, rye cover crop and a no cover crop control. Cereal rye was seeded at a rate of 40 lb/ac on November 1. Rye was terminated mid-May at about 1 foot tall. Starter fertilizer (5 gal/ac 10-34-0) was applied to the subsequent corn crop. Corn yield was evaluated.

Results:

	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	15.5 B*	213 A	686.95 A
Cover Crop - Rye	15.9 A	208 B	656.99 B
P-Value	<0.0001	0.0099	0.0004

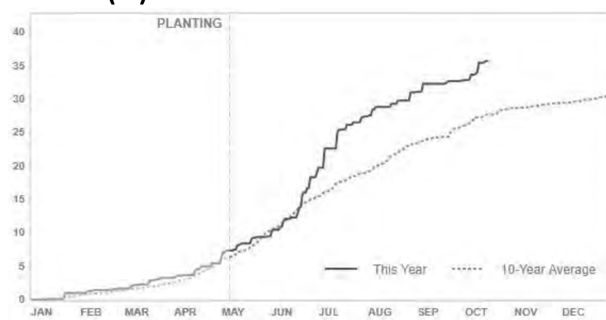
*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn, $7.67/ac rye cover crop seed, and $6/ac for drilling cover crop.

Summary: The no cover crop control had a higher yield and net return than the rye cover crop treatment.

Corn Planted into Cereal Rye Cover Crop

Study ID: 0321027201801
County: Cedar
Soil Type: Crofton-Nora complex 6-11% slopes, eroded; Alcester silty clay loam 2-6% slopes; Shell silt loam occasionally flooded; Nora silt loam 6-11% slopes, eroded
Planting Date: 5/6/18
Harvest Date: 10/17/18
Population: 27,500
Row Spacing (in): 30
Hybrid: Pioneer® P0589AM
Reps: 3
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** 1 qt/ac Bicep Lite II MAGNUM®, 3 oz/ac Balance® Flexx, 1 oz/ac Sharpen®, 6 oz/ac 2,4-D, 32 oz/ac Roundup PowerMAX®, and 8 oz/ac Banvel® on 4/27/18 ***Post:*** 48 oz/ac Durango® and 2 oz/ac Explorer™

Seed Treatment: Poncho® 250
Foliar Insecticides: None
Foliar Fungicides: 6.8 oz/ac Approach® Prima and 6.4 oz/ac Brigade® on 7/22/18
Fertilizer: P, K, and S variable rated in fall 2017; 30 gal/ac 32% UAN with herbicide on 4/27/18; 7 gal/ac 32% UAN, 7 gal/ac 10-34-0, and 2 qt/ac Zn with planter
Irrigation: None
Rainfall (in):



Soil Tests (Oct. 2017 – 6 samples, averaged over study area):

pH	BpH	OM	CEC (meq/ 100g)	P	K	S	Ca	Mg	Na	Zn	Fe	Mn	Cu	B	Base Sat	K	Ca	Mg	Na
				ppm											%				
6.9	6.8	3.4	24	44	156	6.3	3953	303	20	3.2	75	146	1.6	0.6	16.6	2.0	77.5	11.9	0.4

Introduction: This study compared the effects of a cereal rye cover crop on the subsequent corn crop yield. The rye treatment was compared with a no cover crop check. Rye was planted on November 5, 2017, at a rate of 1 bu/ac (56 lb/ac). The cover crop was terminated with the normal burndown program of Roundup® on April 4, 2018. Seed and drilling cost was $36/ac.

Results:

	Moisture (%)	Yield† (bu/acre)	Marginal Net Return‡ ($/ac)
Check	18.0 B*	214 A	691.60 A
Cover Crop - Rye	18.2 A	219 A	669.64 B
P-Value	0.0304	0.149	0.07

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and $36/ac for rye seed and planting.

Summary:

- The rye cover crop treatment had significantly higher grain moisture than the untreated check.
- There was no difference in yield for the corn following the rye cover crop and the check.
- The marginal net return was lower for the corn following the rye cover crop due to the increased input costs for establishing cover crops.

Corn Planted into Rye Cover Crop

Study ID: 0064099201801
County: Kearney
Soil Type: Coly-Kenesaw silt loam 0-3% slope; Hersh fine sandy loam 3-6% slopes; Kenesaw silt loam 0-1% slope; Libory loamy fine sand 0-3% slope; Hersh fine sandy loam 0-3% slope
Planting Date: 5/16/18
Harvest Date: 10/29/18
Row Spacing (in): 30
Hybrid: Mycogen® 11V17 Enlist®
Reps: 8
Previous Crop: Soybean
Tillage: Strip-Till
Fertilizer: 100 lb/ac N, 50 lb/ac P, and 10 lb/ac S on 4/12/18 as strip-till application

Irrigation: Pivot, Total: 8.8"
Note: Field was hailed twice; damage was uniform across the plot; hail insurance was collected for 16% yield loss
Rainfall (in):

Introduction: This study compared the effects of a cereal rye cover crop on the corn crop yield. This is the second year of the study. Rye was drilled following soybean harvest on October 21, 2017. Cattle pastured the rye in March and early April. The rye was terminated with 2 qt/ac of 4 lb glyphosate on May 6, 2018. Rye was approximately 15" tall at the time of termination. Preplant fertilizer of 100 lb/ac N, 50 lb/ac P, and 10 lb/ac S was applied via strip-till on April 12, 2018. Corn was planted into the strips on April 28, however the fertilizer was not incorparated as deep as planned and the corn seedlings had salt injury resulting in a poor stand. The field was replanted on May 17, about 8 inches off the center of the strips and the original thin stand of corn was sprayed and killed on June 6 with Assure® II. Starter fertilizer was not used at planting.

Results:

	Moisture (%)	Corn Yield (bu/ac)†	Marginal Net Return‡ ($/ac)
Check	15.5 A*	227 A	733.70 A
Cover Crop - Rye	15.6 A	228 A	713.43 B
P-Value	0.219	0.454	0.014

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and $24.30 cover crop cost.

Summary:

- There was no yield or grain moisture difference between the corn following the rye cover crop treatment and the corn following the no cover crop check.
- Marginal net return was lower for the corn following the rye cover crop due to the increased input costs for establishing cover crops.

Summary of Previous Years (Year 1)

In year one (2017), cover crops were drilled on November 1, 2016. Rye was terminated with glyphosate on May 5, 2017. Soybeans were drilled in 10" rows on May 8, 2017.

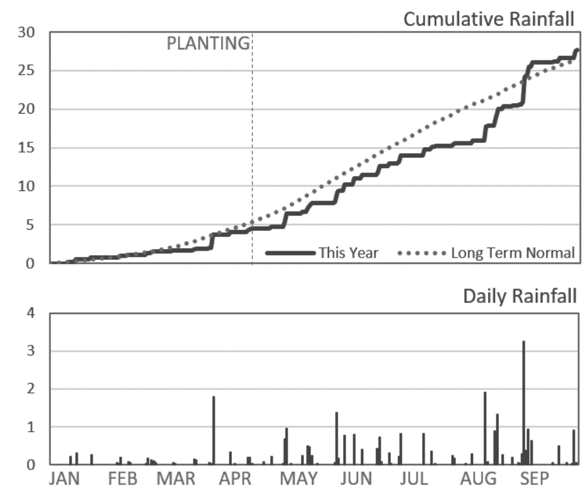
2017 Results:

	Moisture (%)	Soybean Yield (bu/ac)†	Marginal Net Return‡ ($/ac)
Check	12.0 B*	80 A	714.25 A
Cover Crop - Rye	12.1 A	81 A	692.20 B
P-Value	0.058	0.682	0.008

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $8.90/bu soybean and $24.30 cover crop cost.

Corn Following Winter Terminated and Winter Hardy Cover Crops

Study ID: 0656127201802
County: Nemaha
Soil Type: Judson silt loam 0-2% slope; Judson silt loam 2-6% slopes
Planting Date: 4/17/18
Harvest Date: 9/14/18
Row Spacing (in): 30
Hybrid: Pioneer® 0363AM
Reps: 7
Previous Crop: Wheat
Tillage: No-Till
Herbicides: ***Pre:*** 3 qt/ac FulTime® NXT, 16 oz/ac 6# 2,4-D, and 16 oz/ac Buccaneer 5 Extra® on 4/4/18
Post: 3 oz/ac Bellum™, 32 oz/ac Buccaneer 5 Extra®, and 3.2 oz/ac N-Tense™ on 6/4/18
Seed Treatment: PONCHO®/VOTiVO®
Foliar Insecticides: 3.84 oz/ac Lambda-Cy 1EC aerial applied on 7/7/18; 3.84 oz/ac Lambda-Cy 1 EC aerial applied on 7/26/18
Foliar Fungicides: 6 oz/ac AzoxyProp Xtra on 6/4/18; 10.5 oz/ac AzoxyProp Xtra aerial applied on 7/7/18; 10.5 oz/ac AzoxyProp Xtra aerial applied on 7/26/18
Fertilizer: 150 lb/ac N as 32% UAN on 4/4/18; 1 gal/ac NResponse™ on 6/4/18; 82.8 lb/ac N as Urea on 6/11/18; 1 gal/ac Kugler KQ-KRN™ (28% N) aerial applied on 7/7/18;1 gal/ac Kugler KS2075 (20% N, 7.5% P, 5% S) aerial applied on 7/26/18
Irrigation: None
Rainfall (in) as measured at field:



Introduction: This study is being conducted on a soil health demonstration farm as part of the Nebraska USDA/Natural Resources Conservation Service's (NRCS) Soil Health Initiative, and involves the farmer, the Nebraska On-Farm Research Network, and the USDA/NRCS. This is the second year of this study. The two treatments, the use of winter terminated cover crops and the use of winter hardy cover crops, will be used in this five-year study (2016-2021). The cover crops were drilled August 1, 2017. The winter terminated treatment was a mix of 30 lb/ac oats, 1.5 lb/ac canola/rapeseed, and 1 lb/ac turnip. The winter hardy treatment consisted of 30 lb/ac cereal rye, 1.5 lb/ac canola/rapeseed, and 1 lb/ac turnip. This study did not have a no cover crop control. For uniformity, both cover crop mixes were sprayed with herbicide to terminate the cover crops on April 4, 2018. Baseline soil health measures (one per treatment) were collected on 10/19/16 (Table 1).

Table 1. Baseline soil quality measurements for winter terminated and winter hardy treatments from 2016.

	Average Steady State Infiltration (in/hr)	Bulk Density (g/cm^3)	Total Pore Space (%)	Water Holding Capacity if all pores filled (inch H_2O/ft)	Solvita at 24 hr	Estimated Solvita Microbial Activity Rating	Average Soil Health Indicator Score
Sample Site 3 (Winter Terminated)	1.30	1.22	53.8	6.5	2.0	Low	2.44
Sample Site 4 (Winter Hardy)	1.12	1.32	50.2	6.0	2.0	Low	2.59

Table 2. 2018 corn stand counts, test weight, moisture, yield, and net return for winter hardy and winter terminated cover crop treatments.

	Stand Count (plants/ac)	Test Weight (lb/bu)	Moisture (%)	Corn Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Winter Terminated	29,710 A*	56 A	20.7 A	243 A	759.43 A
Winter Hardy	29,515 A	56 A	20.9 A	240 A	748.71 A
P-Value	0.677	0.226	0.516	0.281	0.283

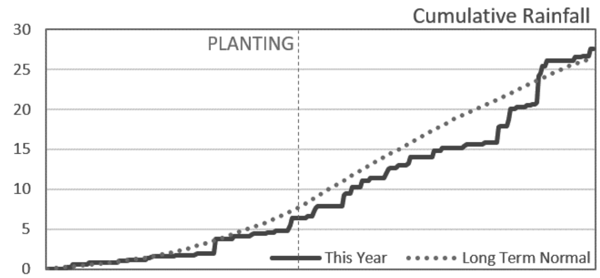
*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture for corn.
‡Marginal net return based on $3.23/bu corn, $12.48/ac winter terminated cover crop seed mix, $12.45/ac winter hardy cover crop seed mix, and $14.40/ac drilling cost.

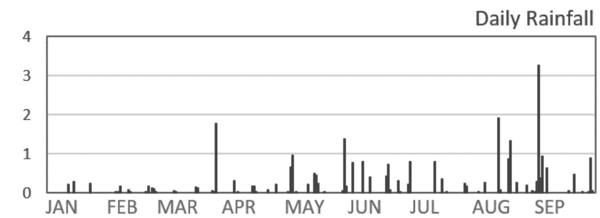
Summary:

- In 2018, there were no differences in corn yield, moisture, test weight, harvest stand counts, or net return between the winter terminated or winter hardy cover crop treatment.

Soybeans Following Winter Terminated and Winter Hardy Cover Crops

Study ID: 0656127201801
County: Nemaha
Soil Type: Judson silt loam 0-2% slope; Judson silt loam 2-6% slopes
Planting Date: 5/7/18
Harvest Date: 9/17/18
Row Spacing (in): 15
Variety: Pioneer® 24T19R
Reps: 7
Previous Crop: Corn
Tillage: No-Till
Herbicides: ***Pre:*** 6 oz/ac Sonic®, 16 oz/ac generic Dual, 16 oz/ac 2,4-D 6#, 8 oz/ac Absorb 100, and 16 oz/ac Buccaneer 5 Extra® on 4/17/18 ***Post:*** 16 oz/ac Shafen Star, 8 oz/ac Clethodim 2EC, 32 oz/ac Buccaneer 5 Extra®, 8 oz/ac Absorb 100, and 4 oz/ac N-Tense™ on 6/16/18
Seed Treatment: PPST 2030
Foliar Insecticides: 3.84 oz/ac Lambda-Cy 1 EC aerial applied on 7/26/18
Foliar Fungicides: 10.5 oz/ac Azoxyprop Xtra aerial applied on 7/26/18
Fertilizer: 1 gal/ac NResponse™ on 6/16/18; 1 gal/ac Kugler KS2075 (20% N, 7.5% P, 5% S) aerial applied on 7/26/18
Irrigation: None
Rainfall (in) as measured at field:





Introduction: This study is being conducted on a soil health demonstration farm as part of the Nebraska USDA/Natural Resources Conservation Service's (NRCS) Soil Health Initiative, and involves the farmer, the Nebraska On-Farm Research Network, and the USDA/NRCS. The two treatments, the use of winter terminated cover crops and the use of winter hardy cover crops, will be used in this five-year study (2016-2021). This is the second year of this study. The cover crops were drilled August 1, 2017. The winter terminated treatment was a mix of 30 lb/ac oats, 1.5 lb/ac canola/rapeseed, and 1 lb/ac turnip. The winter hardy treatment consisted of 30 lb/ac cereal rye, 1.5 lb/ac canola/rapeseed, and 1 lb/ac turnip. This study did not have a no cover crop control. For uniformity, both cover crop mixes were sprayed with herbicide to terminate the cover crops on April 17, 2018. Baseline soil health measures (one per treatment) were collected on 10/19/16 (Table 1).

Table 1. Baseline soil quality measurements for winter terminated and winter hardy treatments from 2016.

	Bulk Density (g/cm^3)	Total Pore Space (%)	Water Holding Capacity if all pores filled (inch H_2O/ft)	Solvita at 24 hr	Estimated Solvita Microbial Activity Rating	Average Soil Health Indicator Score
Sample Site 2 (Winter Terminated)	1.25	52.8	6.3	2.0	Low	2.44
Sample Site 1 (Winter Hardy)	1.22	53.9	6.5	2.0	Low	2.59

Table 2. 2018 soybean stand counts, test weight, moisture, yield, and net return for winter hardy and winter terminated cover crop treatments.

	Stand Count (plants/ac)	Test Weight	Moisture (%)	Soybean Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Winter Terminated	120,744 A*	56 B	11.3 A	65 A	452.80 A
Winter Hardy	120,246 A	56 A	11.2 A	59 B	410.75 B
P-Value	0.872	0.096	0.200	0.002	0.002

*Values with the same letter are not significantly different at a 90% confidence level.

†Bushels per acre corrected to 13% moisture for soybeans.

‡Marginal net return based on $7.40/bu soybean, $12.48/ac winter terminated cover crop seed mix, $12.45/ac winter hardy cover crop seed mix, and $14.40/ac drilling cost.

Figure 1. True color drone imagery from July 24, 2018 of soybeans planted after winter-hardy and winter-killed cover crops.

Summary:

- In 2018, soybeans planted after winter terminated cover crops had a higher yield, lower test weight, and higher net return than the winter hardy cover crops. There were visible differences between the winter terminated and winter hardy cover crops, with the winter terminated having a darker green appearance (Figure 1).

Summary of Previous Year (Year 1 of 5)

In year one, cover crops were drilled on September 29, 2016. The winter terminated treatment was a mix of oats, turnips, and common rapeseed, whereas the winter hardy treatment consisted of cereal rye, turnips, and common rapeseed. For uniformity, both cover crop mixes were sprayed with glyphosate on April 12, 2017. This terminated the winter hardy treatment and controlled weeds and brassicas, which had overwintered in the winter terminated cover crop treatment.

Table 3. 2017 corn stand counts, test weight, yield, and net return for winter hardy and winter terminated cover crop treatments.

	Stand Count (plants/acre)	**Test Weight (lb/bu)**	**Moisture (%)**	**Corn Yield (bu/acre) †**	**Marginal Net Return‡ ($/ac)**
Winter Terminated	30,355 A*	54 A	18.0 B	183 A	546.97 A
Winter Hardy	30,023 A	52 B	19.1 A	168 B	498.00 B
P-Value	0.802	0.0209	0.0034	0.0003	0.0003

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.15/bu corn and $30.07 cost for cover crop seed and drilling in both treatments.

In 2017, corn planted after winter terminated cover crops had a higher yield, higher test weight, and was drier than the winter hardy cover crops. There were no differences in harvest stand counts for the corn following the winter terminated and winter hardy cover crops. The corn following the winter hardy mix was three days slower to tassel than the corn following the winter terminated mix.

Impact of a Cover Crop Mix with One Cereal Grain versus Cover Crop Mix with Multiple Cereal Grains on Soil Quality, Moisture, and the Subsequent Crop Yield

Study ID: 0388131201801
County: Otoe
Soil Type: Wymore silty clay loam 2-6% slopes; Pawnee clay loam 4-8% slopes, eroded; Judson silt loam 2-6% slopes
Planting Date: 4/29/18
Harvest Date: 10/22/18
Population: 165,000
Row Spacing (in): 15
Variety: Channel® R2C3350
Reps: 4
Previous Crop: Corn
Tillage: No-Till
Herbicides: ***Pre:*** 3.25 oz/ac Fierce®, 40 oz/ac Roundup PowerMAX®, 5 lb/ac Array®, 1 qt/100 Choice Weather Master, and 9.6 oz/ac MSO on 5/6/18 ***Post:*** 3.25 oz/ac Fierce®, 32 oz/ac Roundup PowerMAX®, 5 lb/ac Array®, 1 qt/100 Choice Weather Master, and 9.6 oz/ac MSO on 6/12/18
Seed Treatment: None
Foliar Fungicides/Insecticides: 10 oz/ac Aframe™ Plus fungicide, 1 qt/ac Brandt Smart Qualtro®, 3.5 oz/ac Endigo® ZC insecticide, 0.5 pt/ac Warhawk® insecticide, and 2 oz/ac of Wet applied to 30 acres of the field (edges of the field)
Fertilizer: 6 ton/ac of compost and nutrient solids from Prairieland Dairy consisting of 120 lb/ac N, 30 lb/ac P, 82 lb/ac K, 22 lb/ac S, 112 lb/ac Ca, 40 lb/ac Mg, 26 lb/ac Na, 1.2 lb/ac Zn, 79 lb/ac Fe, and 3 lb/ac Mn
Irrigation: None
Rainfall (in):

Introduction: This study is being conducted on a soil health demonstration farm as part of the Nebraska USDA/Natural Resource Conservation Service's (NRCS) Soil Health Initiative, and involves the farmer, the Nebraska On-Farm Research Network, and the USDA/NRCS. The purpose of this study is to compare the impact of a cover crop mixture with one cereal grain and a cover crop mixture with multiple cereal grains on soil quality, soil moisture, and subsequent crop yield. Cover crops were drilled in late October 2017. The one cereal grain mix included 56 lb/ac cereal rye, 2 lb/ac annual ryegrass, and 1.3 lb/ac canola. The cover crop mix with multiple cereal grains included 10 lb/ac cereal rye, 1.3 lb/ac annual ryegrass, 1.3 lb/ac canola, 10 lb/ac winter barley, 6.7 lb/ac triticale, 10 lb/ac oats, 6.7 lb/ac winter wheat, 8 lb/ac spring barley, and 1.3 lb/ac trunip. The cover crops were terminated with the pre-herbicide application on May 6, 2018. Cover crops were 12 to 18 inches tall at the time of termination.

A baseline Haney soil test is available from fall 2016. Haney soil tests were also taken from each treatment in fall 2017 and December 2018. Soybean yield was analyzed using yield monitor data. Aerial imagery was collected on August 11, 2018.

There were several challenges to soybean production. Dectes Stem Borer was evident. There was no rain from July 12 through August 22. Excessive rain after maturity delayed harvest and negatively impacted the crop quality and harvestability.

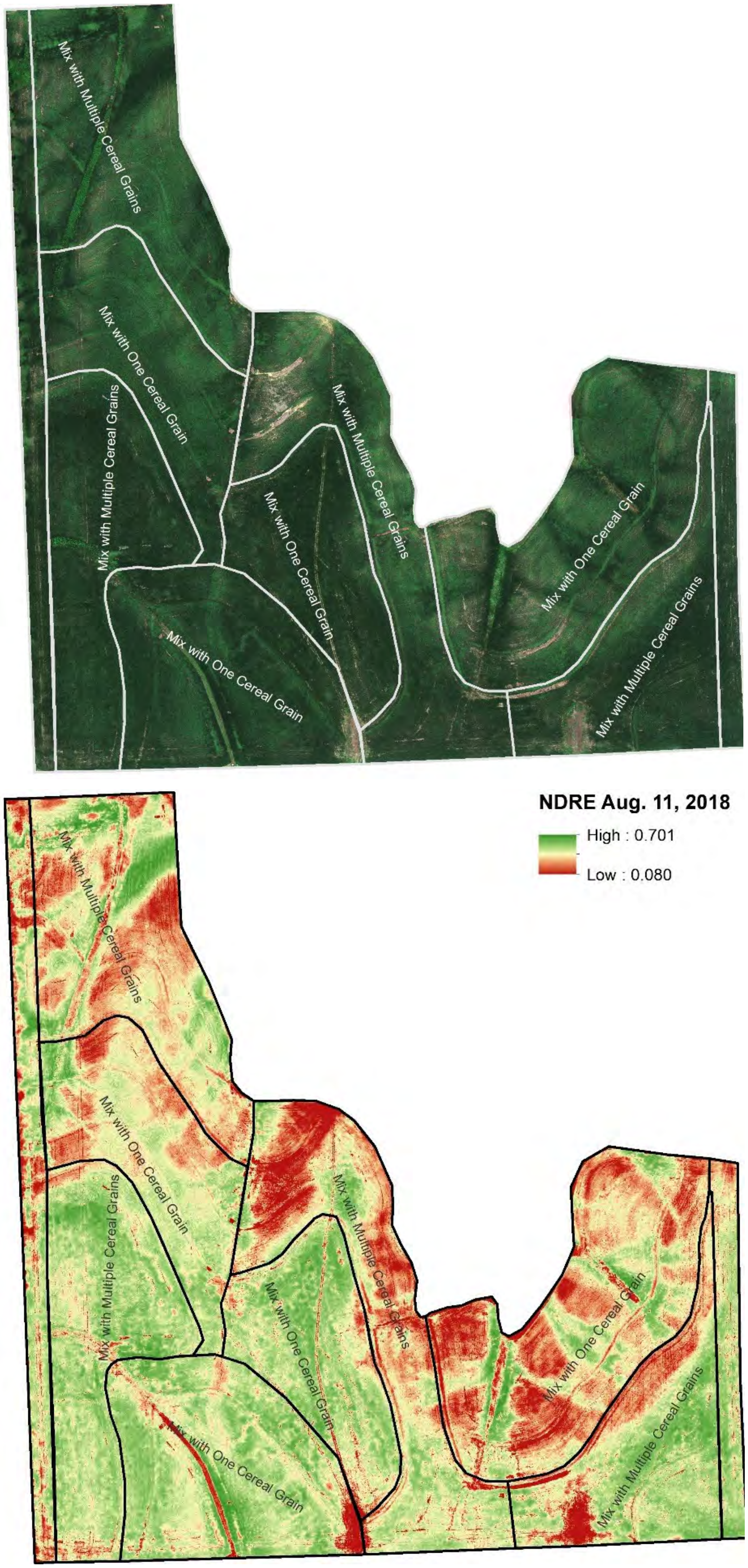


Figure 1. True color imagery (top) and normalized difference red edge index (NDRE) (bottom) from August 11, 2018.

Table 1. Soil health samples from 2016, 2017, and 2018.

Treatment	Solvita CO2 Burst (ppm)	Total Nitrogen (ppm)	Organic Nitrogen (ppm)	Total Organic Carbon (ppm)	Nitrate (ppm)	Ammonium (ppm)	Inorganic Nitrogen (ppm)	Organic C : N	Organic Nitrogen Release (ppm)	Soil Health Score
2016 Baseline	118.0	27.3	17.9	184	9.3	1.0	10.2	10.3	17.9	15.05
2017 Cover Crop Mix with One Cereal Grain	71.8	16.3	12.5	180	2.7	0.1	2.8	14.4	12.5	12.02
2017 Cover Crop Mix with Multiple Cereal Grains	119.2	20.1	13.5	194	4.7	1.5	6.2	14.4	13.5	15.17
2018 Cover Crop Mix with One Cereal Grain	136.3	21.7	12.3	199	9.0	2.5	11.5	16.2	12.3	16.57
2018 Cover Crop Mix with Multiple Cereal Grains	74.5	23.7	14.1	202	8.7	2.9	11.6	14.3	14.1	12.90

Table 2. 2018 yield, moisture, and net return for soybeans following cover crops with one cereal grain and with multiple cereal grains.

	Moisture (%)	Soybean Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Cover Crop Mix with One Cereal Grain	7.0 A*	34 A	199.82 A
Cover Crop Mix with Multiple Cereal Grains	7.6 A	36 A	216.46 A
P-Value	0.613	0.425	0.324

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $7.40/bu soybean, $53.84/ac for the one cereal grain mix, and $50.21/ac for the multiple cereal grain mix.

Summary: There was no difference in moisture, soybean yield, or net return for the two treatments.

Summary of Previous Year (Year 1 of 5)

In year one, cover crops were drilled in the fall of 2016. Both mixtures included annual rye, canola, balansa clover, camelina, vetch, crimson clover, winter lentils, alfalfa, and northern annual field peas. The cover crop mix with one cereal grain included cereal rye as a base while the cover crop mix with multiple cereal grains included winter oats, spring barley, winter barley, triticale, wheat, and cereal rye. The cover crops were terminated with glyphosate herbicide on April 16, 2017. This is an early termination date relative to the corn planting date of May 7 for the area (NRCS Zone 3).

Table 3. 2017 yield, moisture, and net return for corn following cover crops with one cereal grain and with multiple cereal grains.

	Corn Moisture (%)	Corn Yield (bu/acre)†	Marginal Net Return‡ ($/ac)
Cover Crop Mix with One Cereal Grain	14.6 A*	157 A	421.56 A
Cover Crop Mix with Multiple Cereal Grains	14.8 A	159 A	432.92 A
P-Value	0.209	0.708	0.588

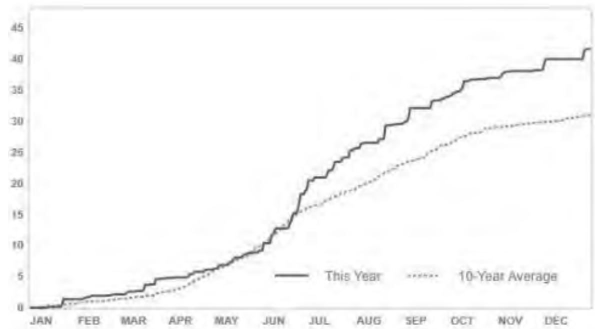
*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.15/bu corn, $53.84/acre for cover crop mix with one cereal grain, $50.21/acre for cover crop mix with multiple cereal grains.

A complete year 1 report is available online at: http://resultsfinder.unl.edu/.

Evaluating the Impact of Monoculture Rye Cover Crop versus Multispecies Cover Crop on Subsequent Wheat Crop Yield and Soil Quality Indicators

Study ID: 0732167201801
County: Stanton
Soil Type: Nora-Crofton complex 6-11% slopes; Nora silty clay loam 11-17% slopes; Moody silty clay loam 2-6% slopes; Nora silty clay loam 6-11% slopes; Alcester silty clay loam 2-6% slopes
Planting Date: 10/24/17
Harvest Date: 7/16/18 and 7/21/18
Population: 1,000,000 seeds/ac
Row Spacing (in): 7.5
Variety: Redfield
Reps: 5
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** None ***Post:*** None
Seed Treatment: Cruiser®

Foliar Insecticides/Fungicides: None
Fertilizer: Spring topdress on 3/30/18; 300 lb/ac Ammonium Nitrate (102 lb N/ac), 40 lb/ac Potash, 40 lb/ac Ammonium Sulfate (8 lb N/ac, 10 lb S/ac)
Note: Field was hailed on 6/23/18
Irrigation: None
Rainfall (in):



Introduction: This study is being conducted on a soil health demonstration farm as part of the Nebraska USDA/Natural Resources Conservation Service's (NRCS) Soil Health Initiative, and involves the farmer, the Nebraska On-Farm Research Network, and the USDA/NRCS. This study compares two treatments, a monoculture rye cover crop versus a cover crop mix. Soil health indicators, soil tests, and yield data are evaluated each year.

Cover crops were drilled in October 2016. The monoculture cover crop was 50 lb/ac rye. The cover crop mix consisted of 35 lb/ac Elbon Rye, 0.5 lb/ac Bayou Kale, 0.5 lb/ac Impact forage collards, 0.5 lb/ac Trophy rape, 0.5 lb/ac purple top turnip, 0.5 lb/ac African cabbage, 3.5 lb/ac hairy vetch, 30 lb/ac Austrian winter pea, and 2 lb/ac winter lentil. Cover crops were terminated on May 14, 2017 and soybeans were planted on May 25, 2017 and harvested on September 29, 2017. Wheat was planted in October 2017. Wheat yield was obtained for each treatment using yield monitor data with a 15' buffer applied to the treatments.

Results:

Soil Health Soil Test (Mar. 2017 – 2 samples, 1 in each treatment):

	Total Bacteria	Bacteria Gram (+)	Bacteria Gram (-)	Total Fungi	Arbuscular Mycorrhizal	Saprophytes	Protozoa	Undifferentiated
	Biomass, PLFA ng/g							
Rye	1596.8	993.3	603.5	221.2	85.4	135.8	10.6	902.3
Mix	1651.6	904.8	746.7	379.8	78.5	301.3	24	1808.8

	Soil pH	Buffer pH	OM %	CO_2-C	Total Nitrogen	Organic Nitrogen	Total Organic Carbon	Nitrate	Ammonium	Organic C:N	Soil Health Score
				ppm							
Rye	6.1	6.7	4.3	118.0	29.7	19.5	186	7.3	1.4	9.5	16.22
Mix	7.2		4.2	128.0	22.0	15.1	159	5.2	1.3	10.5	15.27

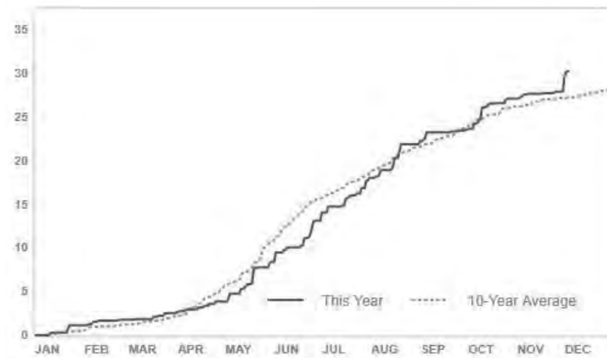
	Moisture (%)	Wheat Yield† (bu/ac)
Cover Crop - Rye	14.2 A*	35 A
Cover Crop - Mix	14.6 A	33 A
P-Value	0.591	0.366

†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 13.5% moisture.
*Values with the same letter are not significantly different at a 90% confidence level.

Summary: There was no difference in wheat yield or moisture for the monoculture versus cover crop mix. The field was hailed on June 23, 2018.

Corn Planted Following Dormant and Interseeded Cover Crop, Dormant Seeded Cover Crop, and No Cover Crop Check

Study ID: 0815121201801
County: Merrick
Soil Type: Kenesaw silt loam 1-6% slopes; Valentine-Thurman soils 0-17% slopes; Thurman loamy fine sand 0-2% slope; Thurman loamy fine sand 2-6% slopes; Kenesaw silt loam 0-1% slope
Planting Date: 5/17/18
Harvest Date: 10/6/18
Population: 35,000
Row Spacing (in): 30
Hybrid: Pioneer® 0157 AMXT
Reps: 6
Previous Crop: Corn
Tillage: Strip-Till
Herbicides: ***Pre:*** 32 oz/ac glyphosate on 5/10/18
Post: 32 oz/ac glyphosate and 5 oz/ac Status® on 6/1/18
Seed Treatment: Herculex® XTRA, Poncho® 1250 + VOTiVO®, AcreMax® Xtreme
Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: Average of 78.6 lb/ac variable rate 11-52-0 and average of 78.4 lb/ac variable rate 0-0-60 preplant; 5 gal/ac 32% UAN, 5 gal/ac 12-0-0-26, and 5 gal/ac 10-34-0 on 5/17/18; numerous fertigation applications from V4 to brown silk, totaling 200 lb/ac of N
Irrigation: Pivot, Total: 8.82"
Rainfall (in):



Soil Health Soil Test (Jan. 2017 – 18 samples, averaged over study area):

CO_2-C	Total Nitrogen	Organic Nitrogen	Total Organic Carbon	Nitrate	Ammonium	Organic C:N	Soil Health Score
ppm							
19.51	11.83	9.47	129.50	1.71	0.56	13.84	5.49

Standard Soil Test (Jan. 2017 - 31 samples, averaged over study area):

OM%	pH	CEC (meq/100 g)	Nitrate	Phosphorus	Potassium	Magnesium	Sulfur	Sodium	Sol Salts (S/m)
			ppm						
1.094	5.57	9.41	7.07	34.55	207.1	121.03	17.1	21.77	0.11

Introduction:

This study is being conducted on a soil health demonstration farm as part of the Nebraska USDA/Natural Resources Conservation Service's (NRCS) Soil Health Initiative, and involves the farmer, the Nebraska On-Farm Research Network, and the USDA/NRCS. This study examined three treatments: 1) dormant seeded cover crops and interseeding cover crops at V4 to V6, 2) a dormant (post-harvest) cover crop seeding, and 3) a no cover crop check.

In the fall of 2017, both the dormant seeded treatment strips and the dormant and interseeded treatment strips had a cover crop mix. The mix consisted of 40 lb/ac Elbon cereal rye, 1 lb/ac rapeseed/canola, 3 lb/ac winter oats, and 6 lb/ac hairy vetch. The cover crop was terminated on May 10 with glyphosate.

During the 2018 growing season, the interseeded cover crop treatment strips were planted with a cover crop mix on June 26 using a Hiniker interseeder (Figure 1). The interseeding mix consisted of 6 lb/ac cowpea, 6 lb/ac soybean, 0.5 lb/ac crimson clover, 5 lb/ac sunhemp, 2 lb/ac hairy vetch, 3 lb/ac buckwheat, 0.5 lb/ac chicory, 0.5 lb/ac flax, 0.5 lb/ac rapeseed/canola, 6 lb/ac Elbon cereal rye, and 6 lb/ac spring oats.

Figure 1. Hiniker twin row interseeder used to establish cover crops. Images from Hiniker (https://www.hiniker.com/ag_products%20new/sp_cover-crop-seeders.html).

The 2018 corn crop was harvested on October 6 and evaluated for yield and moisture. Spatial yield data is shown in Figure 2.

Results:

	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	19.1 A*	203 A	654.96 A
Cover Crop – Dormant Seeded	18.8 A	205 A	624.81 AB
Cover Crop – Dormant + Interseeded	18.8 A	209 A	586.09 B
P-Value	0.280	0.674	0.048

*Values with the same letter are not significantly different at a 90% confidence level.

†Bushels per acre corrected to 15.5% moisture.

‡Marginal net return based on $3.23/bu corn. Interseeded cover crop seed cost $37.50/ac. The dormant seeded cover crop seed in 2017 prior to this growing season cost $24/ac. A typical custom rate for the Hiniker interseeder is not available; therefore, both seeding methods (dormant drilled and interseeded) are estimated to be $14.40/ac. The interseeded cover crop treatment this year also was preceded by a dormant seeded cover crop; therefore, both the dormant and interseeded seed and seeding costs were incurred by this treatment this year.

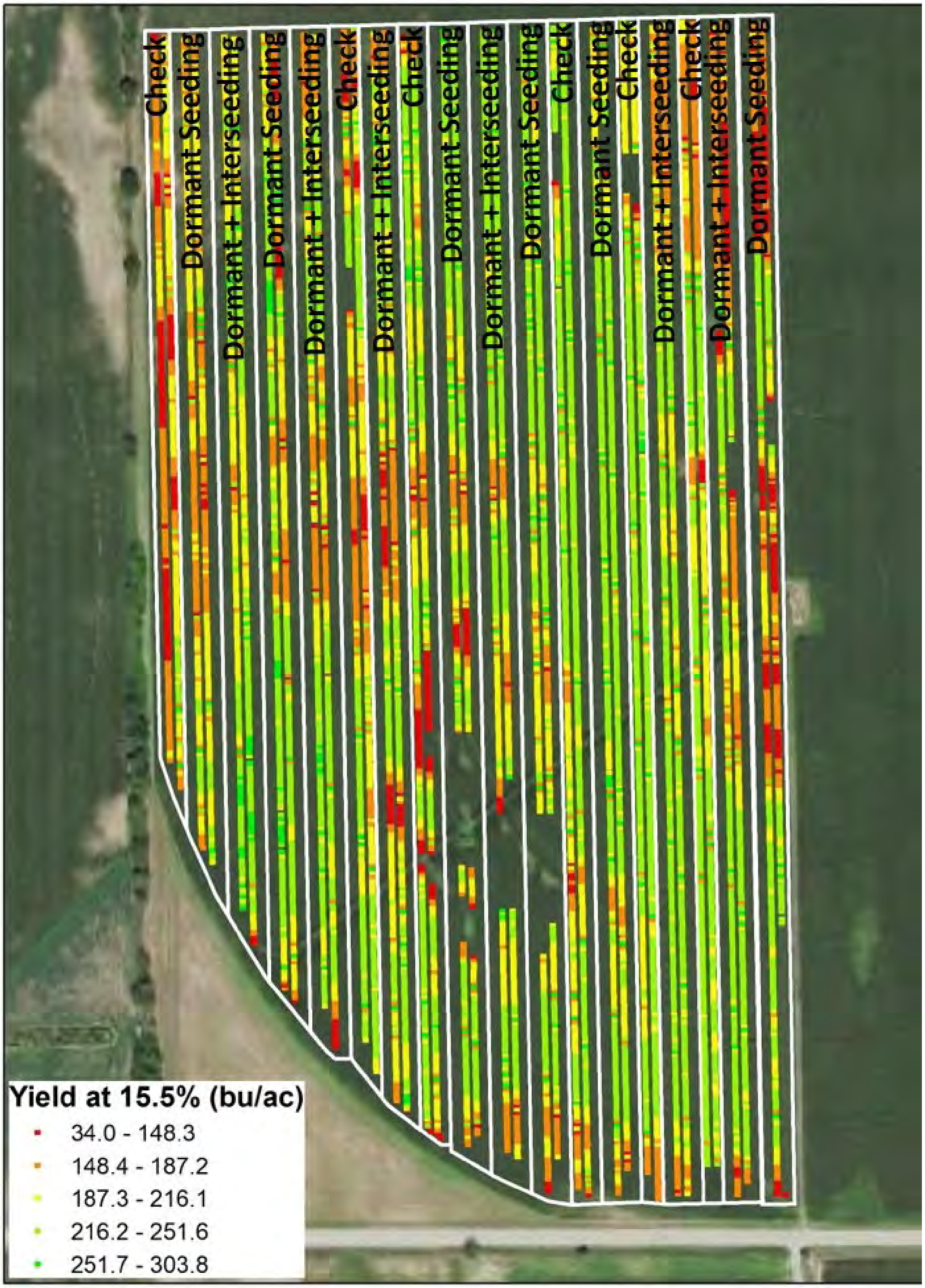


Figure 2. Cleaned yield data from yield monitor for study area with treatment strips overlaid (white outlines).

Summary:

There were no yield or moisture differences between the check, dormant and interseeded cover crop treatment, and dormant seeded cover crop treatment. There were differences in net return due to the cost of the cover crop treatment. This study is planned to continue for five or more years.

Integrating Cover Crops on Sandy Soils to Improve Water Quality and Soil Health

Study ID: 0737119201801
County: Madison
Soil Type: Boel sandy loam 0-1% slope
Planting Date: 4/30/18
Harvest Date: 9/24/18
Population: 32,000
Reps: 6
Previous Crop: Soybean
Tillage: No-Till
Irrigation: Pivot

Rainfall (in):

Introduction: The objective of this study was to evaluate the potential for cover crops to reduce water erosion of nutrients, improve water quality by reducing nitrate leaching, and enhance soil health in Nebraska corn/soybean production systems on sandy soils. The impact of cover crops on the subsequent crop yield was also evaluated.

This report includes data from year two of the three year project. Treatments are located on the same plots during each year of the study to monitor changes in soil erosion, water quality, and soil health over time. This study includes three treatments with six replications: check (no cover crop), pre-harvest planted cereal rye cover crop, and post-harvest planted cereal rye cover crop. Cover crop treatments were seeded at a rate of 56 lb/ac. The pre-harvest planted cover crop was seeded in early September 2017 by hand seeding as a high clearance applicator was not available in year two. The post-harvest planted cover crop was seeded in late October 2017 with a drill.

Cover crop biomass was measured and soil samples were collected to determine nitrate concentration change with depth on May 6, 2018, the same day cover crops were terminated. Aerial imagery was also used to evaluate cover crop biomass. Yield data was collected by hand harvesting ears from a 17.5-foot-long corn row in the center of each plot on September 24, 2018. Ears were dried, shelled, and dried again. Grain weight was then determined and corrected to 15.5% moisture content. Aerial imagery was used to identify plots that had issues with treatment establishment; these plots were removed from the analysis of corn yield, net return, cover crop biomass production, and soil nitrate.

Results:

	Cover Crop Biomass (lb/ac)	Corn Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	N/A	173 A*	559.09 A
Cover Crop – Pre-harvest Planting	427.06 A	183 A	571.54 A
Cover Crop – Post-harvest Planting	330.04 A	164 A	505.22 A
P-Value	0.497	0.7837	0.728

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn, $0.20/lb cover crop seed ($11.20/ac), $14.40/ac for drilling for post-harvest treatment, and $8.25/ac for high-clearance applicator cost for pre-harvest treatment.

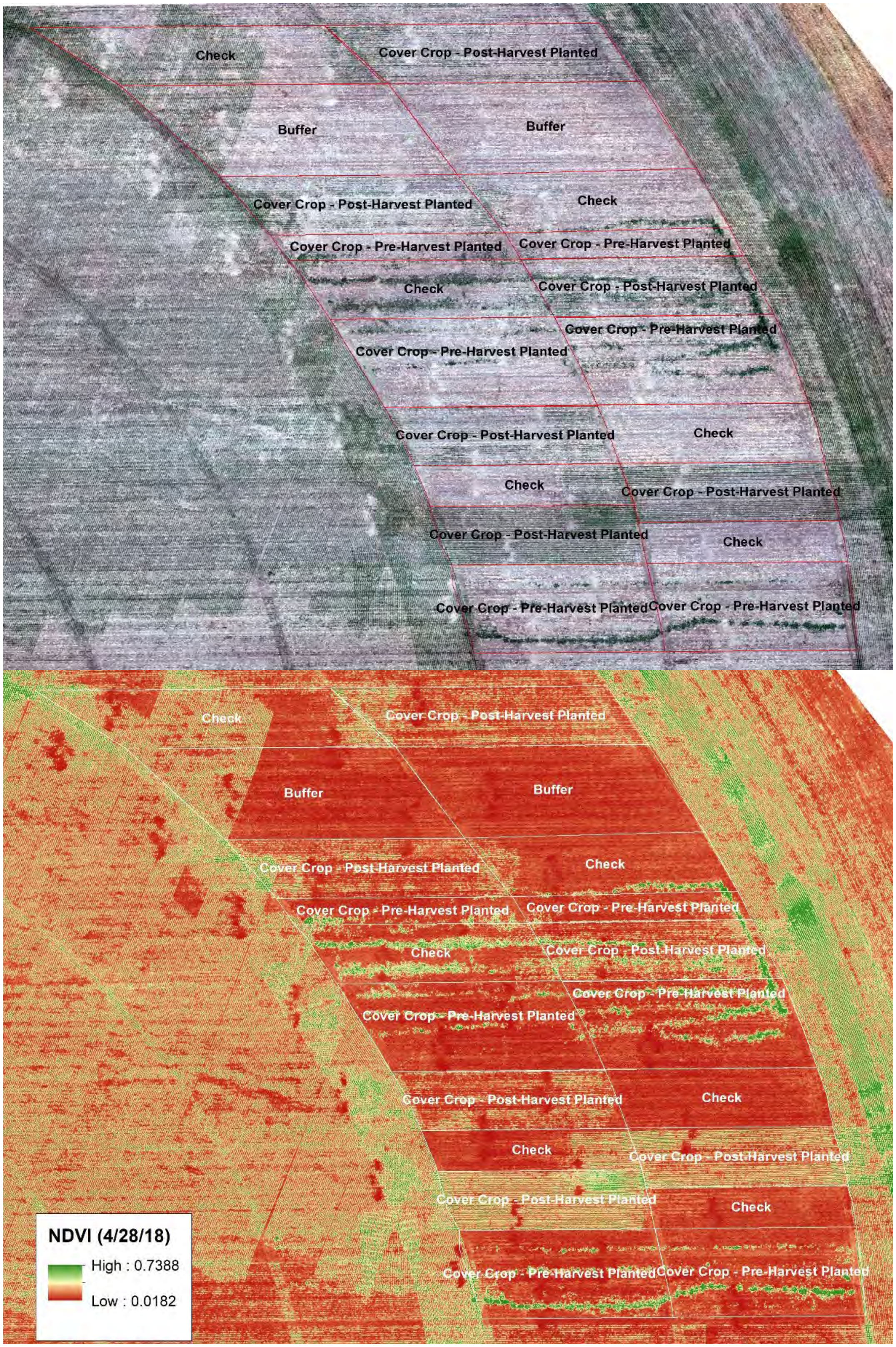


Figure 1. Aerial imagery from April 28, 2018. True color imagery (top) and normalized difference vegetative index (NDVI) (bottom). For NDVI, orange indicates little or no vegetation, green indicates greater vegetation.

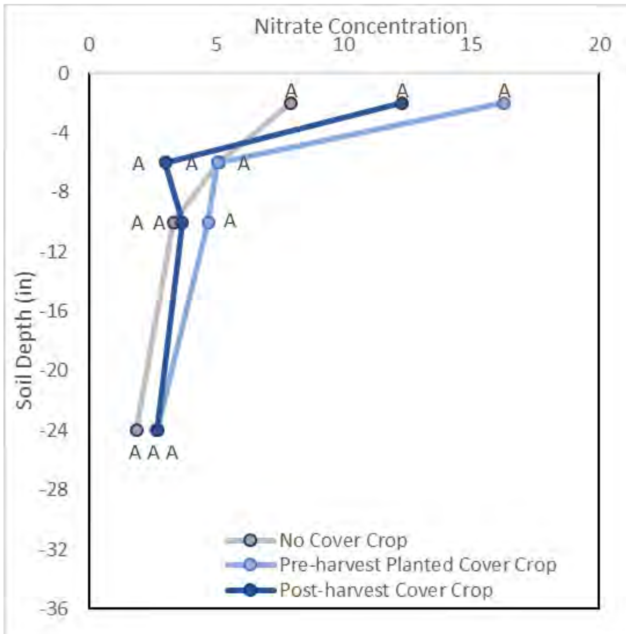


Figure 2. Cover crop effect on nitrate concentration measured on May 6, 2018.

Summary:

- Both the pre-harvest planted cover crop and post-harvest planted cover crop had low biomass production. There was no difference in biomass production between the two seeding approaches. Imagery from April 28, 2018 also showed low biomass production.
- There was no difference in nitrate concentration for any of the treatments at any of the depths evaluated.
- There was no difference between the three treatments for yield as determined by hand harvesting samples or net return.

Summary of Previous Year (Year 1 of 3)

Cereal rye cover crops were seeded at a rate of 56 lb/ac. The pre-harvest rye planting occurred on September 19, 2016, into standing corn using a high-clearance broadcast seeder. The post-harvest planted rye was drilled on November 3, 2016. In year one, soil biological activity was tested through the Solvita® CO2 Burst test (Figure 3). Nitrate concentration was also measured (Figure 4).

	Soybean Yield† (bu/ac)	Spring Cover Crop Biomass (lb/ac)	Marginal Net Return‡ ($/ac)
Check	82 A*	N/A	733.49 A
Cover Crop – Pre-harvest Planting	65 B	254.14 A	556.71 B
Cover Crop – Post-harvest Planting	66 AB	121.21 B	560.55 B
P-Value	0.0575	0.014	0.031

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $8.90/bu soybeans, $0.16/lb cereal rye seed cost, $8.13/ac high clearance applicator cost, and $17.16/ac drill cost.

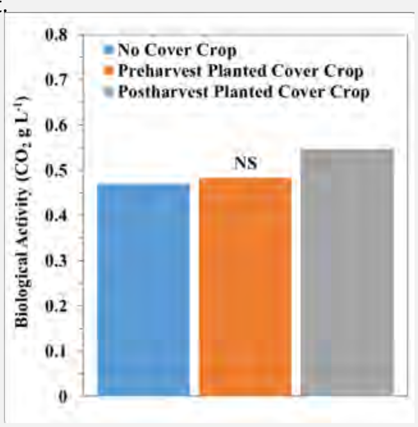


Figure 3. Rye cover crop planting date effect on soil biological activity. NS denotes no significant differences.

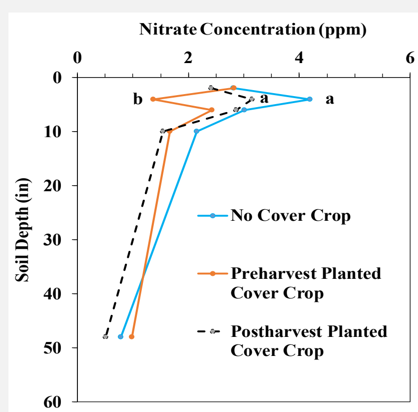


Figure 4. Cover crop planting date effect on nitrate concentration on a sandy site.

Integrating Cover Crops on Sloping Soils to Improve Water Quality and Soil Health

Study ID: 0742023201801
County: Butler
Soil Type: Aksarben silty clay loam; Yutan silty clay loam; Pohocco silty clay loam
Planting Date: 5/1/18
Harvest Date: 10/20/18, 10/21/18
Variety: Golden Harvest® GH3546X
Reps: 6
Previous Crop: Corn
Tillage: No-Till

Irrigation: None
Rainfall (in):

Introduction: The objective of this study was to evaluate the potential for cover crops to reduce water erosion of nutrients, improve water quality by reducing nitrate leaching, and enhance soil health in Nebraska corn/soybean production systems on sloping soils. The impact of cover crops on the subsequent crop yield was also evaluated.

This report is for year two of the three year project. Treatments are located on the same plots during each year of the study to monitor changes in soil erosion, water quality, and soil health over time. This study includes three treatments with six replications: check (no cover crop), pre-harvest planted cereal rye cover crop, and post-harvest planted cereal rye cover crop. The pre-harvest planted cover crop was seeded in late September 2017 with a high clearance broadcast inter-seeder; the post-harvest planted cover crop was seeded on November 23, 2017, with a drill. Cover crop treatments were seeded at a rate of 50 lb/ac.

Cover crop biomass was measured and soil samples were collected to determine nitrate concentration change with depth. Nitrate and cover crop biomass samples were collected on April 31, 2018, one day prior to soybean planting. Aerial imagery was also used to evaluate cover crop biomass. Cover crops were terminated on May 10, 2018. Yield data was collected by hand harvesting one 17.5-foot-long soybean row in the center of each plot on October 20, 2018. The plants plus the beans were harvested, dried in a forced-air oven, and then threshed. Grain was corrected for moisture content.

Results:

	Cover Crop Biomass (lb/ac)	Soybean Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	N/A	58 A	429.39 A
Cover Crop – Pre-harvest Planting	389.00 A*	61 A	432.63 A
Cover Crop – Post-harvest Planting	27.99 B	58 A	402.23 A
P-Value	0.007	0.799	0.695

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $7.40/bu soybean, $0.20/lb rye cover crop seed ($10/ac), $14.40/ac for drilling post-harvest treatments, and $8.25/ac for high clearance applicator for pre-harvest treatments.

Figure 1. Aerial imagery from April 28, 2018. True color imagery (top) and normalized difference vegetative index (NDVI) (bottom). For NDVI, orange indicates little or no vegetation and yellow indicates moderate vegetation.

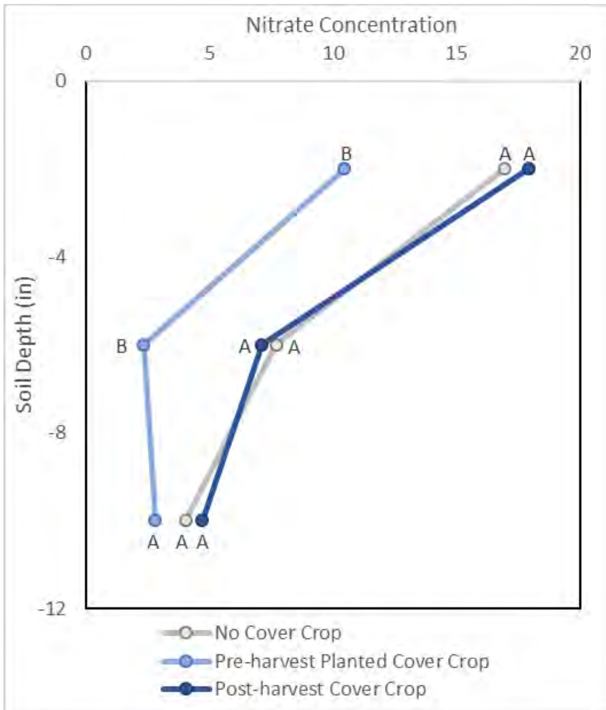


Figure 2. Cover crop effect on nitrate concentration measured on April 31, 2018.

Summary:

- Both the pre-harvest planted cover crop and post-harvest planted cover crop had low biomass production. The post-harvest planted cover crop had significantly lower biomass production than the pre-harvest planted cover crop. Imagery from April 28, 2018, also showed the pre-harvest planted cover crop had greater biomass production than the post-harvest planted cover crop.
- The pre-harvest planted cover crop had significantly lower nitrate concentration at both the 0-4" depth and 4-8" depth.
- There was no difference in yield as determined by hand harvesting samples.
- There was no difference in net return.

Summary of Previous Year (Year 1 of 3)

Cereal rye cover crops were seeded at a rate of 50 lb/ac. The pre-harvest rye planting occurred on October 3, 2016, into standing soybean using a high-clearance broadcast seeder. The post-harvest planted rye was drilled on October 24, 2016. In year one, soil biological activity was tested through the Solvita® CO2 Burst test (Figure 3).

	Corn Yield† (bu/ac)	Cover Crop Biomass (lb/ac)	Marginal Net Return‡ ($/ac)
Check	251 A*	N/A	789.24 A
Cover Crop – Pre-harvest Planting	241 A	2,727 A	741.54 A
Cover Crop – Post-harvest Planting	257 A	2,318 A	781.81 A
P-Value	0.8745	0.3159	0.867

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.15/bu corn, $0.19/lb cover crop seed cost, $8.13/ac high clearance applicator cost, and $17.16/ac drill cost.

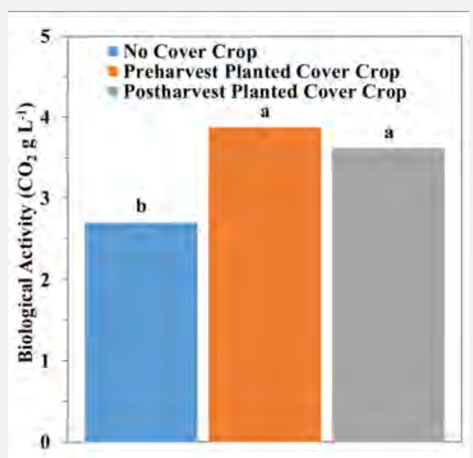


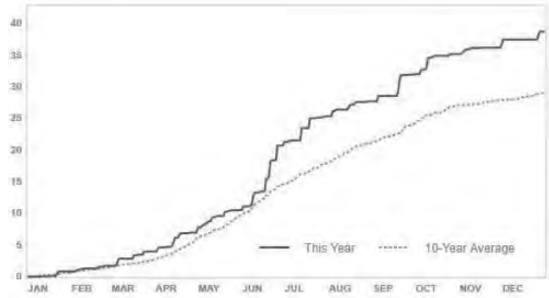
Figure 3. Rye cover crop planting date effect on soil biological activity in a sloping silty clay loam soil in Nebraska.

Complete year 1 report is available online at: http://resultsfinder.unl.edu/

Grazed versus Non-grazed Cover Crop

Study ID: 0719107201801
County: Knox
Soil Type: Trent silt loam 0-2% slope; Nora silt loam 2-6% slopes; Moody loam 0-2% slope; Moody loam 2-6% slopes; Paka loam 11-20% slopes; Alcester silty clay loam 2-6% slopes
Planting Date: 11/4/17
Harvest Date: 7/24/18
Population: 2 bu/ac
Reps: 10
Previous Crop: Field Peas
Tillage: No-Till

Irrigation: None
Rainfall (in):



Introduction: This study is being conducted on a soil health demonstration farm as part of the Nebraska USDA/Natural Resource Conservation Service's (NRCS) Soil Health Initiative, and involves the farmer, the Nebraska On-Farm Research Network, and the USDA/NRCS. Two treatments are being evaluated in this five-year study: grazed cover crop/forage and non-grazed cover crop. The field was divided into plots approximately 2 acres in size that were assigned as grazed or non-grazed. These plots will be maintained throughout the project.

On October 15, 2016, following corn harvest, cover crops were planted and the grazed treatments had 100 head of cows grazing for 1 week in April 2017. Field peas were then planted on April 20, 2017 and harvested on July 26, 2017. Cover crops were again planted July 30, 2017 and 180 head of cows grazed from October 20, 2017 through October 28, 2017 in the grazed treatments. Dry forage production was 9,380 lb/ac.

2016 Cover Crop Mix (10/15/16):

Species	Rate (lb/ac)
Austrian Winter Pea	10
Hairy Vetch	5.5
Cereal Rye	13.6
Siberian Kale	0.5
Trophy Rape seed	0.5
Impact Forage Collard	0.5
Purple Top Turnip	0.5
African Cabbage	0.5
Barley	10.2
Triticale	15.2
TOTAL	**57**

2017 Cover Crop Mix (planted 7/30/17):

Species	Rate (lb/ac)
Cowpea	2.0
Sudan-Sorghum hybrid	7.0
Pearl Millet	3.0
Spring Oats	4.0
Annual Ryegrass	4.0
Sunflower	3.0
Safflower	1.5
Buckwheat	3.0
Sunn Hemp	1.0
Winter Lentil	1.5
Forage Collards	1.0
Chickling Vetch	2.0
TOTAL	**33.0**

Winter wheat was planted on November 4, 2017, at a rate of 2 bu/ac. Wheat was harvested July 27, 2018. Winter wheat yield was evaluated for grazed versus non-grazed cover crop treatments. A 30' buffer was applied to the treatments to adjust for GPS drift when laying out fences and recording yield data.

Soil Quality Measures 2016 (Baseline):

	Bulk Density (g/cm^3)	NRCS Soil Health Assessment Worksheet Field Indicator Score
Cover Crop—Non-grazed	1.23	2.45
Cover Crop—Grazed	1.21	2.48

Soil Quality Measures 2018:

	Bulk Density (g/cm^3)	NRCS Soil Health Assessment Worksheet Field Indicator Score
Cover Crop—Non-grazed	0.98	2.80
Cover Crop—Grazed	0.96	2.75

Soil Health Test: Soil health samples from 2016, 2017, and 2018. Two samples were collected each year, one in each treatment.

Treatment	OM %	Solvita CO2 Burst (ppm)	Total Nitrogen (ppm)	Organic Nitrogen (ppm)	Total Organic Carbon (ppm)	Nitrate (ppm)	Ammonium (ppm)	Inorganic Nitrogen (ppm)	Organic C : N	Organic Nitrogen Release (ppm)	Soil Health Score
2016 Non-grazed	3.0	90.2	23.7	15.2	185	7.8	0.5	8.3	12.2	15.2	10.8
2016 Grazed	2.9	41.5	22.5	14.5	178	7.3	1.2	8.5	12.3	9.5	6.6
2017 Non-grazed	3.7	24.0	29.6	14.5	142	13.6	0.4	14.0	9.8	9.9	6.7
2017 Grazed	3.7	41.0	27.8	13.3	137	12.6	0.6	13.2	10.3	13.3	8.2
2018 Non-grazed	3.5	60.0	12.8	9.3	130	3.0	2.1	5.1	13.9	9.3	9.5
2018 Grazed	3.4	81.8	12.5	9.0	117	2.5	2.6	5.1	13.0	9.0	11.4

2018 Wheat Yield:

	Yield† (bu/acre)
Cover Crop—Non-grazed	46 A*
Cover Crop—Grazed	47 A
P-Value	0.220

*Values with same letters are not significantly different at 90% confidence level.
†Yield values are from cleaned yield monitor data.

Summary: There was no wheat yield difference for the grazed versus non-grazed treatment. Soil quality parameters will continue to be monitored.

Effects of Grazing Cover Crops in a Three-year Non-Irrigated Rotation

Study ID: 0720129201801
County: Nuckolls
Soil Type: Hastings silt loam 0-1% slope; Hastings silt loam 1-3% slope
Planting Date: 4/29/18
Harvest Date: 10/22/18
Population: 140,000
Row Spacing (in): 15
Variety: Asgrow® 28X7
Reps: 4
Previous Crop: Corn
Tillage: No-Till
Herbicides: ***Pre:*** Fierce® and Roundup® ***Post:*** XtendiMax® and Roundup®
Seed Treatment: Inoculant and fungicide

Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: None
Irrigation: None
Rainfall (in):

Introduction: This is the second year of this study. In rainfed systems with limited precipitation, adding cover crops into the rotation can decrease yields; however the use of these cover crops for forage may offset the costs while retaining soil benefits. This study evaluated three treatments: grazed cover crop (or stubble depending on year of rotation), non-grazed cover crop, and non-grazed stubble. In 2016, cover crops were planted and the grazed treatment was grazed in the fall of 2016. Baseline soil samples were taken in April 2017, prior to planting corn (Table 1). Stand counts, yield, grain moisture and marginal net return were collected for each cash crop. Following corn harvest in 2017, no cover crops were planted. In the previously established grazed cover crop treatment, cattle grazed on the corn stalks. The two previously established non-grazed treatments remained non-grazed. Soybeans were planted in 2018 across all treatments. In August, the grazed treatment showed greater moisture stress than the non-grazed treatments (Figure 1).

Table 1. Soil analysis taken prior to corn planting in April 2017.

	0 to 8 inches			
	Soil pH	**OM %**	**Nitrate-N ppm**	**Nitrogen lb N/A**
Cover Crop – Non-grazed	5.52 A	3.1 A	5.4 B	9.3 B
Cover Crop/Stubble – Grazed	5.68 A	3.1 A	7.3 B	12.6 B
Stubble – Non-grazed	5.40 A	3.1 A	12.9 A	24.5 A
P-Value	0.38	0.90	0.01	<0.01

	0 to 4 inches				
	Solvita CO2-C (ppm)	**Total Biomass (ng/g)**	**Total Bacteria Biomass (ng/g)**	**Total Fungi Biomass (ng/g)**	**Diversity Index**
Cover Crop – Non-grazed	133 A	4,225 A	2,187 A	351 A	1.44 A
Cover Crop/Stubble – Grazed	161 A	3,927 AB	2,142 A	333 A	1.44 A
Stubble – Non-grazed	128 A	3,046 B	1,605 A	306 A	1.5 A
P-Value	0.19	0.09	0.12	0.90	0.90

*Values with the same letter are not significantly different at a 90% confidence level.

Figure 1. August 3, 2018 image with grazed treatment (cover crop in 2016 and stubble in 2017) showing greater moisture stress.

2018 Results:

	Stand Count (plants/ac)	Test Weight	Moisture (%)	Soybean Yield† (bu/ac)
Cover Crop—Non-grazed	120,750 A*	55 A	10.7 B	50 A
Cover Crop/Stubble—Grazed	120,500 A	55 A	11.0 A	40 B
Stubble—Non-grazed	117,750 A	55 A	10.6 C	52 A
P-Value	0.629	0.397	0.0002	0.0004

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 13% moisture for soybeans.

Summary:

- For the 2018 soybean crop, there were no differences in test weight or stand counts between the three treatments. Grain moisture was significantly higher for the grazed cover crop treatment, followed by the non-grazed cover crop treatment, then the non-grazed wheat stubble. Yield of the non-grazed treatments was 10-12 bu/ac higher than for the grazed cover crop treatment.
- The study will continue in 2019, with the cash crop rotating back to wheat. A three-year economic analysis will be conducted after the completion of the third year.

Summary of Previous Year (Year 1)

In year one of the study, cover crop treatments were planted on August 14, 2016, following wheat harvest and consisted of a mix of winter peas, spring triticale, oats, collards, and purple top turnip. Cover crop biomass measured on October 19, 2016, was 3,401 lb/ac and consisted mainly of grass and turnip (Table 1). The grazed treatment was grazed in the fall of 2016. Starting in November 2016, twenty-eight (1,100 lb) first-calf heifers grazed 9.6 acres for 22 days, resulting in the cover crop carrying 2.4 animal unit month (AUM)/ac. Post-grazing 2,177 lb/ac of biomass was still present.

Table 1. Cover crop composition (% of biomass on DM basis).

Grass	53.5%
Winter Pea	1.5%
Collards	8.7%
Turnip Tops	20.9%
Turnip Bottoms	14.5%
Other	0.9%

During March through May 2017, prior to planting corn, the cover crop treatments were around 35% depletion (the typical trigger point for irrigation on these soil types) while the wheat stubble treatments remained near field capacity (full soil moisture profile). Corn was planted in 2017 across all treatments. In May 2017, 8” of rain recharged the soil profile and all treatments had a full 4’ soil moisture profile at the beginning of June. Therefore, the cover crop treatments did not result in lower beginning moisture, which could limit yield potential. The grazed treatments began to show greater soil moisture depletion than the ungrazed treatments as time progressed. In June 2017, it was observed that the grazed treatments had concentrations of palmer amaranth where the cattle created trails walking the electric fence.

2017 Results:

	Stand Count (plants/ac)	Moisture (%)	Test Weight	Corn Yield (bu/ac)†
Cover Crop—Non-grazed	22,500 A	15.0 A	61 A	213 A
Cover Crop/Stubble—Grazed	22,167 A	14.9 A	61 A	211 A
Stubble—Non-grazed	22,500 A	15.2 A	61 A	218 A
P-Value	0.952	0.129	0.267	0.141

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture for corn.

For the 2017 corn crop, no significant yield differences occurred among treatments. Corn yield where the cover crop was planted and not grazed (213 bu/ac) did not differ from where it was grazed (211 bu/ac).

EQUIPMENT

- Impact of Planting Corn with Active Down Force versus Constant Down Force on Corn Yield
- Impact of Row Cleaners on Corn Yield
- Impact of SOILPAM™ TRACKLOG on Center Pivot Irrigation Track Rut Depth

Impact of Planting Corn with Active Down Force versus Constant Down Force on Corn Yield

Study ID: 0085141201803
County: Platte
Soil Type: Grigston silt loam wet sub-stratum
Planting Date: 4/27/18
Harvest Date: 10/30/18
Population: 41,200
Row Spacing (in): 30
Hybrid: Dekalb® DKC 63-21
Reps: 7 (3 for stand counts)
Previous Crop: Corn
Tillage: Ridge-Till
Herbicides: ***Pre:*** 2 qt/ac Degree Extra®, 40 oz/ac Roundup®, and 6 oz/ac Sterling Blue® in mid-May
Post: 56 oz/ac Halex®, 1 pt/ac Atrazine, and 16 oz/ac Roundup® in mid-June
Seed Treatment: Acceleron® Basic 500
Foliar Insecticides: None
Foliar Fungicides: None

Fertilizer: 100 lb/ac Urea, 50 lb/ac K-Mag®, and 25 lb/ac Potash on 4/10/18; 5 gal/ac Kugler 6-24-6-1S with 1 pt/ac Micro Max® in-furrow and 5 gal/ac ATS and 5 gal/ac 32% UAN on 4/27/18; 160 lb/ac N from NH3 sidedress on 6/4/18
Irrigation: Gravity, Total: 2"
Rainfall (in):

Introduction: The purpose of this study was to evaluate Precision Planting® DeltaForce active depth control versus a constant down force. The DeltaForce averaged around 90 lb while the constant down force was set at 180 lb.

Results:

	Stand Count (plants/ac)	Moisture (%)	Yield† (bu/acre)
Constant Downforce	36,167 A*	15.3 A	274 A
Active Downforce	36,722 A	15.2 B	275 A
P-Value	0.214	0.004	0.327

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 15.5% moisture.

Summary:

- There was no difference in stand counts or yield between the traditional, constant down force and the Precision Planting® DeltaForce down force.
- No marginal net return calculation is provided for the DeltaForce units as this depends on the number of acres the system is used on and the number of years this cost is spread over. The cost for an individual row unit is around $1,500.

Impact of Row Cleaners on Corn Yield

Study ID: 0136109201803
County: Lancaster
Soil Type: silty clay loam; silt loam
Planting Date: 4/28/18
Harvest Date: 10/4/18
Hybrid: Pioneer® P1197AM
Reps: 9
Tillage: No-Till
Herbicides: ***Pre:*** Bicep II Magnum® ***Post:*** Roundup® and Callisto®
Foliar Insecticides: None
Foliar Fungicides: None

Irrigation: None
Rainfall (in):

Introduction: The purpose of this study was to evaluate the impact of row cleaners on corn yield. Corn was planted with and without row cleaners. The field is in no-till practice and had a rye cover crop that was terminated mid-May at about one foot tall after corn was planted. Yield and moisture were evaluated.

Results:

	Moisture (%)	Yield† (bu/acre)
Planting without Row Cleaners	15.4 A*	193 A
Planting with Row Cleaners	15.5 A	195 A
P-Value	0.312	0.134

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and no cost for row cleaners. This cost will depend on number of units and number of years used.

Summary:

- There was no difference in yield or moisture.
- No net return calculation is provided as this would depend on the cost of row cleaners, number of planter units, and number of years costs would be spread over.

Impact of SOILPAM™ TRACKLOG on Center Pivot Irrigation Track Rut Depth

Study ID: 0290181201801
County: Webster and Franklin
Reps: 25
Irrigation: Pivot

Introduction: SOILPAM™ TRACKLOGS, marketed by EarthChem, are solid polyacrylamide (PAM) contained in a plastic mesh bag. The bags are installed between the wheels of pivot irrigation system towers. As irrigation water and rain strike the bag, the PAM slowly melts and drips to the ground into the pivot wheel track. PAM is a synthetic polymer that acts as a strengthening agent and soil binder. The treated soil particles become larger and heavier, making them harder for water to move them.

TRACKLOGS were installed to center pivot irrigation system towers and monitored in 5 fields in 2017 and 3 fields in 2018. The fields were located in Webster and Franklin counties. The participating farmers were instructed to install TRACKLOGS between the wheels of selected towers of their pivot system. The pivot was then operated as normal. The depth of all wheel tracks were measured after harvest by collecting three subsamples in each tower span. Rut depth from towers with TRACKLOGS were compared to towers without.

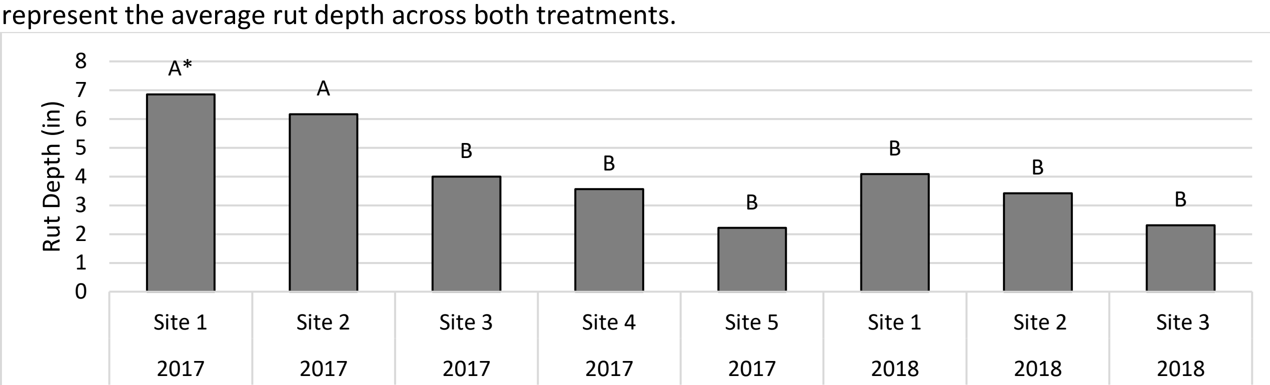
Results: Data were analyzed using the GLIMMIX procedure in SAS 9.4 (SAS Institute Inc., Cary, NC). Mean separation was performed with Tukey's HSD. There was no interaction between the site and the treatment (site x treatment P=0.1814); therefore, these factors are reported separately.

SOILPAM™ TRACKLOGS Treatment:

	Rut Depth (in)
Check	4.3 A*
SOILPAM™ TRACKLOG on Pivot Tower	3.8 A
P-Value	0.113

*Values with the same letter are not significantly different at a 90% confidence interval.

Figure 1. Differences in rut depth between the testing sites. Because there was no difference in rut depth for the SOILPAM™ TRACKLOG treatment and the untreated check, the rut depths reported by site represent the average rut depth across both treatments.



*Values with the same letter are not significantly different at a 90% confidence level.

Summary:

- There was no difference in rut depth where SOILMAP™ TRACKLOGS were used versus where they were not used.
- There were differences in rut depth between the sites tested.

GROWTH PROMOTERS

- Ag Concepts® EnVigor at Two Rates on Irrigated Soybeans
- Impact of Acceleron® QuickRoots® on Corn (3 sites)
- Impact of Conklin® Amplify-D® on Corn (4 sites)

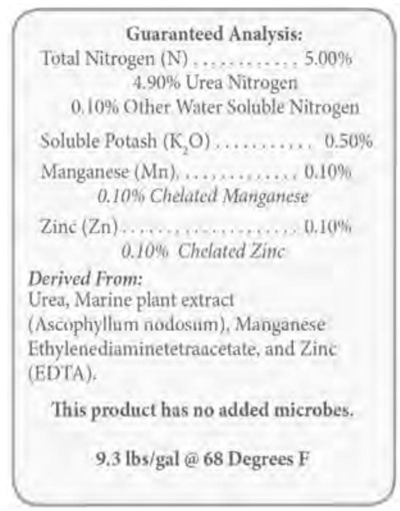
Ag Concepts® EnVigor at Two Rates on Irrigated Soybeans

Study ID: 0085141201802
County: Platte
Soil Type: Gibbon silt loam occasionally flooded
Planting Date: 5/9/18
Harvest Date: 9/27/18
Population: 130,000
Row Spacing (in): 30
Variety: Asgrow® 27X8
Reps: 4
Previous Crop: Corn
Tillage: Two passes with rolling stalk chopper
Herbicides: ***Pre:*** 3 oz/ac Fierce® and 32 oz/ac Roundup® on 5/11/18 ***Post:*** 6 oz/ac Section® 3, 32 oz/ac Roundup®, and 12 oz/ac Flexstar® on 6/5/18
Seed Treatment: Acceleron® Basic 500
Foliar Insecticides: 1 pt/ac manganese on 6/5/18
Foliar Fungicides: Trivapro® on 8/1/18

Fertilizer: 100 lb/ac MicroEssentials® SZ™ on 04/10/18; 8 gal/ac 8-20-5-5S-0.5Zn with planter on 5/9/18
Note: Hailed 6/6/18 with 30% node loss uniform across field (adjuster estimated 10-20% yield loss)
Irrigation: Gravity, Total: 6"
Rainfall (in):

Introduction: Ag Concepts® EnVigor is a foliar product for soybeans. The goal of EnVigor is to increase pod set and therefore yield. EnVigor contains nitrogen, potash, manganese, and zinc (product information is at right). EnVigor was applied on July 8, 2018. Two application rates were evaluated: a low rate of 1 qt/ac and a high rate of 2 qt/ac. Both rates were applied with 10 gal water/qt product. These two rates were compared to an untreated check.

Pod counts were collected for the study by evaluating number of pods on 10 consecutive plants. This was repeated in four locations in each treatment strip, for a total of 40 plants counted per treatment strip. Harvest stand counts, yield, grain moisture, and test weight were also evaluated.


Guaranteed Analysis:
Total Nitrogen (N) 5.00%
4.90% Urea Nitrogen
0.10% Other Water Soluble Nitrogen
Soluble Potash (K_2O) 0.50%
Manganese (Mn) 0.10%
0.10% Chelated Manganese
Zinc (Zn) 0.10%
0.10% Chelated Zinc
Derived From:
Urea, Marine plant extract (Ascophyllum nodosum), Manganese Ethylenediaminetetraacetate, and Zinc (EDTA).
This product has no added microbes.
9.3 lbs/gal @ 68 Degrees F

Product information from: Ag Concepts®

Results:

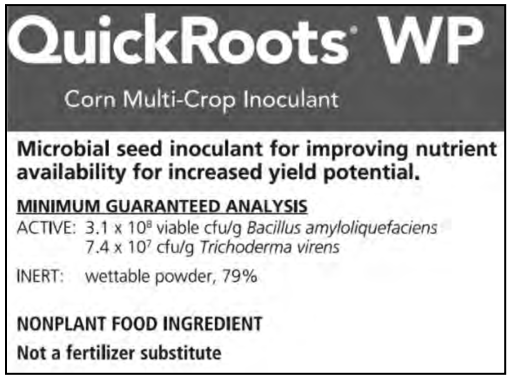
	Harvest Stand Count (plant/ac)	Pods/ plant	Moisture (%)	Test Weight	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	96,989 A*	43 AB	13.5 A	55 A	76 A	563.44 A
Ag Concepts® EnVigor Low Rate	98,948 A	38 B	13.5 A	55 A	78 A	558.26 A
Ag Concepts® EnVigor High Rate	97,207 A	45 A	13.3 A	55 A	76 A	534.18 B
P-Value	0.867	0.109	0.861	0.759	0.116	0.007

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $7.40/bu soybean, $9/qt EnVigor, and $6.84/ac product application cost.

Summary:
- There were no differences in moisture, test weight, harvest stand counts, or yield between the low rate, high rate, and untreated check. This is consistent with the findings of this study in 2017; however, in 2017 the field received severe hail damage.
- There were differences noted in pods per plant. The high rate of EnVigor had a greater number of pods per plant than the low rate of EnVigor. Neither the high rate nor the low rate had a significantly different number of pods than the untreated check.
- The marginal net return was lower for the high rate of EnVigor due to increased production costs.

Impact of Acceleron® QuickRoots® on Corn Summary (3 sites)

The objective of this study was to evaluate Acceleron® QuickRoots® microbial seed inoculant on corn. The product was applied to the seed at a rate of 16 grams per unit of seed. The minimum guaranteed analysis is below.



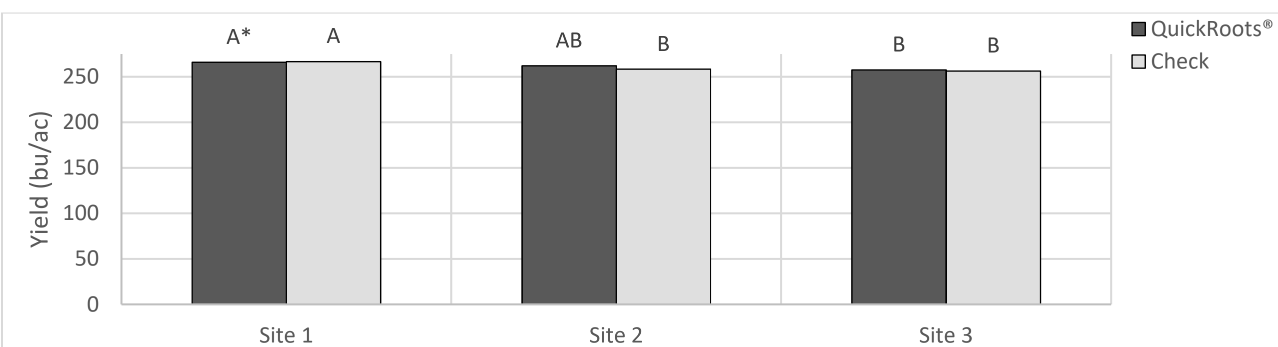
Product information from: http://www.acceleronsas.com/Documents/Labels/114018S5-87_QuickRootsWPCornMC_Specimen_Post.pdf

Three studies were conducted in 2018 for a total of 44 replications. Data from these studies were analyzed together using the GLIMMIX procedure in SAS 9.4 (SAS Institute Inc., Cary, NC). Mean separation was done with Tukey's HSD.

Table 1. Yield of corn with and without Acceleron® QuickRoots® from three site locations.

	Yield (bu/acre)†
Check	260.5 A*
QuickRoots®	261.8 A
Site (P>F)	*0.0001*
Treatment (P>F)	*0.1253*
*Site*Treatment*	*0.0921*

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.



*Values with the same letter are not significantly different at a 90% confidence level.

Figure 1. Yield response to QuickRoots® for three sites in 2018. There was a site by treatment interaction. Bars with the same letter are not significantly different at a 90% confidence level.

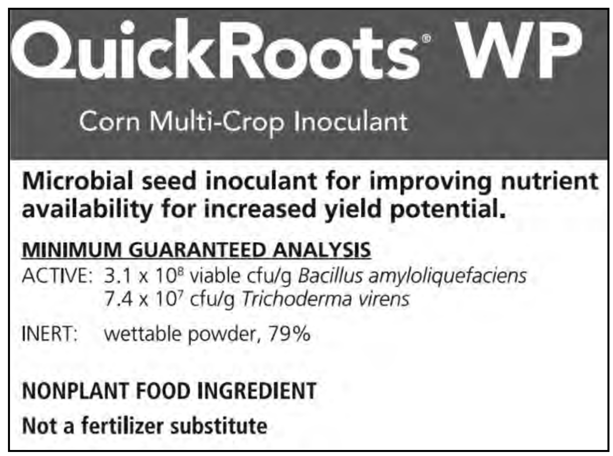
Summary: There was no yield increase for using QuickRoots® when all three sites are considered together. There was a site by treatment interaction; this is presented in Figure 1.

Impact of QuickRoots® on Corn

Study ID: 0085141201804
County: Platte
Soil Type: Gibbon silt loam occasionally flooded; Lawet silt loam occasionally flooded
Planting Date: 4/27/18
Harvest Date: 10/24/18
Population: 33,500
Row Spacing (in): 30
Hybrid: Dekalb® DKC 63-21
Reps: 13
Previous Crop: Corn
Tillage: Ridge-Till
Seed Treatment: Acceleron® Basic 500
Herbicides: ***Pre:*** 2 qt/ac Degree Extra®, 40 oz/ac Roundup®, and 6 oz/ac Sterling Blue® in mid-May ***Post:*** 56 oz/ac Halex®, 1 pt/ac Atrazine, and 16 oz/ac Roundup® in mid-June

Fertilizer: 100 lb/ac Urea, 50 lb/ac K-Mag® and 25 lb/ac Potash on 4/10/18; 5 gal/ac Kugler 6-24-6-1S with 1 pt/ac Micro Max® in-furrow and 5 gal/ac ATS and 5 gal/ac 32% UAN on 4/27/18; 160 lb/ac N from NH3 sidedress on 6/4/18
Irrigation: Gravity, Total: 5”
Rainfall (in):

Introduction: The objective of this study was to evaluate Acceleron® QuickRoots® microbial seed inoculant on corn. The product was applied to the seed at a rate of 16 grams per unit of seed. The minimum guaranteed analysis is at right.



Product information from: http://www.acceleronsas.com/Documents/Labels/114018S5-87_QuickRootsWPCornMC_Specimen_Post.pdf

Results:

	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	14.7 A*	256 A	827.98 A
QuickRoots®	14.8 A	257 A	825.13 A
P-Value	0.295	0.587	0.652

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and $15/unit of corn for QuickRoots (resulting in cost of $6.28/ac at a planting rate of 33,500 seed/ac).

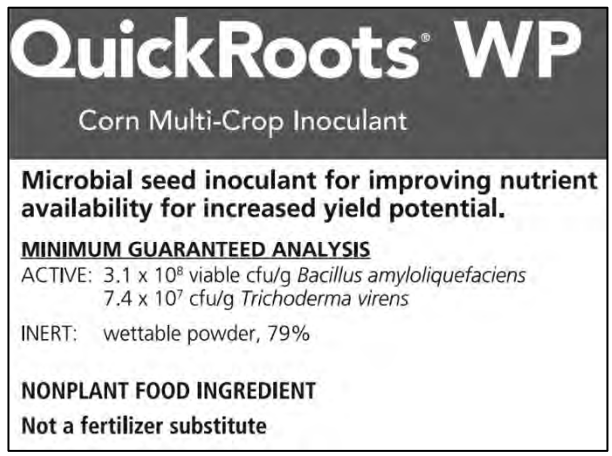
Summary: There was no difference in grain moisture, yield, or net return between the QuickRoots® treatment and untreated check.

Impact of QuickRoots® on Corn

Study ID: 0085141201805
County: Platte
Soil Type: Janude fine sandy loam 0-1% slope; Lawet silt loam occasionally flooded
Planting Date: 4/30/18
Harvest Date: 10/3/18 and 10/4/18
Population: 34,680
Row Spacing (in): 30
Hybrid: Dekalb® DKC 60-88
Reps: 15
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** 2 qt/ac Degree Extra®, 40 oz/ac Roundup®, and 6 oz/ac Sterling Blue® in mid-May
Post: 56 oz/ac Halex®, 1 pt/ac Atrazine, and 16 oz/ac Roundup® in mid-June

Seed Treatment: Acceleron® Basic 500
Fertilizer: 100 lb/ac MicroEssentials® SZ™ 12-4-0-10S-1ZN; 130 lb/ac N from sidedress UAN 32%
Irrigation: Pivot, Total: 5”
Rainfall (in):

Introduction: The objective of this study was to evaluate Acceleron® QuickRoots® microbial seed inoculant on corn. The product was applied to the seed at a rate of 16 grams per unit of seed. The minimum guaranteed analysis is at right.



Product information from: http://www.acceleronsas.com/Documents/Labels/114018S5-87_QuickRootsWPCornMC_Specimen_Post.pdf

Results:

	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	18.77 B*	267 A	861.32 A
QuickRoots®	18.84 A	266 A	852.27 B
P-Value	0.051	0.403	0.009

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and $15/unit of corn for QuickRoots (resulting in cost of $6.50/ac at a planting rate of 34,680 seed/ac).

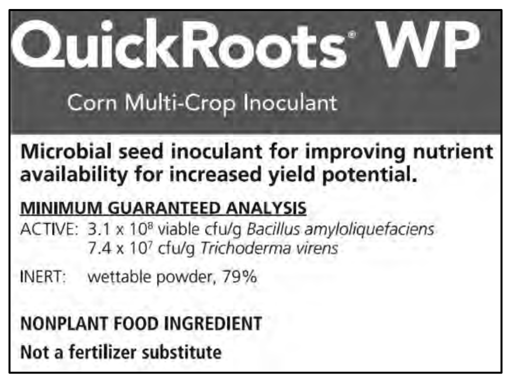
Summary:
- Grain moisture was higher for QuickRoots® than for the untreated check.
- There was no difference in yield between the two treatments.
- The QuickRoots® treatment had a lower net return due to the increased cost of production.

Impact of QuickRoots® on Corn

Study ID: 0085141201806
County: Platte
Soil Type: Grigston silt loam wet sub-stratum; Gibbon silt loam occasionally flooded
Planting Date: 4/27/18
Harvest Date: 10/30/18
Population: 37,080 (south 1/3 of field) and 41,200 (north 2/3 of field) and the treatments (QuickRoots® and check) were equally represented in each population area
Row Spacing (in): 30
Hybrid: Dekalb® DKC 63-21
Reps: 16 (only 4 reps for stand counts)
Previous Crop: Corn
Tillage: Ridge-Till
Herbicides: ***Pre:*** 2 qt/ac Degree Extra®, 40 oz/ac Roundup®, and 6 oz/ac Sterling Blue® in mid-May ***Post:*** 56 oz/ac Halex®, 1 pt/ac Atrazine, and 16 oz/ac Roundup® in mid-June
Seed Treatment: Acceleron® Basic 500
Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: 100 lb/ac Urea, 50 lb/ac K-Mag® and 25 lb/ac Potash on 4/10/18; 5 gal/ac Kugler 6-24-6-1S with 1 pt/ac Micro Max® in-furrow and 5 gal/ac ATS and 5 gal/ac 32% UAN on 4/27/18; 160 lb/ac N from NH3 sidedress on 6/4/18
Irrigation: Gravity, Total: 2”
Rainfall (in):

Introduction:

The objective of this study was to evaluate Acceleron® QuickRoots® microbial seed inoculant on corn. The product was applied to the seed at a rate of 16 grams per unit of seed. The minimum guaranteed analysis is at right.



Product information from: http://www.acceleronsas.com/Documents/Labels/114018S5-87_QuickRootsWPCornMC_Specimen_Post.pdf

Results:

	Early Season Stand Count (plants/ac)	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	34,167 A*	14.9 A	258 B	834.47 A
QuickRoots®	32,125 B	14.9 A	262 A	839.43 A
P-Value	0.070	0.436	0.026	0.319

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and $15/unit of corn for QuickRoots (resulting in cost of $6.95/ac at a planting rate of 37,080 seed/ac).

Summary:

- The untreated check had a higher stand count than the QuickRoots® treatment.
- There was no difference in moisture between the two treatments.
- Yield was 4 bu/ac greater for the QuickRoots® treatment.
- There was no difference in net return.

Impact of Conklin® Amplify-D® on Corn Summary (4 sites)

The purpose of this study was to evaluate Conklin® Amplify-D® on corn. Amplify-D® was applied at a rate of 1.5 oz/ac in the planter box. The guaranteed analysis is below.

Guaranteed analysis:	
Total Nitrogen (N)	2.0%
Available Phosphoric Acid (P_2O_5)	10.0%
Calcium (Ca)	1.0%
Iron (Fe)	2.0%
Manganese (Mn)	0.5%
Zinc (Zn)	2.0%
Nutrients from:	Disodium Phosphate, Adenosine Monophosphate (AMP), Monosodium Phosphate, Calcium Carbonate, Ferrous Sulfate, Manganese Sulfate and Zinc Sulfate

Product information from: https://www.conklin.com/mwdownloads/download/link/id/175/

Four studies were conducted in 2018 for a total of 81 replications. Data from these studies were analyzed together using the GLIMMIX procedure in SAS 9.4 (SAS Institute Inc., Cary, NC). Mean separation was done with Tukey's HSD.

Table 1. Yield of corn with and without Conklin® Amplify-D® from four site locations.

	Yield (bu/acre)†
Check	236.1 A*
Amplify-D®	235.9 A
Site (P>F)	*<0.0001*
Treatment (P>F)	*0.7783*
*Site*Treatment*	*0.2241*

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.

Summary: There was no yield increase for using Amplify-D® when all four sites are considered together. The sites did have significantly different yields from each other (site term is statistically significant). There was no interaction of site and treatment.

Impact of Conklin® Amplify-D® on Corn

Study ID: 0085141201807
County: Platte
Soil Type: Grigston silt loam wet sub-stratum; Boel fine sandy loam occasionally flooded
Planting Date: 4/30/18
Harvest Date: 9/26/18
Population: 34,000 and 36,000 (the treatments – Conklin® Amplify-D® and the untreated check – were equally represented in each population)
Row Spacing (in): 30
Hybrid: Dekalb® DKC 59-50
Reps: 24
Previous Crop: Soybean
Tillage: Ridge-Till
Herbicides: ***Pre:*** 2 qt/ac Degree Extra®, 40 oz/ac Roundup®, and 6 oz/ac Sterling Blue® in mid-May
Post: 56 oz/ac Halex®, 1 pt/ac Atrazine, and 16 oz/ac Roundup® in mid-June

Seed Treatment: Acceleron® Basic 500
Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: 100 lb/ac MicroEssentials® SZ™ 12-4-0-10S-1Zn; 130 lb/ac N from sidedress NH3
Irrigation: Gravity, Total: 2”
Rainfall (in):

Introduction: This study was evaluating Conklin® Amplify-D® on corn. Amplify-D® was applied at a rate of 1.5 oz/ac in the planter box. The guaranteed analysis is below.

Guaranteed analysis:

Total Nitrogen (N)	2.0%
Available Phosphoric Acid (P_2O_5)	10.0%
Calcium (Ca)	1.0%
Iron (Fe)	2.0%
Manganese (Mn)	0.5%
Zinc (Zn)	2.0%
Nutrients from:	Disodium Phosphate, Adenosine Monophosphate (AMP), Monosodium Phosphate, Calcium Carbonate, Ferrous Sulfate, Manganese Sulfate and Zinc Sulfate

Product information from: https://www.conklin.com/mwdownloads/download/link/id/175/

Results:

	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	17.8 A*	257 B	830.88 A
Conklin® Amplify-D®	17.8 A	259 A	833.55 A
P-Value	0.453	0.034	0.190

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and $1.80/ac for the Amplify-D®.

Summary:

- There was no moisture difference between the untreated check and the Amplify-D® treatment.
- Yield was 1.4 bu/ac greater for the Amplify-D® treatment.
- There was no difference in marginal net return between the treatment with Amplify-D® and the untreated check.

Impact of Conklin® Amplify-D® on Corn

Study ID: 0085141201808
County: Platte
Soil Type: Gibbon-Gayville silty clay loam occasionally flooded; Grigston silt loam wet sub-stratum
Planting Date: 5/8/18
Harvest Date: 10/15/18 and 10/16/18
Population: 32,960
Row Spacing (in): 30
Hybrid: Dekalb® DKC 64-34
Reps: 28
Previous Crop: Corn
Tillage: Disk
Herbicides: ***Pre:*** 2 qt/ac Degree Extra®, 40 oz/ac Roundup®, and 6 oz/ac Sterling Blue® in mid-May
Post: 56 oz/ac Halex®, 1 pt/ac Atrazine, and 16 oz/ac Roundup® in mid-June

Seed Treatment: Acceleron® Basic 500
Fertilizer: 100 lb/ac Urea (46 lb actual N/ac); 130 lb/ac N sidedressed with UAN 32% on 6/6/18
Irrigation: Pivot, Total: 5”
Rainfall (in):

Introduction: This study was evaluating Conklin® Amplify-D® on corn. Amplify-D® was applied at a rate of 1.5 oz/ac in the planter box. The guaranteed analysis is below.

Guaranteed analysis:	
Total Nitrogen (N)	2.0%
Available Phosphoric Acid (P_2O_5)	10.0%
Calcium (Ca)	1.0%
Iron (Fe)	2.0%
Manganese (Mn)	0.5%
Zinc (Zn)	2.0%
Nutrients from:	Disodium Phosphate, Adenosine Monophosphate (AMP), Monosodium Phosphate, Calcium Carbonate, Ferrous Sulfate, Manganese Sulfate and Zinc Sulfate

Product information from: https://www.conklin.com/mwdownloads/download/link/id/175/

Results:

	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	19.2 A*	214 A	689.69 A
Conklin® Amplify-D®	19.0 A	212 A	682.62 A
P-Value	0.375	0.308	0.174

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and $1.80/ac for the Amplify-D® treatment.

Summary:

- There was no difference in moisture, yield, or net return between the untreated check and the Amplify-D® treatment.

Impact of Conklin® Amplify-D® on Corn

Study ID: 0085141201809
County: Platte
Soil Type: Grigston silt loam wet sub-stratum; Gibbon silt loam occasionally flooded
Planting Date: 5/5/18
Harvest Date: 10/27/18
Population: 21,000 to 22,600 (while treatments were not necessarily equally represented in each population, the population range was only 1,600 seeds/ac)
Row Spacing (in): 30
Hybrid: Dekalb® DKC 59-50
Reps: 12
Previous Crop: Soybean, then rye planted after harvest on 11-15-17 and grazed
Tillage: No-Till
Herbicides: ***Pre:*** Burndown and rye termination on 4/27/18
Seed Treatment: Acceleron® Basic 500
Fertilizer: 50 lb/ac Urea (23 lb actual N/ac) and 100 lb/ac MicroEssentials® SZ™ 12-40-0-10S-1Zn (12 lb actual N/ac); 100 lb N/ac sidedress as 32% UAN on 6/6/18
Irrigation: None
Rainfall (in):

Introduction: This study was evaluating Conklin® Amplify-D® on corn. Amplify-D® was applied at a rate of 1.5 oz/ac in the planter box. The guaranteed analysis is below.

Guaranteed analysis:	
Total Nitrogen (N)	2.0%
Available Phosphoric Acid (P_2O_5)	10.0%
Calcium (Ca)	1.0%
Iron (Fe)	2.0%
Manganese (Mn)	0.5%
Zinc (Zn)	2.0%
Nutrients from:	Disodium Phosphate, Adenosine Monophosphate (AMP), Monosodium Phosphate, Calcium Carbonate, Ferrous Sulfate, Manganese Sulfate and Zinc Sulfate

Product information from: https://www.conklin.com/mwdownloads/download/link/id/175/

Results:

	Moisture (%)	Yield† (bu/acre)	Marginal Net Return‡ ($/ac)
Check	14.8 A*	216 A	697.44 A
Conklin® Amplify-D®	14.8 A	215 A	691.26 B
P-Value	0.906	0.173	0.064

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and $1.80/ac Amplify-D cost.

Summary:

- There was no difference in moisture or yield between the untreated check and the Amplify-D® treatment.
- Net return was greater for the untreated check.

Impact of Conklin® Amplify-D® on Corn

Study ID: 0085141201810
County: Platte
Soil Type: Gibbon silt loam occasionally flooded; Lawet silt loam occasionally flooded
Planting Date: 4/26/18
Harvest Date: 10/27/18
Population: 32,500 to 34,500 (while treatments were not necessarily equally represented in each population, the population range was only 2,000 seeds/ac)
Row Spacing (in): 30
Hybrid: Dekalb® DKC 63-21
Reps: 17
Previous Crop: Corn
Tillage: Ridge-Till (rolling stalk chopper twice)
Herbicides: ***Pre:*** 2 qt/ac Degree Extra®, 40 oz/ac Roundup®, and 6 oz/ac Sterling Blue® in mid-May
Post: 56 oz/ac Halex®, 1 pt/ac Atrazine, and 16 oz/ac Roundup® in mid-June

Fertilizer: 100 lb/ac Urea (46 lb actual N/ac), 50 lb/ac K-Mag® and 25 lb/ac Potash on 4/10/18; 5 gal/ac Kugler 6-24-6-1S with 1 pt/ac Micro Max® in-furrow and 5 gal/ac ATS and 5 gal/ac 32% UAN on 4/26/18; 160 lb/ac N from NH3 sidedress on 6/4/18
Irrigation: Gravity, Total: 6”
Rainfall (in):

Introduction: This study was evaluating Conklin® Amplify-D® on corn. Amplify-D® was applied at a rate of 1.5 oz/ac in the planter box. The guaranteed analysis is below.

Guaranteed analysis:	
Total Nitrogen (N)	2.0%
Available Phosphoric Acid (P_2O_5)	10.0%
Calcium (Ca)	1.0%
Iron (Fe)	2.0%
Manganese (Mn)	0.5%
Zinc (Zn)	2.0%
Nutrients from:	Disodium Phosphate, Adenosine Monophosphate (AMP), Monosodium Phosphate, Calcium Carbonate, Ferrous Sulfate, Manganese Sulfate and Zinc Sulfate

Product information from: https://www.conklin.com/mwdownloads/download/link/id/175/

Results:

	Moisture (%)	Yield† (bu/acre)	Marginal Net Return‡ ($/ac)
Check	15.1 B*	258 A	832.43 A
Conklin® Amplify-D®	15.2 A	259 A	833.31 A
P-Value	0.0001	0.520	0.831

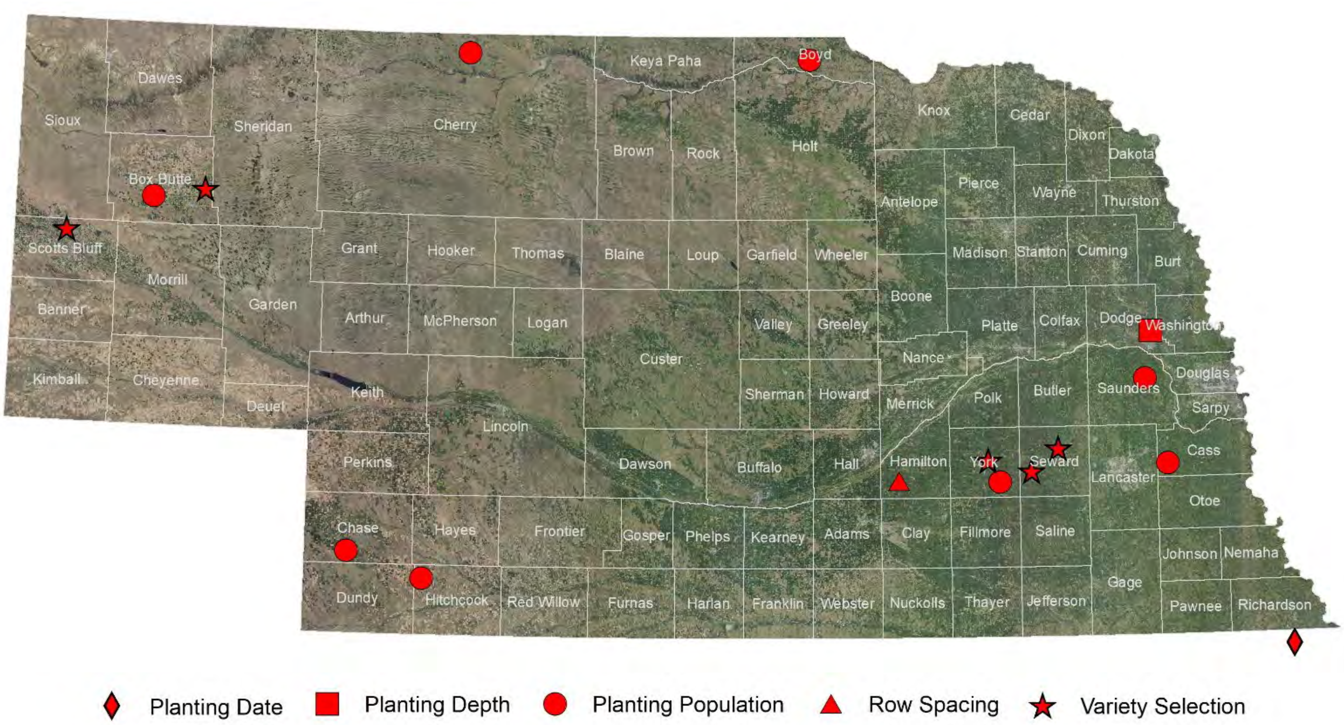
*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and $1.80/ac Amplify-D®.

Summary:

- There was no difference in yield or net return between the untreated check and the Amplify-D® treatment.

CROP PRODUCTION

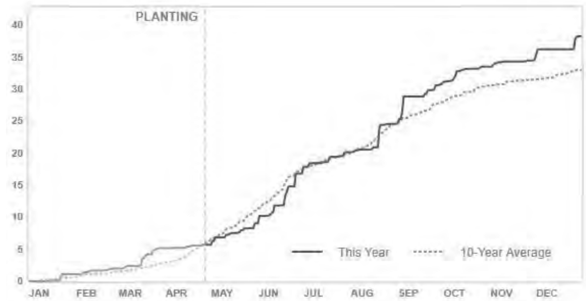
- Impact of Planting Depth on Corn Yield
- Non-Irrigated Corn Planting Population Study
- Group 2.4 versus Group 3.5 Soybean Maturity with Early Planting
- Group 2.5 versus Group 3.1 Soybean Maturity with Early Planting
- Group 2.7 versus Group 3.0 Soybean Maturity with Early Planting
- Impact of Soybean Planting Date and Variety on Yield
- 7.5” vs 15” vs 30” Row Spacing for Soybeans
- Data Intensive Farm Management: Soybean Seeding Rate (2 sites)
- Irrigated Soybean Population Study
- Pinto Bean Plant Population
- Pinto Bean Planting Population for Direct Harvested Dry Beans (3 sites)
- Pinto Varieties for Direct Harvest
- Great Northern Varieties for Direct Harvest



Impact of Planting Depth on Corn Yield

Study ID: 0819053201801
County: Dodge
Soil Type: Moody silty clay loam terrace, 0-2% slopes
Planting Date: 4/27/2018
Harvest Date: 10/3/18
Population: 28,500
Row Spacing (in): 30
Hybrid: Hoegemeyer® 8326AM
Reps: 8
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** 0.5 pint/ac 2-4-D and 1.8 qt/ac Keystone® LA at planting ***Post:*** 3 oz/ac Callisto® and 22 oz/ac Roundup Ultra®Max on 5/25/18

Seed Treatment: None
Fertilizer: 145 lb/ac N from NH3 applied in fall of 2017; 155 lb/ac 10-51-1 broadcast 12/8/17; 5 gal/ac 10-34-0 in-furrow at planting
Irrigation: None
Rainfall (in):



Introduction: The purpose of this study was to evaluate the impact of planting depth on corn yield. Two planting depths were evaluated, 1.5" and 2.25". Yield, moisture, and net return were evaluated. Additionally, soil temperature was recorded with EasyLog USB loggers placed at the seeding depth. Temperature loggers were placed in both the 1.5” and 2.25” planting depth treatments and in two field locations – a higher field elevation and lower field elevation (Figure 1). The percent emergence for the 1.5” and 2.25” treatments in the high and low elevation area was also observed by counting the number of seedlings emerged in a 100’ row length and comparing to the number of seeds dropped in a 100’ row length (Figure 2).

Results:

	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
1.5" Seed Depth	15.8 B*	236 A	763.42 A
2.25" Seed Depth	15.9 A	239 A	772.83 A
P-Value	0.052	0.244	0.244

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and no cost difference between the treatments.

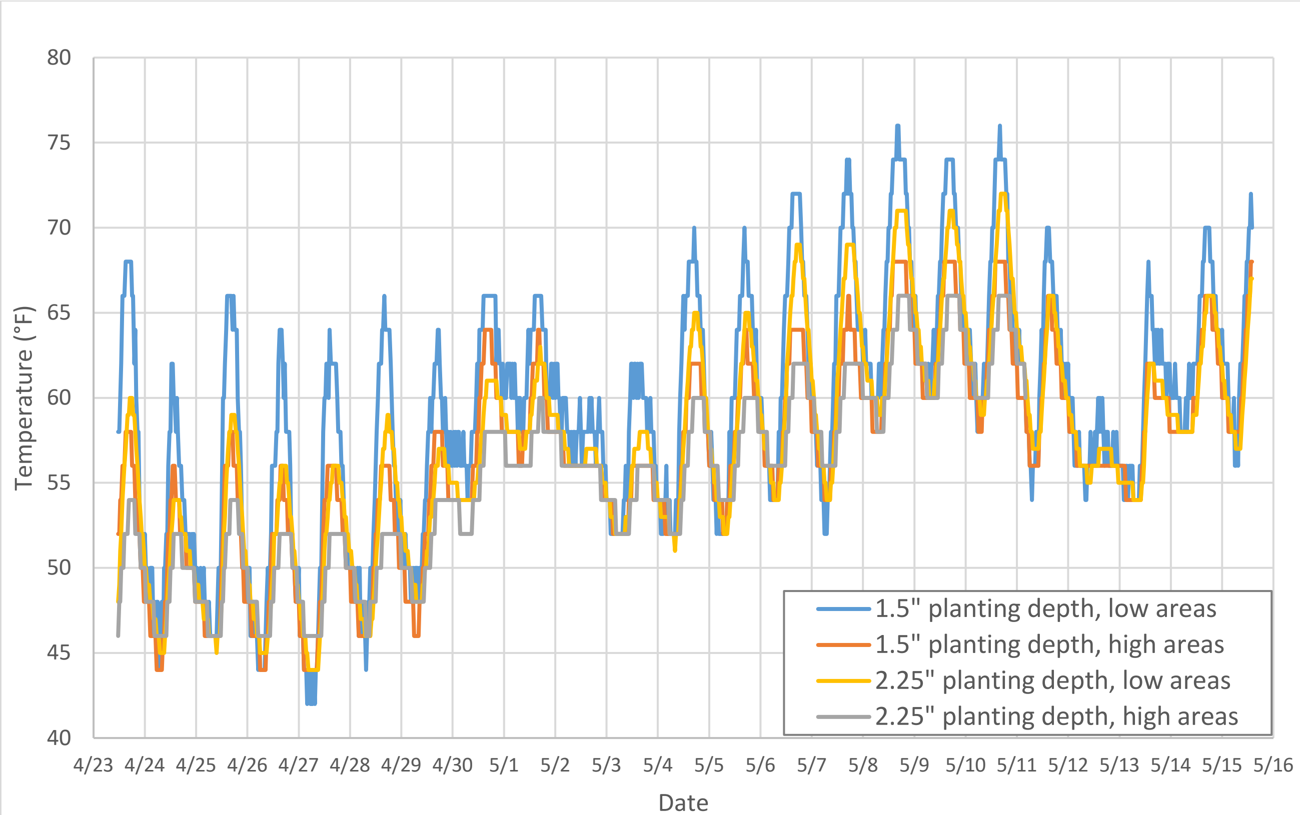


Figure 1. Soil temperature recorded at planting depths of 1.5” and 2.25” for each treatment and in high and low elevation areas of the field from April 23 to May 15.

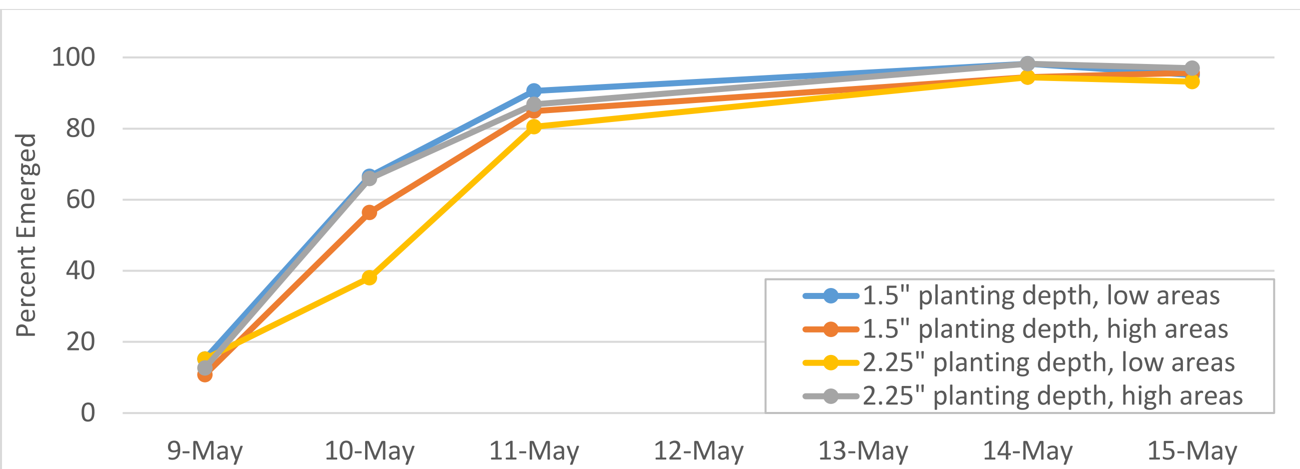


Figure 2. Percent of plants emerged for 1.5” planting depth and 2.25” planting depth in high and low areas of the field.

Summary: There was no difference in yield or net return between the two treatments. Temperature loggers were not replicated in the field; therefore, statistics cannot be calculated for these data. The recorded data does show trends in soil temperature. From May 4 to May 11, when most plants were emerging, the daytime temperatures recorded were warmer in the low areas; additionally, during this time period, the 1.5” depth had higher daytime temperatures than the 2.25” depth regardless of field location (high or low elevation).

Non-Irrigated Corn Planting Population Study

Study ID: 0803015201803
County: Boyd
Soil Type: Onita silt loam 0-2% slope; Reliance silt loam 2-6% slopes
Planting Date: 5/17/18
Harvest Date: 10/31/18
Row Spacing (in): 30
Hybrid: Dekalb® DKC52-61RIB
Reps: 4
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** 1.5 qt/ac Harness® Xtra and 32 oz/ac Roundup® ***Post:*** 0.5 fl oz/ac Armezon®, 3 pt/ac Warrant®, and 26 oz/ac Roundup®
Seed Treatment: Acceleron® Standard (fungicide and insecticide)
Foliar Insecticides: None
Foliar Fungicides: None

Fertilizer: 18.2 gal/ac 18-16-0-5S-0.5Zn starter (equal to 35 lb/ac N, 31 lb/ac P, 10 lb/ac S, and 1 lb/ac Zn); dry sidedress application, actual pounds are 130 lb/ac N, 20.5 lb/ac P, 40 lb/ac K, 10 lb/ac S, and 0.5 lb/ac Zn on 6/16/18
Irrigation: None
Rainfall (in):

Introduction: The purpose of this study was to determine what planting population is most profitable for corn production. Seeding rates of 18,000, 22,000, 26,000, and 30,000 seeds/ac were evaluated.

Results:

	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
18,000 seeds/acre	15.2 B*	191 D	560.59 C
22,000 seeds/acre	15.6 A	195 C	560.00 C
26,000 seeds/acre	14.9 D	207 B	586.98 B
30,000 seeds/acre	15.0 C	223 A	627.45 A
P-Value	<0.0001	<0.0001	<0.0001

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and $250/bag of seed.

Summary: Above average rainfall occurred at this study location in 2018. Yield increased with each seeding rate increase. The highest seeding rate of 30,000 seeds/ac resulted in the highest yield and net return.

Group 2 versus Group 3 Soybean Maturity Summary (3 sites)

With early planting of soybean (in April or as close to May 1 as possible), a longer-season variety may help take advantage of the longer growing season. However, some growers are also obtaining high yields with mid-group 2 varieties. The goal of this study was to determine if growers should plant a longer-season maturity soybean to achieve optimum yields when planting early. A group 2 and group 3 soybean were evaluated at each site. The varieties used and exact maturity dates varied among sites.

Three studies in Seward and York counties were conducted in 2018 with a total of 16 replications. Data from these studies were analyzed together using the GLIMMIX procedure in SAS 9.4 (SAS Institute Inc., Cary, NC). Mean separation was done with Tukey's HSD.

Table 1. Site varieties used and planting date.

	Group 2 Variety	Group 3 Variety	Planting Date
Seward Site 1 Study ID: 0006159201801	Group 2.4 – Big Cob BC24cr2x	Group 3.5 – Big Cob BC35wr2x	5/2/18
Seward Site 2 Study ID: 0802159201801	Group 2.5 – Pioneer 25A12X	Group 3.1 – Pioneer 31A22X	5/7/18
York Study ID: 0118185201801	Group 2.7 – GH 2788X	Group 3.0 – NK S30-C1	5/2/18

Table 2. Yield of group 2 and group 3 soybeans from three site locations.

	Yield (bu/acre)†	Pods/plant	Nodes/plant
Group 2	70.2 A*	60.9 A	22.0 A
Group 3	71.5 A	61.0 A	21.2 B
Site (P>F)	*<0.0001*	*0.1098*	*0.0040*
Treatment (P>F)	*0.1351*	*0.9868*	*0.0469*
*Site*Treatment*	*0.1074*	*0.3434*	*0.0017*

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 13% moisture.

Summary: Yields were similar for both maturity groups. Pods per plant were not different between the group 2 and group 3 soybean. Nodes per plant differed with the group 2 soybeans having 0.8 more nodes per plant than the group 3 soybeans. Individual sites are reported in more detail in the following pages.

Group 2.4 versus Group 3.5 Soybean Maturity with Early Planting

Study ID: 0006159201801
County: Seward
Soil Type: Fillmore silt loam frequently ponded; Hastings silt loam 1-3% slope; Hastings silt loam 0-1% slope
Planting Date: 5/2/18
Harvest Date: 9/19/18 and 10/3/18
Population: 120,000
Row Spacing (in): 15
Reps: 6
Previous Crop: Seed Corn
Tillage: No-Till
Herbicides: ***Pre:*** 6 oz/ac Zidua® Pro, 24 oz/ac glyphosate, and 8 oz/ac 2,4-D on 4/23/18 ***Post:*** 12.8 oz/ac Engenia®, 2 qt/100 gal VaporGard™, 12 oz/ac Outlook®, 10 oz/ac Volunteer®, and 32 oz/ac glyphosate on 5/29/18
Seed Treatment: Treatments applied by seed dealer
Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: None
Irrigation: Pivot, Total: 3-4"
Rainfall (in):

Introduction: With early planting of soybean (in April or as close to May 1 as possible), a longer-season variety may help take advantage of the longer growing season. However, some growers are also obtaining high yields with mid-group 2 varieties. The goal of this study was to determine if growers need to plant a longer-season maturity soybean to achieve optimum yields when planting early. A group 2 (Big Cob® BC25CR2x) and group 3 (Big Cob® BC35WR2x) soybean were evaluated. The early maturing soybeans were harvested on September 19 and the late maturing soybeans were harvested on October 3. Harvest loss difference due to different harvest dates was not examined.

Results:

	Harvest Stand Count (plants/ac)	Nodes/ plant	Pods/ plant	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Group 2.4 (Big Cob® BC24CR2x)	131,333 A*	25 A	72 A	11.8 B	79 A	522.40 A
Group 3.5 (Big Cob® BC35WR2x)	131,000 A	23 B	73 A	15.0 A	78 A	513.89 A
P-Value	0.808	0.051	0.914	<0.0001	0.226	0.226

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $7.40/bu soybean and $63.43/ac for seed and seed treatment. The two varieties tested had the same seed cost.

Summary:

- There were no differences in stand counts or average pods/plant between the two maturity groups tested.
- The early season variety had more nodes per plant than the later season variety.
- The early season variety was also drier at the time of harvest; however, it is important to note that the varieties were harvested on different dates.
- There were no differences in yield or marginal net return between the two varieties tested. Yields for both group 2.4 and group 3.5 soybeans were adjusted to 13% moisture and marginal net return values reported reflect moisture adjusted yields.

Group 2.5 versus Group 3.1 Soybean Maturity with Early Planting

Study ID: 0802159201801
County: Seward
Soil Type: Hall silt loam 0-1% slope; Muir silt loam 1-3% slope; Hastings silty clay loam 7-11% slopes, eroded
Planting Date: 5/7/18
Harvest Date: 9/18/18 (early maturity group) & 9/24/18 (late maturity group)
Population: 146,087
Row Spacing (in): 30
Reps: 3
Previous Crop: Corn
Tillage: No-Till
Herbicides: ***Pre:*** 17 lb/100 gal AMS, 28 oz/ac Roundup PowerMax®, and 6 oz/ac Zidua® Pro on 5/1/18 ***Post:*** 17 lb/100 gal AMS, 6 oz/ac Select Max, and 32 oz/ac Roundup PowerMax® on 6/15/18

Seed Treatment: PPST fungicide seed treatment (high rate), insecticide seed treatment, PPST 2030, 120+ inoculant for the group 3 variety (Pioneer® 31A22X); no seed treatment on the group 2 variety (Pioneer® 25A12X)
Fertilizer: None
Irrigation: None
Rainfall (in):

Introduction: With early planting of soybean (in April or as close to May 1 as possible), a longer-season variety may help take advantage of the longer growing season. However, some growers are also obtaining high yields with mid-group 2 varieties. The goal of this study was to determine if growers need to plant a longer-season maturity soybean to achieve optimum yields when planting early. A group 2 (Pioneer® 25A12X) and group 3 (Pioneer® 31A22X) soybean were evaluated. The group 2 soybean (Pioneer® 25A12X) did not receive seed treatment. The soybeans were planted on May 7, 2018. The group 2 soybeans were harvested on September 18 and the group 3 soybeans were harvested on September 24. Harvest loss difference due to different harvest dates was not examined.

Results:

	Harvest Stand Count (plants/ac)	Pods/plant	Nodes/plant	Moisture (%)	Test Weight (lb/bu)	Yield (bu/acre)†	Marginal Net Return‡ ($/ac)
Group 2.5 (Pioneer 25A12X)	113,667 A*	49 A	19 B	11.1 B	56 A	62 B	401.07 B
Group 3.1 (Pioneer 31A22X)	92,333 B	56 A	21 A	12.6 A	56 A	65 A	409.96 A
P-Value	0.055	0.461	0.019	0.061	0.703	0.009	0.052

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $7.40/bu soybean, $52.22/unit seed cost for Pioneer 25A12X, and $64.72/unit seed and seed treatment cost for Pioneer 31A22X.

Summary:

- The group 2 soybeans had a higher stand count than the group 3 soybeans. Node counts revealed that the group 3 soybeans had more nodes per plant than the group 2 soybeans, indicating greater branching where stand counts were lower. However, there was no difference in pods per plant between the soybeans tested.
- The group 3 soybeans had a 3 bu/ac higher yield than the group 2 soybeans.
- Because the group 2 soybeans did not receive a seed treatment and the group 3 soybeans did, it is not possible to conclude that the yield difference is due to variety and maturity group alone.
- The group 3 soybeans and seed treatment were more expensive; however, due to their higher yield, they resulted in a greater marginal net return.

Group 2.7 versus Group 3.0 Soybean Maturity with Early Planting

Study ID: 0118185201801
County: York
Soil Type: Hastings silt loam 0-1% slope
Planting Date: 5/2/18
Harvest Date: 10/3/18
Population: 130,000
Row Spacing (in): 30
Reps: 7
Previous Crop: Corn
Tillage: Ridge-Till
Herbicides: ***Pre:*** 5 oz/ac Authority® First, 1.5 pt/ac Brawl™, 4 oz/ac Dimetric®, 2 oz/ac InterLock®, 0.7 pt/ac 2-4,D Shredder™, and 8 oz/ac Destiny® on 4/26/18 ***Post:*** 50 oz/ac Class Act®, 32 oz/ac Roundup®, 12 oz/ac Cobra®, 9 oz/ac SelectMax®, and 12 oz/ac StrikeLock® on 6/8/18

Seed Treatment: CLARIVA™ Elite
Foliar Insecticides: None
Foliar Fungicides: None
Note: There were two light hail events on this field
Irrigation: Pivot
Rainfall (in):

Introduction: With early planting of soybean (in April or as close to May 1 as possible), a longer-season variety may help take advantage of the longer growing season. However, some growers are also obtaining high yields with mid-group 2 varieties. The goal of this study was to determine if growers need to plant a longer-season maturity soybean to achieve optimum yields when planting early. A group 2 (GH 2788X) and group 3 (NK S30-C1) soybean were evaluated. The group 3 soybean was not dicamba tolerant and had visual symptoms (cupping) indicating it was affected by off-target dicamba. The group 2 soybean was dicamba tolerant and did not have any visual symptoms (Figure 1). Ten plants of each variety were sampled on July 18; the group 3 soybeans that were affected by the dicamba were shorter but there was no difference in number of nodes at that time (Figure 2). The soybeans were planted on May 2, 2018. Both group 2 and group 3 soybeans were harvested on October 3.

Figure 1: Group 2 (dicamba tolerant) soybean on left and group 3 (not dicamba tolerant) soybean on right.

Figure 2: Group 2 (dicamba tolerant) soybean on left and group 3 (not dicamba tolerant) soybean on right.

Results:

	Harvest Stand Count (plants/ac)	Pods/plant	Nodes/plant	Moisture (%)	Test Weight	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Group 2.7 (GH 2788X)	96,800 A*	62 A	22 A	14.2 B	57 A	70 A	456.14 A
Group 3.0 (NK S30-C1)	105,000 A	54 A	20 B	15.0 A	57 A	72 A	470.17 A
P-Value	0.185	0.185	0.019	0.014	0.197	0.239	0.239

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $7.40/bu soybean, $44/unit seed cost, and $22/ac seed treatment cost. Seed costs were the same for both varieties.

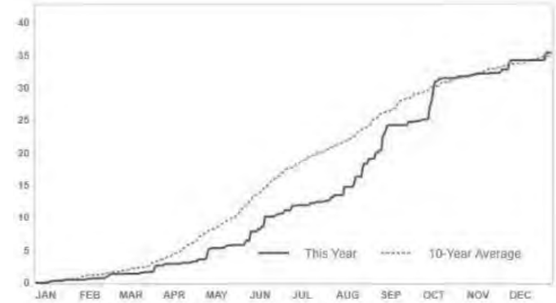
Summary:

- Test weight, pods per plant, and stand counts were the same between the group 2 and group 3 soybeans. At harvest the group 2 early season soybeans had more nodes than the group 3 late season soybeans that were affected by off-target dicamba.
- There were no yield or net return difference between the group 2 and group 3 soybeans. The group 3 late season soybeans were slightly (0.8%) wetter than the group 2 soybeans.

Impact of Soybean Planting Date and Variety on Yield

Study ID: 0821KS013201801
County: Brown, KS
Soil Type: Wymore silty clay loam 1-3% slope; Wymore silty clay loam 3-6% slopes
Harvest Date: 10/22/18
Population: 150,000
Row Spacing (in): 15
Reps: 4
Previous Crop: Corn
Tillage: No-Till
Seed Treatment: PPST, ILeVO®, Inoculant
Foliar Fungicides: applied 8/9/18

Irrigation: None
Rainfall (in):



Introduction:

The study was set up as a split plot design with planting date as the main plot and variety as the sub plot. Data has shown that planting soybeans earlier can increase yields. The purpose of this study was to evaluate how early soybeans could be planted without hurting yields. Four soybean dates were selected with a goal of spacing planting dates two to three weeks apart. Two soybean varieties were evaluated: Pioneer® P31A22X, a group 3.1 variety, and Pioneer® P40T84X, a group 4.0 variety. These maturity groups are typical for the area.

Soil temperature at planting was measured for each main plot (planting date). Stand counts were collected for each main plot on June 6. Moisture, test weight, and yield were evaluated using a test plot weigh wagon. Images of seed quality were also captured for each treatment at harvest.

Results: Data were analyzed using the GLIMMIX procedure in SAS 9.4 (SAS Institute Inc., Cary, NC). Mean separation was performed with Tukey's HSD. There was no interaction between variety and planting date (the varieties responded the same at all four planting dates); therefore, these factors are reported separately (for yield, planting date x variety P=0.1217). Soil temperature at planting and stand counts were collected only at main plot (planting date) level.

Planting Date	Soil Temp at Planting at 2.5" depth (°F)	Stand Count (plants/ac)	Moisture (%)	Test Weight	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Mar 22	44 C*	94,916 C	11.3 A	53.1 C	56.3 C	364.51 C
Apr 11	47 B	107,917 B	11.3 A	53.6 BC	58.6 C	381.18 C
May 7	69 A	133,333 A	11.4 A	54.6 AB	62.4 B	409.68 B
May 22	69 A	129,500 A	11.2 A	55.5 A	67.1 A	444.37 A
P-Value	<0.0001	<0.0004	0.208	0.001	0.0001	0.0001

Variety	Moisture (%)	Test Weight	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Pioneer® P31A22X	11.3 A	53.8 A	58.9 B	382.96 B
Pioneer® P40T84X	11.3 A	54.5 A	63.3 A	416.91 A
P-Value	0.348	0.325	0.01	0.007

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $7.40/bu soybeans, $49.50/unit of 140,000 seeds for 31A22, and $48.15/unit of 140,000 seeds for 40T84.

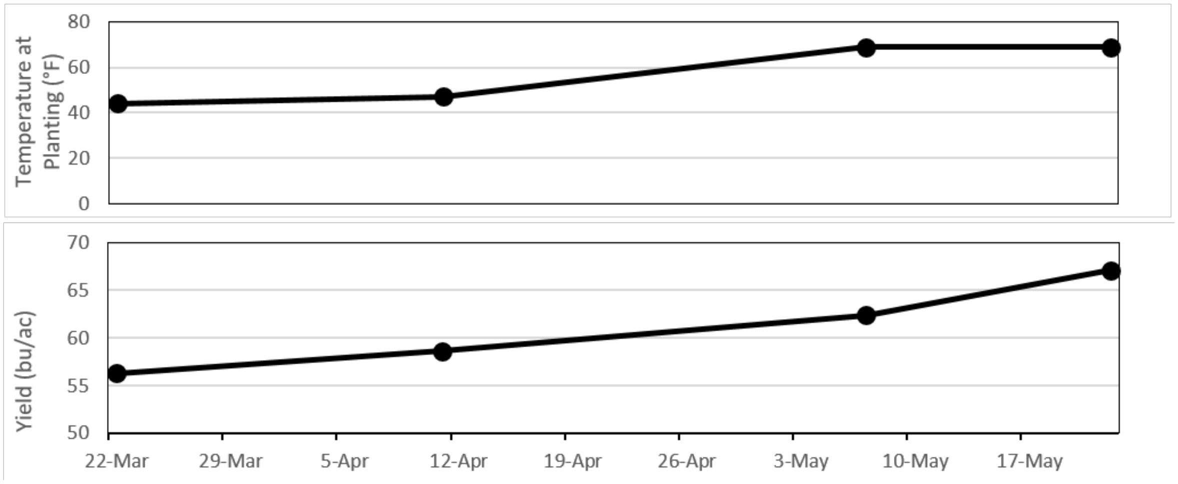


Figure 1. Soil temperature at planting at a depth of 2.5" (top) and yield (bottom) for each planting date.

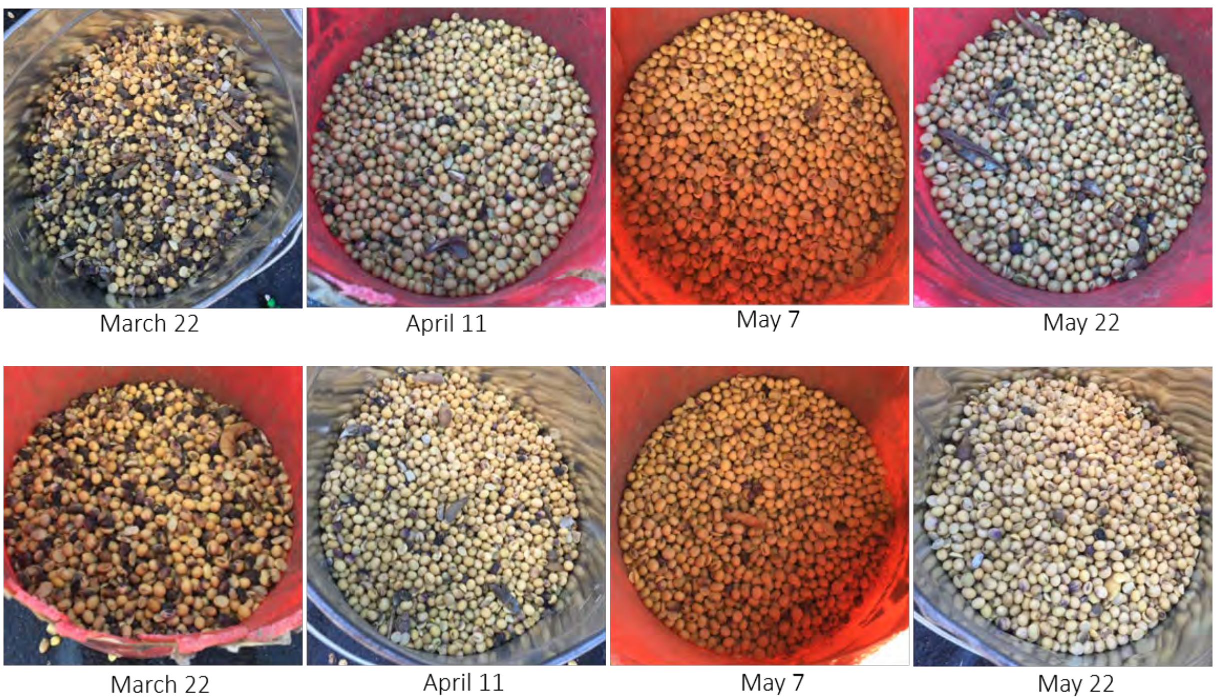


Figure 2. Images showing seed quality at harvest for P31A22X (top) and P40T84X (bottom) for each planting date evaluated.

Summary:

- Multiple snow events in April, followed by a very dry summer with D1 (moderate drought) and D2 (severe drought), created a challenging growing environment.
- From imagery of seed quality samples, we observed a greater amount of purple seed stain (Cercospora blight) in the earlier planting date samples. We also noticed that variety P31A22X had a greater amount of purple seed stain than P40T84X.
- Stand counts, yield, test weight, and marginal net return increased with later planting date, with the latest planting date of May 22 having the highest yield and net return.
- The P40T84X variety had a higher yield and net return than the P31A22X variety.

7.5" vs 15" vs 30" Row Spacing for Soybeans

Study ID: 0073081201802
County: Hamilton
Soil Type: Hastings silt loam 0-1% slope; Hastings silt loam 1-3% slope; Hastings silty clay loam 3-7% slopes, eroded
Planting Date: 5/8/18
Harvest Date: 10/29/18 - 10/30/18
Population: 160,000
Variety: Credenz® 2601 LL
Reps: 3
Previous Crop: Corn
Tillage: No-Till

Seed Treatment: Acceleron®
Irrigation: Pivot, Total: 2.25”
Rainfall (in):

Introduction: The objective of this study was to evaluate soybeans drilled in 7.5" row spacing versus planted in 15" and 30" row spacings. One 15” row spacing treatment was not established due to error, therefore there are only 2 replications of the 15” row spacing treatment. Yield was recorded using a yield monitor; yield data was post-processed to remove erroneous data points prior to analysis. Aerial imagery was collected through the summer to observe differences in total vegetation and canopy closure for each of the row spacings. True color imagery and normalized difference vegetative index (NDVI) is presented for July 10 (Figure 1) when treatment differences were most obvious.

Results:

	Yield† (bu/acre)	Marginal Net Return‡ ($/ac)
7.5"	62 A*	459.81 A
15"	61 A	458.72 A
30"	60 A	446.81 A
P-Value	0.527	0.527

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $7.40/bu soybean.

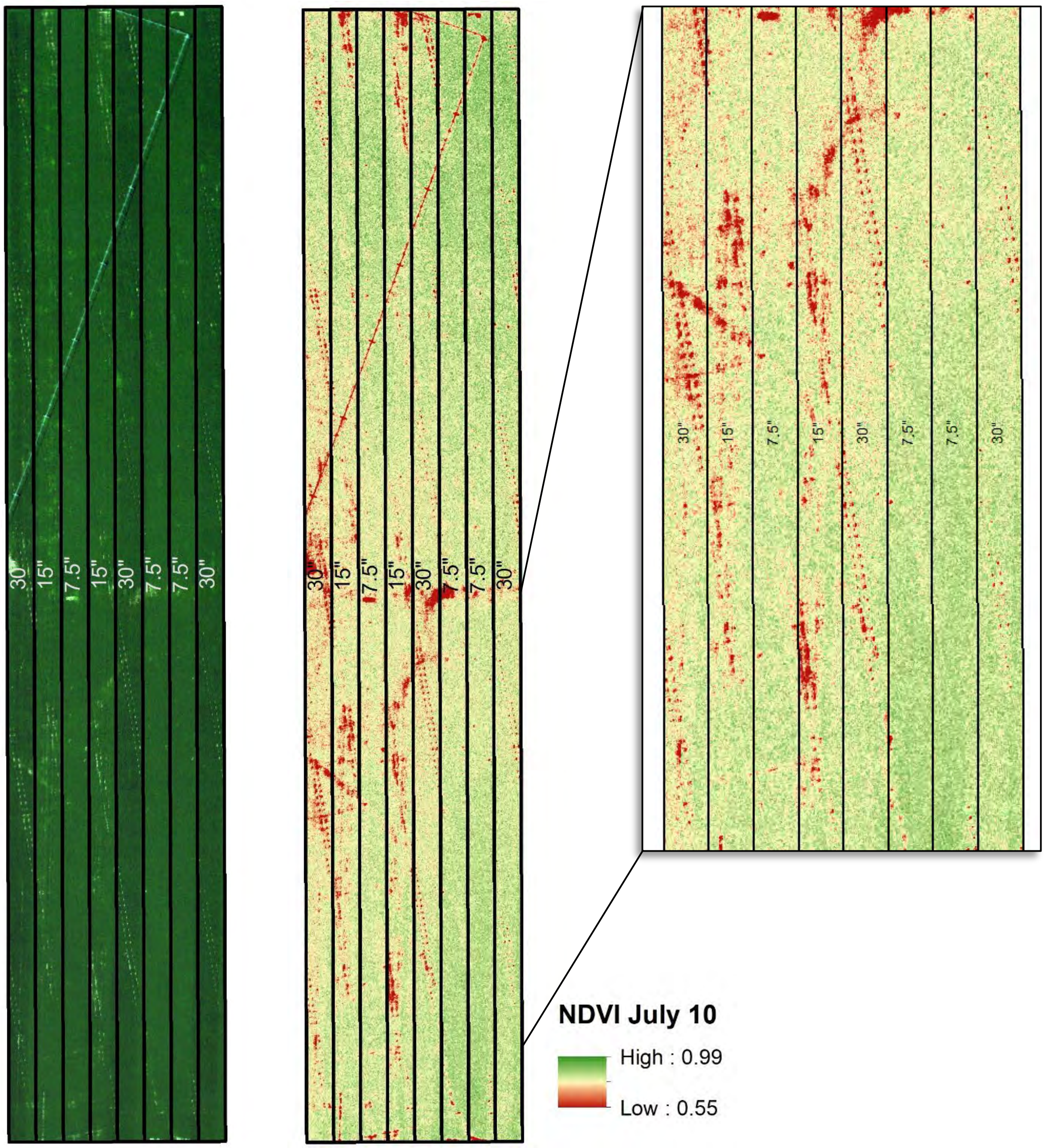


Figure 1. True color imagery (left), NDVI (middle), and NDVI zoom in (right) from July 10, 2018. Higher NDVI values are related to more plant biomass and/or darker green plants; lower NDVI values are related to lower plant biomass and/or lighter green plants.

Summary:

- There was no yield difference between the 7.5", 15", and 30" row spacing treatments.
- Imagery showed that sprayer tracks were less apparent in the 7.5" row on July 10.

Data Intensive Farm Management: Soybean Seeding Rate

Study ID: 0546155201801
County: Saunders
Soil Type: Yutan silty clay loam 2-6% slopes, eroded; Nodaway silt loam occasionally flooded; Filbert silt loam 0-1% slope; Tomek silt loam 0-2% slope
Planting Date: 5/9/18
Harvest Date: 9/27/18
Row Spacing (in): 15
Variety: Asgrow® AG29X8
Reps: 9
Previous Crop: Corn
Tillage: No-Till

Herbicides: ***Pre:*** Zidua® Pro ***Post:*** Flexstar® GT, Warrant® and Select®
Foliar Fungicides: Priaxor® sprayed at R3
Irrigation: Pivot, Total: 1.5”
Rainfall (in):

Introduction: This project is part of the Data Intensive Farm Management project, a multi-university collaboration led by the University of Illinois at Urbana Champaign. The goal of these research studies is to utilize precision agriculture technology for conducting on-farm research. This study tested four soybean seeding rates: 100,000, 125,000, 150,000, and 175,000 seeds/ac. Treatments were randomized and replicated in 90’ wide by 240’ long blocks across the entire field. The research study was implemented by developing a prescription map for the seeding rate blocks (Figure 1) and uploading it to the in-cab monitor. Geospatial yield monitor data were collected at the end of the growing season and post-processed to remove errors with Yield Editor Software from the USDA. As-planted data was also evaluated and blocks which did not achieve target treatment rates were not used in yield analysis; 9 of the 16 originally planned blocks shown in Figure 1 were used in the analysis. Previous on-farm research has demonstrated that soybean planting rates of 80,000 to 120,000 seeds/ac resulted in the highest profitability.

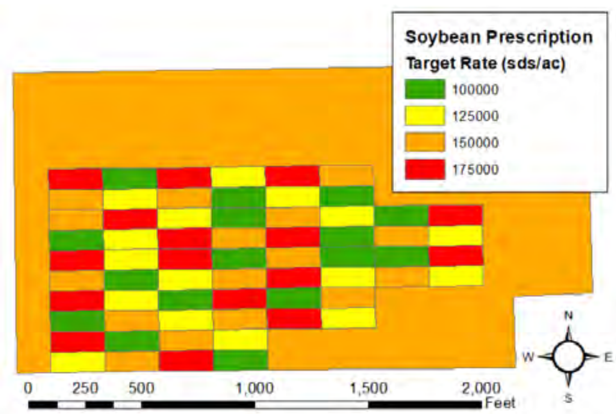


Figure 1. Soybean seeding rate prescription map.

Results:

	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
100,000 seeds/acre	10.8 A*	65 A	441.78 A
125,000 seeds/acre	10.8 A	64 AB	425.51 A
150,000 seeds/acre	10.9 A	62 B	398.85 B
175,000 seeds/acre	10.9 A	63 AB	395.54 B
P-Value	0.612	0.067	0.0001

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $7.40/bu soybean and $55/unit of soybean seed.

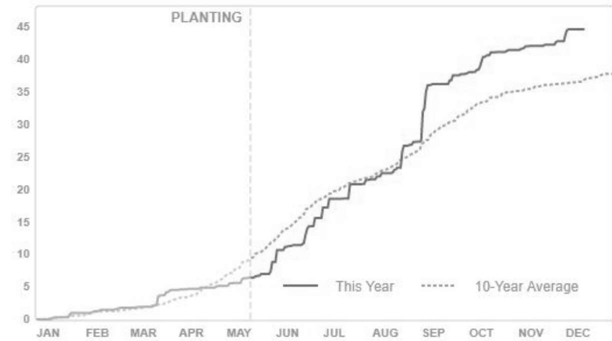
Summary:

- The 100,000 seeds/ac treatment was higher yielding than the 150,000 seeds/ac treatment. There were no differences among yields of other seeding rates.
- There were no grain moisture differences among the seeding rates tested.
- Similar to other on-farm research studies on soybean seeding rate, the lower seeding rates had higher profitability. The 100,000 and 125,000 seeds/ac rates had significantly higher net return than the 150,000 and 175,000 seeds/ac treatments.
- We plan to conduct further analyses on this study to examine seeding rate response as related to soil characteristics.

Data Intensive Farm Management: Soybean Seeding Rate

Study ID: 0816025201801
County: Cass
Soil Type: Wymore silty clay loam 0-2% slope; Wymore silty clay loam 3-6% slopes, eroded; Colo-Nodaway complex frequently flooded; Judson silt loam 2-6% slopes
Planting Date: 5/16/18
Harvest Date: 10/29/18
Row Spacing (in): 30
Variety: CX3622N
Reps: 8
Previous Crop: Corn
Tillage: No-Till
Herbicides: ***Pre:*** 5/7/18 ***Post:*** 6/30/18

Seed Treatment: CruiserMaxx® Vibrance®
Foliar Fungicides: None
Irrigation: Pivot, Total: 0
Rainfall (in):



Introduction: This project is part of the Data Intensive Farm Management project, a multi-university collaboration led by the University of Illinois at Urbana Champaign. The goal of these research studies is to utilize precision agriculture technology for conducting on-farm research. This study tested four soybean seeding rates: 100,000, 125,000, 150,000, and 175,000 seeds/ac. Treatments were randomized and replicated in 90' wide by 240' long blocks. The research study was implemented by developing a prescription map for the seeding rate blocks (Figure 1) and uploading it to the in-cab monitor. Geospatial yield monitor data were collected at the end of the growing season and post-processed to remove errors with Yield Editor Software from the USDA. As-planted data was also evaluated and blocks which did not achieve target treatment rates were not used in yield analysis; 8 of the 16 originally planned blocks shown in Figure 1 were used in the analysis. Previous on-farm research has demonstrated that soybean planting rates of 80,000 to 120,000 seeds/ac resulted in the highest profitability.

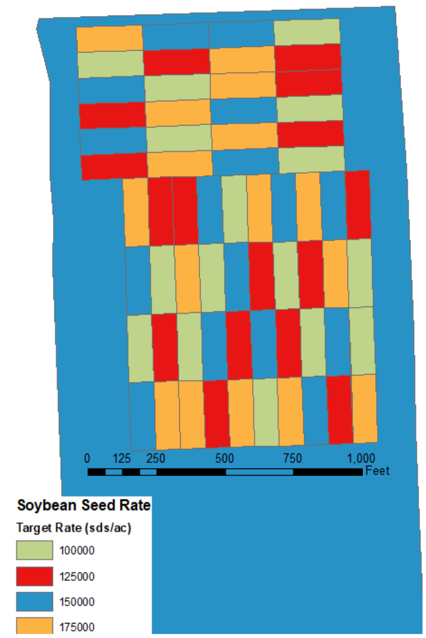


Figure 1. Soybean seeding rate prescription map.

Results:

	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
100,000 seeds/acre	51 A*	340.56 AB
125,000 seeds/acre	54 A	346.52 A
150,000 seeds/acre	53 A	331.10 AB
175,000 seeds/acre	52 A	318.60 B
P-Value	0.403	0.033

*Values with the same letter are not significantly different at a 90% confidence level
†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $7.40/bu soybean and $55/unit of soybean seed.

Summary:

- There were no yield differences among the four seeding rates tested.
- The 100,000, 125,000, and 150,000 seed/ac treatments were not different in yield. The 175,000 seeds/ac treatment had statistically lower net return than the 125,000 seeds/ac treatment. These results are consistent with previous on-farm research results.
- We plan to conduct further analyses on this study to examine seeding rate response as related to soil characteristics.

Irrigated Soybean Population Study

Study ID: 0811185201801
County: York
Soil Type: Hastings silt loam 3-7% slopes; Hord silt loam 1-3% slope; Hastings silt loam 0-1% slope; Uly-Hobbs silt loam 11-30% slopes
Planting Date: 5/1/18
Harvest Date: 9/24/18
Row Spacing (in): 30
Variety: Pioneer® 27T59
Reps: 4
Previous Crop: Corn
Tillage: No-Till
Herbicides: ***Pre:*** 1 pt/ac 2,4-D, 32 oz/ac Roundup PowerMAX®, and 1 pt/ac Dual® for burndown; 0.5 oz/ac Sharpen®, 2 pt/ac Boundary®, and 32 oz/ac Roundup PowerMAX® at planting ***Post:*** 32 oz/ac Roundup PowerMAX®, 8 oz/ac Flexstar®, 6 oz/ac clethodim, and 1 pt/ac metolachlor

Seed Treatment: Lumisena™ fungicide, Gaucho® insecticide, PPST 2030 biological, PPST 120+ inoculant plus extender
Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: None
Irrigation: Pivot, Total: 2.5"
Rainfall (in):

Introduction: Previous on-farm research has demonstrated that soybean planting rates of 80,000 to 120,000 seeds/ac resulted in the highest profitability. The purpose of this study was to evaluate three seeding rates to determine the seeding rate that maximized yield and profit. Seeding rates of 90,000 seeds/ac, 120,000 seeds/ac, and 150,000 seeds/ac were evaluated.

Results:

	Harvest Stand Count (plants/ac)	% of Planted Seeds Present in Final Stand Counts	Moisture (%)	Test Weight	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
90,000 seeds/ac	60,875 C*	68 C	14.3 A	54 A	93 B	629.47 A
120,000 seeds/ac	88,125 B	73 B	13.9 A	55 A	94 AB	622.83 A
150,000 seeds/ac	121,750 A	81 A	13.1 A	55 A	97 A	630.90 A
P-Value	<0.0001	0.002	0.204	0.176	0.038	0.631

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $7.40/bu soybean and $63.06 per 140,000 treated seed unit.

Summary:

- Post-planting analysis of as-planted data from the in-cab monitor showed that seeding rates were close to the intended rates; over 98% of the data points were not lower than 3,000 seeds/ac below the intended treatment. Stand counts at harvest showed significant differences between the three seeding rate treatments as expected. The final stands were compared to the planted rate (percent of planted seeds present in final stand counts). For all treatments, the percent of planted seeds present the in final stand counts was fairly low, ranging from 68% to 81% of planted seeds present at harvest. The three seeding rates also responded differently with the lowest planting population having the lowest survival rate.
- Moisture and test weight were not significantly different between the planting rates tested.
- The yield for the highest planting population of 150,000 seeds/ac was significantly greater than the lowest planting population of 90,000 seeds/ac. The 120,000 seeds/ac treatment was not significantly different than the 90,000 or 150,000 seeds/ac treatment.
- Because yield increases were offset by the increased cost of seed for the higher seeding rate, there was no significant difference in marginal net return between the three planting populations tested.

Pinto Bean Planting Population

Study ID: 0190087201801
County: Hitchcock
Soil Type: Blackwood loam 0-1% slope
Planting Date: 6/10/18
Harvest Date: 9/17/18
Row Spacing (in): 30
Hybrid: La Paz pinto bean
Reps: 2
Previous Crop: Popcorn
Tillage: Chisel, then vertical tilled twice
Herbicides: ***Pre:*** Dual® and Prowl® on 6/14/18
Post: Varisto™, Basagran®, and Outlook® on 7/3/18; 3.5 pt/ac Eptam® through pivot on 7/15/18
Seed Treatment: Cruiser® 250
Foliar Fungicides: Copper fungicide on 7/8/18, 4 oz/ac SaniDate® on 8/1/18 and 8/10/18

Fertilizer: 100 lb/ac 12-40-0-7-1 on 6/1/18, 5 gal/ac 32% UAN on 6/12/18 through pivot, 6.5 gal/ac 32% UAN on 6/15/18 with herbicide, 8 gal/ac 32% UAN on 7/24/18 through pivot, and 4 gal/ac 32% UAN on 8/2/18 through pivot
Irrigation: Pivot, Total: 7"
Rainfall (in):

Introduction: The purpose of this study was to compare several planting rates of dry edible beans (La Paz variety pinto) planted in 30" row spacing. Target populations were 75,000, 90,000, and 105,000 plants/ac, however the planting equipment used resulted in seeding rates which differed from the intended rate. Actual populations based on early-season stand counts were 74,415, 89,879, and 103,019 plants/ac; therefore, planting populations were approximately 10% greater at 81,400, 99,000, and 113,300 seeds/ac, assuming all treatments had similar emergence and germination. The plots were harvested on September 17. These plots were swathed and windrowed then combined. Direct harvest was not possible due to weed pressure. Additionally, due to weed pressure, data from two of the four replications could not be used. Yield was evaluated using the combine yield monitor. Samples from each plot were analyzed for bean quality parameters. Harvest loss estimates were determined by taking counts in 12 one-square-foot frames randomly chosen in the harvested area but equally representing the left side of header, center of header, and right side of header area behind the combine.

Results:

Treatment (seeds/ac)	Stand Count (plants/ac)	Harvest Loss (bu/ac)	Small (%)	Split (%)	Foreign Matter (%)	Moisture (%)	Test Weight (lb/bu)	Seeds per lb	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
75,000	74,415 C*	5.5 A	0.7 B	2.3 A	0.4 A	12.6 A	60 A	1,280 A	35 A	397.34 A
90,000	89,879 B	3.5 A	1.1 A	2.1 A	0.3 A	12.7 A	60 A	1,259 A	36 A	392.71 A
105,000	103,019 A	4.1 A	0.8 AB	3.9 A	0.7 A	13.1 A	60 A	1,259 A	35 A	376.56 A
P-Value	0.008	0.793	0.091	0.285	0.796	0.544	0.310	0.5	0.671	0.245

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 14% moisture and adjusted for clean yield (% splits, % small, and % foreign material removed).
‡Marginal net return based on $22/cwt ($13.20/bu at 60 lb/bu). Seed cost for the treated pinto bean seed was $79/100,000 seeds. Seed costs for each treatment were: $64.31/ac for 81,400 seeds/ac, $78.21/ac for 99,000 seeds/ac, and $89.51/ac for 113,300 seeds/ac.

Summary:

- Due to issues with weeds, data from only two of the four planted replications were used in this study.
- Actual stand counts were close to the targeted populations for all three treatments.
- There was no significant difference in the harvest loss, percent splits, percent foreign material, moisture, test weight, seeds per lb, yield, or net return among the three seeding rates tested.
- There were differences in percent small beans between the treatments with the 75,000 seeds/ac treatment having a lower number of percent smalls than the 90,000 seeds/ac treatment.

Pinto Bean Planting Population for Direct Harvested Dry Beans

Study ID: 0812029201801
County: Chase
Soil Type: Valent loamy sand 3-9% slopes; Valent loamy sand 0-3% slope; Dailey loamy sand 0-3% slope
Planting Date: 6/5/18
Harvest Date: 9/21/18
Row Spacing (in): 30
Variety: Vibrant pinto bean
Reps: 4
Previous Crop: Corn
Tillage: Strip-Till
Herbicides: ***Pre:*** 12 oz/ac Outlook® on 6/6/18; 3 pt/ac Eptam® chemigated on 6/6/18
Seed Treatment: Dynasty®, Maxim®, Apron®, Vibrant, and Cruiser®
Foliar Fungicides: 1 lb/ac Copper on 7/14/18; 1 lb/ac Copper and 4 oz/ac Priaxor® on 7/24/18
Fertilizer: 50 lb/ac 11-52-0, 50 lb/ac 0-0-60, 5 lb/ac Hydra-Hume™, and 1 lb/ac Zinc on 5/31/18; 6 gal/ac 10-34-0 with planting in 2-by-2 placement on 6/5/18
Irrigation: Pivot, Total: 5
Rainfall (in):

Introduction: The purpose of this study was to compare several planting rates of dry edible beans (Vibrant variety pinto) planted in 30" row spacing. Target populations were 65,000, 85,000, and 105,000 plants/ac, however the planting equipment used resulted in seeding rates which differed from the indended rate. Actual populations were determined by early-season stand counts and were 68,789, 84,833, and 99,970 plants/ac, respectively. To estimate the treatment seeding rate and subsequent seed costs, 10% was added to the stand count values; this resulted in treatment seeding rates of approximately 75,900, 93,500, and 110,000 seeds/ac, and assumes all treatments had similar emergence and germination. The plots were direct harvested on September 21 with a Case IH 8240 combine and MacDon® 40 foot flex draper head. Yield was evaluated using the combine yield monitor. Samples from each plot were analyzed for bean quality parameters. Pod height measurements were taken to determine the percent of pods 2" or greater above the soil surface. Harvest loss estimates were determined by taking counts in one-square-foot frames randomly chosen in the harvested area but equally representing the left side of header, center of header, and right side of header area behind the combine.

Results:

Treatment (seeds/ac)	Stand Count (plants /ac)	Pods >2" above-ground (%)	Harvest Loss (bu/ac)	Small (%)	Split (%)	Foreign Material (%)	Damaged (%)	Moisture (%)	Density (lb/bu)	Seeds per lb	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
65,000	68,789 C*	72 A	3.2 A	0.3 A	0.3 B	0.2 A	0.4 B	14.7 A	61 A	1,123 A	61 B	743.11 A
85,000	84,833 B	63 AB	1.9 B	0.2 A	0.9 A	0.1 A	0.9 A	14.3 A	62 A	1,166 A	62 AB	738.90 A
105,000	99,970 A	49 B	2.3 AB	0.4 A	0.5 B	0.2 A	0.7 AB	14.4 A	62 A	1,145 A	63 A	745.45 A
P-Value	<0.0001	0.051	0.042	0.242	0.003	0.318	0.084	0.480	0.454	0.426	0.054	0.791

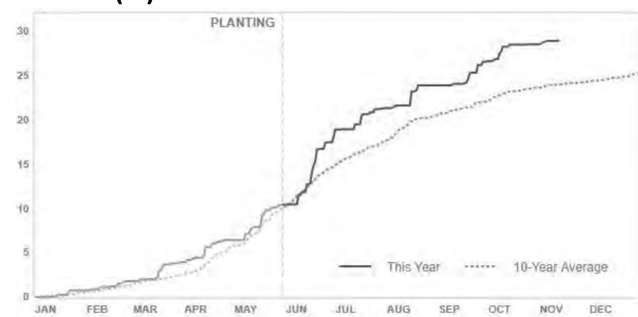
*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 14% moisture and adjusted for clean yield (% splits, % small, and % foreign material removed).
‡Marginal net return based on $22/cwt ($13.20/bu at 60 lb/bu). Seed cost for the Vibrant pinto bean seed was $79/100,000 seeds. Seed costs for each treatment were: $59.96/ac for 75,900 seeds/ac, $73.87/ac for 93,500 seeds/ac, and $86.90/ac for 110,000 seeds/ac.

Summary:

- Actual stand counts were fairly close to the targeted population for all three treatments.
- The percent of pods greater than 2" above the soil was greater for the 65,000 seeds/ac treatment than for the 105,000 seeds/ac treatment. For the 105,000 seeds/ac treatment, only 49% of pods were greater than 2" above the ground.
- Harvest loss was highest for the 65,000 seeds/ac treatment despite having the greatest number of pods greater than 2" above the ground. Considering the percent of pods greater than 2" above the ground was low for all treatments (highest was 71%), the harvest losses of 1.9 to 3.1 bu/ac are very good.
- The 85,500 seeds/ac treatment had a higher percentage of splits than the other two seeding rates; however, all had splits of under 1%. Percent small, splits, and foreign material is deducted from the yield.
- Similarly, the 85,000 seeds/ac treatment had a higher percent damage than the 65,000 seeds/ac treatment; however, all treatments had damage under 1%. For pinto beans, damage ratings greater than 3% are docked.
- There were no differences in percent small, moisture, test weight, or seeds per lb.
- Yield for the highest seeding treatment of 105,000 seeds/ac was 2.2 bu/ac higher than the 65,000 seeds/ac treatment.
- There were no significant differences in net return among the three populations tested.

Pinto Bean Planting Population for Direct Harvested Dry Beans

Study ID: 0807031201801
County: Cherry
Soil Type: Sandose-Hennings loamy fine sand 6-11% slopes; Sandose-Hennings loamy fine sand 3-6% slopes
Planting Date: 5/30/18
Harvest Date: 9/12/18
Row Spacing (in): 20
Variety: La Paz pinto bean
Reps: 4
Previous Crop: Corn
Tillage: Disk chopping vertical till twice, then rolled before planting
Herbicides: ***Pre:*** 1.3 pt/ac Medal® II ***Post:*** 21 oz/ac Varisto™, 7 oz/ac Targa®, and 1 pt/ac crop oil on 7/2/18; desiccant of 2 oz/ac Sharpen®, 32 oz/ac Durango®, 1 pt/ac MSO surfactant, 5 oz/ac Flame®, and 3 oz/ac Downdraft® on 8/31/18
Seed Treatment: Cruiser®
Foliar Insecticides: 5 oz/ac Drexel L-C Insecticide™ applied through the pivot on 8/3/18
Foliar Fungicides: 19 oz/ac SaniDate® 12.0 applied through the pivot on 7/22/18, 24 oz/ac SaniDate® 12.0 applied through the pivot on 8/7/18, and 24 oz/ac SaniDate® 12.0 applied through the pivot on 8/20/18
Fertilizer: 12 lb N/ac, 45 lb P/ac, 90 lb K/ac, 5 lb S/ac, 1 lb Zn/ac, and 1 lb B/ac broadcast on 4/3/18; 20 lb N/ac, 40 lb P/ac, 15 lb S/ac, and 1 lb Zn/ac starter on 5/30/18; 70 lb N/ac and 10 lb S/ac fertigated in July; 2.8 lb N/ac with herbicide 7/2/18
Irrigation: Pivot, Total: 9”
Rainfall (in):



Introduction: The purpose of this study was to compare several planting rates of dry edible beans (LaPaz variety pinto) planted in 20" row spacing. Target populations were 60,000, 85,000, and 110,000 plants/ac, however the planting equipment used resulted in seeding rates which differed from the indended rate. Actual populations were determined by early-season stand counts and were 61,188, 83,888, and 109,474; therefore, planting populations were approximately 10% greater at 67,100, 92,400, and 119,900 seeds/ac respectively and assumes all treatments had similar emergence and germination. The plots were harvested on September 12, with a John Deere S-series combine and 35' John Deere 635FD header. The temperature at harvest was 76°F, and 50% relative humidity. Hot and dry weather conditions at harvest generally result in greater harvest loss through pod shattering. Yield was evaluated using the combine yield monitor. Samples from each plot were analyzed for bean quality parameters. Pod height measurements were taken to determine the percent of pods 2" or greater above the soil surface. Harvest loss estimates were determined by taking counts in 9 one-square-foot frames randomly chosen in the harvested area but equally representing the left side of header, center of header, and right side of header area behind the combine. Satellite imagery for the plot area is in Figure 1.

Results:

Treatment (seeds/ac)	Stand Count (plants/ac)	Pods >2" above ground (%)	Harvest Loss (bu/ac)	Small (%)	Split (%)	Foreign Material (%)	Moisture (%)	Density (lb/bu)	Seeds per lb	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
60,000	61,188 C*	73 B	2.9 A	1.3 A	3.8 A	0.1 A	13.2 AB	62 AB	1,288 A	55 B	683.79 A
85,000	83,888 B	84 A	1.7 B	1.8 A	5.1 A	0.3 A	13.3 A	62 A	1,305 A	55 B	676.49 A
110,000	109,474 A	89 A	2.1 B	1.0 A	4.2 A	0.4 A	13.0 B	61 B	1,245 A	59 A	708.53 A
P-Value	<0.0001	0.002	0.011	0.393	0.130	0.365	0.092	0.035	0.293	0.016	0.126

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 14% moisture and adjusted for clean yield (% splits, % small, and % foreign material removed).
‡Marginal net return based on $22/cwt ($13.20/bu at 60 lb/bu). Seed cost for the treated LaPaz pinto bean seed was $0.70/lb of seed. There are 1,290 seeds/lb for this variety. Seed costs for each treatment were: $36.41/ac for 67,100 seeds/ac, $50.13/ac for 92,400 seeds/ac, and $65.06/ac for 119,900 seeds/ac.

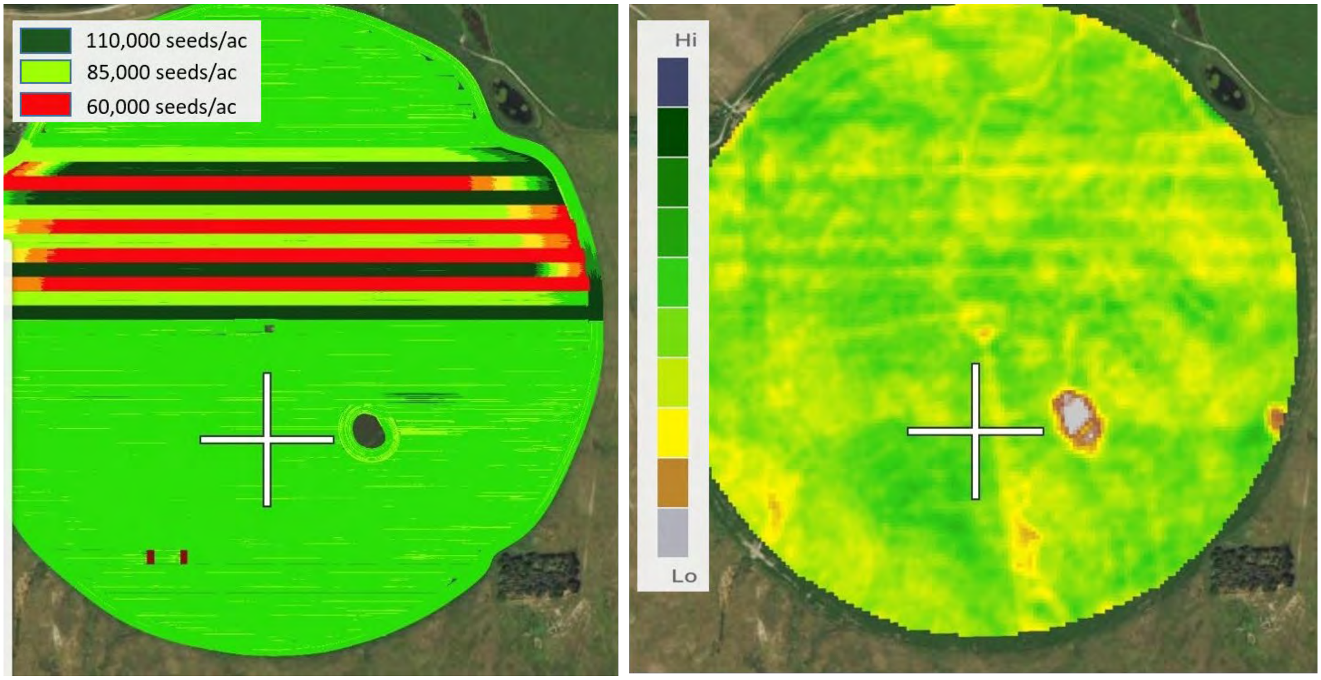


Figure 1. Planting map showing three planting population treatments (left) and satellite imagery from July 14, 2018, obtained from Climate FieldView™ showing the Climate Crop Index (CCI), a proprietary vegetative index generated using European Space Agency Copernicus Sentinel data (right). Stripes of lower (yellow) CCI values correspond to the lowest target population (60,000 seeds/ac).

Summary:

- Actual stand counts were close to the target populations for all three treatments.
- The percent of pods greater than 2" above the soil was greater for the 85,000 seeds/ac and 110,000 seeds/ac treatments than for the 60,000 seeds/ac treatment. For the 60,000 seeds/ac treatment, only 73% of the pods were greater than 2" above the ground compared to 84% for the 85,000 seeds/ac treatment and 89% for the 110,000 seeds/ac treatment.
- Harvest loss was significantly greater for the lowest seeding rate tested. This is expected as the lowest seeding rate also had the fewest number of pods greater than 2” above the soil, which would result in greater harvest loss. Considering the pod height in all treatments was less than 90% above 2", the harvest loss range of 1.7 to 2.9 bu/ac is very good.
- There were no significant differences in percent splits, percent small beans, percent foreign material, and seeds per lb for the three treatments tested.
- Moisture and density for the 85,000 seeds/ac treatment was significantly greater than the 110,000 seeds/ac treatment.
- Yield was 3.6 bu/ac greater for the 110,000 seeds/ac treatment than the other two populations tested.
- There were no significant differences in net return among the three populations tested. The increased seed cost for the 110,000 seeds/ac treatment was offset by the increased yield.

Pinto Bean Planting Population for Direct Harvested Dry Beans

Study ID: 0809013201801
County: Box Butte
Soil Type: Alliance loam 0-1% slope; Alliance loam 1-3% slope
Planting Date: 6/5/18
Harvest Date: 9/24/18
Row Spacing (in): 20
Variety: Radiant pinto bean
Reps: 4
Previous Crop: Sugarbeets
Tillage: Vertical tillage, rolled field after planting, rotary hoe after planting
Herbicides: ***Pre:*** 2 pt/ac Prowl®, 14 oz/ac Outlook®, and 22 oz/ac Roundup PowerMAX® ***Post:*** 21 oz/ac Varisto™, 8 oz/ac Basagran®, and 7 oz/ac Outlook® on 6/30/18; desiccation with 2 oz/ac Sharpen® and 2 pts/ac Gramoxone® on 9/12/18
Seed Treatment: Dynasty®, Maxim®, Apron®, Vibrance®, Cruiser®
Foliar Insecticides: None
Foliar Fungicides: 12 oz/ac Approach® for white mold on 7/20/18, 2 pts/ac Champ® for common and Halo blight on 7/30/18, and 2 pts/ac Champ® for blight on 8/7/18
Fertilizer: 8 gal/ac 10-34-0, 2 gal/ac Thio-sul® (12-0-0-26S), and 1 gal/ac Awaken (16-0-2) coulter applied; 2 gal/ac 10-34-0 and 4 gal/ac Riser® in furrow; 1 gal/ac Awaken (16-0-2) with fungicide on 7/20/18
Irrigation: Pivot, Total: 8.3"
Rainfall (in):

Introduction: The purpose of this study was to compare several planting rates of dry edible beans (Radiant variety pinto) planted in 20" row spacing. Target populations were 90,000, 110,000, and 130,000 plants/ac, however the planting equipment used resulted in seeding rates which differed from the intended rate. Actual populations determined by early-season stand counts were 72,075, 91,237, and 112,740 plants/ac. Seeding rates were estimated to be 10% greater at 79,200, 100,100, and 124,300 seeds/ac, respectively; these rates were used to calculate seed costs. The plots were direct harvested on September 24, with a John Deere S680 combine with a 35' MacDon® FD-75 flex draper header. The temperature at harvest was 69°F, and 45% relative humidity. Hot and dry weather conditions at harvest generally result in greater harvest loss through pod shattering. Yield was evaluated using the combine yield monitor. Samples from each plot were analyzed for bean quality parameters. Pod height measurements were taken to determine the percent of pods 2" or greater above the soil surface. Harvest loss estimates were determined by taking counts in 9 one-square-foot frames randomly chosen in the harvested area but equally representing the left side of header, center of header, and right side of header area behind the combine.

Results:

Treatment (seeds/ac)	Stand Count (plants/ac)	Pods >2" above ground (%)	Harvest Loss (bu/ac)	Small (%)	Split (%)	Foreign Matter (%)	Damaged (%)	Moisture (%)	Density (lb/bu)	Seeds per lb	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
90,000	72,075 C*	80 B	3.2 A	0.8 A	1.2 A	0.5 A	0.6 A	10.2 A	61 A	1,258 A	38 A	432.60 A
110,000	91,237 B	82 B	3.5 A	0.9 A	1.3 A	0.4 A	0.7 A	10.4 A	60 A	1,238 A	38 A	417.38 A
130,000	112,740 A	85 A	3.0 A	1.2 A	1.4 A	0.3 A	0.6 A	10.3 A	61 A	1,276 A	39 A	417.34 A
P-Value	<0.0001	0.012	0.684	0.436	0.761	0.600	0.702	0.185	0.337	0.281	0.922	0.952

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 14% moisture and adjusted for clean yield (% splits, % small, and % foreign material removed).
‡Marginal net return based on $22/cwt ($13.20/bu at 60 lb/bu). Seed cost for the Radiant pinto bean seed was $79/100,000 seeds. Seed costs for each treatment were: $62.57/ac for 79,200 seeds/ac, $79.08/ac for 100,100 seeds/ac, and $98.20/ac for 124,300 seeds/ac.

Summary:

- There were a number of negative things that affected population, plant health, and yield, including compaction from wet beet harvest the year before, heavy rains resulting in crusting at emergence, and wet conditions leading to root disease early and throughout the year. Because of these challenges, actual stand counts were less than the targeted populations for all three treatments.
- The percent of pods greater than 2" above the soil was greater for the 130,000 seeds/ac than for the 100,000 seeds/ac and 90,000 seeds/ac treatments. For the 130,000 seeds/ac treatment, 85% of the pods were greater than 2" above the ground compared to only 82% for the 110,000 seeds/ac treatment and 80% for the 90,000 seeds/ac treatment.
- There was no significant difference in harvest loss, percent splits, percent small beans, percent foreign material, percent moisture, density, seeds per lb, and percent damage for the three treatments tested.
- There was no significant difference in yield and net return among the three populations tested.

Pinto Varieties for Direct Harvest

Study ID: 0608013201801
County: Box Butte
Soil Type: Keith loam 0-1% slope
Planting Date: 6/7/18
Harvest Date: 10/3/18
Population: 110,000 target
Row Spacing (in): 7.5
Reps: 4
Previous Crop: Corn
Tillage: Vertical Till, Chisel and 2 Packings
Herbicides: ***Pre:*** 35 oz/ac Gly Star®, 5 oz/ac Glyphosate, 4.5 oz/ac Weather Guard Complete, and 25.6 oz/ac Prime Oil, on 6/8/18 ***Post:*** 21 oz/ac Varisto™, 8 oz/ac Basagran®, 9 oz/ac Section® Three, 9 oz/ac Weather Gard Complete, and 25.6 oz/ac Prime Oil® on 6/29/18
Seed Treatment: Cruiser®
Foliar Insecticides: 1.92 oz/ac Grizzly® Too on 8/4/18
Foliar Fungicides: 4 oz/ac Priaxor® and 1 lb/ac Nu-Cop® on 8/4/18
Fertilizer: 132.6 lb/ac of 30-4-0-5S-1Z dry spread, 64 oz/ac 32% UAN on 6/8/18, and 64 oz/ac 32% UAN on 6/29/18
Irrigation: Pivot, Total: 4.94”
Rainfall (in):

Introduction: The purpose of this study was to compare four different Pinto bean varieties in a direct harvest bean production system, looking at both yield and harvest loss. Currently, most dry beans in western Nebraska are harvested in a two-step process starting with a cutting windrowing operation, and then combining. Direct harvest is simply one pass through the field with the combine. A good upright bean variety, proper level field conditions, and a combine header suitable for direct harvest are essential to minimize harvest loss and economically justify direct harvest.

The study evaluated Radiant, Vibrant, WYO 50, and Sundance. These are all newer, slow darkening varieties of pinto beans that industry desires. The study was planted with a 40-foot air drill. The targeted population for the study was 110,000 plants per acre. Because of the inaccuracy of drills, normally as a result of seed size and seed flow through the machine, our actual plant populations determined by early-season stand counts were 104,550 plants/ac for Radiant, 104,332 plants/ac for Vibrant, 112,609 plants/ac for WYO 50, and 107,817 plants/ac for Sundance. Planting populations were assumed to be approximately 10% greater at 115,500 seeds/ac, 114,400 seeds/ac, 124,300 seeds/ac, and 118,800 seeds/ac, respectively. Low hanging pods are a major cause of harvest loss in the direct harvest process; therefore, pod height measurements were taken to determine the percent of pods greater than 2" above the ground just before harvest.

The plots were direct harvested on October 3 with a John Deere 635 flex auger head. The temperature at harvest was 84°F and relative humidity was 19%. Hot and dry weather conditions at harvest generally result in greater harvest loss through pod shattering.

Results:

	Stand Count (plants/ac)	Pods >2" above ground (%)	Harvest Loss (bu/ac)	Small (%)	Split (%)	Foreign Material (%)	Moisture (%)	Density (lb/bu)	Seeds per lb	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Radiant	104,550 A*	85 AB	2.2 B	1.2 A	7.2 A	2.0 A	14.2 A	57 C	1,358 A	47 A	529.59 A
Vibrant	104,332 A	90 A	2.7 B	1.4 A	4.2 A	1.0 AB	13.7 AB	59 BC	1,360 A	50 A	569.00 A
WYO 50	112,609 A	66 C	7.9 A	1.3 A	6.2 A	1.4 AB	11.8 B	59 AB	1,283 A	48 A	541.13 A
Sundance	107,817 A	81 B	3.4 B	1.6 A	3.6 A	0.7 B	13.8 AB	60 A	1,368 A	44 A	487.27 A
P-Value	0.208	<0.0001	0.0001	0.889	0.258	0.079	0.058	0.003	0.530	0.286	0.274

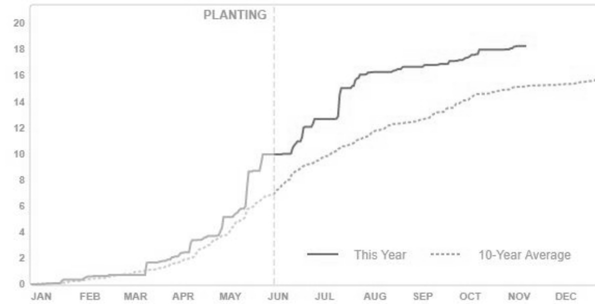
*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 14% moisture and adjusted for clean yield (% splits, % small, and % foreign material removed).
‡Marginal net return based on $22/cwt ($13.20/bu at 60 lb/bu). The seed cost was $79/100,000 seeds. There was no difference in seed cost for the varieties tested. Actual planted populations were slightly different; therefore, treatment costs were adjusted accordingly. Seed costs for each treatment were: $91.25/ac for Radiant, $90.38/ac for Vibrant, $98.20/ac for WYO 50, and $93.85/ac for Sundance.

Summary:

- There were no significant differences in stand counts among the treatments.
- The percent of pods greater than 2" above the soil differed among the varieties with Vibrant and Radiant having the greatest percentage of pods above 2". WYO 50 had only 66% of the pods 2" above the soil or greater.
- Due to low pod height, harvest loss was greater for WYO 50.
- There were no differences among varieties in percent small beans, percent split beans, or seeds per pound.
- Percent foreign material varied among varieties with Radiant having more foreign material than Sundance.
- Moisture also varied among varieties. WYO 50 was significantly drier than Radiant at the time of harvest due to WYO 50 maturing earlier.
- Differences existed in test weight among the varieties as well.
- Despite harvest loss differences, yields were not significantly different among the four varieties tested. There was also no difference in the net return among the four varieties.
- WYO 50 yielded competitively with the other varieties but based on low pod height and high harvest loss in this year’s data, it would not be recommended for direct harvest.

Great Northern Varieties for Direct Harvest

Study ID: 0808157201801
County: Scotts Bluff
Soil Type: Tripp very fine sandy loam 0-3% slope
Planting Date: 6/5/18
Harvest Date: GN 14164 on 9/13/18; 13172 and 14172 on 9/14/18; 14168 on 9/26/18
Row Spacing (in): 22
Reps: 4
Previous Crop: Corn
Tillage: Double disk then zone tillage with Schlagel till
Herbicides: ***Pre:*** 14 oz/ac Outlook® and 2 pt/ac Prowl® H2O on 6/5/18 ***Post:*** 4 oz/ac Raptor®, 1.2 pt/ac Basagran®, and 1 qt/100 gal NIS on 7/4/18
Seed Treatment: Cruiser®
Foliar Fungicides: 4 oz/ac Priaxor® on 7/19/18
Fertilizer: 53 lb/ac N in manure application; 2 qt/ac UAN with herbicide on 7/4/18
Irrigation: Pivot, Total: 8.5”
Rainfall (in):



Soil Sample:

Residual N (lb/ac)	P2O5 (ppm)
89	23.9

Introduction: The purpose of this study was to compare four different Great Northern (GN) bean varieties in a direct harvest bean production system, looking at both yield and harvest loss. Currently, most dry beans in western Nebraska are harvested in a two-step process starting with a cutting windrowing operation, and then combining. Direct harvest is simply one pass through the field with the combine. A good upright bean variety, proper level field conditions, and a combine header suitable for direct harvest are essential to minimize harvest loss and economically justify direct harvest.

The study evaluated GN 14172, GN 14168, GN 14164, and GN 13172 Great Northern dry bean varieties. The plots were planted with a 33-foot Monosem planter in 22" row spacing. The targeted population for the study was 94,000 plants per acre. Because of inaccuracy in the planter based on vacuum pressure and varying seed size among varieties, our actual plant populations determined by early-season stand counts were 88,803 seeds/ac for GN 14172, 77,740 seeds/ac for GN 14168, 93,704 seeds/ac for GN 14164, and 88,135 seeds/ac for GN 13172; therefore, planting populations were assumed to be approximately 10% greater at 97,900 seeds/ac, 85,800 seeds/ac, 103,400 seeds/ac and 96,800 seeds/ac, respectively. Low hanging pods are a major cause of harvest loss in the direct harvest process; therefore, pod height measurements were taken to determine the percent of pods greater than 2" above the ground just before harvest.

Figure 1. Drone imagery of study area from August 20, 2018, with varieties delineated and labeled. Image courtesy of Dr. Bijesh Maharjan.

The plots were harvested with a John Deere 9500 combine and a John Deere 925 flex auger head. Due to differences in maturity date between the varieties, the plots were harvested on different dates; GN 14164 was harvested on 9/13/18 with a temperature of 84°F and a relative humidity of 29%, GN 13172 and GN 14172 were harvested on 9/14/18 with a temperature of 83°F and a relative humidity of 35%, and GN 14168 was harvested on 9/26/18 with a temperature of 72°F and a relative humidity of 25%. Hot and dry weather conditions at harvest generally result in greater harvest loss through pod shattering.

Results:

	Stand Count (plants/ac)	Pods >2" above ground (%)	Harvest Loss (bu/ac)	Small (%)	Split (%)	Foreign Material (%)	Moisture (%)	Density (lb/bu)	Seeds per lb	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
GN 14172	88,803 B*	77 A	12.7 B	0.6 AB	1.8 A	0.3 A	13.7 A	62 A	1,268 A	54 B	632.85 B
GN 14168	77,740 C	67 B	14.8 AB	0.3 B	2.3 A	0.7 A	12.5 C	62 A	1,153 B	46 C	544.99 C
GN 14164	93,704 A	80 A	16.5 A	0.8 A	2.3 A	0.5 A	12.9 BC	62 A	1,145 B	42 D	468.51 D
GN 13172	88,135 B	85 A	12.5 B	0.5 AB	1.8 A	0.2 A	13.4 AB	62 A	1,295 A	58 A	684.40 A
P-Value	<0.001	0.001	0.035	0.033	0.237	0.507	0.001	0.200	<0.0001	<0.0001	<0.0001

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 14% moisture and adjusted for clean yield (% splits, % small, and % foreign material removed).
‡Marginal net return based on $22/cwt ($13.20/bu at 60 lb/bu). The seed cost was $79/100,000 seeds. There was no difference in seed cost for the varieties tested. Actual planted populations were slightly different due to different seed size and shape, therefore treatment costs were adjusted accordingly. Seed costs for each treatment were: $77.34/ac for GN 14172, $67.78/ac for GN 14168, $81.69/ac for GN 14164, and $76.47/ac for GN 13172.

Summary:

- Stand counts differed significantly among treatments.
- The percent of pods greater than 2" above the soil was lower for GN 14168, which was also the variety with the lowest seeding rate and was harvested last.
- Harvest loss was greater for GN 14164, the first harvested variety, than for GN 14172 and GN 13172.
- GN 14164 also had a higher percentage of small beans than GN 14168.
- Moisture also differed between the varieties.
- GN 13172 and GN 14172 had more seeds per pound than GN 14168 and GN 14164.
- There was no significant difference in percent splits, percent foreign material, or density.
- Yield and net return were significantly different among each variety tested. Yield was highest for GN 13172, and was 3.9 bu/ac higher than the next highest yielding variety GN 14172. GN 14164 was the lowest yielding variety, 16 bu/ac less than the highest yielding variety. Seed costs were very close among the treatments; therefore, the net return ranking was the same as the yield ranking.
- Several factors contributed to excessive harvest loss in this study. Based on the residual soil N, the N in the manure application, and the UAN applied with herbicide, there was greater than 140 lb/ac of N in this field. A normal N recommendation is around 120 lb/ac. Excess N application can result in excessive top growth, which can cause plants to lodge. The crop was also planted on beds, which in the event of plants lodging and going down, can cause the plants to fall into the depressions between beds which can increase harvest loss. It is possible that a newer flex draper header with multiple adjustments could have reduced harvest loss. With only one year of data and numerous factors contributing to harvest loss, these varieties need to be looked at further to determine their acceptability for direct harvest. Given the harvest loss that occurred, the yields were excellent.

CROP PROTECTION

- Insecticide Seed Treatment on Soybeans Following Corn Silage or Corn Grain Harvest

Insecticide Seed Treatment on Soybeans Following Corn Silage or Corn Grain Harvest

Study ID: 0676155201801
County: Saunders
Soil Type: Yutan silty clay loam terrace, 2-6% slopes, eroded; Tomek silt loam 0-2% slope; Filbert silt loam 0-1% slope; Fillmore silt loam terrace, occasionally ponded
Planting Date: 5/7/18 - 5/8/18
Harvest Date: 10/9/18
Population: 138,671
Row Spacing (in): 15
Hybrid: Asgrow® 29X8
Reps: 10 (40 total treatment strips)
Previous Crop: Corn
Tillage: No-Till
Herbicides: ***Pre:*** 15 gal/ac water, 12.8 oz/ac Engenia®, 18 oz/ac Outlook®, and 12 oz/ac VaporGard™ ***Post:*** 15 gal/ac water, 6 oz/ac Intensity®, 4.84 oz/ac NIS, 40 oz/ac Roundup PowerMAX®, and 2.57 lb/ac AMS
Seed Treatment: being studied, therefore described in introduction
Foliar Fungicides: 4 oz/ac Priaxor® and 6 oz/ac Masterlock®
Fertilizer: None
Irrigation: Pivot
Rainfall (in):

Introduction: The purpose of this study was to evaluate the use of an insecticide seed treatment on soybeans following corn that was harvested for grain and corn that was harvested for silage. The no insecticide treatment received Acceleron® Basic seed treatment which is a fungicide seed treatment with active ingredients of Pyraclostrobin, Metalaxyl, and Fluxapyroxad applied at a rate of 2 oz/100 lb seed. The insecticide treatment received Acceleron® Standard which contains the same fungicide seed treatment as Acceleron® Basic plus an insecticide treatment with active ingredient Imidacloprid which was applied at a rate of 4 oz/100 lb seed. All treatments also received 4 oz/ac of Priaxor® foliar fungicide at R3. Yield, moisture, and net return were evaluated.

Results: Data were analyzed using the GLIMMIX procedure in SAS 9.4 (SAS Institute Inc., Cary, NC). Mean separation was performed with Tukey's HSD.

For grain moisture, there was no interaction between insecticide treatment (with or without insecticide) and previous crop (corn grain harvest or corn silage harvest); therefore, these factors are analyzed separately. There was a difference in grain moisture for soybeans following silage versus grain. The use of an insecticide seed treatment did not impact grain moisture.

	Moisture (%)
Soybeans Following Corn Silage Harvest	11.6 B*
Soybeans Following Corn Grain Harvest	12.0 A
P-Value	*<0.0001*

For yield and net return, there was an interaction of insecticide treatment (with or without insecticide) and previous crop (corn grain harvest or corn silage harvest) therefore these factors are presented together.

Treatment applied to Soybeans	**Yield† (bu/ac)**	**Marginal Net Return‡ ($/ac)**
No Insecticide Following Silage Harvest	76.6 B	566.50 AB
Insecticide Following Silage Harvest	78.5 A	574.68 A
No Insecticide Following Corn Grain Harvest	75.3 BC	557.48 B
Insecticide Following Corn Grain Harvest	74.6 C	545.23 C
P-Value of Previous Crop x Treatment	*0.006*	*0.001*

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $7.40/bu soybean and $6.50/ac for additional cost of Acceleron® standard over Acceleron® basic to provide insecticide seed treatment.

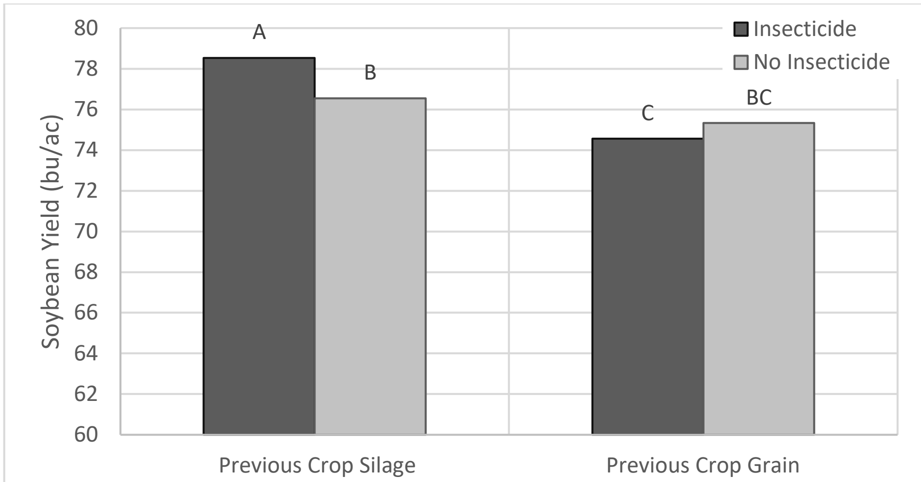


Figure 1. Impact of insecticide seed treatment on soybean yield evaluated for area that had a previous crop of corn silage and previous crop of grain.

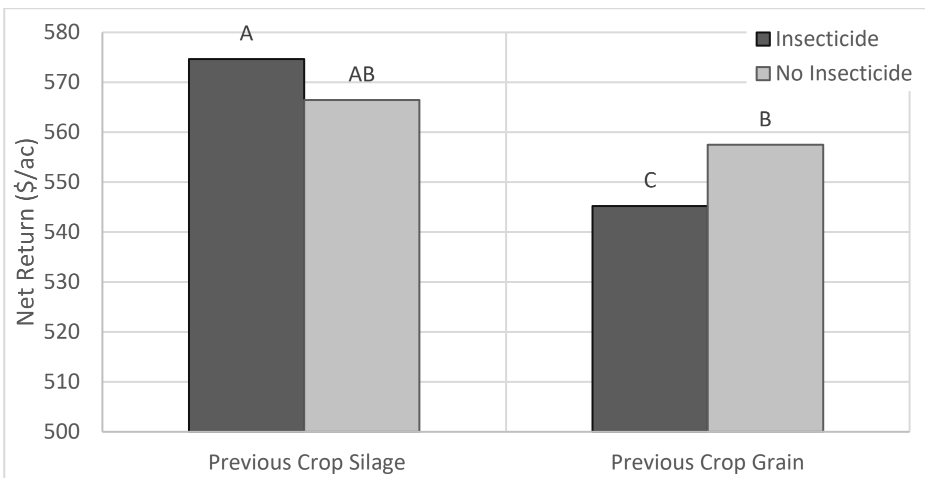


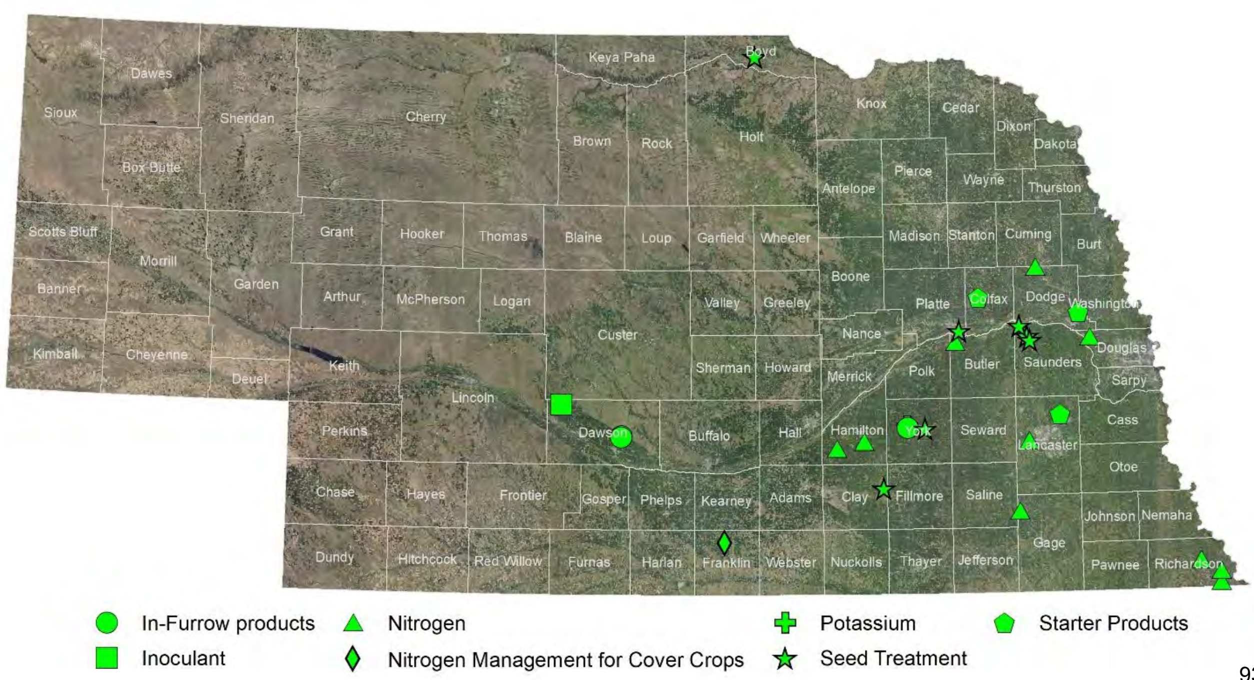
Figure 2. Impact of insecticide seed treatment on marginal net return evaluated for area that had a previous crop of corn silage and previous crop of grain.

Summary:

- The soybeans following the corn which was harvested for grain were significantly wetter at harvest than the soybeans following the corn which was harvested for silage.
- The insecticide provided an advantage over no insecticide where the previous corn crop was harvested for silage. The insecticide did not provide an advantage over the no insecticide check where the previous corn crop was harvested for grain.
- The use of the insecticide seed treatment resulted in no difference in net return where the previous crop was corn harvested for silage; the use of the insecticide seed treatment decreased net return where the previous corn crop was harvested for grain.

FERTILITY AND SOIL MANAGEMENT

- Starter Fertilizer on Irrigated Corn
- Starter Fertilizer on Non-Irrigated Corn
- Comparison of Starter Fertilizers on Irrigated Corn
- Comparison of In-Furrow Starter Fertilizers on Non-Irrigated Corn
- Impact of Commence® Seed Treatment on Soybeans (2 sites)
- Impact of Commence® Seed Treatment on Corn (4 sites)
- Evaluation of Commence®, Generate®, and Bio-Sure Grow in Corn
- Impact of Generate® In-Furrow at Planting on Soybean Yield
- Impact of Generate® In-Furrow at Planting on Corn Yield (2 sites)
- Impact of Seed Treatment and In-Furrow Inoculant on Soybeans
- Impact of Potassium Application on Irrigated Corn
- Nitrogen Application to Corn Following Cover Crops (NRCS Demo Farm)
- In-season Nitrogen Application on Corn Following Rye Cover Crop
- Nitrogen Source Study: Anhydrous Ammonia versus UAN Broadcast
- Impact of Anhydrous Ammonia Nitrogen Rate on Corn Yield
- Impact of NutriSphere-NH3™ with Anhydrous Ammonia Application
- Data Intensive Farm Management: Nitrogen Application Rates on Corn (2 sites)
- Using Drone Based Sensors to Direct Variable-Rate In-Season Aerial Nitrogen Application on Corn (2 sites)
- Project SENSE: Sensor-based In-season N Management (3 sites)



Starter Fertilizer on Irrigated Corn

Study ID: 0718185201802
County: York
Soil Type: Hastings silt loam 0-1% slope; Uly-Hobbs silt loam 11-30% slopes; Hastings silt loam 3-7% slopes
Planting Date: 4/24/18
Harvest Date: 10/4/18
Population: 32,000
Row Spacing (in): 30
Hybrid: Pioneer® P1828AM
Reps: 6
Previous Crop: Soybean
Tillage: Ridge-Till
Herbicides: ***Pre:*** 3 pt/ac Weedmaster® in December 2017; 1 qt/ac Staunch® II and 1 qt/ac Atrazine at planting in April 2018 ***Post:*** 32 oz/ac Durango®, 1 oz/ac Impact®, and 1 pt/ac Atrazine in June 2018
Seed Treatment: None
Insecticides: 1 oz/ac Perm-Up® on top of the soil for cutworm control at planting
Foliar Fungicides: 6 oz/ac Aframe™ and 3 oz/ac Onset® on 7/31/18
Fertilizer: 150 lb/ac 11-52-0, 100 lb/ac AMS, and 175 lb/ac N as anhydrous in November 2017; 3 gal/ac 10-34-0 as starter at planting
Note: Light hail and wind
Irrigation: Pivot, Total: 1.5"
Rainfall (in):

Soil Test (Nov. 2017) – 2 samples were taken in the study area:

Soil pH 1:1	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lb N/A 0-10"	Mehlich P-III ppm P	Ca-P Sulfate ppm S	Zn (ppm)	Ammonium Acetate (ppm) K	Ca	Mg	Na	CEC me/100g	% Base Saturation H	K	Ca	Mg	Na
7.0	0.18	NONE	3.0	7.3	22	6	10.1	1.76	421	2311	326	52	15.6	0	7	74	17	1
6.6	0.23	NONE	2.5	6.5	20	24	10	0.98	485	2635	575	53	19.4	0	6	68	25	1

Introduction: The purpose of this study was to evaluate starter fertilizer in irrigated corn production. Previous on-farm research starter fertilizer studies showed minimal yield and economic gains if soil test phosphorus levels were 10 ppm or greater in a corn and soybean rotation (https://go.unl.edu/starter). Yet a number of growers still utilize starter fertilizer for various reasons. Studies have shown that there can be an early growth and yield response from N in an N-P starter fertilizer (https://go.unl.edu/starterfert). In this study, the starter fertilizer included 3 gal/ac 10-34-0 and was compared with a no starter check.

Results:

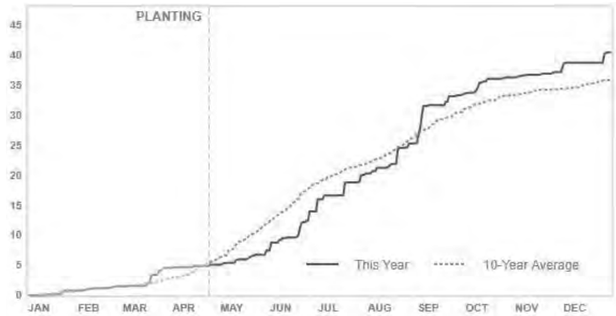
	Harvest Stand Count (plants/acre)	Moisture (%)	Stalk Rot (%)	Yield† (bu/acre)	Marginal Net Return‡ ($/ac)
Check	30,583 A*	21.3 A	46.25 A	246 A	795.09 A
Starter (3 gal 10-34-0)	29,750 A	21.2 A	45.00 A	246 A	786.19 A
P-Value	0.296	0.363	0.797	0.940	0.746

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre adjusted to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and$6.85/ac for starter fertilizer.

Summary: Using a starter fertilizer did not result in differences in stand count, grain moisture, stalk rot ratings, yield, or marginal net return.

Starter Fertilizer on Non-Irrigated Corn

Study ID: 0136109201801
County: Lancaster
Soil Type: silty clay loam; silt loam
Planting Date: 4/24/18
Harvest Date: 10/4/18
Population: 30,000
Hybrid: Dekalb® DKC 62-98
Reps: 10
Tillage: No-Till
Herbicides: ***Pre:*** Bicep II Magnum® ***Post:*** Roundup® and Callisto®
Foliar Insecticides: None
Foliar Fungicides: None
Irrigation: None
Rainfall (in):



Introduction: The objective of this study was to determine if using 5 gal/ac of 10-34-0 starter fertilizer (6 lb/ac actual N and 20 lb/ac actual P) at planting results in higher yield and profit. Recent soil tests are not available.

Results:

	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	16.0 A*	208 A	671.24 A
Starter (5 gal 10-34-0)	15.8 B	208 A	655.36 B
P-Value	0.007	0.688	<0.0001

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre adjusted to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and $15/ac for starter fertilizer.

Summary: There was no yield difference between the starter treatment and the unfertilized check. Due to the additional starter fertilizer cost, the check was more profitable.

Comparison of Starter Fertilizers on Irrigated Corn

Study ID: 0819053201802
County: Dodge
Soil Type: Luton silty clay occasionally flooded; Gibbon silty clay loam occasionally flooded
Planting Date: 4/28/18
Harvest Date: 11/1/18
Population: 32,000
Row Spacing (in): 30
Hybrid: Pioneer® P1379
Reps: 8
Previous Crop: Soybean
Tillage: Fall Turbo Tilled
Herbicides: ***Post:*** 2.5 qt/ac Resicore® and 1 pt/ac Atrazine applied with fertilizer on 5/1/18
Seed Treatment: None

Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: 125 lb/ac N from 32% UAN broadcast on 5/1/18
Irrigation: Pivot, Total: 5"
Rainfall (in):

Soil Test (1993-1994, last available soil test. New samples will be taken as soon as is feasible.)

Sample*	pH	Excess Lime	BpH	OM%	Bray P1	Olson P†	K	Zn
					---------------------------ppm-------------------------			
1	7.7	Very High	-	3.8	0.9	3.6	189	0.63
2	8.1	Very High	-	4.3	0.6	3.4	131	-
3	5.8	-	6.5	3.6	32	-	281	1.18
4	6.6	-	-	3.6	25	-	298	0.91
5	6.5	-	-	3.6	28	-	311	0.98

*Samples one through five represent zones of the field moving from north to south with one in the north and five in the south.
†Olson P was completed for samples with excess lime.

Introduction: The objective of this study was to evaluate starter fertilizer rates and placements on a high pH soil. 5 gal/ac 10-34-0 fertilizer applied in-furrow was compared to 12 gal/ac 10-34-0 fertilizer applied in a 2x2 placement (2" to the side and 2" deep). Aerial multispectral imagery was obtained for the field during the growing season. The normalized difference vegetative index (NDVI) values are presented for June 29 and July 10. The NDVI imagery from July 10 is shown in Figure 1.

Results:

	NDVI June 29	NDVI July 10	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
5 gal/ac 10-34-0 in-furrow	-0.306 B	0.190 B	14.4 A*	174 B	547.91 A
12 gal/ac 10-34-0 2x2	-0.305 A	0.196 A	14.6 A	187 A	574.56 A
P-Value	0.093	0.002	0.170	0.020	0.114

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre adjusted to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn, $12.50/ac for 5 gal/ac 10-34-0, and $30/ac for 12 gal/ac 10-34-0.

Summary:

- The 12 gal/ac 10-34-0 placed in 2x2 had higher NDVI values on June 29 and July 10.
- The 12 gal/ac 10-34-0 placed in 2x2 resulted in a higher yield than the 5 gal/ac 10-34-0 placed in-furrow.
- There was no significant difference in marginal net return.

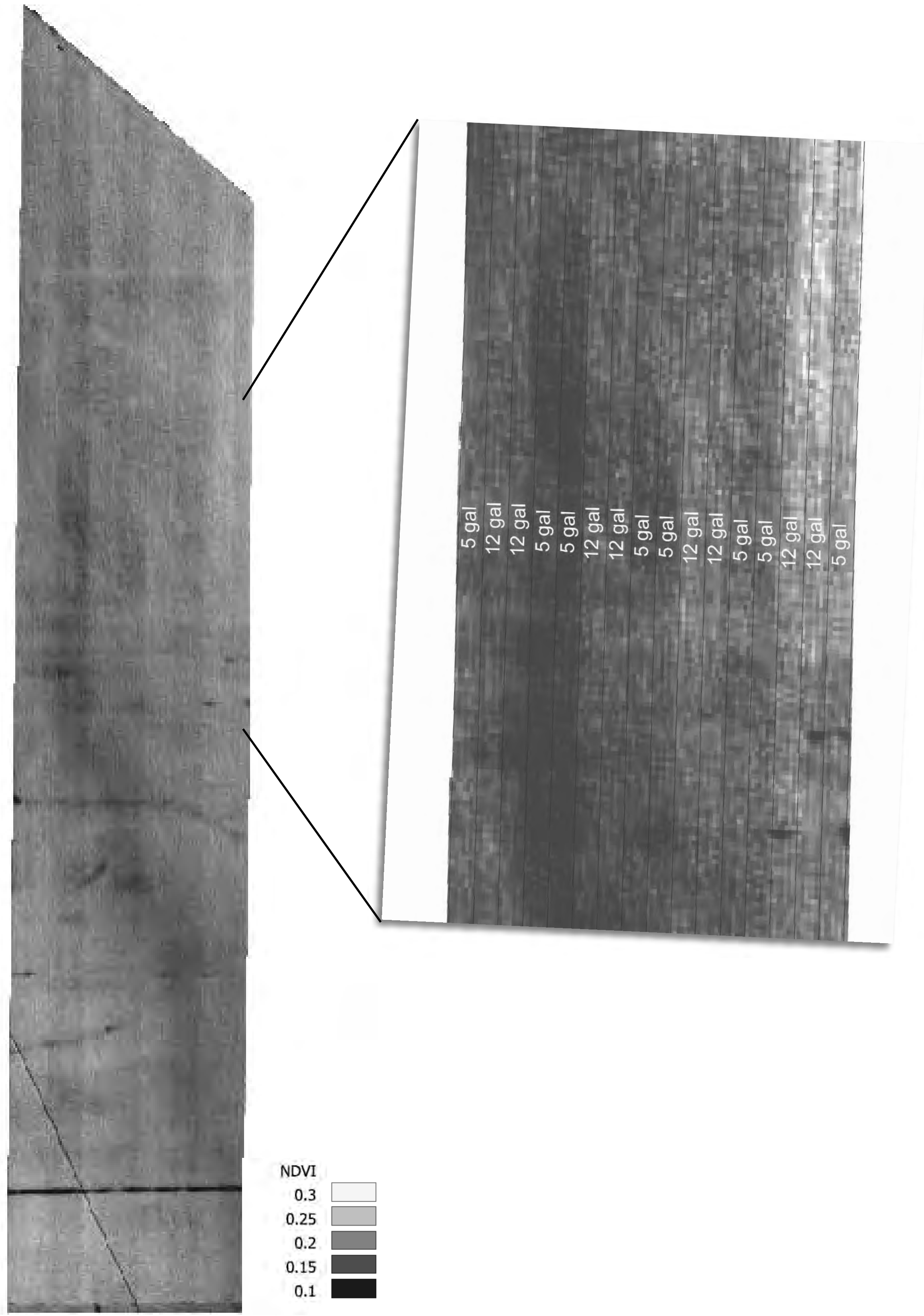
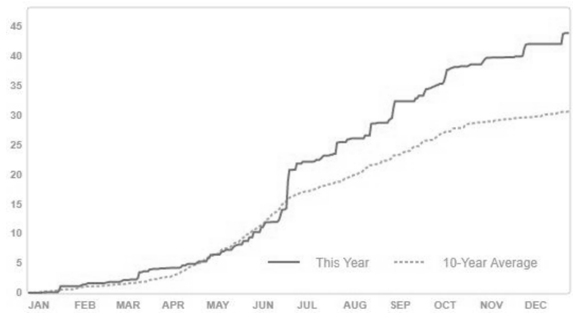


Figure 1. Normalized difference vegetative index (NDVI) from July 10, 2018, for 5 gal/ac 10-34-0 in-furrow and 12 gal/ac 10-34-0 with 2x2 placement.

Comparison of In-Furrow Starter Fertilizers on Non-Irrigated Corn

This study was completed by the Maple Creek Creators 4-H Club as part of the Innovative Youth Corn Challenge

Study ID: 0820037201801
County: Colfax
Soil Type: Belfore silty clay loam 0-2% slope; Moody silty clay loam 2-6% slopes
Planting Date: 5/8/18
Harvest Date: 11/19/18
Population: 27,700
Row Spacing (in): 30
Hybrid: Pioneer® P0919AM
Reps: 4
Previous Crop: Soybean
Tillage: No-Till
Seed Treatment: Pioneer® PPST 250, Raxil® fungicide and DuPont Lumivia® insecticide
Herbicide: ***Pre:*** 1.2 qt/ac Harness® Extra, 2.1 oz/ac Balance® Flexx, and 1.03 pt/ac 2,4-D LV4 on 5/17/18 ***Post:*** 1.4 qt/ac Roundup PowerMAX® on 6/15/18
Foliar Insecticides: None
Foliar Fungicides: 10 oz/ac Headline AMP® on 8/7/18
Fertilizer: 154 lb N/ac from 32% UAN applied pre-emerge with pre-herbicide on 5/17/18; 12.5 gal/ac 32% UAN and 3.5 gal/ac 12-0-0-26 providing 49 lb N/ac and 10 lb S/ac on 6/6/18; 0.25 lb/ac Boron, and 0.17 lb/ac Manganese sidedressed on 6/6/18
Irrigation: None
Rainfall (in):



Soil Test (Jan. 2018):

pH	BpH	Soluble Salts	OM	Nitrate	Bray P1	Bray P2	K	Mg	Ca	S	Zn	Mn	Fe	Cu	B	Na
		mS/cm	*(%)*	----------	----------	----------	----------	*ppm*	----------	----------	----------	----------	----------	----------	----------	----------
6	6.6	0.4	2.9	9	55	73	354	608	2752	24	3.0	8	52	1.4	0.5	44

Introduction: This project was conducted by the Maple Creek Creators 4-H Club as part of the Innovative Youth Corn Challenge. Previously, this club had looked at applying starter fertilizer in-furrow using Triple Nickel. They were concerned about the higher salt content of this starter fertilizer when placed close to the seed. For this year's project, they decided to evaluate another starter fertilizer with lower salt content. Triple Nickel is an inexpensive, but higher salt starter fertilizer. This was compared to Conklin® Feast®, a more expensive but lower salt starter fertilizer. The two products had similar amounts of each nutrient, and zinc was applied with the Conklin® Feast® product so that each treatment would have the same nutrients applied. A no starter fertilizer check was also included. The in-furrow fertilizer was applied at a rate of 5 gal/ac through Keeton seed firmers with a splitter attachment, so the fertilizer is applied to the sidewall and not directly on the seed.

The field had 25 tons/ac of cattle feedlot manure spread and incorporated in the spring of 2017. Soil test levels for phosphorus in January 2018 were 55 ppm Bray P1. Previous on-farm research on starter fertilizer found that the mean yield increase with starter was 12 bu/ac when Bray P1 <10 ppm, 3 bu/ac when Bray P1 was 10-20 ppm, and 1 bu/ac when Bray P1 > 20 ppm (https://go.unl.edu/starter). Studies have also shown there can be an early growth and yield response from the nitrogen in an N-P starter fertilizer (https://go.unl.edu/starterfert).

Strong winds on June 7 stripped some leaves off plants. On June 24, strong winds and hail again stripped leaves and caused some green snap. On June 25, an all-day rain event resulted in over five inches of rain, which caused some ponding. In response to suspected N loss, N was applied in-season. Gray leaf spot was present in August; therefore, Headline AMP® was aerially applied.

Yield, moisture, and net return were evaluated. Additionally, emergence counts were taken from May 17 to May 30. Counts were taken by flagging plants as they emerged. Counts were taken from all eight rows of the planter.

Results:

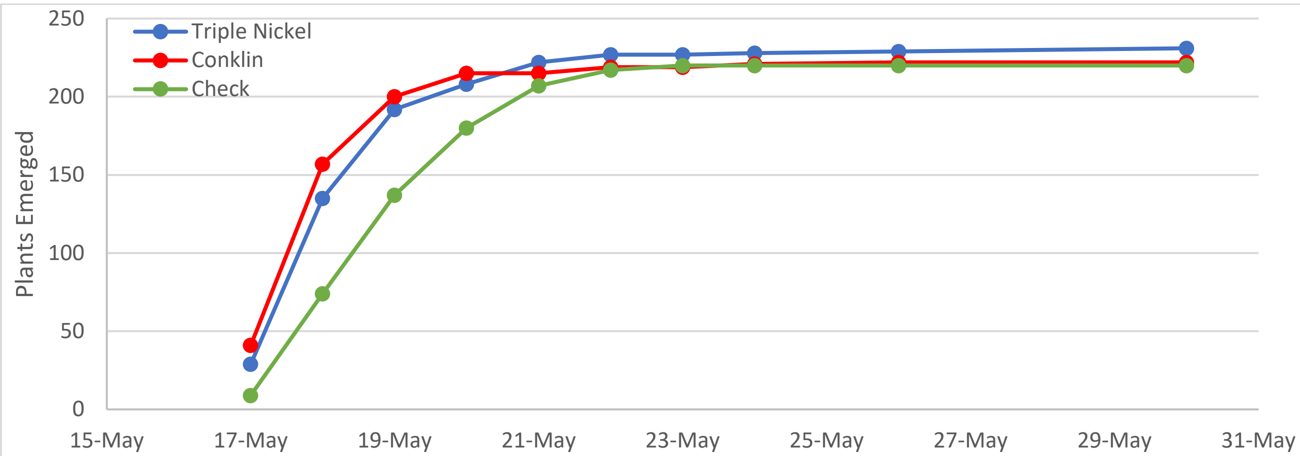


Figure 1. Emergence counts obtained from all eight rows of the planter from May 17 to May 30 for the three treatments.

	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	16.4 A*	234 A	756.96 A
5 gal/ac Triple Nickel 8-20-5-5S-0.5Zn	16.2 A	235 A	747.86 A
5 gal/ac Conklin Feast 8-16-11-2S + 1 pt Zn	16.0 A	233 A	710.62 B
P-Value	0.412	0.362	0.0004

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre adjusted to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn, $11.35/ac for Triple Nickel, $35.05/ac for Conklin Feast, and $5.18/ac for Zinc.

Summary:

- There was no difference in moisture or yield for the treatments evaluated.
- Marginal net return was lower for the Conklin® Feast® product due to the increased production cost.
- Emergence counts are presented graphically in Figure 1. Emergence counts were not replicated; therefore, statistical analysis is not available.
- The impact of green snap on yields and fertilizer response was not documented.

"The Innovative Youth Corn Challenge has been a very valuable and educational experience for our team. We have also learned that an increase in yield doesn't mean an increase in profit, and that in most cases, profit is more important than yield. We have learned it is important to go to the field regularly, because you can find problems and treat them before they become too severe that they harm yield and profitability."

- Maple Creek Creators 4-H Club

Impact of Commence® Seed Treatment on Soybean Summary (2 sites)

The purpose of this study was to evaluate Commence® seed treatment. Commence® was applied at a rate of 4 oz/100 lb of seed. Product information is below.

GUARANTEED ANALYSIS
Cobalt (Co)............... 1.43%
Copper (Cu) 0.34%
Iron (Fe).................... 0.71%
Manganese (Mn)....... 0.46%
Zinc (Zn) 0.29%

DERIVED FROM: Cobalt Carbonate, Cobalt Sulfate, Copper (II) Carbonate, Iron (III) Oxide, Manganese (II) Oxide, Manganese (II) Sulfate, Zinc Carbonate, Zinc Sulfate

Product information from: *Agnition*

Two studies were conducted in 2018 for a total of 13 replications. Data from these studies were analyzed together using the GLIMMIX procedure in SAS 9.4 (SAS Institute Inc., Cary, NC). Mean separation was done with Tukey's HSD.

Table 1. Yield of soybean with and without Commence seed treatment from two site locations.

	Yield (bu/acre)†
Check	67.9 A*
Commence Seed Treatment	68.1 A
Site (P>F)	*0.0001*
Treatment (P>F)	*0.8269*
*Site*Treatment*	*0.6773*

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 13% moisture.

Summary: There was no significant yield increase for using Commence seed treatment when both sites are considered together. The sites did have significantly different yields. Individual site reports with separate analysis evaluating treatment effect in that site only follow.

Impact of Commence® Seed Treatment on Soybean

Study ID: 0718185201804
County: York
Soil Type: Hastings silt loam 0-1% slope; Hastings silt loam 1-3% slope; Crete silt loam 0-1% slope
Planting Date: 5/7/18
Harvest Date: 9/23/18
Population: 140,000
Row Spacing (in): 30
Variety: Pioneer® P31A22X
Reps: 5
Previous Crop: Seed Corn
Tillage: Ridge-Till
Herbicides: ***Pre:*** 1 qt/ac Brash® on 4/19/18, 5 oz/ac Authority® First and 22 oz/ac Roundup® on 5/7/18 with planting ***Post:*** 24 oz/ac Durango® and 1 pt/ac Brawl™ on 6/8/18
Seed Treatment: Lumisena™, EverGol® Energy, and PPST 2030
Foliar Insecticides: 5 oz/ac Hero® on 7/28/18
Foliar Fungicides: 5 oz/ac Preemptor™ on 7/28/18
Fertilizer: 125 lb/ac 11-52-0 in Nov. 2017
Irrigation: Pivot, Total: 1.5"
Rainfall (in):

Soil Test (Oct. 2017) – 2 samples were taken in the study area:

Soil pH 1:1	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lb N/A 0-10"	Mehlich P-III ppm P	Ca-P Sulfate ppm S	Zn (ppm)	Ammonium Acetate (ppm) K	Ca	Mg	Na	CEC me/100g	% Base Saturation H	K	Ca	Mg	Na
6.8	0.15	NONE	3.5	0.5	2	24	10	1.08	359	2580	368	49	17.1	0	5	75	18	1
7.0	0.16	NONE	3.6	1.0	3	39	9	1.69	391	2544	293	42	16.3	0	6	78	15	1

Introduction: The purpose of this study was to evaluate the impact of Commence® seed treatment on soybeans. The product was applied at 4 oz/100 lb of seed. Product information is at right. Yield, grain moisture, stand counts, and marginal net return were determined for this study. Stand counts were collected post-harvest on 9/28/18.

GUARANTEED ANALYSIS
Cobalt (Co)............... 1.43%
Copper (Cu) 0.34%
Iron (Fe)................... 0.71%
Manganese (Mn)....... 0.46%
Zinc (Zn) 0.29%

DERIVED FROM: Cobalt Carbonate, Cobalt Sulfate, Copper (II) Carbonate, Iron (III) Oxide, Manganese (II) Oxide, Manganese (II) Sulfate, Zinc Carbonate, Zinc Sulfate

Product information from: *Agnition®, Ralco Nutrition, Inc.*

Results:

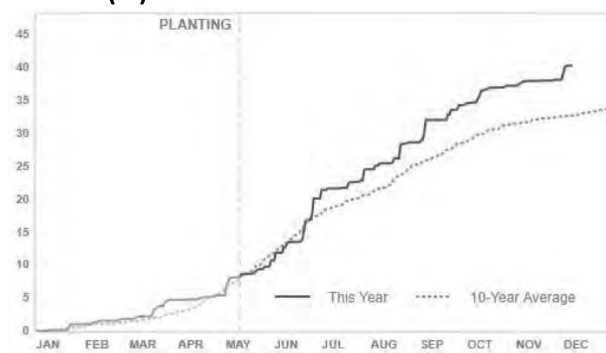
	Harvest Stand Count (plants/ac)	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	99,400 A*	12.0 A	76.5 A	566.18 A
Commence	99,300 A	12.0 A	77.1 A	561.77 A
P-Value	0.975	<0.0001	0.583	0.592

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre adjusted to 13% moisture.
‡Marginal net return based on $7.40/bu soybean, $7/ac Commence seed treatment, and $2/ac seed treating.

Summary: There were no differences in grain moisture, harvest stand counts, yield, or marginal net return between the Commence® treated seed and the check.

Impact of Commence® Seed Treatment on Soybean

Study ID: 0007155201802
County: Saunders
Soil Type: Wann fine sandy loam occasionally flooded; Gibbon silt loam occasionally flooded; Boel loamy fine sand occasionally flooded; Lex loam occasionally flooded
Planting Date: 5/10/18
Harvest Date: 10/21/18
Population: 140,000
Row Spacing (in): 15
Hybrid: Stine® 26LH02
Reps: 8
Previous Crop: Corn
Tillage: No-Till
Herbicides: ***Pre:*** 3 oz/ac Valor® XLT, 0.5 pt/ac 2,4-D 6#, 18 oz/ac Buccaneer® 5, and 8.5 lb/100 gal dry AMS on 4/20/18 ***Post:*** 32 oz/ac Liberty®, 3 lb/ac dry AMS, and 5.33 oz/ac Volunteer® on 6/19/18
Seed Treatment: Insecticide and ILeVO®
Foliar Insecticides: 3.2 oz/ac lambda-cyhalothrin on 8/9/18
Foliar Fungicides: 4 oz/ac Priaxor®
Fertilizer: 11-52-0 variable rate application and 1 gal/ac Humate
Irrigation: None
Rainfall (in):



Soil Test (Jan. 2015 – 44 samples averaged over the study area):

	pH	BpH	OM %	P	K	S	Ca	Mg	Na	Zn	CEC	%Na
Min	5.2	6.8	0.7	10	94	12	795	107	10	0.7	5	1
Max	7.7	7.1	3.7	76	481	42	4670	429	31	4.7	28	1
Avg	7.1	7.1	1.8	22	294	23	2676	309	21	1.4	17	1

Introduction: The purpose of this study was to evaluate Commence® seed treatment on soybeans. Commence® was applied at a rate of 4 oz/100 lb of seed. Product information is at right.

GUARANTEED ANALYSIS
Cobalt (Co)................ 1.43%
Copper (Cu) 0.34%
Iron (Fe).................... 0.71%
Manganese (Mn)....... 0.46%
Zinc (Zn).................. 0.29%

DERIVED FROM: Cobalt Carbonate, Cobalt Sulfate, Copper (II) Carbonate, Iron (III) Oxide, Manganese (II) Oxide, Manganese (II) Sulfate, Zinc Carbonate, Zinc Sulfate

Results:

	Moisture (%)	Yield† (bu/acre)	Marginal Net Return‡ ($/ac)
Check	9.8 A*	59 A	438.73 A
Commence®	9.7 A	59 A	428.30 A
P-Value	0.685	0.890	0.394

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre adjusted to 13% moisture.
‡Marginal net return based on $7.40/bu soybean, $7/ac Commence seed treatment, and $2/ac seed treating.

Summary:
- There were no differences in moisture, yield, and net return between the Commence® treated seed and the check.

Impact of Commence® Seed Treatment on Corn Summary (5 sites)

The purpose of this study was to evaluate Commence® seed treatment. Commence® was applied at a rate of 6 oz/100 lb of seed. Product information is below.

GUARANTEED ANALYSIS
Cobalt (Co)................ 1.58%
Copper (Cu) 0.33%
Iron (Fe).................... 0.85%
Manganese (Mn)....... 0.49%
Zinc (Zn)................... 0.27%

DERIVED FROM: Cobalt Carbonate, Cobalt Sulfate, Copper (II) Carbonate, Iron (III) Oxide, Manganese (II) Oxide, Manganese (II) Sulfate, Zinc Carbonate, Zinc Sulfate

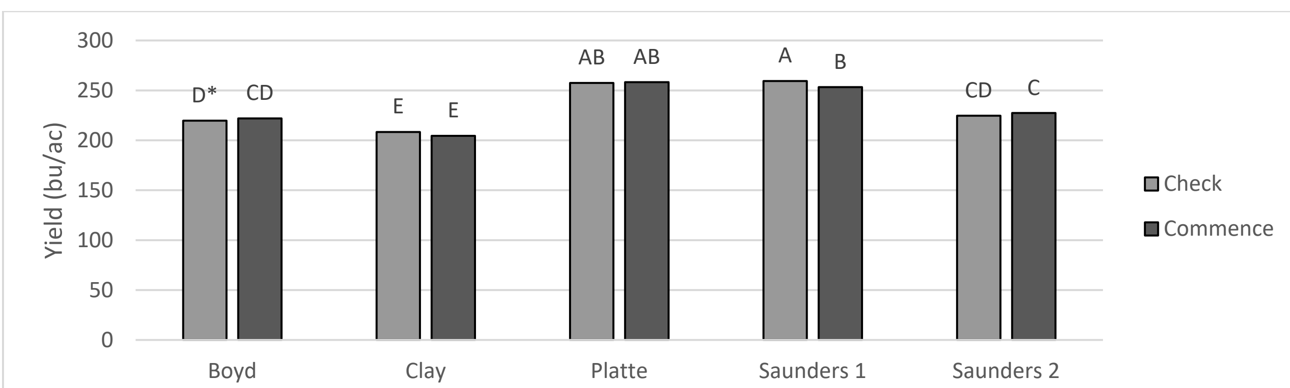
Product information from: *Agnition*

Five studies were conducted in 2018 for a total of 80 replications. Data from these studies were analyzed together using the GLIMMIX procedure in SAS 9.4 (SAS Institute Inc., Cary, NC). Mean separation was done with Tukey's HSD.

Table 1. Yield of corn with and without Commence seed treatment from five site locations.

	Yield (bu/acre)†
Check	233.9 A*
Commence Seed Treatment	233.0 A
Site (P>F)	*<0.0001*
Treatment (P>F)	*0.2371*
*Site*Treatment*	*0.0001*

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.



*Values with the same letter are not significantly different at a 90% confidence level.

Figure 1. Yield response to Commence® for five sites in 2018. There was a site by treatment interaction. Bars with the same letter are not significantly different at a 90% confidence level.

Summary: There was a site by treatment interaction (sites responded differently to the treatment). The site by treatment response is shown in Figure 1. Individual site reports with separate analysis evaluating treatment effect in that site only follow.

Impact of Commence® Seed Treatment on Corn

Study ID: 0085141201801
County: Platte
Soil Type: Boel fine sandy loam occasionally flooded
Planting Date: 4/27/18
Harvest Date: 10/4/18
Population: 35,000
Row Spacing (in): 30
Hybrid: Dekalb® DKC 60-87
Reps: 29 (only 4 reps for stand counts)
Previous Crop: Corn
Tillage: Ridge-Tilled Twice
Herbicides: ***Pre:*** 2 qt/ac Degree Extra®, 40 oz/ac Roundup®, and 6 oz/ac Sterling Blue® on 5/16/18
Post: 56 oz/ac Halex®, 1 pt/ac Atrazine, and 16 oz/ac Roundup® on 6/12/18
Seed Treatment: Acceleron® Basic 500
Foliar Insecticides: None
Foliar Fungicides: Trivapro® on 7/16/18
Fertilizer: 100 lb/ac Urea, 50 lb/ac K-Mag® and 25 lb/ac Potash on 4/10/18; 5 gal/ac Kugler 6-24-6-1S with 1 pt/ac Micro Max® in-furrow and 5 gal/ac ATS and 5 gal/ac 32% UAN on 4/27/18; 160 lb/ac N from NH3 sidedress on 6/4/18
Irrigation: Gravity, Total: 4"
Rainfall (in):

Introduction: The purpose of this study was to evaluate Commence® seed treatment. Commence® was applied at a rate of 6 oz/100 lb of seed. Product information is at right.

GUARANTEED ANALYSIS
Cobalt (Co)............... 1.58%
Copper (Cu) 0.33%
Iron (Fe).................... 0.85%
Manganese (Mn)....... 0.49%
Zinc (Zn) 0.27%

DERIVED FROM: Cobalt Carbonate, Cobalt Sulfate, Copper (II) Carbonate, Iron (III) Oxide, Manganese (II) Oxide, Manganese (II) Sulfate, Zinc Carbonate, Zinc Sulfate

Product information from: *Agnition*

Results:

	Early Season Stand Count (plants/ac)	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	33,125 A*	17.5 A	257 A	831.29 A
Commence	32,875 A	17.3 B	258 A	825.26 B
P-Value	0.432	0.021	0.307	0.043

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre adjusted to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn, $7/ac Commence seed treatment, and $2/ac seed treating.

Summary:
- There was no difference in stand counts or yield between the Commence® treated seed and the non-treated check.
- The Commence® treated seed was drier than the non-treated check.
- The Commence® treatment resulted in lower marginal net return.

Impact of Commence® Seed Treatment on Corn

Study ID: 0803015201801
County: Boyd
Soil Type: Onita silt loam 0-1% slope; Reliance silt loam 2-6% slopes
Planting Date: 5/18/18
Harvest Date: 11/21/18, 11/22/18, 11/23/18
Population: 25,197
Row Spacing (in): 30
Hybrid: Dekalb® DKC52-61RIB
Reps: 26
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** 1.5 qt/ac Harness® Xtra and 32 oz/ac Roundup® ***Post:*** 0.5 fl oz/ac Armezon®, 3 pt/ac Warrant®, and 26 oz/ac Roundup®
Seed Treatment: Acceleron® Standard (fungicide and insecticide)
Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: 18.2 gal/ac 18-16-0-5S-0.5Zn starter (equal to 35 lb/ac N, 31 lb/ac P, 10 lb/ac S, 1 lb/ac Zn); sidedress (rescue) fertilizer of 30 gal/ac 30-0-0-3S (equal to 133 lb/ac N and 22 lb/ac S) applied due to wet conditions on 7/11/18
Irrigation: None
Rainfall (in):

Introduction: The purpose of this study was to evaluate Commence® seed treatment. Commence® was applied at a rate of 6 oz/100 lb of seed. Product information is at right.

GUARANTEED ANALYSIS
Cobalt (Co)................ 1.58%
Copper (Cu) 0.33%
Iron (Fe).................... 0.85%
Manganese (Mn)....... 0.49%
Zinc (Zn).................. 0.27%

DERIVED FROM: Cobalt Carbonate, Cobalt Sulfate, Copper (II) Carbonate, Iron (III) Oxide, Manganese (II) Oxide, Manganese (II) Sulfate, Zinc Carbonate, Zinc Sulfate

Product information from: *Agnition*

Results:

	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	14.1 A*	220 A	709.32 A
Commence Seed Treatment	14.2 A	222 A	707.61 A
P-Value	0.424	0.115	0.706

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre adjusted to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn, $7/ac for Commence seed treatment, and $2/ac for seed treatment application.

Summary: There were no differences in moisture, yield, or net return between the Commence® seed treatment and untreated check.

Impact of Commence® Seed Treatment on Corn

Study ID: 0007155201803
County: Saunders
Soil Type: Yutan, eroded-Aksarben silty clay loam 2-6% slopes; Yutan, eroded-Judson complex 6-11% slopes; Aksarben silty clay loam 0-2% slope
Planting Date: 5/5/18
Harvest Date: 11/2/18
Population: 30,000
Row Spacing (in): 15
Hybrid: Channel® 209-53STX
Reps: 11
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** 36 oz/ac Buccaneer® 5 and 8.5 lb/100 lb dry AMS on 5/1/18 to terminate rye cover crop; 4.5 oz/ac Corvus® and 1 lb/ac Atrazine on 5/9/18 ***Post:*** 24 oz/ac Buccaneer® 5, 8.5 lb/100 gal dry AMS, 3 oz/ac Mesotrione, and 5 gal/1,200 gal crop oil concentrate on 6/6/18
Seed Treatment: Acceleron® Basic 500
Foliar Fungicides: 13.7 oz/ac Trivapro® fungicide with 2 oz/ac WETCIT®
Fertilizer: 170 lb/ac N as 32% UAN and 1 gal/ac Humate on 5/9/18; 7 gal/ac 6-24-6 and zinc in furrow at planting
Irrigation: None
Rainfall (in):

Soil Test (Oct. 2018) average of 17 sample points in field:

Soil pH	Buffer pH	OM %	Bray 1 P	K	Mg	Ca	Na	S	Zn	CEC	H	K	Mg	Ca	Na
			ppm								%				
6.4	6.7	2.9	25.4	254.5	373.5	2506.9	11.2	4.9	1.4	19.3	15.9	6.8	29.7	47.4	0.2

Introduction: The purpose of this study was to evaluate Commence® seed treatment. Commence® was applied at a rate of 6 oz/100 lb of seed. Product information is at right.

GUARANTEED ANALYSIS
Cobalt (Co)................ 1.58%
Copper (Cu) 0.33%
Iron (Fe).................... 0.85%
Manganese (Mn)....... 0.49%
Zinc (Zn).................. 0.27%

DERIVED FROM: Cobalt Carbonate, Cobalt Sulfate, Copper (II) Carbonate, Iron (III) Oxide, Manganese (II) Oxide, Manganese (II) Sulfate, Zinc Carbonate, Zinc Sulfate

Product information from: *Agnition*

Results:

	Early Season Stand Count (plants/ac)	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	31,456 A*	14.7 A	260 A	838.03 A
Commence	30,928 A	14.8 A	253 B	808.95 B
P-Value	0.541	0.422	<0.0001	<0.0001

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre adjusted to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn, $7/ac for Commence seed treatment, and $2/ac for seed treating.

Summary:

- There were no differences in stand counts or grain moisture between the Commence® treated seed and the untreated check.
- The Commence® seed treatment was significantly lower yielding and lower in net return than the untreated check.

Impact of Commence® Seed Treatment on Corn

Study ID: 0007155201804
County: Saunders
Soil Type: Kenridge silty clay loam occasionally flooded; Yutan, eroded-Judson complex 6-11% slopes; Judson silt loam 2-6% slopes
Planting Date: 5/5/18
Harvest Date: 11/1/18
Population: 32,000
Row Spacing (in): 15
Hybrid: Channel® 209-53STX
Reps: 9
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** 36 oz/ac Buccaneer® 5 and 8.5 lb/100 lb dry AMS on 5/1/18 to terminate rye cover crop; 4.5 oz/ac Corvus® and 1 lb/ac Atrazine on 5/7/18 ***Post:*** 24 oz/ac Buccaneer® 5, 8.5 lb/100 lb dry AMS, 3 oz/ac mesotrione, and 5 gal/1,200 gal crop oil concentrate on 6/5/18

Seed Treatment: Acceleron® Basic 500
Foliar Fungicides: 13.7 oz/ac Trivapro® fungicide with 2 oz/ac WETCIT®
Fertilizer: 170 lb/ac N as 32% UAN and 1 gal/ac Humate on 5/7/18; 7 gal/ac 6-24-6 and zinc in-furrow at planting
Irrigation: None
Rainfall (in):

Soil Test (Jan. 2015 40 samples, averaged over study area):

pH	BpH	OM	P	K	S	Ca	Mg	Na	Zn	CEC	%Na
		%	ppm								
6.1	6.8	2.4	31	313	31	2330	353	17	0.9	18.5	1.3

Introduction: The purpose of this study was to evaluate Commence® seed treatment. Commence® was applied at a rate of 6 oz/100 lb of seed. Product information is at right.

GUARANTEED ANALYSIS
Cobalt (Co)................ 1.58%
Copper (Cu) 0.33%
Iron (Fe).................... 0.85%
Manganese (Mn)....... 0.49%
Zinc (Zn) 0.27%

DERIVED FROM: Cobalt Carbonate, Cobalt Sulfate, Copper (II) Carbonate, Iron (III) Oxide, Manganese (II) Oxide, Manganese (II) Sulfate, Zinc Carbonate, Zinc Sulfate

Product information from: *Agnition*

Results:

	Early Season Stand Count (plants/ac)	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	30,447 A*	13.4 A	225 B	725.44 A
Commence	30,705 A	13.4 A	227 A	725.24 A
P-Value	0.816	0.681	0.055	0.961

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre adjusted to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn, $7/ac Commence seed treatment, and $2/ac seed treating.

Summary:

- There were no differences in stand counts or grain moisture between the Commence® treated seed and the untreated check.
- The Commence® treated seed yielded 2.7 bu/ac greater than the untreated check.
- There were no differences in marginal net return.

Evaluation of Commence®, Generate®, and Bio-Sure Grow in Corn

Study ID: 0011035201801
County: Clay
Soil Type: Crete silt loam 1-3% slope; Hastings silty clay loam 3-7% slopes; Fillmore silt loam frequently ponded
Planting Date: 4/26/18
Harvest Date: 10/28/18
Population: 33,000
Row Spacing (in): 30
Hybrid: Dekalb® DKC 64-34
Reps: 5
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** TripleFLEX® II, Roundup PowerMAX®, Locktite® ***Post:*** Resicore®, Roundup PowerMAX®, Atrazine, Premier 90®, and Actamaster®

Foliar Fungicides: Headline AMP®
Fertilizer: 125 lb/ac N, 1 pt/ac Agrotain® Ultra; 3 gal/ac 6-24-6 with 1 qt/ac Zn at planting
Irrigation: Pivot, Total: unknown
Rainfall (in):

Introduction: This study evaluated the impact of several microbial and nutrient products on corn yield and stalk quality. All treatments including the check received a starter fertilizer of 6-24-6 non-salt starter + 9% Zn. Three microbial and nutrient products were evaluated. Products were applied additively, not separately. Commence was applied to the seed prior to planting. Bio-Sure Grow was applied at a rate of 1 gal/ac in-furrow at planting. Generate was applied at a rate of 1 pt/ac in-furrow at planting. Product information is below.

Commence®

GUARANTEED ANALYSIS
Cobalt (Co)................ 1.58%
Copper (Cu) 0.33%
Iron (Fe).................... 0.85%
Manganese (Mn)....... 0.49%
Zinc (Zn) 0.27%

DERIVED FROM: Cobalt Carbonate, Cobalt Sulfate, Copper (II) Carbonate, Iron (III) Oxide, Manganese (II) Oxide, Manganese (II) Sulfate, Zinc Carbonate, Zinc Sulfate

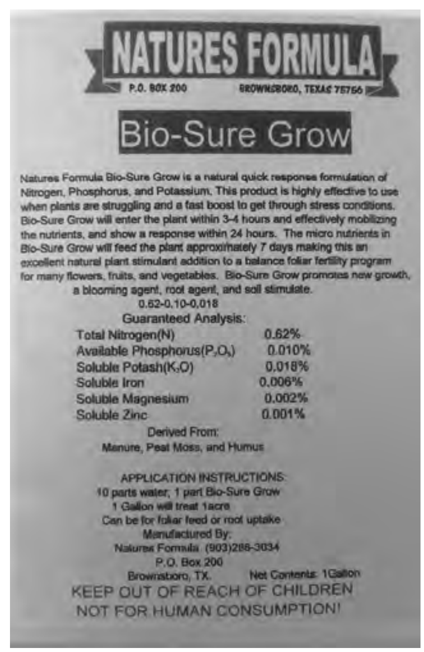
Product information from: *Agnition®*

Generate®

GUARANTEED ANALYSIS
Cobalt (Co)......................... 1.04%
Copper (Cu) 0.28%
Iron (Fe)............................. 0.56%
Manganese (Mn)................. 0.26%
Zinc (Zn)............................. 0.22%

DERIVED FROM: Cobalt Carbonate, Cobalt Sulfate, Copper (II) Carbonate, Iron (II) Oxide, Manganese (II) Oxide, Zinc Carbonate, Zinc Sulfate

Product information from: *Agnition®*



Results:

	Harvest Stand Count (plants/ac)	Stalk Rot (%)	Snapped Below Ear (%)	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	24,200 A*	3.00 A	23 A	15.1 A	208 A	673.07 A
Commence®	23,200 A	6.00 A	22 A	15.3 A	204 AB	651.21 B
Commence® + BioSureGrow	23,000 A	2.00 A	39 A	15.2 A	199 BC	619.48 C
Commence® + BioSureGrow + Generate®	21,800 A	2.00 A	33 A	15.2 A	198 C	607.93 C
P-Value	0.823	0.408	0.394	0.196	0.001	<0.0001

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn, $7/ac Commence seed treatment, $2/ac seed treatment application, $8/ac Generate, and $15/ac Bio-Sure Grow.

Summary:

- The field experienced 35% loss from green snap on June 30. Stand counts, stalk rot ratings, and percent of plants snapped below the ear measured on October 4 showed no differences between any of the treatments.
- Moisture was not significantly different among treatments.
- Yield was significantly lower for the treatments with Bio-Sure Grow and Generate® compared to the check. Yields of the check and Commence® treatment were not significantly different.
- Marginal net return was $21.86/ac to $65.14/ac greater for the check.

Impact of Generate® In-Furrow at Planting on Soybean Yield

Study ID: 0709047201802
County: Dawson
Soil Type: Cozad silt loam 0-1% slope; Cozad silty clay loam 0-1% slope
Planting Date: 5/17/18
Harvest Date: 10/10/18
Population: 140,000
Row Spacing (in): 30
Variety: Pioneer® P31A22X
Reps: 5
Previous Crop: Corn
Tillage: Ridge-Till
Herbicides: ***Post:*** 24 oz/ac Buccaneer® 5 Xtra, 12.8 oz/ac Engenia®, and 2.5 oz/ac Valor® XLT on 5/23/18; 24 oz/ac Buccaneer® 5 Xtra, 12.8 oz/ac Engenia®, and 10 oz/ac Charger Basic® on 6/28/18; 8 oz/ac Atlas® on 7/3/18

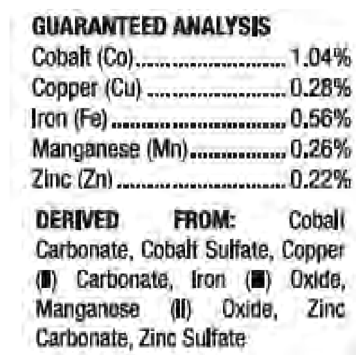
Seed Treatment: None
Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: None
Irrigation: Gravity, Total: 0"
Rainfall (in):

Soil Test (January 2018) – 4 samples were taken in the study area:

Sample	pH	Soluble Salts	OM	KCl Nitrate		Mehlich P-III	$CaPO_4$ SO_4-S	K	Ca	Mg	Na	Sum of Cations	Zn
		mS/cm	*(%)*	*ppm*	*lb/ac*	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*	*meq/100g*	*ppm*
1	7.2	0.6	2.4	12	29	111	27	550	2858	575	134	21	4.0
2	7.4	0.7	2.5	12	29	100	42	648	2370	594	271	20	3.0
3	7.3	0.7	2.1	8	19	46	55	591	2471	502	192	19	1.7
4	7.2	1.0	2.1	22	53	111	66	664	2184	484	201	18	3.8

Introduction: This study was looking at Generate® applied in-furrow at soybean planting. The product was applied at a rate of 1 pt/ac and was compared to an untreated check. Product information is at right. Yield was recorded using a yield monitor and weigh wagon scale. Yield from the weigh wagon is reported here.

Generate®



GUARANTEED ANALYSIS
Cobalt (Co)........................ 1.04%
Copper (Cu)........................ 0.28%
Iron (Fe)........................ 0.56%
Manganese (Mn)........................ 0.26%
Zinc (Zn)........................ 0.22%

DERIVED FROM: Cobalt Carbonate, Cobalt Sulfate, Copper (II) Carbonate, Iron (II) Oxide, Manganese (II) Oxide, Zinc Carbonate, Zinc Sulfate

Product information from: *Ralco Nutrition, Inc.*

Results:

	Harvest Stand Count (plants/ac)	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	59,914 A*	12.8 A	66 A	489.00 A
Generate In-Furrow	59,333 A	12.9 A	66 A	476.04 B
P-Value	0.859	0.648	0.453	0.029

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre adjusted to 13% moisture.
‡Marginal net return based on $7.40/bu soybean and $9.75/ac Generate.

Summary:

- The addition of Generate® resulted in no difference in stand counts, moisture, or yield.
- Due to the additional cost of the Generate® product and no yield increase, the untreated check had a $12.96/ac higher marginal net return.

Impact of Generate® In-Furrow at Planting on Corn Summary (2 sites)

The purpose of this study was to evaluate Generate® on corn. Generate® was applied at a rate of 1 pt/ac in-furrow at planting. The guaranteed analysis is below.

Generate®

GUARANTEED ANALYSIS

Cobalt (Co)	1.04%
Copper (Cu)	0.28%
Iron (Fe)	0.56%
Manganese (Mn)	0.26%
Zinc (Zn)	0.22%

DERIVED FROM: Cobalt Carbonate, Cobalt Sulfate, Copper (II) Carbonate, Iron (II) Oxide, Manganese (II) Oxide, Zinc Carbonate, Zinc Sulfate

Product information from: *Ralco Nutrition, Inc.*

Two studies were conducted in 2018 for a total of 11 replications. Data from these studies were analyzed together using the GLIMMIX procedure in SAS 9.4 (SAS Institute Inc., Cary, NC). Mean separation was done with Tukey's HSD.

Table 1. Yield of corn with and without Generate® from two site locations.

	Yield (bu/acre)†
Check	243.6 A*
Generate®	243.5 A
Site (P>F)	*<0.0001*
Treatment (P>F)	*0.9592*
*Site*Treatment*	*0.1221*

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.

Summary: There was no interaction of site and treatment (the Generate® treatment responded the same at all sites). There was no yield increase for using Generate® when both sites are considered together. The sites did have significantly different yields from each other. Individual site reports with separate analysis evaluating treatment effect in that site only follow.

Impact of Generate® In-Furrow at Planting on Corn Yield

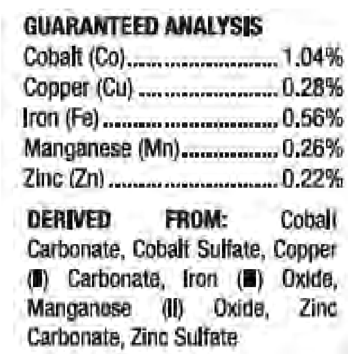
Study ID: 0718185201801
County: York
Soil Type: Hastings silt loam 0-1% slope; Uly-Hobbs silt loam 11-30% slopes; Hastings silt loam 3-7% slopes
Planting Date: 4/26/18
Harvest Date: 10/6/18
Population: 32,000
Row Spacing (in): 30
Hybrid: Pioneer® P1197AM
Reps: 6
Previous Crop: Soybean
Tillage: Ridge-Till
Herbicides: ***Pre:*** 3 pt/ac Weedmaster® in December 2017; 1 qt/ac Staunch® II and 1 qt/ac Atrazine at planting in April 2018 ***Post:*** 32 oz/ac Durango®, 1 oz/ac Impact®, and 1 pt/ac Atrazine in June 2018
Seed Treatment: None
Insecticides: 1 oz/ac Perm-Up® on top of the soil for cutworm control at planting
Foliar Fungicides: 6 oz/ac Aframe™ and 3 oz/ac Onset® on July 31
Fertilizer: 150 lb/ac 11-52-0, 100 lb/ac AMS, and 175 lb/ac N as anhydrous in November 2017; 3 gal/ac 10-34-0 as starter at planting
Note: Light hail and wind
Irrigation: Pivot, Total: 1.5"
Rainfall (in):

Soil Test (November 2017) – 2 samples were taken in the study area:

Soil pH 1:1	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lb N/A 0-10"	Mehlich P-III ppm P	Ca-P Sulfate ppm S	Zn (ppm)	Ammonium Acetate (ppm) K	Ca	Mg	Na	CEC me/100g	% Base Saturation H	K	Ca	Mg	Na
7.0	0.18	NONE	3.0	7.3	22	6	10.1	1.76	421	2311	326	52	15.6	0	7	74	17	1
6.6	0.23	NONE	2.5	6.5	20	24	10	0.98	485	2635	575	53	19.4	0	6	68	25	1

Introduction: This study looked at Generate® applied in-furrow at corn planting. The product was applied at a rate of 1 pt/ac. Both treatments had 3 gal/ac 10-34-0 starter fertilizer in-furrow. Product information is at right. Plant health was assessed with stalk rot ratings and yield was recorded using a yield monitor.

Generate®


GUARANTEED ANALYSIS
Cobalt (Co)........................ 1.04%
Copper (Cu)........................ 0.28%
Iron (Fe)........................ 0.56%
Manganese (Mn)................ 0.26%
Zinc (Zn)........................ 0.22%

DERIVED FROM: Cobalt Carbonate, Cobalt Sulfate, Copper (II) Carbonate, Iron (II) Oxide, Manganese (II) Oxide, Zinc Carbonate, Zinc Sulfate

Product information from: *Ralco Nutrition, Inc.*

Results:

	Harvest Stand Count (plants/ac)	Moisture (%)	Stalk Rot (%)	Yield† (bu/acre)	Marginal Net Return‡ ($/ac)
Check	27,833 A*	17.7 A	15.83 A	273 A	882.72 A
Generate® In-Furrow	27,167 A	17.7 A	13.75 A	271 A	864.39 B
P-Value	0.249	0.530	0.669	0.306	0.059

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre adjusted to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and $9.75/ac Generate.

Summary:

- There were no differences in moisture, stand counts, stalk rot, or yield between the Generate® treatment and the check.
- Due to no increase in yield and the higher production cost for using Generate®, the check had a higher marginal net return.

Impact of Generate® In-Furrow at Planting on Corn Yield

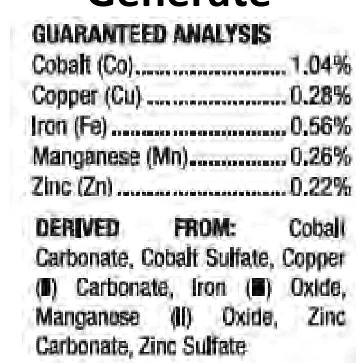
Study ID: 0709047201801
County: Dawson
Soil Type: Cozad silty clay loam 0-1% slope; Cozad silt loam 0-1% slope
Planting Date: 4/28/18
Harvest Date: 11/14/18
Population: 33,000
Row Spacing (in): 30
Hybrid: Pioneer® P0589AMXT
Reps: 5
Previous Crop: Corn
Tillage: Ridge-Till
Herbicides: ***Pre:*** 0.825 oz/ac Basis® Blend, 3.5 oz/ac Balance® Flexx, 1 qt/ac Atrazine 4L, 8 oz/ac Dicamba, and 24 oz/ac Buccaneer® 5 Xtra on 4/19/18
Seed Treatment: None
Foliar Insecticides: 2 oz/ac Warrior® and 4 oz/ac Brigade® on 7/16/18
Foliar Fungicides: 10.5 oz/ac Quilt® on 7/16/18
Fertilizer: 15 gal/ac 32-0-0 on 4/19/18; 4 gal/ac 32-0-0, 5.5 gal/ac 10-34-0, 0.5 gal/ac Aventine® and 2 gal/ac 12-0-0-26S on 4/27/18; 48 gal/ac 32-0-0 and 5 gal/ac 12-0-0-26 S on 6/14/18
Irrigation: Gravity, Total: 0"
Rainfall (in):

Soil Test (January 2018) – 4 samples were taken in the study area:

Sample	pH	Soluble Salts	OM	KCl Nitrate		Mehlich P-III	$CaPO_4$ SO_4-S	K	Ca	Mg	Na	Sum of Cations	Zn
		mS/cm	*(%)*	*ppm*	*lb/ac*	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*	*meq/100g*	*ppm*
1	7.3	0.6	2.1	11	26	54	25	432	3303	464	151	22	2.1
2	7.0	0.5	2.7	12	29	29	8	611	1874	370	120	15	2.2
3	7.0	0.6	2.3	9	22	21	14	490	3634	495	125	24	2.0
4	7.1	0.6	2.9	9	22	44	33	619	3833	642	171	27	1.4

Introduction: This study was looking at Generate® applied in-furrow at corn planting. The product was applied at a rate of 1 pt/ac. Both treatments had 2.5 gal/ac 10-34-0 starter fertilizer and 0.5 gal/ac Aventine™ in-furrow. Product information is at right. Yield was recorded using a yield monitor and weigh wagon. Weight wagon yield values are reported here.

Generate®



GUARANTEED ANALYSIS
Cobalt (Co)........................ 1.04%
Copper (Cu)........................ 0.28%
Iron (Fe)........................ 0.56%
Manganese (Mn)........................ 0.26%
Zinc (Zn)........................ 0.22%

DERIVED FROM: Cobalt Carbonate, Cobalt Sulfate, Copper (II) Carbonate, Iron (III) Oxide, Manganese (II) Oxide, Zinc Carbonate, Zinc Sulfate

Product information from: *Ralco Nutrition, Inc.*

Results:

	Harvest Stand Count (plants/ac)	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	32,400 A*	12.7 A	214 A	690.81 A
Generate® In-Furrow	31,867 A	12.5 A	216 A	689.13 A
P-Value	0.495	0.141	0.227	0.781

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre adjusted to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and $9.75/ac for Generate.

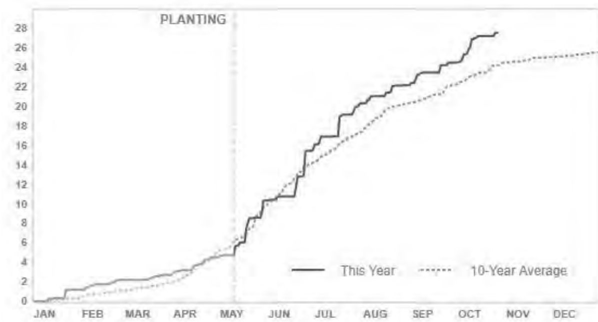
Summary:

- The addition of Generate® did not result in a difference in moisture, stand counts, yield, or net return.

Impact of Seed Treatment and In-Furrow Inoculant on Soybeans

Study ID: 0805047201801
County: Dawson
Soil Type: Cozad silt loam 3-6% slopes; Cozad silt loam 0-1% slope; Cozad silt loam 1-3% slope
Planting Date: 5/10/18
Harvest Date: 9/19/18
Population: 185,000
Row Spacing (in): 30
Variety: Pioneer® P25A12X
Reps: 5
Previous Crop: Corn
Tillage: Strip-Till
Herbicides: ***Pre:*** 5 oz/ac Zidua® PRO and Roundup PowerMAX® on 4/30/18 ***Post:*** 1.5 oz/ac Zidua®, 10 oz/ac Outlook®, and 32 oz/ac Roundup PowerMAX® on 6/1/18

Seed Treatment: Inoculant PPST 120+, Lumisena™ and EverGol™ Energy® (fungicides), Gaucho® (insecticide), and PPST 2030 Biological
Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: 5 gal/ac 10-34-0 and 5 gal/ac 12-0-0-26S banded with strip-till around April 15
Irrigation: Pivot, Total: 12"
Rainfall (in):



Introduction: The objective of this study was to assess the impact of seed treatment and in-furrow inoculants. The study compared a seed treatment inoculant, PPST 120+, versus the seed treatment inoculant with the addition of an in-furrow inoculant, TerraMax Liquid IF™. TerraMax Liquid IF™ was applied at a rate of 12.8 oz/ac. TerraMax contains two strains of Bradyrhyzobium and two strains of Azospirillum.

Results:

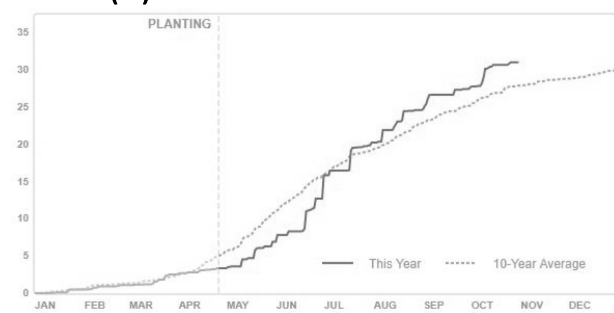
	Harvest Stand Count (plants/ac)	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Seed-treated Inoculum	161,395 A*	10.9 A	82 A	605.06 A
Seed-treated Inoculum + In-furrow Inoculum	159,885 A	10.7 A	83 A	607.16 A
P-Value	0.678	0.374	0.264	0.701

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre adjusted to 13% moisture.
‡Marginal net return based on $7.40/bu soybean and $45/gal TerraMax Liquid-IF™ Inoculant ($4.50/ac). Seed treatment costs were the same for both treatments so they were not included in marginal net return calculation.

Summary: The addition of TerraMax Liquid IF™ did not result in differences in stand count, grain moisture, soybean yield, or marginal net return.

Impact of Potassium Application on Irrigated Corn

Study ID: 0718185201803
County: York
Soil Type: Hastings silt loam 0-1% slope; Hastings silty clay loam 7-11% slopes, eroded
Planting Date: 4/26/18
Harvest Date: 10/22/18
Population: 32,000
Row Spacing (in): 30
Hybrid: Pioneer® P1366AMXT
Reps: 6
Previous Crop: Corn
Tillage: Ridge-Till
Herbicides: ***Pre:*** 3 pt/ac Weedmaster® in December 2017; 1 qt/ac Staunch® II and 1 qt/ac Atrazine on 4/26/18 at planting ***Post:*** 32 oz/ac Durango®, 1 oz/ac Impact®, and 1 pt/ac Atrazine in June 2018
Seed Treatment: None
Foliar Insecticides: 8 oz/ac Brigade® on 4/26/18 with planting
Foliar Fungicides: 6 oz/ac Aframe™ and 3 oz/ac Onset® on 7/31/18
Fertilizer: 150 lb/ac 11-52-0, 100 lb/ac AMS, and 215 lb N/ac as anhydrous ammonia in Nov. 2017; 3 gal/ac 10-34-0 on 4/26/18 with planting
Note: Light hail and wind
Irrigation: Pivot, Total: 1.5"
Rainfall (in):



Soil Test (Nov. 2017):

Soil pH 1:1	BpH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lb N/A 0-10”	Mehlich P-III ppm P	Ca-P Sulfate ppm S	Zn (ppm)	Ammonium Acetate (ppm) K	Ca	Mg	Na	CEC me/100g	% Base Saturation H	K	Ca	Mg	Na
7.0	-	0.18	NONE	3.2	6.4	19	35	10.2	2.19	470	2247	276	47	14.9	0	8	75	15	1
5.8	6.3	0.22	NONE	3.1	5.8	18	19	12.7	0.84	375	2608	596	58	26.3	27	4	49	19	1

Introduction: The purpose of this study was to determine if the addition of potash would improve corn production. Potash was applied at a rate of 118 lb/ac using the modified insecticide blower in Figure 1. The soil test potassium (K) levels for this field were 375 and 470 ppm. The Nebraska Extension NebGuide *Fertilizer Suggestions for Corn* (EC117) indicates that potassium levels greater than 125 ppm K are considered high and do not warrant additional potassium application. Yield, grain moisture, stand counts, stalk rot percent, and marginal net return were evaluated.

Figure 1. Modified blower used to apply potash.

Results:

	Harvest Stand Count (plants/ac)	Stalk Rot (%)	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	30,833 A*	2.92 A	17.4 A	242 A	561.14 A
118 lb/ac Potash	31,250 A	2.50 A	17.5 A	238 A	527.15 B
P-Value	0.486	0.867	0.110	0.203	0.003

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre adjusted to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn, $23/ac potash, and $2/ac application.

Summary:

- There was no difference in stalk rot, stand count, grain moisture, or yield where potash was applied.
- Due to the additional cost of potash product and application, marginal net return was $34/ac lower where potash was applied.

Nitrogen Application to Corn Following Cover Crops

Study ID: 0731061201801
County: Franklin
Soil Type: Kenesaw silt loam 1-3% slope
Planting Date: 5/8/18
Harvest Date: 11/1/18
Population: 30,000
Row Spacing (in): 30
Hybrid: Curry®
Reps: 4
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** Roundup® for burn down ***Post:*** Impact® and Status® on 6/25/18
Seed Treatment: Poncho®

Foliar Insecticides: None
Foliar Fungicides: None
Irrigation: Pivot, Total: 4"
Rainfall (in):

Introduction: The purpose of this study was to better understand N management of corn following cover crops. Nitrogen was applied as urea broadcast at V6 at four rates: 0, 100, 175, and 250 lb N/ac. Additionally, the 0 lb N/ac treatment was split so that half had a cover crop preceding it, and half did not (therefore the 0 lb N/ac treatment with no cover crop was not randomized). Plots were 80 foot wide and 200 foot long, with the exception of the 0 lb N/ac treatments, which were only 40 foot wide.

For treatments that had cover crops preceeding the corn, the cover crop mix included 40 lb/ac cereal rye, 10 lb/ac winter wheat, 5 lb/ac winter pea, 1 lb/ac rapeseed, 2 lb/ac spring barley, and 2 lb/ac Crimson clover. They were established by drilling in the fall following harvest and were grazed in the spring. The cover crops were terminated on April 20; cover crops were approximately 12" tall at termination.

Yield was collected for each plot by hand harvesting. Soil samples were taken for each plot in June 2018.

Results:

Rep	Treatment	Soil pH (1:1)	Soluble Salts 1:1 (mmho/cm)	OM (%)	Nitrate (ppm)	Nitrate lb (0-8")	MP3 (ppm)	---------Ammonium Acetate----------- K (ppm)	Ca (ppm)	Mg (ppm)	Na (ppm)	Sulfate (ppm)	--% Base Saturation-- H	K	Ca	Mg	Na
1	0 (no cover crop)	5.9	0.17	1.8	10.3	25	25	341	1550	253	20	11.7	5	8	68	18	1
1	0	5.8	0.14	2.0	6.9	17	21	366	1596	277	25	13.7	20	7	56	16	1
1	100	5.7	0.12	1.5	8.3	20	18	228	1252	192	15	11.0	12	6	64	16	1
1	250	5.8	0.13	1.7	7.0	17	14	284	1743	306	22	12.0	8	6	65	20	1
1	175	5.8	0.14	1.5	7.5	18	31	300	1645	295	24	13.2	7	6	66	20	1
2	0 (no cover crop)	5.2	0.15	1.7	12.7	30	27	226	1362	249	21	15.3	19	5	57	18	1
2	0	5.9	0.25	3.6	20.9	50	44	307	1717	267	27	17.4	13	6	64	16	1
2	175	5.7	0.1	1.6	13.1	31	26	297	1346	232	18	10.8	19	7	57	17	1
2	100	5.8	0.09	1.5	7.4	18	18	380	1470	261	18	13.7	17	8	57	17	1
2	250	5.9	0.16	2.5	17.0	41	54	443	1704	266	17	14.2	14	8	61	16	1
3	0 (no cover crop)	5.8	0.21	2.3	11.3	27	43	373	1947	345	29	14.6	21	6	55	17	1
3	0	6.0	0.17	2.8	11.0	26	50	380	2107	362	28	14.6	9	6	65	19	1
3	250	6.0	0.16	2.3	7.2	17	19	293	1743	306	22	12.0	13	5	63	18	1
3	175	6.0	0.17	2.1	13.4	32	8	230	1608	275	25	12.7	8	5	67	19	1
3	100	5.8	0.16	2.0	9.1	22	26	292	1710	302	24	13.4	14	5	62	18	1
4	0 (no cover crop)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	0	5.5	0.19	3.1	13.2	32	52	318	1529	233	23	16.3	24	6	55	14	1
4	100	6.0	0.1	2.3	12.5	30	28	259	1427	219	20	11.7	7	6	68	18	1
4	250	6.2	0.17	2.8	13.5	32	45	367	1925	323	24	13.4	7	7	66	19	1
4	175	5.6	0.17	2.8	17.1	41	111	441	2109	379	41	14.2	22	6	55	16	1

	Yield† (bu/acre)	Marginal Net Return‡ ($/ac)
0 lb N/ac Following No Cover Crop	188 B*	606.34 C
0 lb N/ac Following Cover Crop	210 B	677.78 BC
100 lb N/ac Following Cover Crop	254 A	785.00 AB
175 lb N/ac Following Cover Crop	272 A	815.78 A
250 lb N/ac Following Cover Crop	275 A	799.30 A
P-Value	0.0001	0.001

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and $0.35/lb N. This analysis does not account for cover crop costs.

For the four nitrogen rates that all had a cover crop, a regression with economic optimum nitrogen rates was calculated (Figure 1). All N rates included in the analysis in Figure 1 had cover crops preceding them, therefore the cover crop cost is the same for all treatments and is therefore not included.

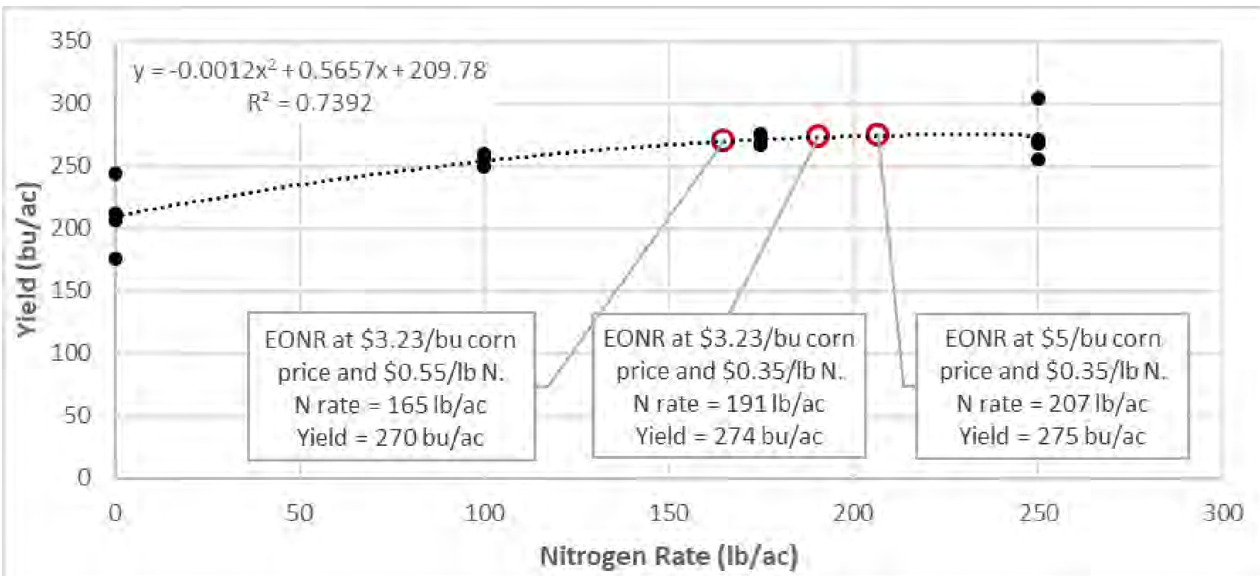


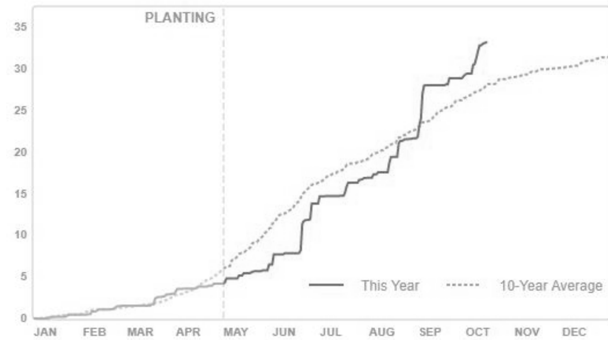
Figure 1. Yield versus nitrogen rate based on the four cover crop nitrogen rate treatments. Economic optimum nitrogen rates (EONR) for several price scenarios are indicated.

Summary:

- At a corn price of $3.23/bu and N price of $0.35/lb, the optimum N rate was 191 lb/ac.
- There was no yield difference between the 0 lb N/ac rate that was preceded by cover crops and the 0 lb N/ac rate that did not have cover crops.

In-season Nitrogen Application on Corn Following Rye Cover Crop

Study ID: 0710067201801
County: Gage
Soil Type: Wymore silty clay loam
Planting Date: 5/1/18
Harvest Date: 9/17/18
Population: 24,000
Row Spacing (in): 30
Hybrid: Pioneer® P0805AM
Reps: 5
Previous Crop: Corn
Tillage: No-Till
Herbicides: ***Pre:*** 32 oz/ac Roundup PowerMAX®, 1 pt/ac metolachlor, and 1.5 oz/ac Sharpen® at 8.5 gal/ac on 5/4/18 to terminate cover crop ***Post:*** 32 oz/ac Roundup PowerMAX® and 3 qt/ac Lexar® at 15 gal/ac
Seed Treatment: None
Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: 150 lb N/ac as 32% UAN in April; 5 gal/ac 10-34-0 in-furrow as starter
Irrigation: None
Rainfall (in):



Soil Tests (April 2018):

Soil pH 1:1	Buffer pH	CEC	OM	Nitrate (0-8")	Nitrate (8-24")	Nitrate (24-36")	Mehlich-P3	K	Mg	Ca	S	Zn	K	Mg	Ca	H
		mg/100g	*%*	----------------(lb/ac)------------			-------------------------(ppm)------------------------						---% Base Saturation--			
6.2	6.6	18.1	3.6	7	9	6	22	207	2032	363	6.1	1.36	3	17	56	24

Introduction:

The corn in this study followed a rye cover crop. The rye cover crop was grazed for a couple of weeks in April. The corn was planted on May 1, and the rye cover crop was terminated with herbicide application of Roundup® and Sharpen® on May 4. As the rye cover crop breaks down, nitrogen may be temporarily unavailable to the growing corn crop. Because of this, many growers are trying to better understand nitrogen management for corn following a rye cover crop. A total of 156 lb/ac N was applied prior to emergence.

This study tested three rates of nitrogen sidedress applied as ammonium sulfate (21% N, 24% S). Ammonium sulfate was applied on May 25 at V4. For analysis, two rows of 15 foot length were hand harvested, shelled, and weighed.

Figure 1. Cover crop post-grazing regrowth on May 4 at time of termination (left) and corn growing in terminated rye on May 25 at time of hand application of ammonium sulfate (right).

Results: Because of the variability in stand counts, harvest stand count was included as a confounding variable (covariate) in the model so that yield and net return can be evaluated for the N rates without the complicating factor of stand count. The yield and net return analysis was completed with the GLIMMIX procedure in SAS 9.4 (SAS Institute Inc., Cary, NC). Mean separation for yield and net return was performed with Tukey's HSD.

	Harvest Stand Count (plants/ac)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
0 lb/ac Sidedress	19,768 A*	137 B	442.97 A
50 lb/ac Sidedress	20,814 A	161 A	484.55 A
100 lb/ac Sidedress	19,535 A	151 AB	414.59 A
P-Value	0.547	0.0124	0.0251

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre adjusted to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and $305/ton ammonium sulfate.

Summary:

- There was no difference in stand counts between the three nitrogen rates tested.
- The 50 lb N/ac treatment resulted in a yield increase compared to no additional N application. However, the 100 lb N/ac treatment did not result in a yield increase over the 0 lb N/ac or 50 lb N/ac treatment.
- There was no difference in marginal net return between the three treatments.

Nitrogen Source Study: Anhydrous Ammonia versus UAN Broadcast

Study ID: 0701147201801
County: Richardson
Soil Type: Marshall silty clay loam 2-6% slopes
Planting Date: 5/1/18
Harvest Date: 9/22/18
Population: 27,500
Row Spacing (in): 30
Hybrid: Hoegemeyer® 8414
Reps: 6
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** 8 oz/ac Banvel® and 6 oz/ac of 6# 2,4-D ***Post:*** 2.5 lb/ac mesotrione, 1 pt/ac Atrazine, and 12 oz/ac of 5.4 lb Roundup®

Irrigation: None
Rainfall (in):

Soil Tests (Dec. 2018):

Soil pH 1:1	Buffer pH	CEC	OM	Bray P1 Weak Bray	Bray P2 Strong Bray	K	Mg	Ca	S	Zn	K	Mg	Ca	H
		mg/100g	*%*	*ppm*	*ppm*	*-------------(ppm)-------------*					*--% Base Saturation---*			
5.9	6.6	19.9	2.7	20	24	199	402	2533	8	3.3	2.6	16.8	63.6	17
6.9		20.9	2.7	12	21	192	412	3403	8	3.2	2.4	16.4	81.2	0
6.3	6.7	15.8	2.7	12	18	152	261	2312	8	2.2	2.5	13.8	73.2	10.5
6.3	6.7	19.1	3.3	22	29	173	318	2804	8	2.0	2.3	13.9	73.4	10.4

Introduction: The purpose of this study was to compare liquid UAN with anhydrous ammonia. Both were applied at a rate of 160 lb N/ac. The anhydrous ammonia was applied on December 21, 2017 with a minimal disturbance AgSynergy® Genesis TRX® anhydrous applicator. The broadcast 32% UAN was applied on top of crop residue and cereal rye cover crop residue (Figure 1). The UAN was applied on April 24 around 11 AM. There was a 0.28” rainfall on April 25 from 9 AM to noon. The next rain was seven days later on May 1 (0.15”) and May 2 (1.15”). Maximum and minimum daily temperatures for the three days following application are presented below. Daily rainfall and temperature data are from Brenner Airfield, approximately 5 miles from the field site.

Figure 1. Soybean residue and cereal rye cover crop residue at time of UAN application on April 24.

Date	Max Temp (°F)*	Min Temp (°F)
April 24	76	39
April 25	56	40
April 26	70	34
April 27	79	36

Yield, grain moisture, test weight, and stand counts were collected at harvest on September 22, 2018. Yield data from the yield monitor is displayed in Figure 2. Yield data reported in the table below is from weigh wagon measurements.

Results:

	Harvest Stand Count (plants/ac)	Test Weight	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
32% UAN	25,667 A*	55 A	15.8 B	154 B	443.61 B
Anhydrous Ammonia	25,167 A	56 A	16.9 A	180 A	519.67 A
P-Value	0.641	0.107	0.009	0.044	0.049

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield data reported from weigh wagon measurements. Bushels per acre adjusted to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn, $380/ton ($0.23/lb N) anhydrous ammonia, $182/ton ($0.28/lb N) 32% UAN, $15.18/ac anhydrous application, and $6.43 liquid fertilizer application.

Summary:

- Stand counts collected at harvest did not differ between the treatments.
- The UAN treatment had significantly drier grain at harvest and lower test weight than the anhydrous ammonia treatment.
- Yield was 26 bu/ac greater for the anhydrous ammonia treatment.
- The anhydrous ammonia product was cheaper than the UAN; however, the cost of application is greater. This resulted in very similar treatment costs: $51.93/ac for the UAN product and application compared to $52.25/ac for the anhydrous ammonia product and application. Marginal net return was greater for the anhydrous ammonia application method, resulting in a profit increase of $76.06/ac this year.

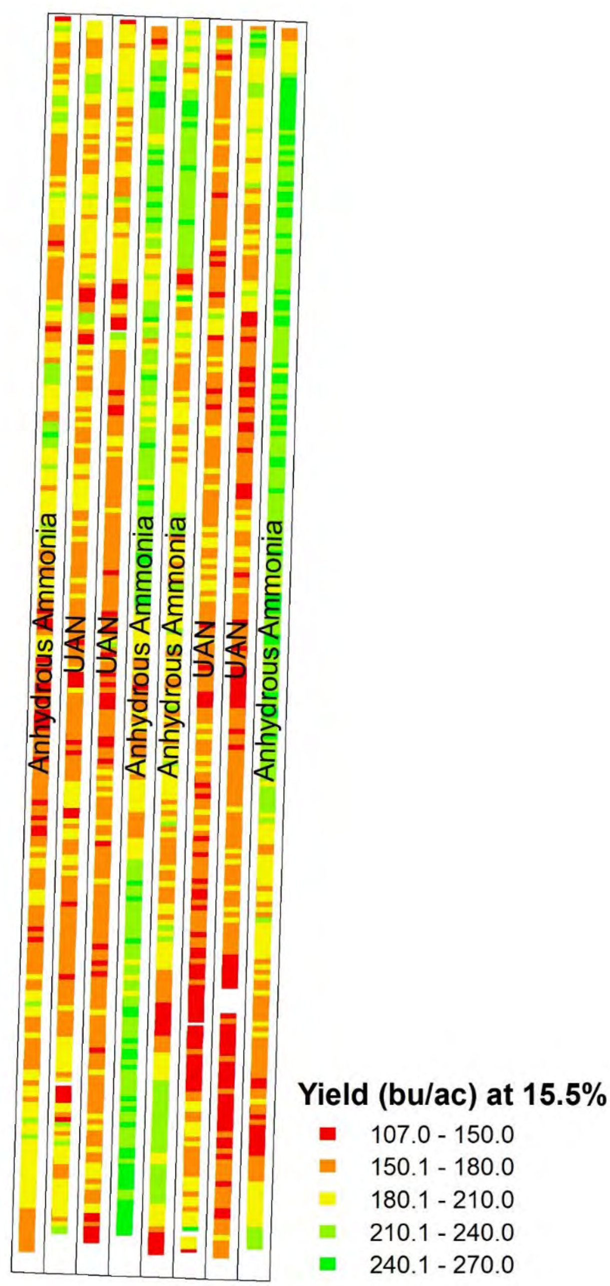


Figure 2. Yield from combine yield monitor.

Impact of Anhydrous Ammonia Nitrogen Rate on Corn Yield

Study ID: 0701147201802
County: Richardson
Soil Type: Marshall silty clay loam 2-6% slopes
Planting Date: 5/1/18
Harvest Date: 9/22/18
Population: 27,500
Row Spacing (in): 30
Hybrid: Hoegemeyer® 8414
Reps: 4
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** 8 oz/ac Banvel® and 6 oz/ac of 6# 2,4-D ***Post:*** 2.5 lb/ac mesotrione, 1 pt/ac Atrazine, and 12 oz/ac of 5.4 lb Roundup®

Irrigation: None
Rainfall (in):

Soil Test (Dec. 2018):

Soil pH 1:1	CEC	OM	Bray P1 Weak Bray	Bray P2 Strong Bray	K	Mg	Ca	S	Zn	K	Mg	Ca	H
	mg/100g	*%*	*ppm*	*ppm*	----------------(ppm)---------------					---% Base Saturation--			
6.5	18.7	2.9	29	44	189	385	2723	8	4.1	2.6	17.2	72.8	7.4
6.9	19.2	3.0	30	52	173	375	3133	7	3.9	2.3	16.3	81.4	0
6.9	18.5	3.1	34	53	191	384	2962	7	4.1	2.6	17.3	80.1	0
7.0	20.3	2.8	22	32	177	353	3378	7	3.7	2.2	14.5	83.3	0

Introduction: The purpose of this study was to evaluate three nitrogen application rates to determine which nitrogen rate maximized yield and profit. The nitrogen was applied as anhydrous ammonia on December 21, 2017, with a minimal disturbance AgSynergy® Genesis TRX® anhydrous applicator. Aerial imagery was collected on July 28, 2018, with a drone and MicaSense RedEdge™ multispectral camera to observe differences in plant vegetation. Aerial imagery was used to calculate the normalized difference red edge index (NDRE). This index is indicative of overall plant biomass and greenness. True color imagery and NDRE are presented in Figure 1. Yield, grain moisture, test weight, and stand counts were collected at harvest on September 22, 2018. Yield data from the yield monitor is displayed in Figure 1. Yield data reported in the table below is from weigh wagon measurements. The anhydrous ammonia tank ran out on the furthest east treatment (160 lb N/ac); therefore, all measurements from this pass were excluded from the analysis.

Results:

	Harvest Stand Count (plants/ac)	Test Weight	Moisture (%)	NDRE (Red Edge Sensor)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
130 lb N/ac	25,953 A*	56 A	17.0 A	0.621 B	184.4 A	565.60 A
160 lb N/ac	25,967 A	56 A	17.1 A	0.627 B	183.6 A	556.30 A
190 lb N/ac	25,868 A	56 A	17.4 A	0.640 A	194.0 A	583.10 A
P-Value	0.994	0.108	0.266	0.002	0.278	0.496

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield data reported from weigh wagon measurements. Bushels per acre adjusted to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and $0.25/lb N as anhydrous ammonia.

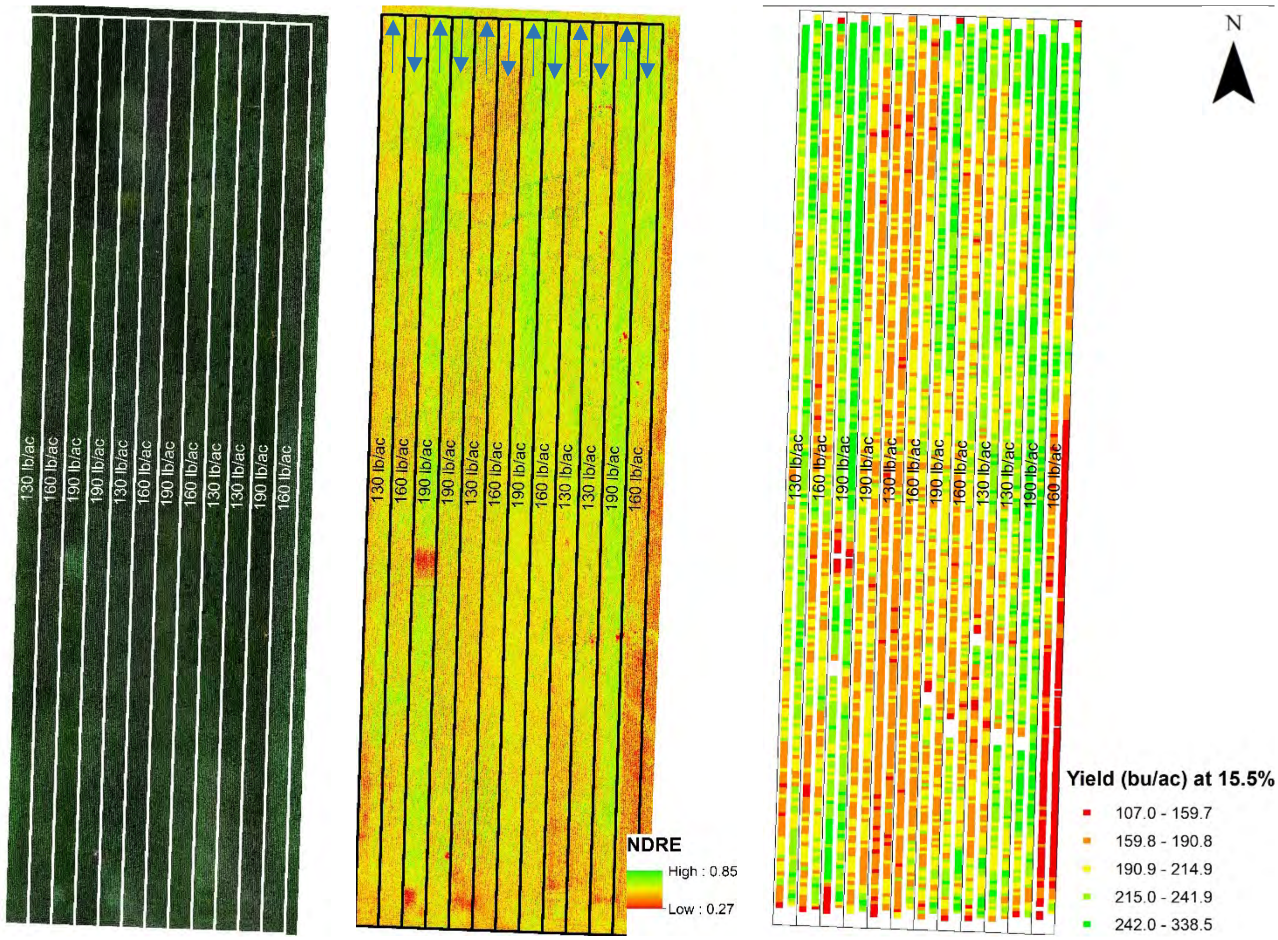


Figure 1. True color imagery of the plot from July 28, 2018 (left), NDRE imagery of the plot from July 28, 2018 (center), and yield of plot from combine yield monitor (right). The furthest east treatment (160 lb/ac) was eliminated from the analysis as the anhydrous ammonia tank ran out part way through the pass. The direction of travel of the anhydrous applicator is indicated on NDRE image with blue arrows.

Summary:

- Imagery from July 28, 2018, showed different NDRE values, with the 190 lb N/ac treatment having the highest NDRE reading. This indicates this treatment had greater biomass and/or greater chlorophyll content.
- There was no difference in test weight, grain moisture, harvest stand counts, yield, or marginal net return for the three nitrogen rates evaluated.
- Imagery and field observations of neighboring passes of the same rate suggest the applicator may not have been applying as much when headed south (downhill). Direction of anhydrous applicator travel is indicated on the NDRE map in Figure 1. This could have created greater variability in the treatment response; therefore, the study should be continued in future years.

Impact of NutriSphere-NH3™ with Anhydrous Ammonia Application

Study ID: 0822109201801
County: Lancaster
Soil Type: Kennebec silt loam occasionally flooded
Planting Date: 4/28/18
Harvest Date: 10/6/18 and 10/29/18
Population: 29,000
Row Spacing (in): 30
Hybrid: Fontanelle® 13D843
Reps: 5
Previous Crop: Soybean
Tillage: No-Till

Fertilizer: 130 lb N/ac as anhydrous ammonia on 11/15/17
Irrigation: None
Rainfall (in):

Introduction: The purpose of this study was to evaluate NutriSphere-NH3® applied with anhydrous ammonia. NutriSphere-NH3® is marketed by Verdisian Life Sciences to manage and protect nitrogen fertilizer applied as anhydrous ammonia. The active ingredient is partial calcium salt of maleic-itaconic copolymer, which is promoted to act as a urease and nitrification inhibitor.

Past research on NutriSphere-N® with urea and UAN applications had mixed results. To access a review of research studies evaluating NutriSphere-N®, visit https://go.unl.edu/nutrisphere.

On August 2, the field was flown over with a drone equipped with a MicaSense RedEdge 5 band sensor (Figure 1). The normalized difference red edge index (NDRE) was calculated. The NDRE index is correlated to plant biomass and chlorophyll content and is often used to assess nitrogen status of corn plants. Yield and grain moisture were collected at harvest with a yield monitor.

Results:

	Moisture (%)	Yield† (bu/acre)
Check	16.1 A*	251 B
NutriSphere-NH3™	16.0 A	261 A
P-Value	0.536	0.086

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre adjusted to 15.5% moisture.

Summary:

- Visual differences in NDRE and true color imagery were not apparent on August 2 (Figure 1).
- The NutriSphere-NH3™ treatment had an 11 bu/ac yield increase compared to the untreated check.
- As with any product, this study should be repeated in future years.

Figure 1. True color imagery (top) and normalized difference red edge index (NDRE) from August 2, 2018.

Data Intensive Farm Management: Nitrogen Application Rates on Corn

Study ID: 0817081201801
County: Hamilton
Soil Type: Hastings silt loam 0-1% slope; Crete silt loam 0-1% slope; Fillmore silt loam 0-1% slope
Planting Date: 4/27/18
Harvest Date: 11/1/18
Population: 34,000
Row Spacing (in): 30
Hybrid: Pioneer® P1306 WHR
Reps: 21
Previous Crop: Soybean
Tillage: Ridge-Till

Irrigation: Pivot, Total: 5.5”, 9.2 ppm N in irrigation water results in 11 lb N/ac (based on 2015 water test)
Rainfall (in):

Introduction: This project is part of the Data Intensive Farm Management project, a multi-university collaboration led by the University of Illinois at Urbana Champaign. The goal of these research studies is to utilize precision agriculture technology for conducting on-farm research. This study tested four nitrogen rates. Treatments were randomized and replicated in 60’ wide by 280’ long blocks across the entire field. Variable-rate prescription maps for the nitrogen study were developed and uploaded to the in-cab monitor. Geospatial yield monitor data were collected at the end of the growing season and post-processed to remove errors with Yield Editor Software from the USDA.

A total of 33 lb N/ac was applied to the whole field (250 lb/ac of 11-52-0 and 5 gal/ac of 10-34-0 at planting). The N treatments were established with an anhydrous ammonia application on March 30. Rates of 0, 110, 150, 190, and 220 lb N/ac were applied to equal the total treatment rates of 33, 143, 183, 223, and 253 lb N/ac respectively.

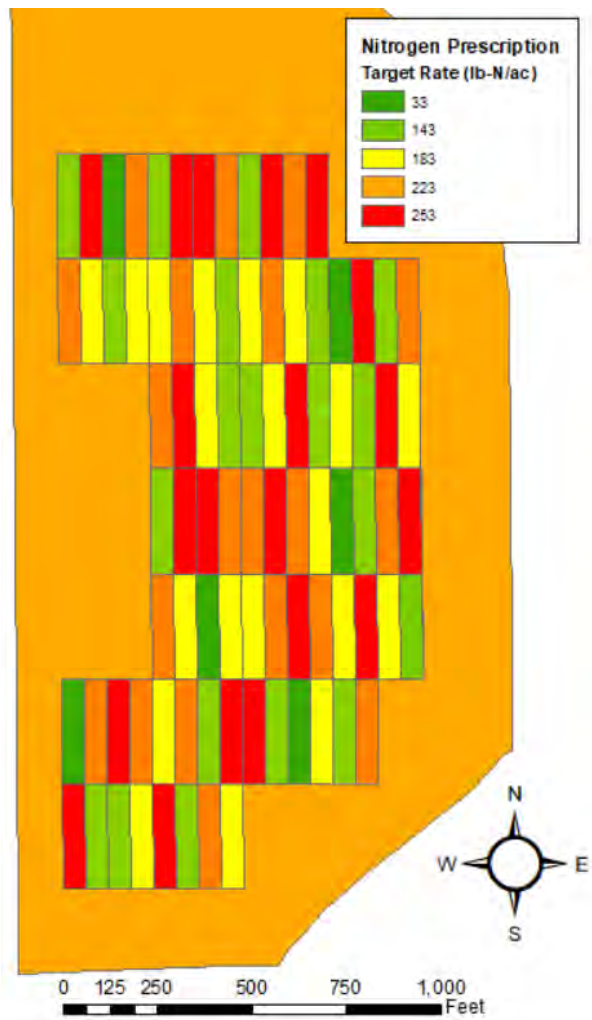


Figure 1. Nitrogen prescription map (total lb N/ac).

Results:

	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
33 lb N/ac	14.7 B*	240 D	763.01 C
143 lb N/ac	15.1 A	279 C	850.90 A
183 lb N/ac	15.1 A	282 BC	845.66 A
223 lb N/ac	15.2 A	285 A	843.11 A
253 lb N/ac	15.2 A	284 AB	828.50 B
P-Value	<0.0001	<0.0001	<0.0001

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre adjusted to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and $0.35/lb N.

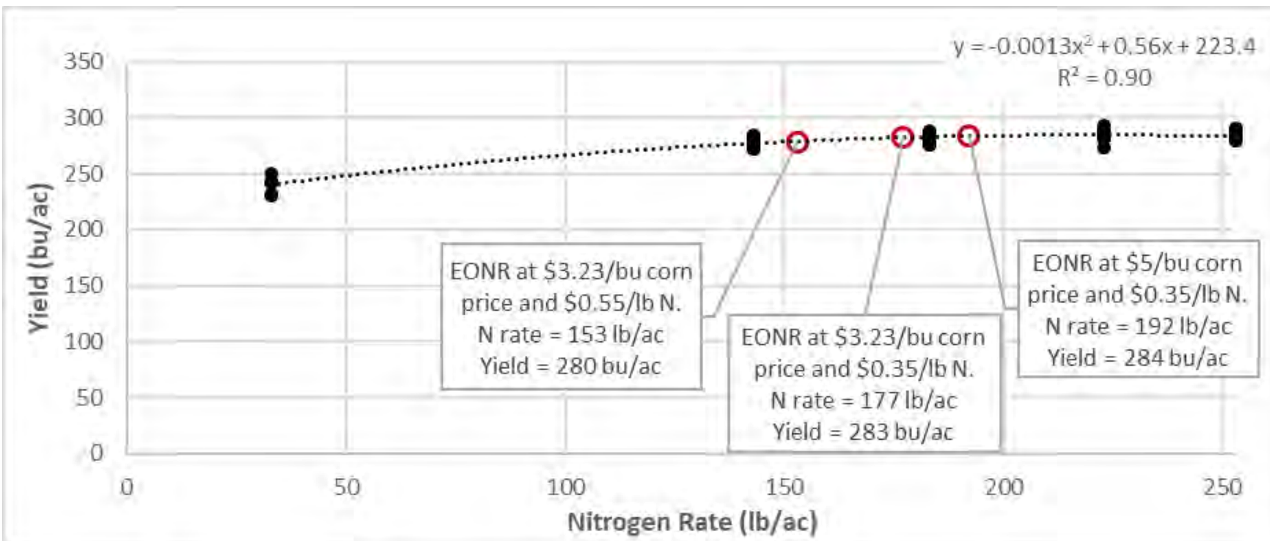


Figure 2. Yield versus nitrogen rate with economic optimum nitrogen rates (EONR) indicated.

Summary: At a corn price of $3.23/bu and N price of $0.35/lb (prices used in this year's report) the EONR was 177 lb/ac. This resulted in a yield of 283 bu/ac.

Data Intensive Farm Management: Nitrogen Application Rates on Corn

Study ID: 0073081201801
County: Hamilton
Soil Type: Hastings silt loam 0-1% slope; Hastings silt loam 1-3% slope; Hastings silty clay loam 3-7% slopes, eroded
Planting Date: 5/9/18
Harvest Date: 10/3/18
Population: 33,000
Row Spacing (in): 30
Hybrid: Pioneer® 1306WHR
Reps: 11
Previous Crop: White Corn
Tillage: Strip-Till

Irrigation: Pivot, Total: 3”
Rainfall (in):

Introduction: This project is part of the Data Intensive Farm Management project, a multi-university collaboration led by the University of Illinois at Urbana Champaign. The goal of these research studies is to utilize precision agriculture technology for conducting on-farm research. This study tested four nitrogen rates. Treatments were randomized and replicated in 120' wide by 280' long blocks across the entire field (Figure 1). Variable-rate prescription maps for the nitrogen study were developed and uploaded to the in-cab monitor. Geospatial yield monitor data were collected at the end of the growing season and post-processed to remove errors with Yield Editor Software from the USDA.

A total of 130 lb N/ac was applied to the whole field (urea prior to planting and 32% UAN with planting). The N treatments were established with 28% UAN on June 30. Rates applied were 35, 65, 95, and 125 lb N/ac to equal the total treatment rates of 165, 195, 225, and 255 lb N/ac, respectively.

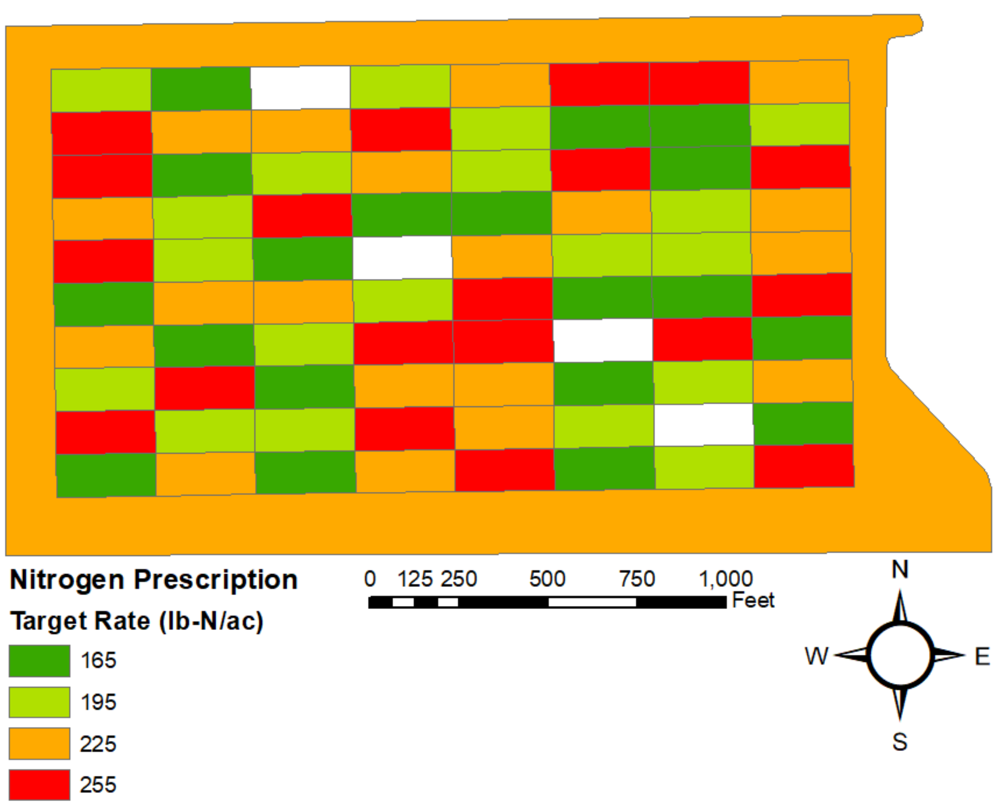


Figure 1. Nitrogen prescription map (total lb N/ac).

Results:

	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
165 lb N/ac	189 B	552.67 A
195 lb N/ac	196 AB	565.68 A
225 lb N/ac	205 A	583.16 A
255 lb N/ac	203 A	565.29 A
P-Value	0.012	0.306

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre adjusted to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and $0.23/lb N fertilizer.

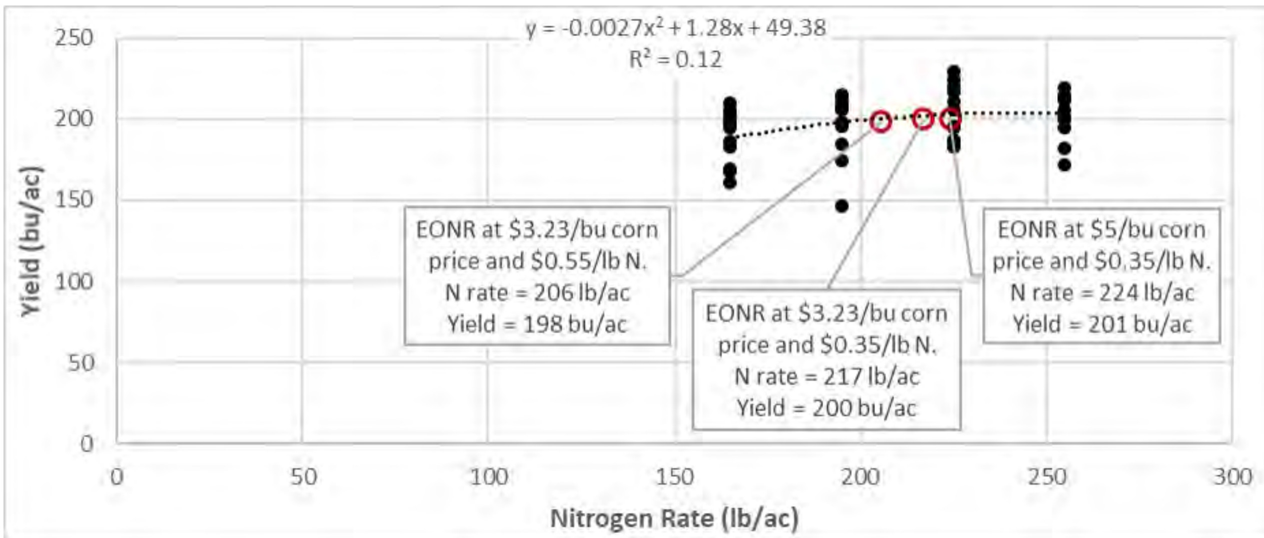


Figure 2. Yield versus nitrogen rate with economic optimum nitrogen rates (EONR) indicated.

Summary: At a corn price of $3.23/bu and N price of $0.35/lb (prices used for this year's report) the EONR was 217 lb/ac, resulting in a yield of 200 bu/ac.

Using Drone Based Sensors to Direct Variable-Rate In-Season Aerial Nitrogen Application on Corn

Study ID: 0416147201801
County: Richardson
Soil Type: Kennebec silt loam rarely flooded; Zook silty clay loam occasionally flooded
Planting Date: 5/1/18
Harvest Date: 10/2/18
Population: 33,000
Row Spacing (in): 30
Hybrid: Pioneer® P1197
Reps: 4
Previous Crop: Soybean
Tillage: Strip-Till

Irrigation: None
Rainfall (in):

Soil Test (2017 – 17 samples, averaged over study area):

Soil pH 1:1	Buffer pH	CEC *mg/100g*	OM *%*	Bray P1 *ppm*	K	Ca	Mg	Mn	Fe	Na	Cu	B	Zn	H	Ca	Mg	K	Na
					(ppm)									*% Base Saturation*				
6.6	6.8	14.4	3.2	46	211	2190	229	101.6	151	19.2	1.5	0.44	2.5	6.1	76.4	13.3	3.8	0.6

Introduction: Applying a portion of the N fertilizer during the growing season alongside the growing corn crop is one way to improve N management. In-season N applications allow N fertilizer availability and crop N uptake to more closely match and allows for N management that is responsive to current growing season conditions. Active crop canopy sensors have been used during the growing season to direct in-season N application and have been found to reduce N application and increase profit. This sensor technology is most commonly used on high clearance applicators, where sensing and application take place simultaneously. In regions with rolling topography, contour, and terrace farming practices, some farmers rely on airplanes for in-season N applications. Additionally, small, passive, multi-spectral sensors can be carried on drones, enabling crop sensing to occur from the air. This study uses drone based sensing and aerial N application to demonstrate in-season N management that is conducted without vehicles on the ground in the field. The goal of this research project is to evaluate the use of a passive crop canopy sensor to direct variable-rate, in-season N fertilizer recommendation rates on corn and apply this recommendation using variable-rate aerial technology. There were two treatments:

1. Farmer management: 180 lb N/ac

2. Drone management: 100 lb/ac N base rate + in-season N directed by drone and applied by airplane.

Pre-plant N was applied on December 1, 2017, as anhydrous ammonia. During the growing season, the field was flown with a DJI™ Inspire 2 drone equipped with a MicaSense® RedEdge® 5 band sensor. Imagery was obtained on June 3, June 10, June 18, June 22, June 27, July 8, July 21, and August 9. The normalized difference vegetation index (NDVI) was calculated for the June 3 and June 10 flights. For the remaining flights, the normalized difference red edge index (NDRE) was used. The NDRE index uses the near-infrared portion of the spectrum and allows differences in crop vegetation to be apparent, even when not visible in regular, true-color imagery. A sufficiency index (SI) was calculated by dividing the NDRE of the target N application area to the NDRE value of the top 5% of the field (virtual reference method). This allows each portion of the field to be compared to non-N limiting corn. NDRE data from the June 27 flight (Figure 2) was used to create an in-season prescription. Due to very similar N recommendation rates across the field, only one N rate was applied at a rate of 53 lb/ac. In-season N application was applied as urea (46% N) with Agrotain® ULTRA nitrogen stabilizer on June 28. On June 30, the field received a 0.45” rainfall.

NDRE values from imagery prior to and after in-season N application were collected as well as final crop yield, moisture, test weight, nitrogen use efficiency (NUE) and net return.

Results:

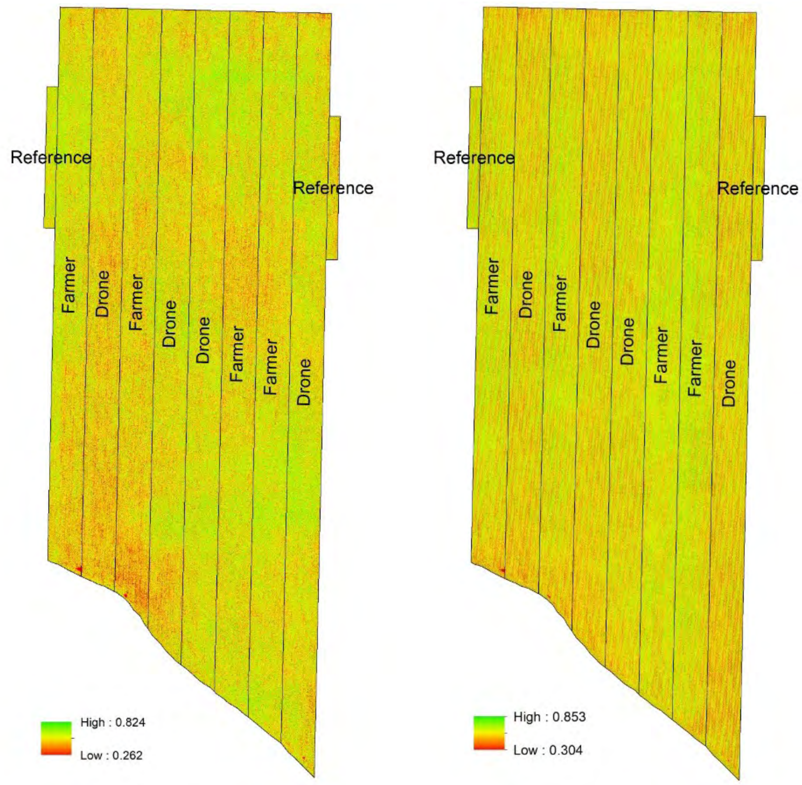


Figure 1. Normalized difference red edge index (NDRE) for June 27, prior to N application on June 28 (left) and July 8, following N application (right).

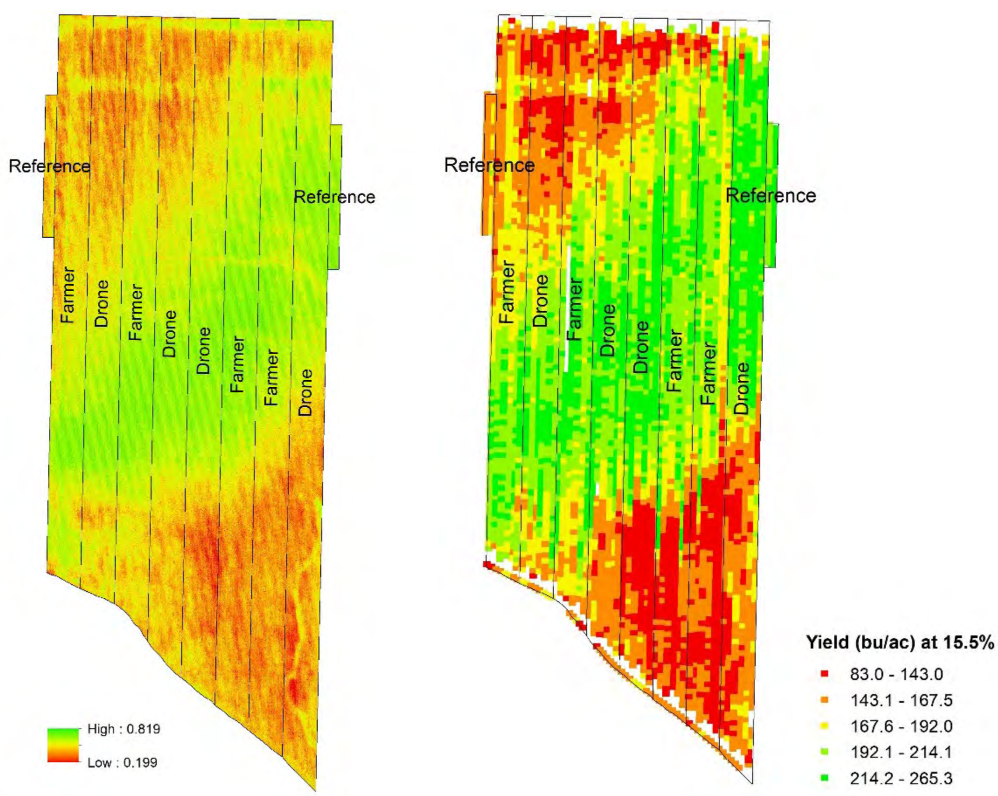


Figure 2. Normalized difference red edge index (NDRE) for August 9 (left) and yield map from October 2 (right).

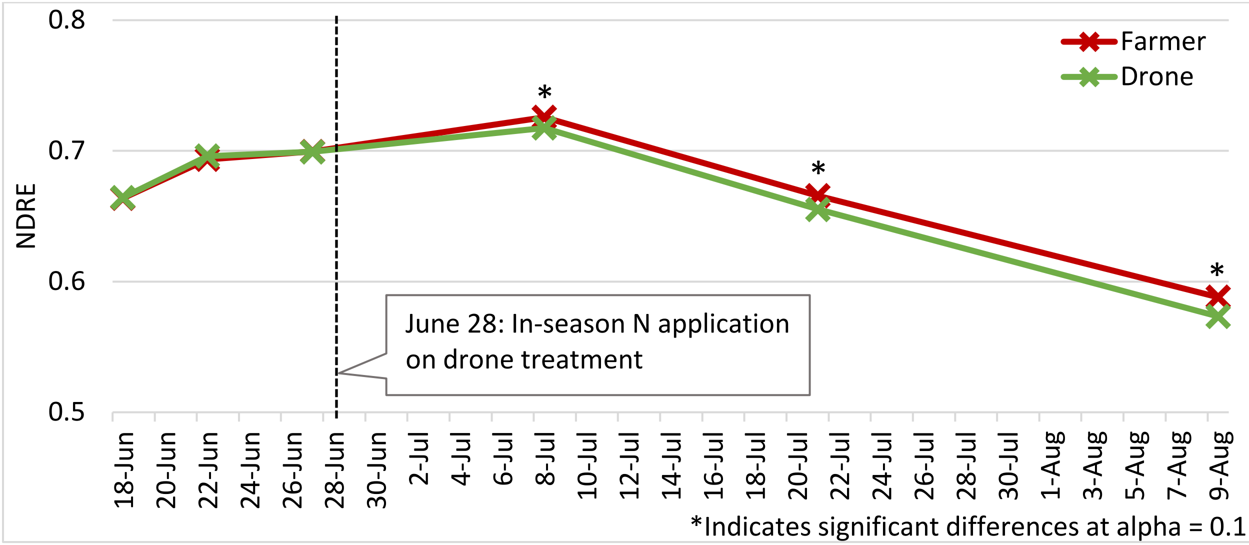


Figure 3. Normalized difference red edge index (NDRE) values for the farmer's N management versus the drone and sensor N management for flights on June 18, June 22, June 27, July 8, July 21, and August 9.

	Total N (lb/ac)	Moisture (%)	Test Weight	Yield† (bu/ac)	NUE (lb N/bu grain)	Marginal Net Return‡ ($/ac)
Farmer N Management	180	17.1 A*	58 A	183 A	0.99 A	538.89 A
Drone N Management	153	16.7 A	58 A	183 A	0.84 B	520.67 A
P-Value	-	0.205	0.231	0.947	0.002	0.128

*Values with the same letter are not significantly different at a 90% confidence level.

†Yield values are from cleaned yield monitor data. Bushels per acre adjusted to 15.5% moisture.

‡Marginal net return based on $3.23/bu corn, $15/ac anhydrous application, $15.90/ac airplane urea application, $335/ton anhydrous, and $335/ton coated urea.

Summary:

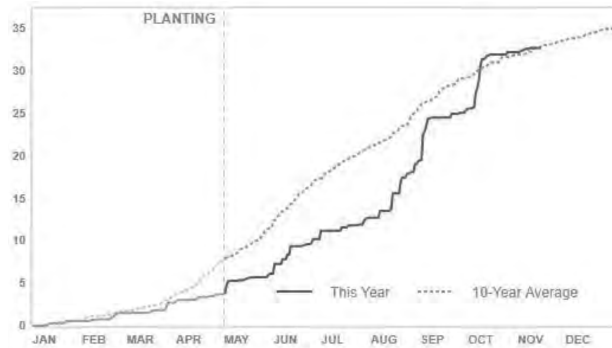
- For the drone N management treatment, 53 lb/ac was applied in-season. If the high N reference had been used in place of the virtual reference, very little to no N would have been applied in-season (the sufficiency index calculated with the high N reference did not go below 0.97 through July 21); this is a potential area for future research.
- The drone N management method saved 27 lb/ac N compared to the farmer's traditional management. There was no yield difference between the two treatments. Nitrogen use efficiency was greater for the drone method, using 0.84 lb N to produce a bushel of grain. Increasing N use efficiency is important in reducing negative environmental impacts of N application.
- Marginal net return was not statistically different; however, the drone N management method had an additional cost of an in-season application that the farmer's N management did not have.
- The field in this study was in D1 (moderate) to D2 (severe) drought throughout the entire growing season. It would be valuable to evaluate this technique for N management in a wet year.

This study was funded in part with a grant from the North Central Region-SARE.

Using Drone Based Sensors to Direct Variable-Rate In-Season Aerial Nitrogen Application on Corn

Study ID: 0810147201801
County: Richardson
Soil Type: Monona silt loam 1-6% slopes
Planting Date: 5/1/18
Harvest Date: 9/28/18
Population: 29,500
Row Spacing (in): 30
Hybrid: MOEWS 3751
Reps: 4
Previous Crop: Soybean
Tillage: Strip-Till

Irrigation: None
Rainfall (in):



Soil Test (Nov. 2017 – 7 samples, averaged over study area):

Soil pH 1:1	Buffer pH	CEC	OM	Nitrate-N	Bray P1	Bray P2	K	S	Mg	Mn	Cu	B	Zn
		mg/100g	*%*	*ppm*	*ppm*	*ppm*	----------	----------	----------	*(ppm)*	----------	----------	----------
6.5	6.9	16.52	3.0	6.7	29	38	165	22	185	6.4	0.74	0.76	4.7

Introduction: Applying a portion of the N fertilizer during the growing season alongside the growing corn crop is one way to improve N management. In-season N applications allow N fertilizer availability and crop N uptake to more closely match and allows for N management that is responsive to current growing season conditions. Active crop canopy sensors have been used during the growing season to direct in-season N application and have been found to reduce N application and increase profit. This sensor technology is most commonly used on high clearance applicators, where sensing and application take place simultaneously. In southeast Nebraska and other regions of the corn belt, in-season N application by ground-based applicators is not common due to rolling topography, and contour and terrace farming practices. Some farmers in these landscapes rely on airplanes for in-season N applications. Additionally, small, passive, multi-spectral sensors can be carried on drones, enabling crop sensing to occur from the air. This study uses drone based sensing and aerial N application to demonstrate in-season N management that is conducted without vehicles on the ground in the field.

The goal of this research project is to evaluate the use of a passive crop canopy sensor to direct variable-rate, in-season N fertilizer recommendation rates on corn and apply this recommendation using variable-rate aerial technology.

There were two treatments:

1. Farmer management: 160 lb N/ac
2. Drone management: 100 lb/ac N base rate + in-season N directed by drone and applied by airplane.

Pre-plant N was applied on November 30, 2017, as anhydrous ammonia. During the growing season, the field was flown with a DJI™ Inspire 2 drone equipped with a MicaSense® RedEdge® 5 band sensor. Imagery was obtained on June 3, June 10, June 18, June 22, June 27, July 8, July 21, and August 9. The normalized difference vegetation index (NDVI) was calculated for the June 3 and June 10 flights. For the remaining flights, the normalized difference red edge index (NDRE) was used. The NDRE index uses the near-infrared portion of the spectrum and allows differences in crop vegetation to be apparent, even when not visible in regular, true-color imagery. A sufficiency index (SI) was calculated by dividing the NDRE of the target N application area to the NDRE value of the top 5% of the field. This allows each portion of the field to be compared to non-N limiting corn. NDRE data from the June 27 flight (Figure 2) was used to create an in-season prescription. Due to very similar N recommendation rates across the field, only one N rate was applied at a rate of 25 lb/ac. In-season N application was applied as urea (46% N) with Agrotain® ULTRA nitrogen stabilizer on June 28. On June 30, the field received a 1.07" rainfall.

NDRE values from imagery prior to and after in-season N application were collected as well as final crop yield, moisture, test weight, nitrogen use efficiency (NUE), and net return.

Results:

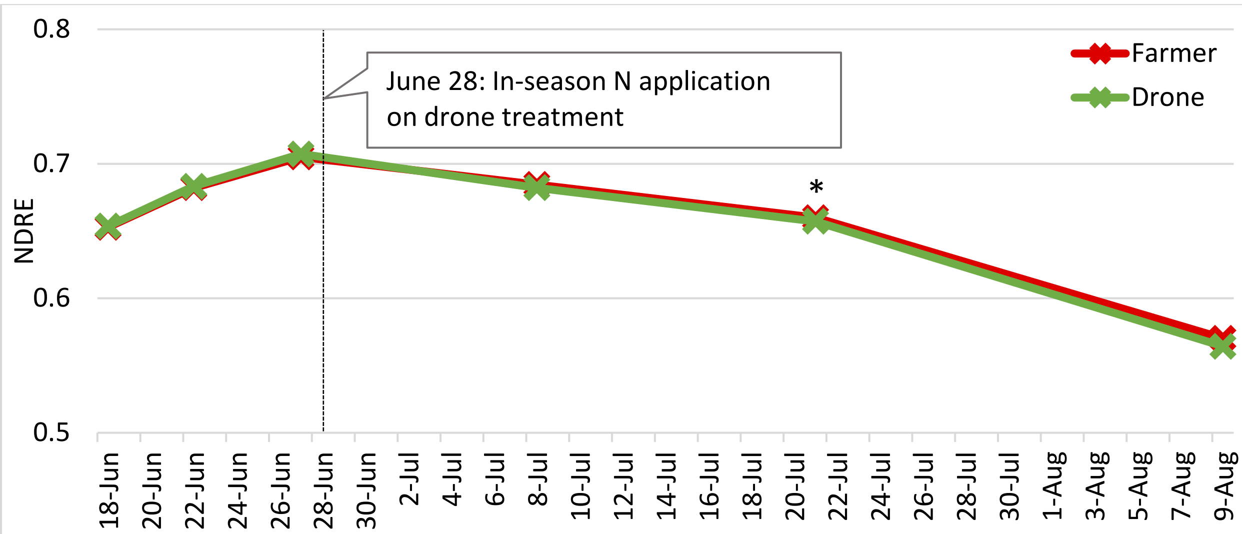


Figure 1. Normalized difference red edge index (NDRE) values for the farmer's N management versus the drone and sensor N management for flights on June 18, June 22, June 27, July 8, July 21, and August 9.

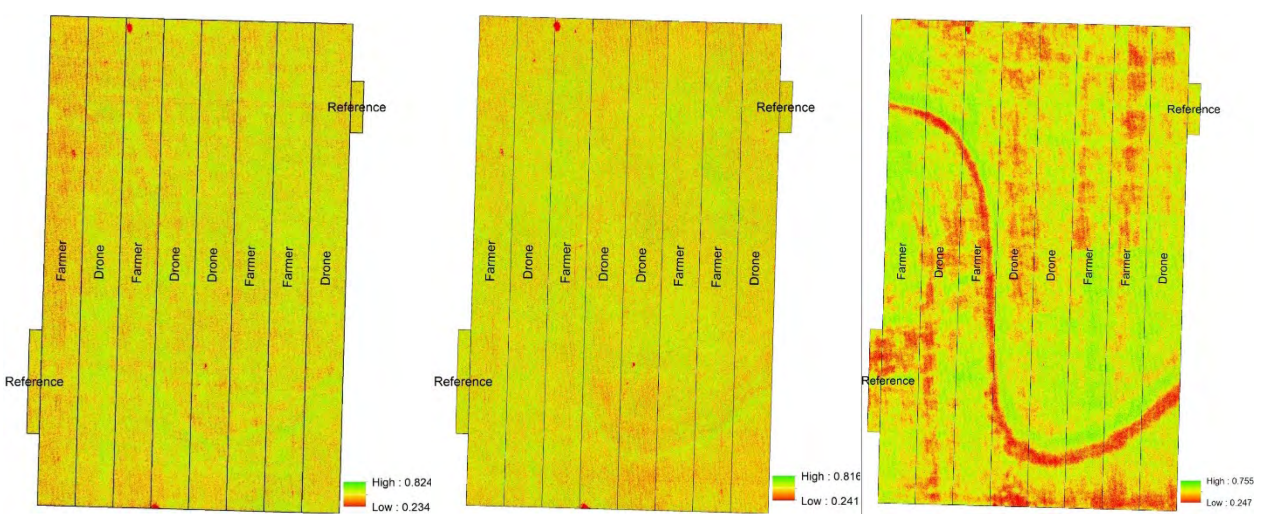


Figure 2. Normalized difference red edge index (NDRE) for June 27, prior to N application on June 28 (left), July 8, following N application (center), and on August 9 (right).

	Total N (lb/ac)	Moisture (%)	Test Weight	Yield† (bu/ac)	NUE (lb N/bu grain)	Marginal Net Return‡ ($/ac)
Farmer N Management	160	15.9 A*	59 A	203 A	0.79 A	606.44 A
Drone N Management	125	15.7 A	60 A	201 A	0.62 B	589.02 A
P-Value	-	0.212	0.295	0.667	0.001	0.175

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre adjusted to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn, $15/ac anhydrous application, $15.90/ac airplane urea application, $335/ton anhydrous, and $335/ton coated urea.

Summary:

- For the drone N management treatment, only 25 lb/ac was applied in-season. If the high N reference had been used in place of the virtual reference, no in-season N application would have been recommended (the sufficiency index calculated with the high N reference did not go below 0.99 through July 21); this is a potential topic of future research. Furthermore, throughout the season there was little to no difference in NDRE values between the drone N management and the grower N management.
- The drone N management method saved 35 lb/ac N compared to the farmer's traditional management. There was no yield difference between the two treatments. Nitrogen use efficiency was greater for the drone method, using only 0.62 lb N to produce a bushel of grain. Increasing N use efficiency is important in reducing negative environmental impacts of N application.
- Marginal net return was not statistically different; however, the drone N management method had an additional cost of an in-season application that the farmer's N management did not have.
- The field in this study was in D1 (moderate) to D2 (severe) drought throughout the entire growing season. It would be valuable to evaluate this technique for N management in a wet year.

This study was funded in part with a grant from the North Central Region-SARE.

Project SENSE – 3 Year Summary Report

Sensors for Efficient N use and Stewardship of the Environment

The Nebraska On-Farm Research Network launched a project in 2015 focused on improving the efficiency of nitrogen fertilizer use. Project SENSE (Sensors for Efficient Nitrogen Use and Stewardship of the Environment) was a three-year project that looked at using crop canopy sensors to direct variable-rate, in-season nitrogen application in corn. Over the three years of the project, 52 sites were conducted with five partnering Natural Resources Districts (NRDs): Central Platte, Little Blue, Lower Loup, Lower Platte North, and Upper Big Blue. In 2018, the project continued with fewer sites and sites were not constrained to a specific NRD or to irrigated fields; the 2018 sites are reported individually following this summary. This summary report presents the results of 48 sites from 2015 to 2018. Several sites were removed from the final analysis due to weather issues, which delayed the sensor-based application beyond the targeted V8 to V14 crop stages.

Nitrogen Management Challenges

Since 1988, the nitrate concentration in groundwater in Nebraska's Central Platte River Valley has been steadily declining, largely due to the conversion from furrow to center-pivot irrigation. However, over the last 25 years, fertilizer nitrogen use efficiency has remained static. This trend points to the need for adoption of available technologies such as crop canopy sensors for further improvement in nitrogen use efficiency. Strategies that direct crop nitrogen status at early growth stages are promising as a way to improve nitrogen fertilizer efficiency.

Managing Variability with Sensors

Figure 1. Active crop canopy sensor positioned over corn canopy.

It is difficult to determine the optimum amount of nitrogen to apply in a field; nitrogen needs in a field vary spatially and from year to year. Because crop canopy sensors are designed to be responsive to nitrogen needs, they can help account for this variability. Another challenge with nitrogen management is that all the nitrogen for the crop is often applied prior to the growing season, before the crop begins to rapidly uptake nitrogen. This results in unnecessary losses of nitrogen from the cropping system and has negative economic and environmental implications. Applying a portion of the total nitrogen during the growing season helps better match nitrogen availability to the timing of nitrogen uptake.

Active sensors work by emitting light onto the crop canopy and then measuring reflectance from the canopy with photodetectors (*Figure 1*). The light source simultaneously emits visible and near-infrared light, which is detected synchronously by sensor electronics. When used to detect plant health, light in both the visible (VIS; 400-700 nm) and near-infrared (NIR; 700-1000 nm) portions of the electromagnetic spectrum are generally measured. These wavelengths are combined to create various vegetation indices (VI), such as the commonly used normalized difference vegetation index (NDVI), that are correlated with specific crop conditions of interest. Algorithms are then used to translate the NDVI values into an in-season nitrogen recommendation rate. In this study, the normalized difference red edge (NDRE) index was used.

Study Design

Figure 2. High clearance applicator equipped with OptRx® crop canopy sensors, GPS, and drop nozzles.

A high clearance applicator was equipped with an Ag Leader® Integra in-cab monitor and four OptRx® sensors. A master module enables connection between the OptRx® sensors and Ag Leader® in-cab monitor. An application rate module communicates the target rate from the Ag Leader® monitor to the rate controller. A GPS receiver is not required for sensing but may be used for applicator ground speed and as-applied mapping. The applicator was equipped with straight stream drop nozzles in order to apply UAN fertilizer to the crop as it was sensed (*Figure 2*).

Project SENSE plots were arranged in a randomized complete block design with six replications. The grower's normal N management was compared with the Project SENSE N Management. For the Project SENSE strips, a base rate (75 lb N/ac for most sites) was applied at planting or very early in the growing season. Between V8 and VT, corn was sensed with the crop canopy sensors and variable-rate N was applied on-the-go. Grower N rates were noted and in-season Project SENSE N rates were logged and averaged. At harvest, yield monitor data was recorded, logged, and averaged. For each site, the average difference in N applied (lb/acre) and the average difference in yield (bu/acre) were calculated. Nitrogen use efficiency (NUE) was also calculated as partial factor productivity of N (PFPn) (lb grain/lb N fertilizer) and as lb N applied per bushel of grain produced.

2015, 2016, and 2017 Results

Data were analyzed using the GLIMMIX procedure in SAS 9.4 (SAS Institute Inc., Cary, NC). Mean separation was performed with Fisher's LSD.

Across the 48 sites (Table 1), ***the sensor-based approach used 29 lb-N/ac less*** than the cooperating growers' approaches; the result was an ***average of 1.5 bu/ac less corn produced using the sensor-based method***. In terms of productivity and NUE, the sensor-based approach produced an additional 16 lb-grain/lb-N compared to the cooperator approaches.

The sensor-based approach resulted in an average increase in profit compared to the grower approaches. At the higher N and corn prices ($0.65/lb-N and $3.65/bu) noted during the study (typically in 2015), ***the sensor-based approach was $13.23/ac more profitable.*** At lower N and corn prices ($0.41/lb-N and $3.05/bu) experienced in 2016 and 2017, ***the sensors were $7.24/ac more profitable compared to the grower approaches***. Input costs and crop revenues are important considerations regarding decisions about technology adoption; however, the sensors were a viable option for improving economic returns based on this study.

Table 1. Summary of 48 sites in 2015, 2016, and 2017 comparing sensor-based N management to the grower's traditional method.

Three Year Average	SENSE	Grower
Total N rate (lb-N/ac)	161.1 B*	189.8 A
Yield (bu/ac)	218.5 B	219.9 A
Partial Factor of Productivity (lb grain/lb-N)	83 A	68 B
Nitrogen Use Efficiency (lb-N/bu grain)	0.76 B	0.92 A
Partial Profitability ($/ac) [@3.65/bu and $0.65/lb-N]	$692.82 A	$679.59 B
Partial Profitability ($/ac) [@3.05/bu and $0.41/lb-N]	$600.39 A	$593.15 B

*Values with the same letter are not significantly different at a 95% confidence interval.

Differences (Grower – SENSE) in project metrics for each year are summarized in the table 2. For 2015 and 2016, the sensor-based method resulted in significant reductions in N required and also improved profitability. In 2016, average yields increased using the sensors; in 2015 a loss of 4.2 bu/ac was noticed. In 2017, a few factors may have contributed to reduced performance using the sensors (high economic optimum N rates, for example, in some SENSE plots); however N required was still less using the sensors. As expected, yearly variability was noted using this technology.

Table 2. Yearly differences for production metrics for 2015, 2016, and 2017 for sites comparing sensor-based N management to the grower's traditional method. Values presented represent the difference between the grower's value and the sensor values (grower-sensor).

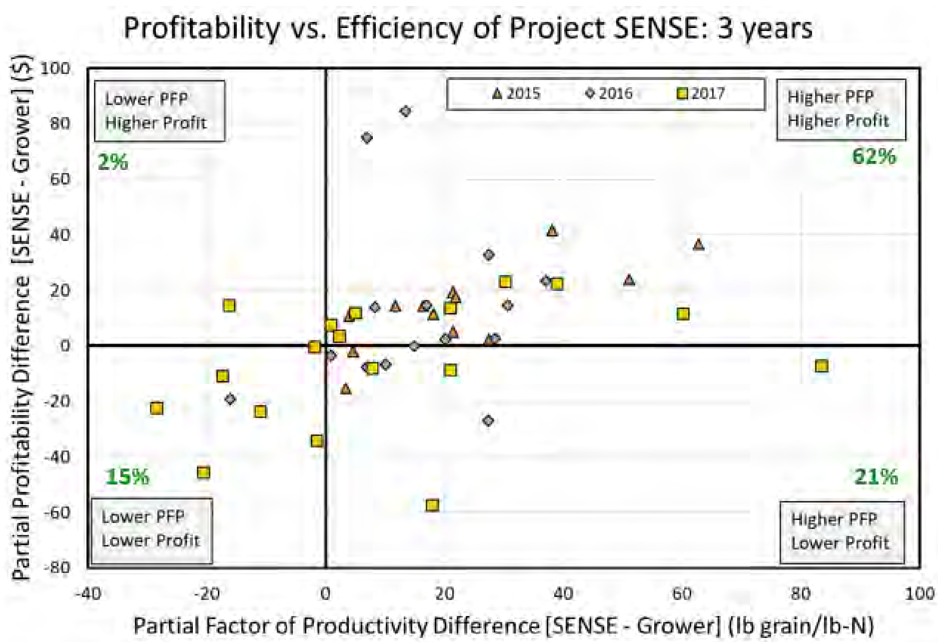
	2015	2016	2017
Total N rate (lb-N/ac)	45*	33*	15*
Yield (bu/ac)	4.2*	-2.3*	3.5*
Partial Factor of Productivity (lb grain/lb-N)	-23*	-15*	-11*
Nitrogen Use Efficiency (lb-N/bu grain)	0.20*	0.24*	0.06*
Partial Profitability ($/ac)†	-$13.91*	-$21.86*	$5.05*

†At yearly corn and N prices: $3.65/bu and $0.65/lb-N in 2015; $3.05/bu and $0.45/lb-N in 2016; $3.15/bu and $0.41/lb-N in 2017

*Values are statistically different at a 95% confidence level.

Profitability and efficiency of Project SENSE N management was compared with the grower's standard management (Figure 3). Sites falling above the horizontal line represent higher profitability for Project SENSE; sites falling to the right of the vertical line represent greater efficiency for Project SENSE management. Profitability and productivity were improved for 62% of sites (upper right quadrant) along with an additional 21% (lower right quadrant), where productivity was improved while profitability suffered. For 15% of the sites, productivity and profitability were both negatively impacted by using the sensors. When considering productivity alone, 83% of sites saw an improvement using sensors for N management.

Figure 3. Profitability and nitrogen use efficiency of sensor-based N management compared to the grower's traditional management.



Continuing On

Summaries for each site in 2015, 2016, and 2017 can be found at https://cropwatch.unl.edu/on-farm-research. Results of three studies in 2018 are in the following pages of this report.
Project SENSE will continue with increased emphasis on sensor-based fertigation and drone based sensors. Additionally, field demonstration days will continue to be held in each NRD to showcase the equipment, teach how it is used, and present study results.

Project SENSE is made possible through support from:

Nebraska's Natural Resources Districts

Central Platte
Little Blue
Lower Loup
Lower Platte North
Upper Big Blue

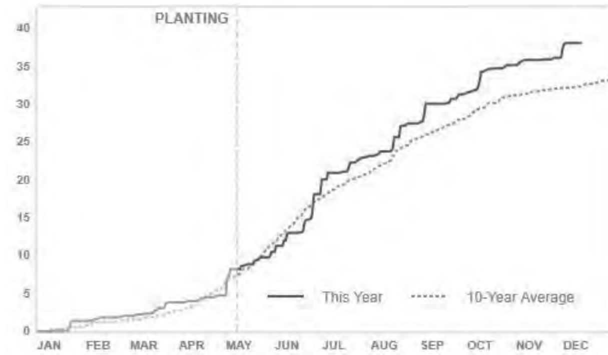
Nebraska CornBoard

USDA

Project SENSE (Sensor-based In-season N Management)

Study ID: 0621023201801
County: Butler
Soil Type: Brocksburg sandy loam
Planting Date: 5/8/18
Harvest Date: 10/18/18
Population: 31,000
Row Spacing (in): 30
Hybrid: Pioneer® P1479AM
Reps: 6
Previous Crop: Soybean
Tillage: No-Till

Irrigation: Pivot, Total: 8.5", 16.9 ppm N in irrigation water results in 32 lb N/ac
Rainfall (in):



Introduction: A high clearance applicator was equipped with Ag Leader® OptRx sensors. UAN fertilizer was applied with drop nozzles as the crop canopy was sensed. This study compares crop canopy sensor-based in-season N application with the grower's standard N management.

Grower Nitrogen Treatment: The initial grower N rate was 75 lb N/ac applied at planting. An additional 127 lb N/acre was applied at V6 growth stage, and 20 lb N/acre was applied at V8 growth stage. Total N applied was 222 lb N/acre.

Project SENSE Nitrogen Treatment: For the SENSE treatment strips, 75 lb N/acre was applied at planting and 20 lb N/acre was applied at V8 growth stage. Crop canopy sensing and application occurred on July 3, 2018 at V12 growth stage. Across all project SENSE treatments, the average N rate applied in-season, based on the sensor, was 88 lb N/acre. The total N rate averaged 183 lb N/acre.

Results:

	Total N rate (lb/ac)	Yield† (bu/ac)	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
Grower N Management	222	208 A*	52 B	1.07 A	593.21 A
Project SENSE N Management	183	206 A	63 A	0.89 B	601.21 A
P-Value	N/A	0.591	0.004	0.001	0.482

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and $0.35/lb N.

Summary:

- The Project SENSE N management was 39 lb N/ac lower than the grower's N management.
- There was no yield difference between the Project SENSE N management and the grower's N management.
- Project SENSE had a higher partial factor productivity of N and used fewer pounds of N to produce a bushel of grain.
- There was no difference in marginal net return between the Project SENSE N management and the grower's N management.

Project SENSE (Sensor-based In-season N Management)

Study ID: 0103053201801
County: Dodge
Soil Type: Moody silty clay loam; Nora silty clay loam
Planting Date: 5/7/18
Harvest Date: 10/21/18
Population: 31,000
Row Spacing (in): 30
Hybrid: Fontanelle® 11D637
Reps: 6
Previous Crop: Soybean
Tillage: No-Till

Irrigation: None
Rainfall (in):

Introduction: A high clearance applicator was equipped with Ag Leader® OptRx sensors. UAN fertilizer was applied with drop nozzles as the crop canopy was sensed. This study compares crop canopy sensor-based in-season N application with the grower's standard N management.

Grower Nitrogen Treatment: The initial grower N rate was 14 lb N/ac as 11-52-0 and 35 lb N/ac applied at planting. An additional 70 lb N/ac was applied at V6 growth stage. Total N applied was 119 lb N/ac.

Project SENSE Nitrogen Treatment: For the SENSE treatment strips, 14 lb N/ac was applied as 11-52-0 and 35 lb N/ac was applied at planting. An additional 35 lb N/acre was applied at V6 growth stage. Crop canopy sensing and application occurred on July 3, 2018 at V12 growth stage. Across all project SENSE treatments, the average N rate applied based on the in-season sensing was 47 lb N/ac. The average total N rate was 131 lb N/acre.

Results:

	Total N rate (lb/ac)	Yield† (bu/ac)	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
Grower N Management	119	214 A*	101 A	0.56 B	648.78 A
Project SENSE N Management	131	211 A	90 B	0.62 A	635.21 A
P-Value	N/A	0.231	0.0001	0.0001	0.104

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and $0.35/lb N.

Summary:

- The Project SENSE N management was 12 lb N/ac higher than the grower's N management.
- There was no yield difference between the Project SENSE N management and the grower's N management.
- Project SENSE had lower partial factor productivity of N and took more pounds of N to produce a bushel of grain.
- There was no difference in profitability between the grower's N management and Project SENSE N management.

Project SENSE (Sensor-based In-season N Management)

Study ID: 0818055201801
County: Douglas
Soil Type: Gibbon-Wann complex
Planting Date: 5/4/18
Harvest Date: 10/30/18
Population: varied
Row Spacing (in): 30
Hybrid: Dekalb® D54VC52RIB
Reps: 6
Previous Crop: Soybean
Tillage: No-Till

Irrigation: Pivot, Total: 0”
Rainfall (in):

Introduction: A high clearance applicator was equipped with Ag Leader® OptRx sensors. UAN fertilizer was applied with drop nozzles as the crop canopy was sensed. This study compares crop canopy sensor-based in-season N application with the grower's standard N management.

Grower Nitrogen Treatment: The initial grower N rate was 100 lb N/ac applied at planting. An additional 64 lb N/acre was applied at V6 growth stage. Total N applied was 164 lb N/ac.

Project SENSE Nitrogen Treatment: For the SENSE treatment strips, 100 lb N/ac was applied at planting. Crop canopy sensing and application occurred on June 30, 2018 at V12-14 growth stage. Across all project SENSE treatments, the average N rate applied in-season, based on the sensor, was 53 lb N/ac. The average total N rate was 153 lb N/acre.

Results:

	Total N rate (lb/ac)	Yield† (bu/ac)	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
Grower N Management	164	216 A*	74 B	0.76 A	640.20 A
Project SENSE N Management	153	217 A	80 A	0.71 B	648.13 A
P-Value	N/A	0.649	0.070	0.073	0.436

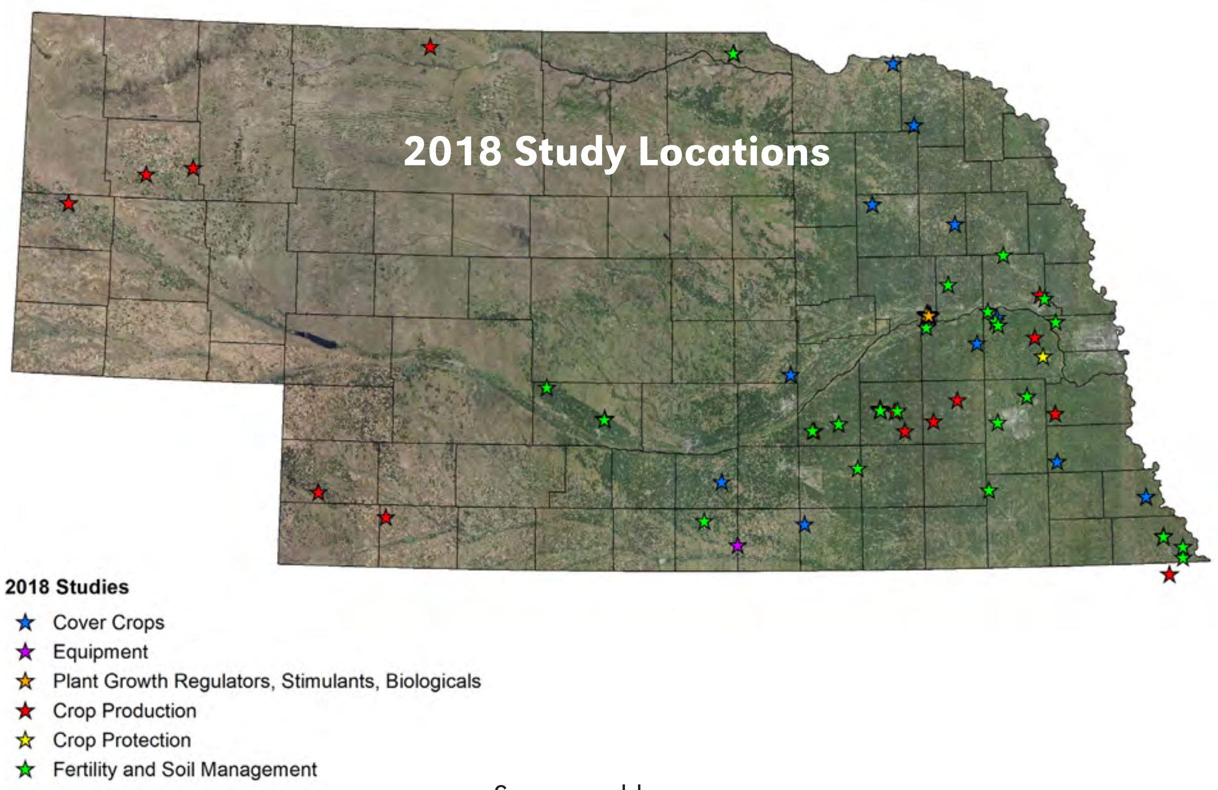
*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.23/bu corn and $0.35/lb N.

Summary:

- The Project SENSE N application was 11 lb N/ac lower than the grower’s N application.
- The growers N management and the Project SENSE N management resulted in the same yield.
- Project SENSE had a higher partial factor productivity of N and used fewer pounds of N to produce a bushel of grain.
- There was no difference in profitability between the grower’s N management and Project SENSE N management.

Nebraska On-Farm Research Network

Working with Nebraska's producers to address critical production, profitability, and natural resources questions.



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