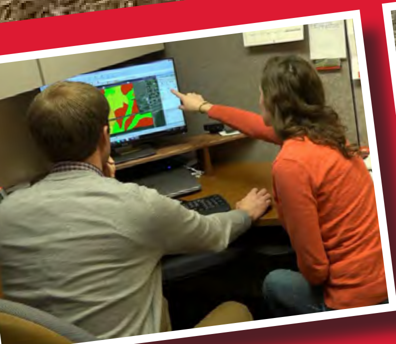
EC3014

EXTENSION

On-Farm Research

2016 GROWING SEASON RESULTS



Post-Conference Publication March 2017

University of Nebraska-Lincoln

NEBRASKA ON-FARM RESEARCH NETWORK

2017 Results Update Meetings

- **Feb. 20, 2017 - Agricultural Research and Development Center, near Mead**
- **Feb. 21, 2017 - Lifelong Learning Center, Northeast Community College, Norfolk**
- **Feb. 23, 2017 - West Central Research and Extension Center, North Platte**
- **Feb. 24, 2017 - Knight Museum & Sandhills Center, 908 Yellowstone Ave., Alliance**
- **Feb. 27, 2017 - Hall County Ext. Office, College Park Campus, Grand Island**

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Nebraska CornBoard

NEBRASKA CORN GROWERS ASSOCIATION

NEBRASKA SOYBEAN CHECKOFF

Nebraska Dry Bean Commission

University of Nebraska–Lincoln Institute of Agriculture and Natural Resources

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NEBRASKA ON-FARM RESEARCH NETWORK

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

Educators

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

* LAURA THOMPSON
On-Farm Research Coordinator
Nebraska Extension Educator
1071 County Road G, Ithaca, NE 68033
(402)624-8000 * laura.thompson@unl.edu
** Contact Laura Thompson for questions about this publication or the on-farm research network.*

CHUCK BURR
Nebraska Extension Educator
402 W. State Farm Road, North Platte, NE 69101
(308)696-6783 * chuck.burr@unl.edu

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

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

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

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

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

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

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

MICHAEL RETHWISCH
Nebraska Extension Educator
451 N. 5th St., David City, NE 68632-1666
(402)367-7410 * mrethwisch2@unl.edu

STRAHINJA STEPANOVIC
Nebraska Extension Educator
P.O. Box 99, Grant NE 69153
(308)352-7580 *strahinja.stepanovic@unl.edu

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

TODD WHITNEY
Nebraska Extension Educator
1308 2nd Street, Holdrege NE 68949-2803
(308)995-4222 * twhitney3@unl.edu

GARY ZOUBEK
UNL Emeriti Extension Educator
1530 Duke Drive, York NE 68467
(402)326-8185 * gary.zoubek@unl.edu

Specialists

TONY ADESEMOYE
Nebraska Extension Plant Pathologist
402 W. State Farm Road, North Platte, NE 69101
(308)696-6708 * tony.adesemoye@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

LOREN GIESLER
Nebraska Extension Plant Pathologist
448 Plant Sci Hall, Lincoln, NE 68583-0722
(402) 472-2559 * lgiesler1@unl.edu

JOE LUCK
Nebraska Extension Precision Ag Specialist
206 CHA, Lincoln, NE 68583-0726
(402)472-1488 * jluck2@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
University of Nebraska-Lincoln
Asst. Professor Ag Economics
208A FYH, Lincoln NE 68583-0922
(402)72-2386 * tmieno2@unl.edu

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

JULIE PETERSON
Nebraska Extension Entomology Specialist
402 W. State Farm Road, North Platte, NE 69101
(308)696-6704 * julie.peterson@unl.edu

DARAN RUDNICK
Nebraska Extension Agriculture Water Management Specialist - Crops
402 W. State Farm Road, North Platte, NE 69101
(308)696-6709 * daran.rudnick@unl.edu

CHARLES SHAPIRO
University of Nebraska–Lincoln
Soil Scientist - Crop Nutrition
HAL 57905 866 Rd, Concord, NE 68728
(402)584-3803 * cshapiro@unl.edu

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

KENT ESKRIDGE
University of Nebraska-Lincoln Statistics Professor, HARH 343E Lincoln NE 68583-0963
(402)472-7213 * keskridge1@unl.edu

Graduate Students

JOEL CROWTHER, Graduate Student
JOHN PARISH, Project SENSE Technician
RACHEL STEVENS, Graduate Student

Report, Program and Research Assistance

NICHOLAS ARNESON
Pathology Research Technologist
UNL Department of Plant Pathology
(402) 472-6771 * nicholas.arneson@unl.edu

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

DELORIS PITTMAN
Marketing and Promotions Manager, Univ. of NE Eastern NE Research & Extension Center
122 MUS Hall, Lincoln, NE 685883-0718
(402)472-3293 * dpittman1@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

NEBRASKA ON-FARM RESEARCH NETWORK

Special thanks to the cooperators involved with the
on-farm research projects listed in this report.

Marv Ackerman
Cole Anderson
Matt Bailey
Steve Benzel
Brian Birkel
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Ron Bopp
Chad Christianson
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Arnie Hinkson
Brandon Hunnicut
Paul Jarecke
James Kirch
Justin Krafka
Todd Kudlacek
Steve Kyes
Clint Lamprecht
Tom Lesiak
Ron and Ray Makovicka
John McNamara
Kyle McReynolds
Brent Melliger
Dusty Mihm
Larry Mueller
Nathan Mueller
Dave Nielsen and Chris Lovitt
Jeff Olsen
Steve Olson
Brandon Oswald
Frank Pleskac
Mike Panowicz
Tom Peterson
Ron Prochaska
Chris Pursley
Mickey Ryan
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Thank you also to the companies and businesses
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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 de¬veloped first and foremost to meet individual coop¬erator 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.

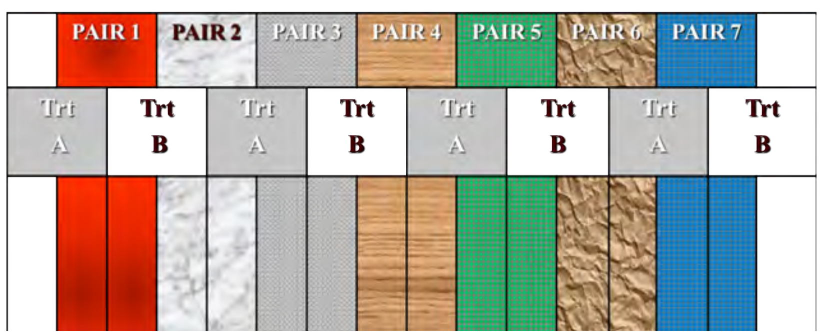
Randomization: Using random sampling as a method of selecting a sample from a population in which all the items in the population have an equal chance of being chosen in the sample. Randomization reduces the introduction of bias into the analysis. Two common designs that meet these criteria are shown 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 there were no treatments 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.

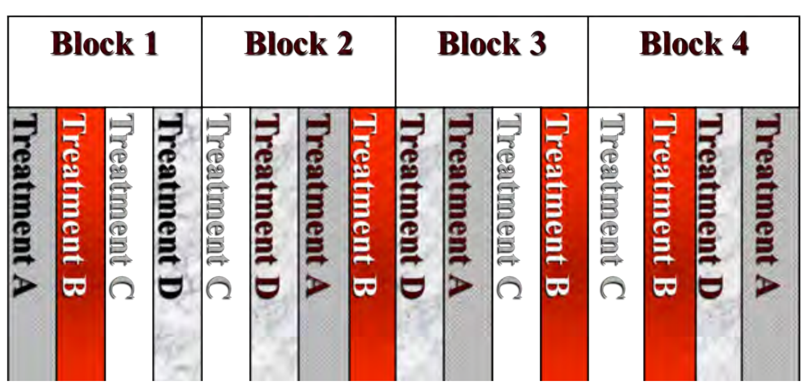
- As the P-Value decreases, the probability that differences are due to random chance decreases.
- As the P-Value increases, we are less able to distinguish if the difference is due to error or the treatment (hence we have less confidence in the results being due to the treatment).

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 Extensions 2016 Nebraska Farm Custom Rates – Part 1 and 2 (EC823 and EC826 - both revised May 2016), and an average commodity market price for 2016.

Average market commodity prices for the 2016 report are:

Corn	$3.05/bu
Soybeans	$9.25/bu
Dry Edible Beans	$30/cwt ($18/bu at 60 lb/bu)
Field Peas	$7/bu
Alfalfa Hay	$84.64/ton
Hay (non-alfalfa)	$76.09/ton

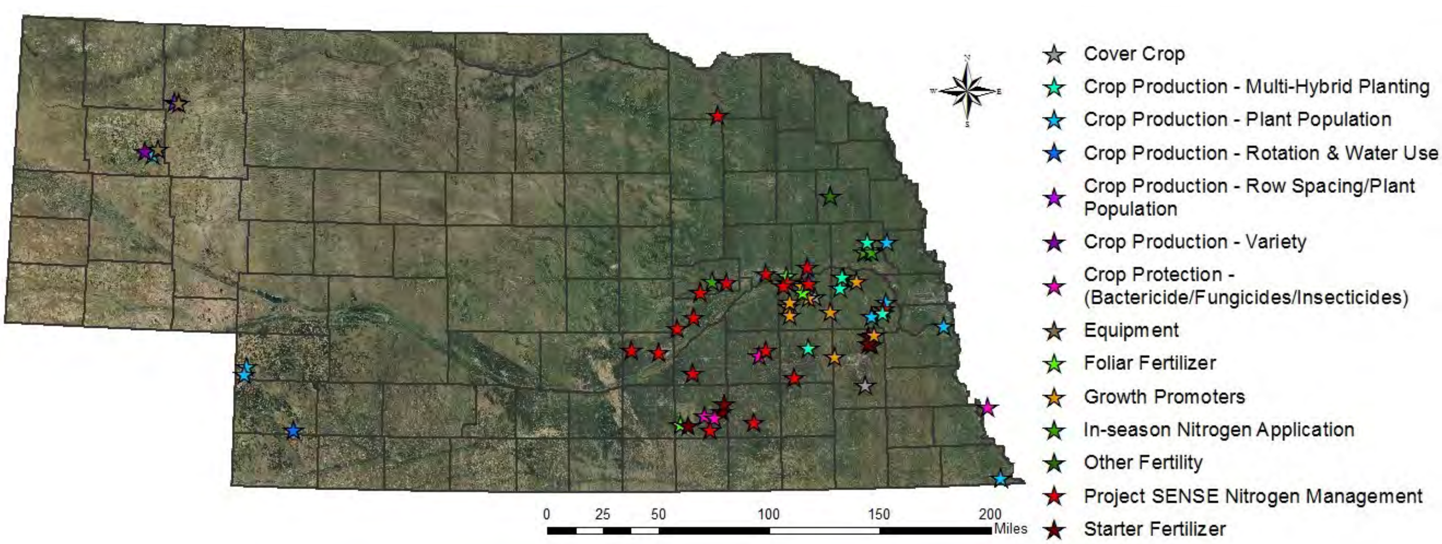
In order to make this information relevant to your operation, you may need to refigure return per acre with costs that you expect.

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.

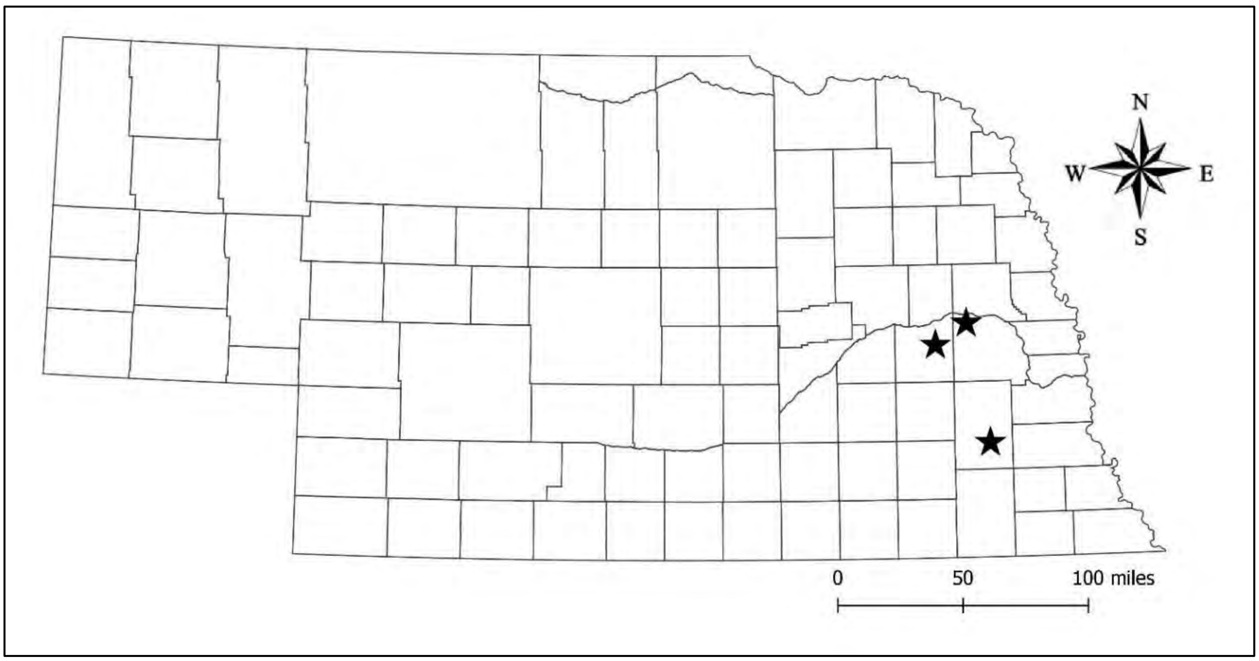
FarmLogs https://farmlogs.com

2016 Study Locations



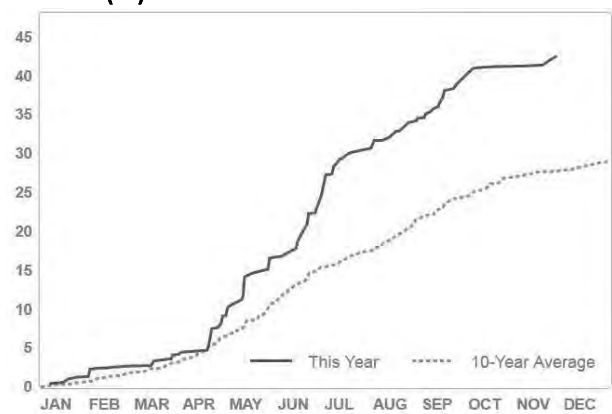
COVER CROPS

- Corn Planted into Rye Cover Crop
- Impact of Terminating Rye Pre-Emerge vs Post-Emerge on Corn Production
- Soybeans Planted into Rye and SmartMix Cover Crop



Corn Planted into Rye Cover Crop

Study ID: 007155201601
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; Nodaway silt loam occasionally flooded
Planting Date: 4/25/16
Harvest Date: 10/23/16
Population: 36,000
Row Spacing (in): 15
Hybrid: Channel 209-53STXRIB
Reps: 6
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** 5.4 oz/ac Corvus® ***Post:*** 32 oz/ac Buccaneer® Plus, 1.5 gal/100gal Liquid AMS, 8 oz/ac Diflexx®, and NIS 25%
Seed Treatment: Acceleron® 500V
Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: 110 lb N/ac Anhydrous Ammonia in Fall 2015; Variable rate application of 11-52-0 in Winter; 120 lb N/ac as 32% UAN with Agrotain®, 8 gal/ac of 6-24-6, and 1 pt/ac of zinc on 4/28/16
Irrigation: Pivot, Total: 1"
Rainfall (in):



Introduction: The rye cover crop was drilled on Oct. 15, 2015. To kill the rye, the strips were sprayed with 32 oz/ac Roundup and 1.5 gal/100gal of Liq AMS on April 16, 2016. Rye was approximately 16” in height. Corn was planted into rye and check strips on April 25, 2016.

Results:

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

†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.

To assess differences in soil loss and soil conditioning index (SCI) for the rye cover crop, the USDA-NRCS Revised Universal Soil Loss Equation 2 (RUSLE2) was used. The output is on the following page.

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 inch 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 inch 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 inch 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

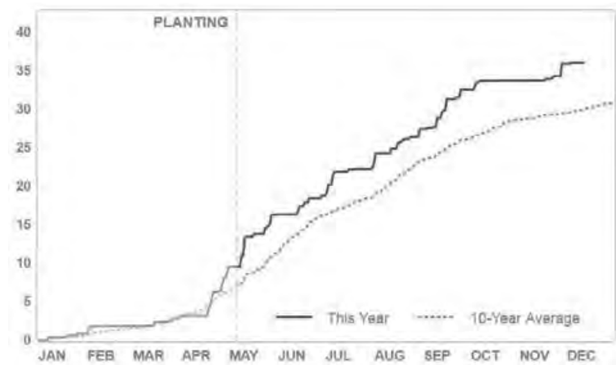
NRCS RUSLE2 Inputs:
Location: Saunders County
Soil: Yutan, eroded-Judson complex, 6 to 11 percent slopes\Yutan Silty clay loam eroded 64%
Slope length (along slope): 150 ft
Avg. slope steepness: 9.0 %
Yield values used: 215 bu/acre corn, 60 bu/acre soybean, and 3,360 lb/acre rye
Contouring: default
Strips/barriers: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

Summary: Grain yields did not differ between the no cover crop and cereal rye cover crop treatments. The RUSLE2, NRCS erosion calculation model indicates that no differences in soil loss occurred between the two treatments under these specific soil conditions. However, the soil conditioning index (SCI) was improved on the rye cover crop strips when compared to the no cover crop. Marginal net return was less for the cereal rye cover crop.

Impact of Terminating Rye Pre-Emerge vs Post-Emerge on Corn Production

Study ID: 102023201601
County: Butler
Soil Type: Pohocco silty clay loam 11-17% slopes, eroded; Hastings silty clay loam 3-7% slopes, eroded; Judson silt loam 2-6% slopes
Planting Date: 5/6/16
Harvest Date: 11/7/16
Population: 29,281
Row Spacing (in): 30
Hybrid: Pioneer 1197AM
Reps: 8
Previous Crop: Soybean
Tillage: No-Till
Seed Treatment: Poncho® 250 with Raxil®
Foliar Insecticides: None
Foliar Fungicides: None

Fertilizer: 150 lb N/ac as Anhydrous Ammonia on 3/12/16;
10.58 gal/ac 32% N, 4.18 gal/ac 10-34-0, and 0.25 gal/ac Zinc Chelate on 5/6/16; 100 lb/ac of 21-0-0-24S and 100 lb/ac AMS on 5/31/16;
2.25 T/ac chicken manure (121 lb P/ac, 1.5 lb Zn/ac, and 16 lb S/ac) 1/2/15
Irrigation: None
Rainfall (in):



Introduction: The goal of this study was to determine if it is more profitable to plant corn into standing rye or into rye straw. One bushel per acre of rye was planted on Oct. 22, 2015. The rye was terminated at two different times: before corn was planted (pre-emerge) on April 13, 2016, and after corn was planted (post-emerge) on May 15, 2016.

The pre-emerge terminated rye was 8-12" tall at the time of termination. Field conditions were 73° F and winds at 15-20 mph. Rye was sprayed with 55 oz/ac Abundit Extra, 1 oz/ac Sharpen, 8 oz/ac SuperB, with 16 oz/ac Class Act. This treatment was sprayed again on May 30, 2016 with 18 oz/ac Abundit, 56 oz/ac Halex GT, 2.4 oz/ac Preference, and 23 oz/ac Class Act for small pigweed, 8" rapeseed, and small grass.

The post-emerge terminated rye was 24-36" tall at the time of termination. Field conditions were 61°F (35°F the night before), sunny, and 5 mph winds from the SW. Rye was sprayed with 66 oz/ac Abundit Extra, 6 oz/ac SuperB, 3 oz/ac Class Act, and 32% as a water softener. This treatment was sprayed again on June 20, 2016 with 40 oz/ac Roundup PowerMax and 32 oz/ac Class Act.

Results:

Several field observations were made. In early June, the corn planted into standing rye (post-emerge termination treatment) was V6, while the corn planted into rye stubble (pre-emerge termination treatment) was V10.

Plant population counts were taken on Aug. 4, 2016. Corn planted into standing rye was at R2 with 26,875 plants/ac. In contrast, corn planted into stubble was at the R3 stage with 28,562 plants/ac. Green snap was observed in the corn which was planted into the pre-emerge termination rye (stubble) which resulted in a 14% loss of stand. During harvest, there were small weeds and green snap in the pre-emerge terminated rye treatment. In the post-emerge termination treatment, there was still rye straw and less erosion.

Grain yields and imagery from April 22, 2016 is shown in *Figure 1*.

Figure 1: Google Earth image from April 22, 2016 showing early terminated and not yet terminated rye with yield for each treatment overlaid.

	Yield (bu/acre)†	Marginal Net Return‡ ($/ac)
Terminating Rye Pre-Emerge	221 A*	636.49
Terminating Rye Post-Emerge	212 B	628.37
P-Value	0.0015	N/A

†Bushels per acre corrected to 15.5% moisture.

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

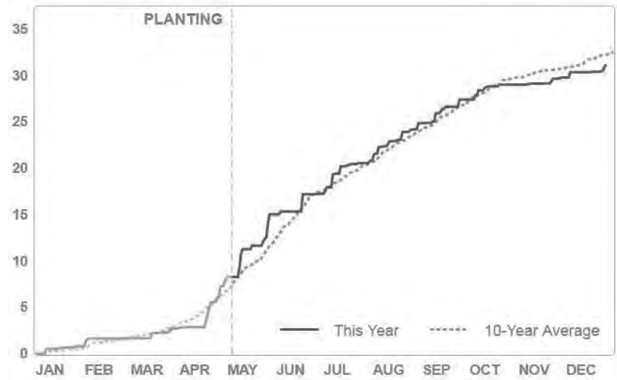
‡Marginal net return based on $3.05/bu corn and $37.56/ac herbicide cost for the pre-emerge treatment and $18.23/ac herbicide cost for the post-emerge treatment.

Summary: Terminating the rye cover crop pre-emerge resulted in higher yields. Even though the herbicide cost for terminating the rye prior to planting was higher, the increased yield made up for this and resulted in greater profit.

Soybeans Planted into Rye and SmartMix Cover Crop

Study ID: 417109201601
County: Lancaster
Soil Type: Wymore silty clay loam; Judson silt loam
Planting Date: 5/4/16
Harvest Date: 10/30/16
Population: 120,500
Row Spacing (in): 30
Hybrid: ND 39-62
Reps: 4
Previous Crop: Corn
Tillage: No-Till
Seed Treatment: Cruiser Maxx® Advanced and Vibrance®

Fertilizer: None
Irrigation: None
Rainfall (in):



Introduction: Cereal rye was seeded at 63 lb/acre. The SmartMix was winter pea at 10 lb/acre, hairy vetch at 5 lb/acre, common vetch at 4 lb/acre, lentils at 4 lb/acre, winter wheat at 30 lb/acre, rape at 1 lb/acre, and winfred hybrid turnip at 1 lb/acre.

Herbicide Application: The herbicide weed control program was the same for all treatments including the check:

Pre-emergence Application – May 2016		Post-emergence Application – June 29, 2016	
Roundup® PowerMax	48 oz/acre	Roundup PowerMax	40oz/acre
2,4-D	5.4 oz/acre	Cobra®	10.5 oz/acre
Tricor® 4F	7.5 oz/acre	AMS	2#
Authority® XL	4 oz/acre	Herbimax	16 oz
Herbimax	1 gal/100	Trust®	0.5 #
Choice WeatherMaster	26 oz/100		
Array	0.5#		

Results:

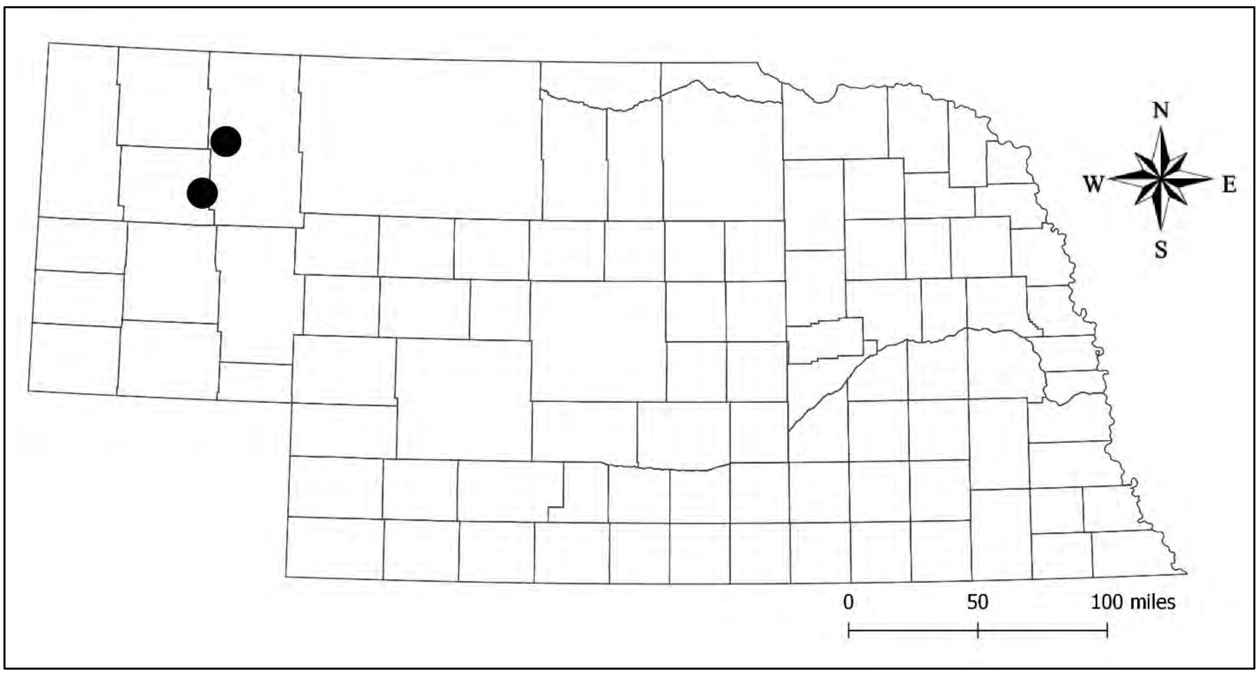
	Harvest Stand Count (plants/acre)	Moisture (%)	Yield (bu/acre)†	Marginal Net Return‡ ($/ac)
Check	95,356 A*	10.5 A	51 A	471.75
Cover Crop - Rye	95,356 A	10.5 A	51 A	446.15
Cover Crop - SmartMix	89,696 A	10.5 A	50 A	418.56
P-Value	0.0724	0.824	0.5801	N/A

†Bushels per acre corrected to 13% moisture.
*Values with the same letter are not significantly different at a 90% confidence level.
‡Marginal net return based on $9.25/bu soybean and $11/ac rye cover crop seed, $29.34 smart mix seed, and $14.60 drilling cost.

Summary: A late season hail event resulted in significant shattering of all three treatments, resulting in undocumented loss of yield. There was no significant difference in harvest stand counts and grain yield between the no cover crop treatment, cereal rye, and SmartMix. Net return was less for both the cereal rye and smart mix cover crop.

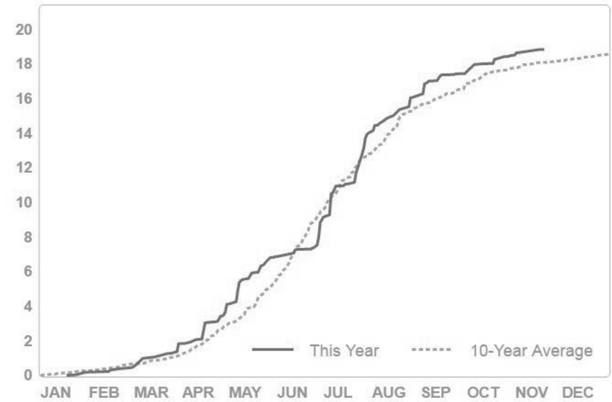
EQUIPMENT

- Dry Bean Direct Harvest Combine Speed Evaluation (2 sites)



Dry Bean Direct Harvest Combine Speed Evaluation

Study ID: 601161201602
County: Sheridan
Soil Type: Keith loam gravelly substratum; Johnstown loam 0-2% slope
Planting Date: 6/6/16
Harvest Date: 9/26/16
Population: 90,000
Row Spacing (in): 30
Hybrid: Sinaloa Pinto Bean
Reps: 4
Previous Crop: Corn
Tillage: Strip-till
Herbicides: ***Pre:*** 14 oz/ac Outlook® and 32 oz/ac Sonalan® ***Post:*** 21 oz/ac Varisto™
Seed Treatment: None
Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: 55 lb N/ac and 55 lb P/ac
Irrigation: Pivot, Total: 8-10 in
Rainfall (in):



Introduction:

Combining harvest is the final and one of the most critical aspects of raising dry beans. You can grow a good crop but combine operation is critical to successfully harvesting that crop. The purpose of this study is to examine combine speed and the affect it has on harvest loss and bean quality. In this case we looked at a Case International 2388 combine with a 24 foot Case International 1020 flex auger head. The plots were 300 feet long by the width of the combine and the speeds were 1.0, 2.5 and 4.0 mph. The beans were harvested on September 26th. The beans were planted in 30 inch rows with an estimated population of 90,000 plants/ac. No desiccant was applied to the crop. The temperature was 70°F and relative humidity was 31% at harvest time. The harvested bean moisture was 13.5%. The overall yield for the field was 44.7 bu/ac. Nine square foot samples were taken randomly in the harvested area in the left, center and right zones behind the combine and header to estimate harvest loss. The bean variety was Sinaloa and the pod height was measured at 92.6% being two inches or more above the soil surface. In the table, damage means any seed visibly split, cracked or broken *(Figure 1)*, and seed coat damage means visibly intact beans that show wrinkling during a 5 minute water soak test *(Figure 2)*. One hundred grams of seed was examined for damage and damage percent by weight was recorded. One hundred seeds were soaked in water for five minutes to determine seed coat damage and the percent by number of seeds was recorded.

Figure 1. Bean seed damage (splits and cracks).

Figure 2. Seed coat damage. Left-damaged (wrinkled), right-not damaged as determined by soak test.

Because combine speed impacts harvest loss and damaged seed, combine speed directly influences profit. Profit lost due to harvest loss was calculated by multiplying the harvest loss by the price beans would have been sold for ($18/bu). Total damaged beans for each treatment strip (bu/acre) were determined using the average yield for the field (44.7 bu/acre) adjusted for harvest loss (adding in bu/acre lost for each treatment strip to determine a relative total yield) and multiplied by the percent damaged beans. No payment is made for damaged beans, therefore the bu/acre of damaged beans for each treatment strip was multiplied by the price the beans would have been sold for. The profit loss due to harvest loss and due to damaged beans were summed to determine the total profit loss. Seed coat damage does not impact profit.

Results:

	Harvest Loss (bu/ac)	Damaged (%)	Seed Coat Damage (%)	Profit Loss ($/acre)
Combine Speed 1 mph	4.3 B*	5.2 A	22 A	122.98 B
Combine Speed 2.5 mph	5.5 B	2.2 B	14 B	118.20 B
Combine Speed 4 mph	10.8 A	0.9 B	12 C	202.09 A
P-Value	0.0011	0.0039	<0.0001	0.0183

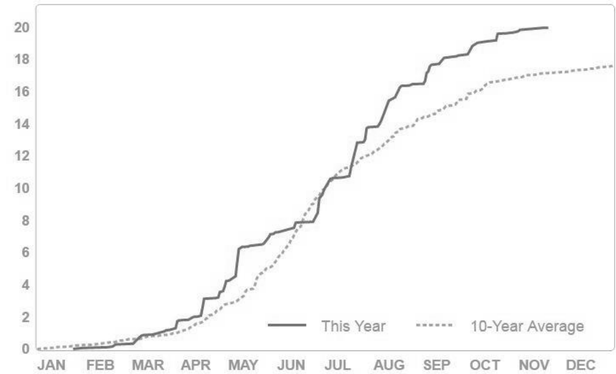
*Values with the same letter are not significantly different at a 90% confidence level.

Summary Observations:

1) The higher speed of 4 mph had significantly more harvest loss than the 1 mph and 2.5 mph harvest speeds. Higher combine speeds doubled the harvest loss and was not acceptable. At higher speeds the cutter bar could not effectively cut the beans, resulting in plants being laid over and pushed under the header bar.
2) Visibly broken seed *(Figure 1)*, was significantly higher at the slowest speed. The medium and high speed treatments were not significantly different from one another. This is probably due to a lower volume of plant material moving through the machine at the slower speeds, resulting in bean seeds having greater contact with the metal surfaces within the combine.
3) Wrinkling of seed coats from the five minute soak test *(Figure 2)* showed greatest damage under the slowest speed tested, reinforcing increased seed contact with metal surfaces inside the combine during the harvesting process.
4) The 4 mph combine speed resulted in a significantly greater profit loss when compared to the 1 mph and 2.5 mph combine speeds. The grower's standard operation is at 2.5 mph, therefore increasing the combine speed to 4 mph resulted in an additional profit loss of $83.89/acre. In the profit loss figures shown, increased harvest time for slower combine speeds is not accounted for, but is certainly an economic and practical consideration. Growers need to evaluate the expected profit loss associated with different combine speeds and determine the level of loss and length of harvest time that works with their operation.
5) This study evaluated harvest loss and seed damage at varying harvest speeds. Ideal harvest speeds may vary depending on the harvest equipment and the operator's comfort level. However, we would expect similar trends between harvest speed and loss or damage. This study demonstrates the need for operators to understand the importance of harvest speed and take observations on loss or damage in order to determine an optimal harvest speed.

Dry Bean Direct Harvest Combine Speed Evaluation

Study ID: 608013201601
County: Box Butte
Soil Type: Keith silt loam 0-1% slope; Busher-Jayem loamy very fine sand 0-3% slope; Duroc loam occasionally flooded; Satanta fine sandy loam 1-3% slope
Planting Date: 5/29/2016
Harvest Date: 9/12/16
Population: 124,000
Row Spacing (in): 7.5 drilled
Hybrid: Sinaloa Pinto Bean
Reps: 4
Previous Crop: Corn
Tillage: Vertical Till, Chisel and 2 Packings
Herbicides: ***Pre:*** None ***Post:*** Raptor®/Basagran®
Foliar Insecticides: None
Foliar Fungicides: 40 oz/ac Priaxor® and 1 lb/ac Kocide® on 7/28/16
Fertilizer: 40 lb N/ac, 40 lb/ac P, 10 lb/ac S, 1 lb/ac Zn on 6/4/16
Irrigation: Pivot, Total: 8-10
Rainfall (in):



Introduction:

Combining harvest is the final and one of the most critical aspects of raising dry beans. You can grow a good crop but combine operation is critical to successfully harvesting that crop. The purpose of this study is to examine combine speed and the affect it has on harvest loss and bean quality. In this case we looked at a John Deere 9760 combine with a JD635 flex auger head (35 ft.) using a Crary wind system. The plots were 300 feet long by the width of the combine and the speeds were 2, 3.5 and 4.5 mph. The beans were harvested on September 12th. The beans were drilled in 7.5 inch rows with an estimated population of 124,000 plants/ac. No desiccant was applied to the crop. The temperature was 64^{o}F and relative humidity was 46% at harvest time. The harvested bean moisture was 12.8%. The overall yield for the field was 55 bu/ac. Nine square foot samples were taken randomly in the harvested area in the left, center and right zones behind the combine and header to estimate harvest loss. The bean variety was Sinaloa and the pod height was measured at 94.5% being two inches or more above the soil surface. In the table, damage means any seed visibly split, cracked or broken (*Figure 1*), and seed coat damage means visibly intact beans that show wrinkling during a 5 minute water soak test (*Figure 2*). One hundred grams of seed was examined for damage and damage percent by weight was recorded. One hundred seeds were tested for seed coat damage and the percent by number of seeds was recorded.

Figure 1. Bean seed damage (splits and cracks).

Figure 2. Seed coat damage. Left damaged (wrinkled), right not damaged as determined by soak test.

Because combine speed impacts harvest loss and damaged seed, combine speed directly influences profit. Profit lost due to harvest loss was calculated by multiplying the harvest loss by the price beans would have been sold for ($18/bu). Total damaged beans for each treatment strip (bu/acre) were determined using the average yield for the field (55 bu/acre) adjusted for harvest loss (adding in bu/acre lost for each treatment strip to determine a relative total yield) and multiplied by the percent damaged beans. No payment is made for damaged beans, therefore the bu/acre of damaged beans for each treatment strip was multiplied by the price the beans would have been sold for. The profit losses due to harvest loss and due to damaged beans were summed to determine the total profit loss. Seed coat damage does not impact profit.

Results:

	Harvest Loss (bu/ac)	**Damaged (%)**	**Seed Coat Damage (%)**	**Profit Loss ($/acre)**
Combine Speed 2 mph	1.9 B*	1.4 A	19 A	47.96 B
Combine Speed 3.5 mph	2.8 AB	1.6 A	18 A	67.24 AB
Combine Speed 4.5 mph	3.3 A	1.7 A	16 A	77.23 A
P-Value	0.078	0.632	0.775	0.066

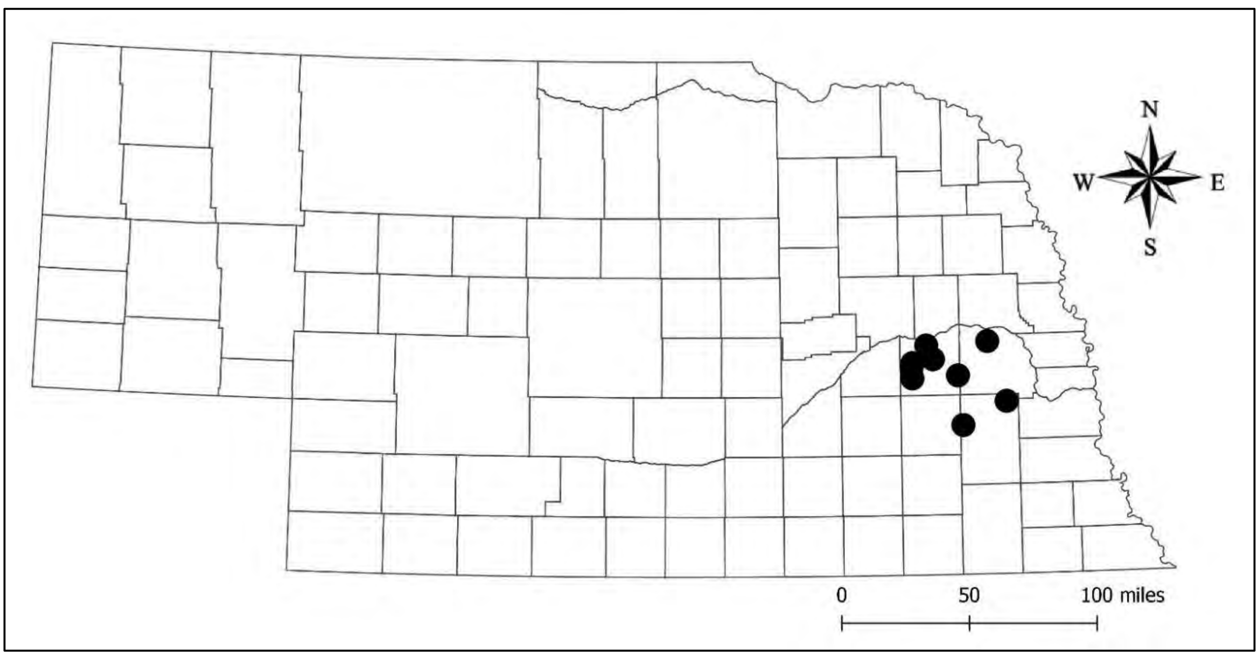
*Values with the same letter are not significantly different at a 90% confidence level.

Summary and Observations:

1) The higher combining speed of 4.5 mph had significantly higher harvest loss but not a lot higher. Overall harvest loss was in an acceptable range.
2) In this study there was not a significant difference in damage (splits and cracks), or in seed coat damage at the different speeds.
3) Combining at 4.5 mph resulted in greater profit loss than combining at 2 mph. There is a trend toward increasing profit loss as speed increases. The grower's standard combine speed is 3 to 3.5 mph; the impact of changing combine speeds can be evaluated by looking at the change in profit loss for an increase or decrease in harvest speed. In the profit loss figures shown, increased harvest time for slower combine speeds is not accounted for, but is certainly an economic and practical consideration. Growers need to evaluate the expected profit loss associated with different combine speeds and determine the level of loss and length of harvest time that works with their operation.
4) This study evaluated harvest loss and seed damage at varying harvest speeds. Ideal harvest speeds may vary depending on the harvest equipment and the operator's comfort level. However, we would expect similar trends between harvest speed and loss or damage. This study demonstrates the need for operators to understand the importance of harvest speed and take observations on loss or damage in order to determine an optimal harvest speed.

GROWTH PROMOTERS

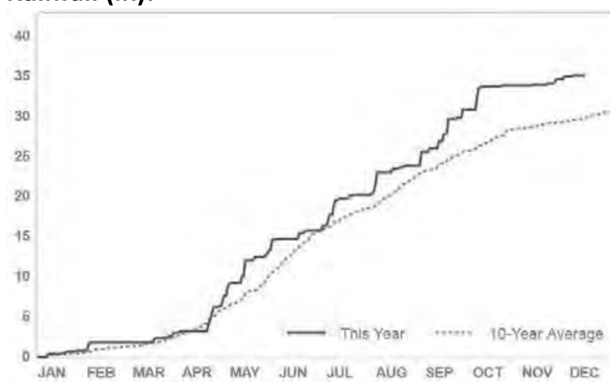
- Starter Fertilizer and 3 Rates of Vitazyme® at Planting on Soybeans
- Three Rates of Vitazyme® at First Flower on Soybeans
- Residual Effects of Generate® and Vitazyme® on Soybeans
- RyzUp SmartGrass®, Green Sol 48, and Surfactants on Smooth Brome*
- RyzUp SmartGrass® and Surfactants on Big Bluestem*
- RyzUp SmartGrass® on Winter Wheat
- RyzUp SmartGrass® on Soybeans at Unifoliate and V2
- RyzUp SmartGrass® on Soybeans at V1
- RyzUp SmartGrass® at V1 or V2 on Soybeans



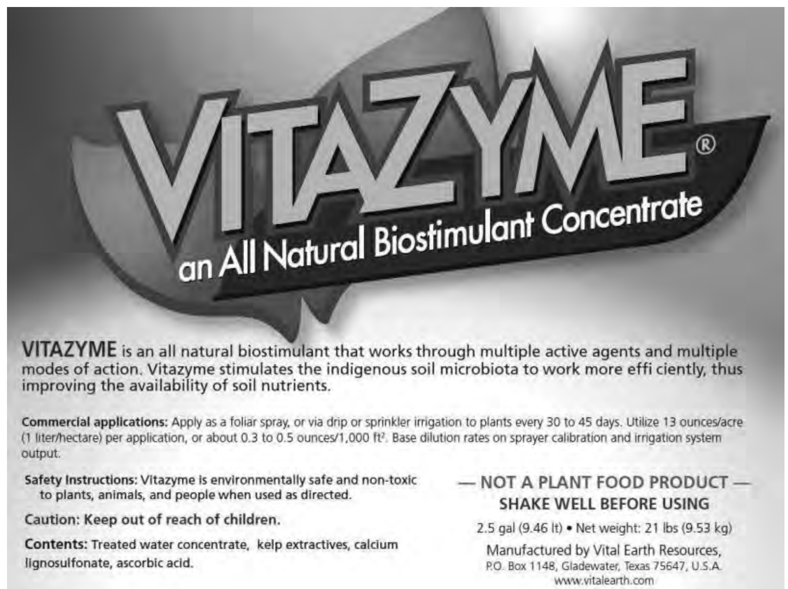
Starter Fertilizer and Three Rates of Vitazyme® at Planting on Soybeans

Study ID: 114023201601
County: Butler
Soil Type: Hastings silt loam 0-1% slope
Planting Date: 6/2/16
Harvest Date: 10/24/16
Population: 156,000
Row Spacing (in): 36
Hybrid: Pioneer P28T08R-S426
Reps: 4
Previous Crop: Corn
Tillage: No-Till
Herbicides: ***Post:*** 0.6 oz/ac Cadet® and 33.6 oz/ac Roundup® on 6/29/16

Irrigation: Pivot, Total: 4.88 in
Rainfall (in):



Introduction: Differing rates of biostimulants can potentially result in different levels of plant responses. This study was conducted to compare and document soybean response to three rates of Vitazyme® in combination with starter fertilizer. Product information for Vitazyme is at right. Starter fertilizer was Begin, a 7-23-4-0.25 Zn product applied at 6.65 gpa. The solution was 60% Begin and 40% water. Actual nutrient supplied were 3.1 lb/acre of actual N, 10.2 lb/acre of actual P, 1.8 lb/acre of actual K, and 0.1 lb/acre of actual Zn.



Product information from:
http://www.greenearthagandturf.com/vitazyme-label.pdf

Results:

	Stand Count			Chlorophyll Meter
	June 9	June 12	June 22	June 22
Check	94,970 A*	116,886 A	128,381 AB	37.2 B
Starter	77,728 B	107,494 B	119,125 C	40.0 A
Starter + 7 oz/ac Vitazyme	84,716 AB	112,167 AB	120,032 BC	39.7 A
Starter + 13 oz/ac Vitazyme	84,443 AB	114,209 AB	131,043 A	40.2 A
Starter + 26 oz/ac Vitazyme	76,457 B	116,070 AB	124,812 ABC	39.4 A
P-Value	0.0649	0.0981	0.0136	0.0003

	Yield (bu/acre)†	Protein (%)	Oil (%)	Seeds per lb	Marginal Net Return‡
Check	67 A	37.5 A	19.8 A	2,222 A	$619.75
Starter	66 A	38.0 A	19.4 AB	2,228 A	$597.53
Starter + 7 oz/ac Vitazyme	67 A	37.9 A	19.2 B	2,209 A	$602.73
Starter + 13 oz/ac Vitazyme	67 A	37.7 A	19.5 AB	2,214 A	$599.26
Starter + 26 oz/ac Vitazyme	67 A	37.6 A	19.7 AB	2,210 A	$591.75
P-Value	0.7672	0.709	0.0661	0.9694	N/A

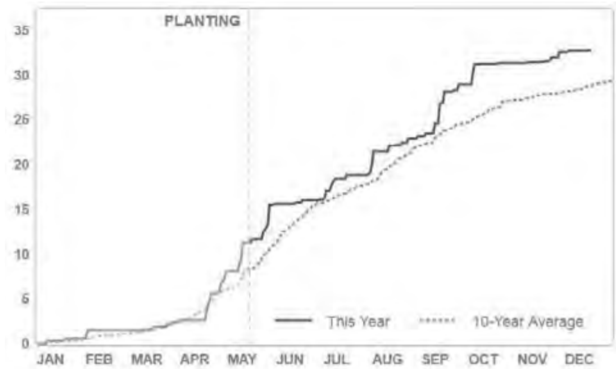
*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $9.25/bu soybean, $12.97/ac starter fertilizer cost, and $0.58/oz Vitazyme.

Summary: There were some differences in plant height; however, none of the treatments tested had greater yield, percent oil, percent protein, or seeds per acre than the untreated check. The chlorophyll meter readings in June 22 were significantly lower for the check when compared to all other treatments including the starter alone and starter with Vitazyme.

Three Rates of Vitazyme® at First Flower on Soybeans

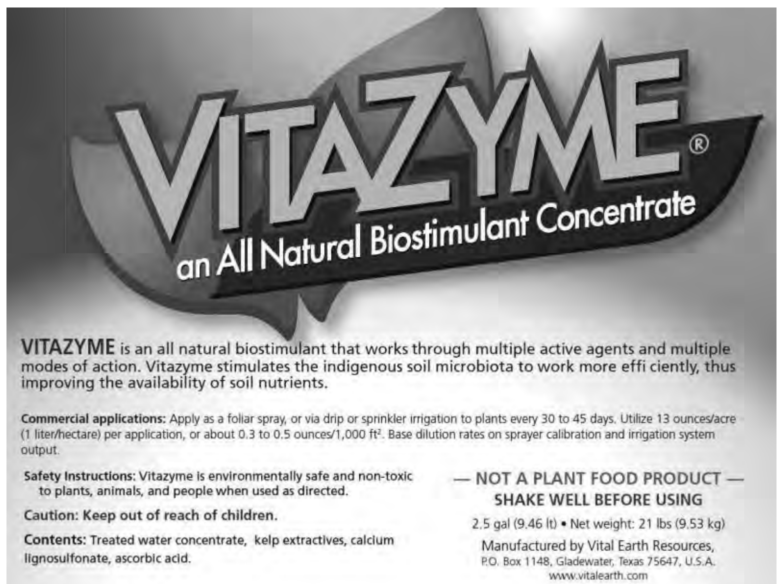
Study ID: 611023201601
County: Butler
Soil Type: Butler silt loam; Hastings silt loam; Hastings silty clay loam; Fillmore silt loam
Planting Date: 5/15/16
Harvest Date: 10/3/16
Population: 180,000
Row Spacing (in): 15
Hybrid: Channel 3303R2
Reps: 4
Previous Crop: Corn
Tillage: No-Till
Herbicides: ***Pre:*** 4 oz/ac Fierce® XLT, 16 oz/ac 2,4-D, 17 lb/100 gal AMS, and Glyphosate on 4/11/16
Post: FirstRate®, Glyphosate, and 17 lb/100 gal AMS on 6/23/16

Irrigation: None
Rainfall (in):



Introduction:

Differing rates of biostimulants can potentially result in different levels of plant response. This study was conducted to compare and document soybean response to three rates of Vitazyme®. Product information for Vitazyme is at right. Vitazyme was applied on June 30 at 20 gpa. No surfactants were used.



Product information from:
http://www.greenearthagandturf.com/vitazyme-label.pdf

Results:

	Stem Height (in)	Trifoliate Nodes	Yield (bu/acre)†	Seeds per lb	Protein (%)	Oil (%)	Marginal Net Return‡ ($/ac)
Check	11.2 A*	7 A	68 A	2,626 A	38.5 A	17.7 A	$629.00
Vitazyme at 7 oz/ac	11.5 A	7 A	69 A	2,601 A	38.9 A	17.9 A	$627.38
Vitazyme at 13 oz/ac	11.3 A	7 A	69 A	2,621 A	39.0 A	17.7 A	$623.91
Vitazyme at 26 oz/ac	12.1 A	7 A	68 A	2,543 A	38.7 A	18.2 A	$607.15
P-Value	0.244	0.111	0.959	0.540	0.621	0.745	N/A

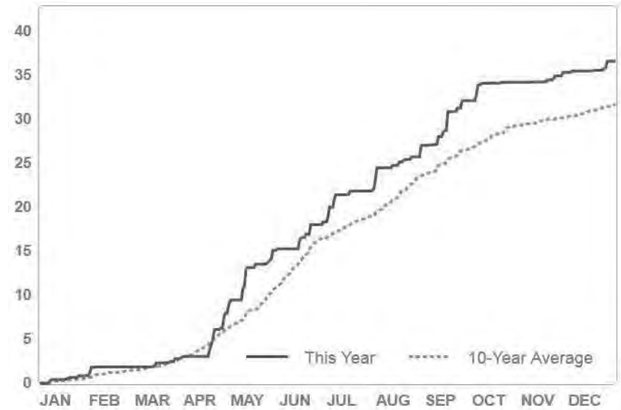
*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $9.25/bu soybean and $0.58/oz Vitazyme and $6.82/ac application cost.

Summary: There were no differences in plant height, number of trifoliate nodes, yield, seed density, % protein, or % oil between the treatments tested. The untreated check resulted in the greatest profit due to lower input costs.

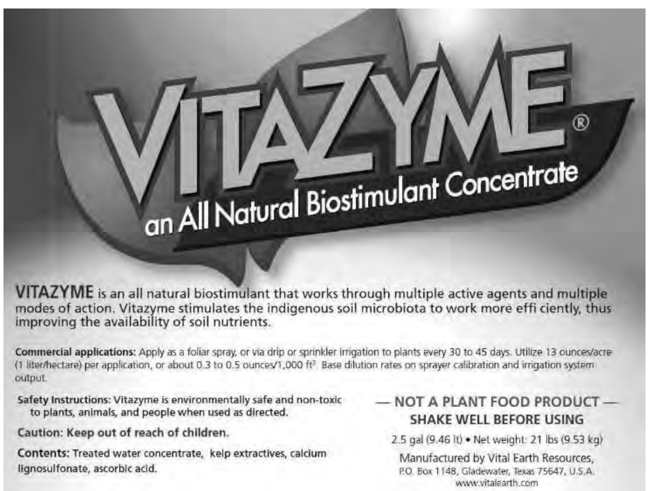
Residual Effects of Generate® and Vitazyme® on Soybeans

Study ID: 314023201601
County: Butler
Soil Type: Grigston silt loam; Zook silty clay loam; Muir silt loam
Tillage: Ridge-till
Row Spacing (in): 30
Reps: 4
Previous Crop: Rye (fall/winter)
Fertilizer: 9 gal/ac of solution which consisted of 50 gal 32-0-0, 2.5 gal SuperPhos™, 2.5 gal Z-Max, 2.5 gal Start-L, 2.5 gal BREAKOUT®, 2.5 gal Soil-Max®, and 120 gal water.

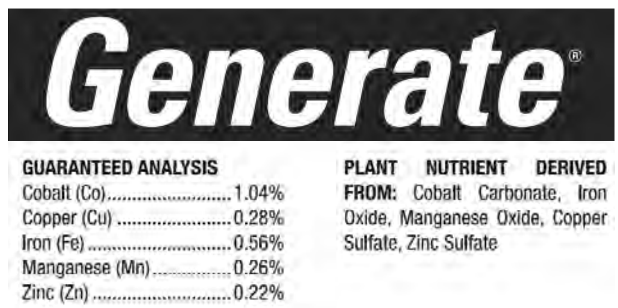
Irrigation: Pivot
Rainfall (in):



Introduction: 16 oz/acre Generate® and 13 oz/acre Vitazyme® were each applied in the seed furrow when popcorn was planted. The popcorn crop was lost to disease in early June and soybeans were planted directly into the same row where the corn was planted. The objective of this study was to evaluate the residual effect from an application of Generate and Vitazyme prior to soybean planting. Product information is below.



Product information from:
http://www.greenearthagandturf.com/vitazyme-label.pdf



Product information from:
http://www.kellysolutions.com/erenewals/documentsubmit/KellyData/ND%5CFertilizer%5CProduct%20Label%5CGenerate_for_Crops_____new__1_2_2015_3_32_14_PM.pdf

Results:

	Height (in) July 20	Pods/plant Aug. 11	Yield (bu/acre)†	Seeds per lb	Protein (%)	Oil (%)	Marginal Net Return‡ ($/ac)
Check	15.0 A*	31 A	68 A	2,524 A	38.4 B	19.4 A	$629.00
Generate	15.5 A	31 A	66 A	2,478 A	38.8 AB	19.4 A	$600.75
Vitazyme	15.3 A	25 B	67 A	2,494 A	39.0 A	19.4 A	$612.23
P-Value	0.490	0.035	0.329	0.318	0.075	0.815	N/A

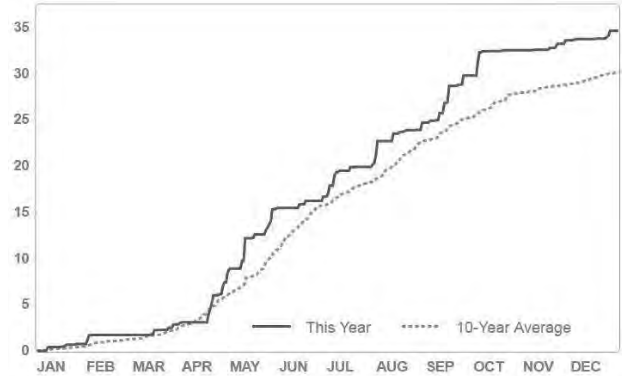
*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $9.25/bu soybean, $9.75/ac Generate, and $7.52/ac Vitazyme.

Summary: The residual effects of Generate and Vitazyme did not increase yield, seeds per pound, or oil. The residual Vitazyme treatment resulted in higher protein than the untreated check. The check treatment had the highest marginal net return.

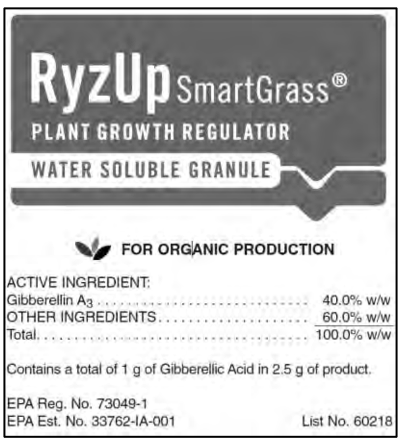
RyzUp SmartGrass®, Green Sol 48, and Surfactants on Smooth Brome

Study ID: 160023201601
County: Butler
Soil Type: Hastings silt loam
Harvest Date: 5/23/16
Reps: 4
Herbicides: 1.33 pt/ac 2,4-D LoVol 6 on 5/1/16
Seed Treatment: None
Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: 75 lb/ac broadcast of 42-0-0 (with inhibitor) on 4/16/16

Irrigation: None
Rainfall (in):



Introduction: The objective of this study was to evaluate the effect of RyzUp SmartGrass® and Green Sol 48 in combination with a surfactant, ClassAct® NG® or fertilizer uptake enhancer, AnnGro®. Plant growth and forage production were measured. RyzUp SmartGrass was applied at a rate of 0.3 oz/acre and Green Sol 48 was applied at a rate of 8 oz/acre. Treatment combinations are listed in the results tables on the next page. Products were applied on April 25, 2016 with a backpack sprayer at 28 gpa. Active ingredients for RyzUp SmartGrass and Green Sol 48 are below. This is a small plot study conducted on-farm.



Product information from: *http://www.valent.com/agriculture/products/ryzupsmartgrass/label-msds.cfm*

GREEN SOL 48
ACTIVE INGREDIENTS:
Gibberellic Acid
Kinetin [N-(2-Furanyl methyl)-1-H-Purin-6-amine]

GUARANTEED ANALYSIS (Fertilizer)
8-20-20
Total Nitrogen (N) 8.0%
    8.0% Ammoniacal Nitrogen
    0.0% Nitrate Nitrogen
Available Phosphate (P2O5) 20.0%
Soluble Potash (K2O) 20.0%
Sources: Monoammonium Phosphate, Potassium Sulfate
Trace Elements:
Boron (B) 0.02%
Copper (Cu) 0.05%
    0.05% Chelated Cu
Iron (Fe) 0.10%
    0.10% Chelated Fe
Manganese (Mn) Total 0.05%
    0.05% Water Soluble Mn
Molybdenum (Mo) 0.0005%
Zinc (Zn) 0.05%
    0.05% Chelated Zn
Sources: Sodium Borate, Copper Chelate, Iron Chelate, Manganese Chelate, Sodium Molybdate, Zinc Chelate. Chelating Agent: Ethylene Diamine Tetra Acetate (EDTA)

Product information from: *www.greensol.com/labels/GS48_Label.doc*

Results:

	Natural Height (in)		Extended Heights (in)		
	May 2	**May 23**	**May 2**	**May 9**	**May 23**
Check	6.3 B	11.5 A	8.4 C*	12.5 C	15.6 A
RyzUp SmartGrass (0.3 oz) + ClassAct NG 2.5%	7.7 A	13.4 A	10.5 A	17.8 A	18.4 A
RyzUp SmartGrass (0.3 oz) + AnnGro	7.4 A	13.3 A	9.4 B	15.0 B	18.1 A
GreenSol 48 (8 oz/ac) + ClassAct NG 2.5%	6.0 B	11.6 A	8.5 C	12.6 C	15.7 A
P-Value	0.0001	0.189	0.001	<0.0001	0.097

	Yield (lb hay/ac)†	Marginal Net Return‡ ($/ac)
Check	3,331 B	126.71
RyzUp SmartGrass (0.3 oz) + ClassAct NG 2.5%	4,543 A	155.28
RyzUp SmartGrass (0.3 oz) + AnnGro	4,196 AB	149.35
GreenSol 48 (8 oz/ac) + ClassAct NG 2.5%	3,576 AB	113.28
P-Value	0.0444	N/A

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

†Yield standardized to 10% moisture.

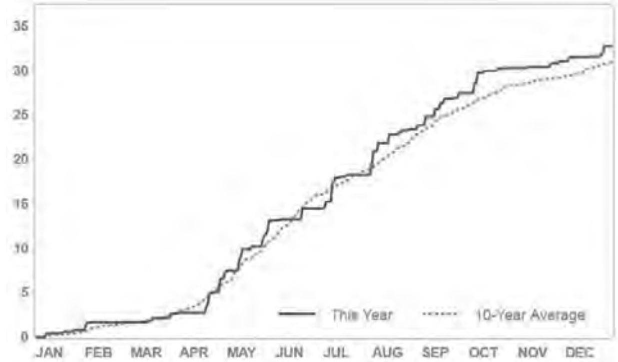
‡Marginal net return based on $76.09/ton hay, $11.50/oz RyzUp SmartGrass, $7.29/ac for ClassAct NG 2.5%, $1.08/oz Green Sol 48, and $6.82 application cost. Product cost for AnnGro is not available and therefore is not included in these calculations.

Summary: When plant height was recorded on May 2 and 9, 2016, the two treatments with RyzUp SmartGrass had taller natural leaf height (both dates) and extended leaf height (measured on May 2, 2016 only). When brome grass was cut on May 23, 2016 there was no difference in leaf height between any of the treatments. The RyzUp SmartGrass with ClassAct 2.5% NG had the greatest hay production and resulted in the highest marginal net return at standardized hay prices used. The other treatments tested did not have production that was significantly different than the check.

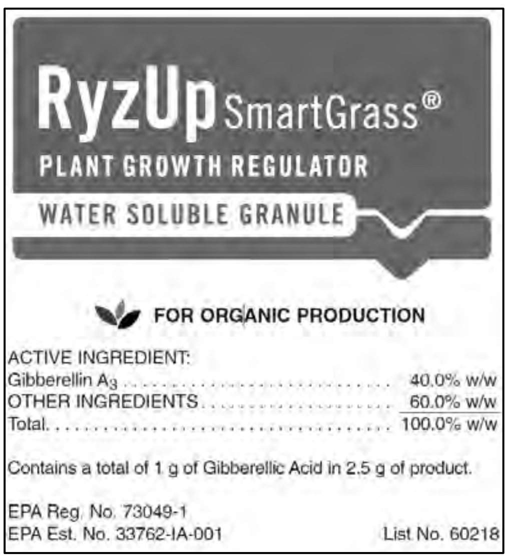
RyzUp SmartGrass® and Surfactants on Big Bluestem

Study ID: 222109201601
County: Lancaster
Soil Type: Aksarben silty clay loam
Harvest Date: 7/13/16
Reps: 4
Herbicides: 1.33 pt/ac LoVol 6 2,4-D on 5/15/16
Seed Treatment: None
Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: Granular nitrogen

Irrigation: None
Rainfall (in):



Introduction: The objective of this study was to evaluate the effect of RyzUp SmartGrass® applied in combinations with various surfactants on plant growth and forage production. RyzUp SmartGrass was applied at a rate of 0.3 oz/acre and 0.9 oz/acre in combination with various surfactants and uptake enhancers, including ClassAct® NG® 2.5%, BioLink® Spreader-Sticker, and AnnGro®. Treatment combinations are listed in the results table below. All treatments were applied on the afternoon of May 10, 2016. The big bluestem was approximately 12 inches tall and 28 gpa solution was used for applications. RyzUp SmartGrass active ingredients are shown below. This is a small plot study conducted on-farm.



Product information from:
http://www.valent.com/agriculture/products/ryzupsmartgrass/label-msds.cfm

Results:

	Natural Height (in)							
	5/18	5/25	6/1	6/8	6/15	6/22	6/29	7/6
Check	9.8 A*	13.2 A	17.2 A	19.9 A	22.1 A	24.2 A	26.9 A	28.4 A
BioLink Spreader-Sticker (3.36 oz)	9.8 A	12.9 A	17.1 A	19.5 A	22.1 A	22.9 A	27.0 A	27.3 A
RyzUp SmartGrass (0.3 oz) + BioLink Spreader-Sticker	9.7 A	13.3 A	17.2 A	19.2 A	21.5 A	23.3 A	25.9 A	28.1 A
RyzUp SmartGrass (0.3 oz) + ClassAct NG 2.5%	10.1 A	13.8 A	17.7 A	19.1 A	21.7 A	24.0 A	26.7 A	28.0 A
RyzUp SmartGrass (0.9 oz) + ClassAct NG 2.5%	10.4 A	14.1 A	18.2 A	20.0 A	21.7 A	23.4 A	26.4 A	27.3 A
RyzUp SmartGrass (0.3 oz) + ClassAct 2.5% + BioLink Spreader-Sticker	10.2 A	14.0 A	18.3 A	19.4 A	22.5 A	24.1 A	26.4 A	27.4 A
RyzUp SmartGrass (0.3 oz) + AnnGro	9.7 A	13.2 A	17.9 A	19.4 A	21.9 A	23.5 A	27.0 A	27.5 A
RyzUp SmartGrass (0.3 oz) + AnnGro + ClassAct 2.5%	9.7 A	13.2 A	17.3 A	19.3 A	21.4 A	23.2 A	26.4 A	27.0 A
P-Value	0.5165	0.2822	0.0522	0.5545	0.7252	0.4588	0.8668	0.9067
	Extended Height (in)							
	5/18	5/25	6/1	6/8	6/15	6/22	6/29	7/6
Check	13.5 A	17.6 A	22.3 A	25.3 A	28.2 A	31.3 A	34.6 A	36.9 A
BioLink Spreader-Sticker (3.36 oz)	13.3 A	17.4 A	22.7 A	25.2 A	28.4 A	30.0 A	34.1 A	34.8 A
RyzUp SmartGrass (0.3 oz) + BioLink Spreader-Sticker	13.5 A	17.3 A	22.4 A	24.5 A	27.9 A	31.0 A	32.9 A	36.7 A
RyzUp SmartGrass (0.3 oz) + ClassAct NG 2.5%	13.1 A	17.9 A	23.0 A	25.7 A	29.2 A	30.9 A	34.5 A	36.7 A
RyzUp SmartGrass (0.9 oz) + ClassAct NG 2.5%	13.9 A	18.8 A	23.6 A	25.1 A	28.7 A	31.2 A	34.5 A	35.3 A
RyzUp SmartGrass (0.3 oz) + ClassAct 2.5% + BioLink Spreader-Sticker	13.6 A	18.4 A	23.6 A	25.6 A	29.2 A	31.1 A	34.6 A	36.5 A
RyzUp SmartGrass (0.3 oz) + AnnGro	13.0 A	17.5 A	23.2 A	25.4 A	28.6 A	30.6 A	35.0 A	36.4 A
RyzUp SmartGrass (0.3 oz) + AnnGro + ClassAct 2.5%	13.1 A	17.5 A	22.5 A	25.1 A	28.4 A	30.3 A	33.5 A	35.6 A
P-Value	0.3056	0.1299	0.2149	0.8366	0.8138	0.8118	0.4749	0.6327

	Yield (lb hay/ac)†	Marginal Net Return‡ ($/ac)
Check	4,968 A	189.01
BioLink Spreader-Sticker (3.36 oz)	4,972 A	181.34
RyzUp SmartGrass (0.3 oz) + BioLink Spreader-Sticker	4,677 A	166.67
RyzUp SmartGrass (0.3 oz) + ClassAct NG 2.5%	4,850 A	166.96
RyzUp SmartGrass (0.9 oz) + ClassAct NG 2.5%	4,427 A	143.97
RyzUp SmartGrass (0.3 oz) + ClassAct 2.5% + BioLink Spreader-Sticker	4,588 A	155.99
RyzUp SmartGrass (0.3 oz) + AnnGro	4,622 A	165.13
RyzUp SmartGrass (0.3 oz) + AnnGro + ClassAct 2.5%	4,622 A	158.28
P-Value	0.5382	N/A

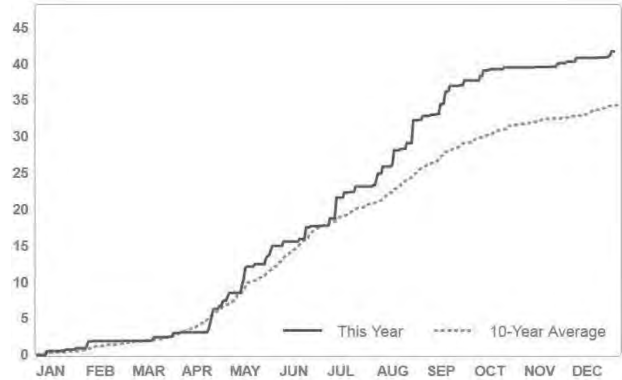
†Yield standardized to 10% moisture.
*Values with the same letter are not significantly different at a 90% confidence level.
‡Marginal net return based on $76.09/ton hay, $6.82/ac application cost,$1/ac BioLink Spreader-Sticker, $11.50/oz RyzUp SmartGrass, and $7.29/ac ClassAct 2.5%. AnnGro costs not available as the product is not on the market, so this cost is not included in these treatments.

Summary: Plant height was recorded at eight different times during the growing season; there were no differences in plant height among the treatments tested. Yield was determined on July 13, 2016. None of the treatment combinations resulted in a yield increase above the untreated check.

RyzUp SmartGrass® on Winter Wheat

Study ID: 368109201601
County: Lancaster
Soil Type: Aksarben silty clay loam
Harvest Date: 6/28/16
Hybrid: SY Wolf
Reps: 5
Tillage: Disked prior to drilling
Fertilizer: 80 lb/ac actual N applied as 46-0-0 on 3/23/16

Irrigation: None
Rainfall (in):



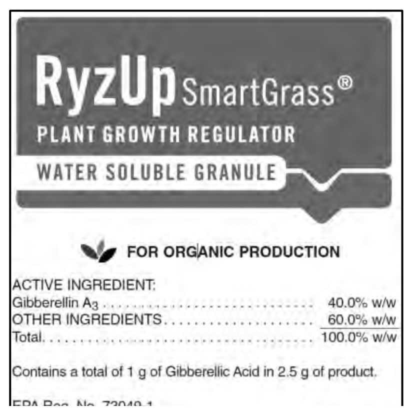
Soil Test:

Soil pH = 6.3	Organic matter = 3.8%	Lbs. nitrate/acre (0-8") = 69

Parts per million (ppm)

P	K	Ca	Mg	Na	Sulfate	Zn	Fe	Mn	Cu
123	471	2404	348	13	19	1.47	58.6	12.1	1.00

Introduction: RyzUp SmartGrass® 40WDG (active ingredient = gibberellic acid 3, Valent USA) was recently registered for many grass-type crops, including wheat (product information at right). RyzUp SmartGrass has been reported to enhance the yield potential of wheat as well as increase vigor and plant health in weak stands. In addition, it can potentially overcome slow growth from cold conditions, winter injury, or post emergent herbicide when applied during tillering but before stem elongation. Gibberellic acid, the active ingredient in the product, is a plant hormone that causes cells and subsequently leaves and stems to elongate, thus resulting in increased forage availability for many cool season grasses.



Product information from: *http://www.valent.com/agriculture/products/ryzupsmartgrass/label-msds.cfm*

While increasing early season forage production is important for wheat producers that also graze wheat prior to seed head formation, many producers grow wheat only for seed production. The effect(s) of RyzUp SmartGrass on Nebraska wheat production has not been robustly evaluated and documented.

This experiment was initiated to determine winter wheat growth and yield responses to an application of RyzUp SmartGrass, and to evaluate the economics of this product in eastern Nebraska when combined with a highly effective surfactant.

Treatments were applied in 15 gallons/acre of solution with an Apache AS720 sprayer equipped with AIXR nozzles 15 in spacings. Plots were 60 feet wide, and approximately 1,662 feet long. The treatment was replicated four times in this experiment, alternating with untreated strips on which the sprayer did not traverse.

Plots were sampled on March 22 and 29 for natural heights and plant widths. Ten samples were obtained from each plot. Height samples were obtained by placing a ruler in the wheat row, and noting the last height that was no longer obscured by wheat foliage. Sampling on March 22 for plant width went to the leaf tips, while March 29 width sampling recorded the distance across foliage through which the ruler was no longer visible (narrower than leaf tips).

Plots were harvested on June 28 with a John Deere 9670 STS combine with 625F HydroFlex 25 ft head. Two 25 ft. swaths per treatment strip were harvested, and transferred to a Kinze 640 weigh wagon equipped with a DigiStar E2150 electronic scale which measured in 20 lb increments from which weights were recorded.

Small sub-samples (approximately 1 pint) of combine harvest wheat from each plot were delivered to the University of Nebraska-Lincoln Department of Agronomy and Horticulture for protein, moisture and seed counts/pound determinations.

Results:

	March 22, 2016		**March 29, 2016**	
	Height (in)	Width (in)	Height (in)	Width (in)
Check	6.9	5.3	8.1	4.2
RyzUp SmartGrass 0.5 oz/ac + ClassAct® NG® 1.9%	8.2	5.6	9.0	4.6
P-Value	N/A	N/A	N/A	N/A

	Moisture (%)	**Protein (%)**	**Seeds per lb**	**Seeds/ac**	**Yield (bu/ac)†**	**Marginal Net Return‡ ($/ac)**
Check	12.8	12.8	13,459	66,974,125	83	$240.70
RyzUp SmartGrass 0.5 oz/ac + ClassAct NG 1.9%	12.7	13.8	14,444	74,661,965	86	$233.43
P-Value	N/A	N/A	N/A	N/A	N/A	N/A

†Bushels per acre are corrected to 14% moisture.

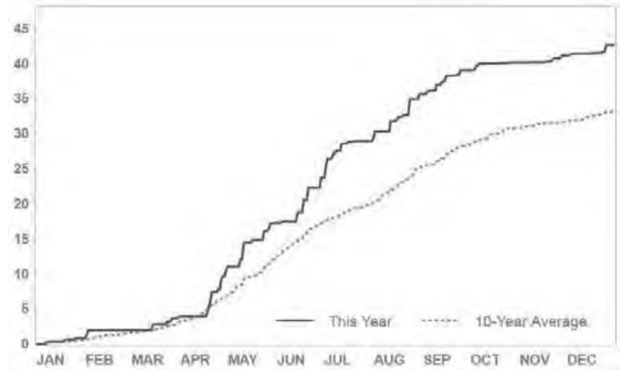
‡Marginal net return based on $2.90/bu wheat, $8.72 product cost, and $7.25 application cost.

Summary: Plots were replicated but not randomized, therefore a statistical analysis was not performed and conclusions could not be drawn. Treatment means are provided in the results table.

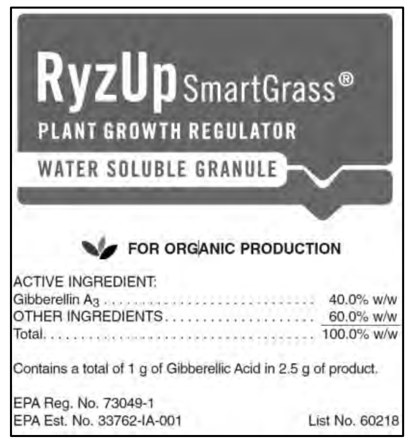
RyzUp SmartGrass® on Soybeans at Unifoliate and V2

Study ID: 039155201601
County: Saunders
Soil Type: Tomek silt loam 0-2% slope; Filbert silt loam 0-1% slope; Yutan silty clay loam 2-6% slopes, eroded
Planting Date: 5/7/16
Harvest Date: 9/30/16
Population: 119,310
Row Spacing (in): 15
Hybrid: S31-F1
Reps: 5
Previous Crop: Seed Corn
Tillage: No-Till
Seed Treatment: Mertect® and Clariva™

Irrigation: None
Rainfall (in):



Introduction: RyzUp SmartGrass® was applied two times, at Unifoliate and V2. RyzUp SmartGrass active ingredients are at right. The first application of RyzUp SmartGrass was 0.3 oz/acre with Quest® 0.25% v/v on June 2, 2016. Solution was 10 gpa. The second application of RyzUp SmartGrass was 0.3 oz/ac with Quest at 0.17 lb/ac applied on June 10, 2016. RyzUp SmartGrass is not currently labeled for use in soybeans, however there is a tolerance for the active ingredient. There were some areas in the field with sudden death syndrome and some areas which were drowned out.



Product information from: *http://www.valent.com/agriculture/products/ryzupsmartgrass/label-msds.cfm*

Results:

	Pods/plant	Yield (bu/ac)†	Seeds per lb	Protein (%)	Oil (%)	Marginal Net Return‡ ($/ac)
Check	51	73	2,326	36.4	20.8	698.29
RyzUp 0.3 oz at VU and V2	54	75	2,176	36.5	21.4	672.96
P-Value	N/A	N/A	N/A	N/A	N/A	N/A

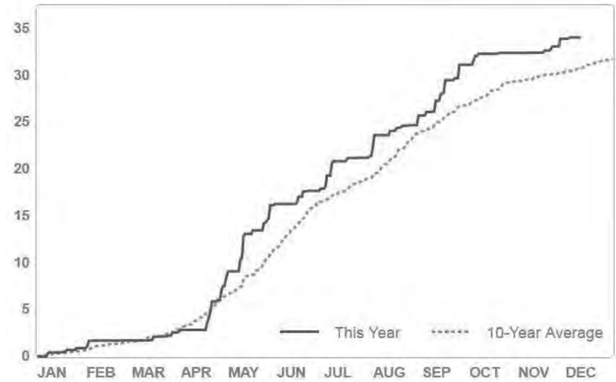
†Yield standardized to 10% moisture.
‡Marginal net return based on $9.25/bu soybean, $6.82/ac per application, $7.67/ac product costs for the first application, and $4.02/ac product costs for the second application.

Summary: Treatments were replicated but not randomized, therefore, a statistical analysis was not performed and conclusions could not be drawn. Treatment means are provided in the results table.

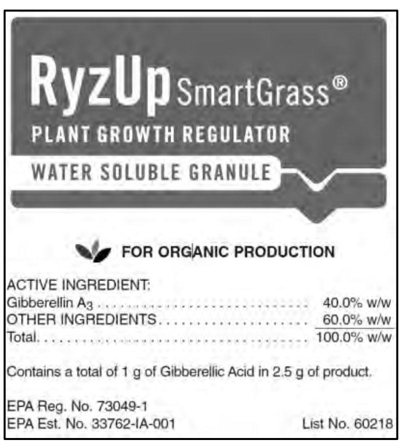
RyzUp SmartGrass® on Soybeans at V1

Study ID: 218023201601
County: Butler
Soil Type: Butler silt loam 0-1% slope; Hastings silty clay loam 0-7% slopes, eroded
Planting Date: 6/2/16
Harvest Date: 10/18/16
Row Spacing (in): 30
Hybrid: Asgrow 3034
Reps: 9
Previous Crop: Corn
Tillage: No-Till
Seed Treatment: None
Foliar Insecticides: None
Foliar Fungicides: None

Fertilizer: None
Irrigation: None
Rainfall (in):



Introduction: This study was looking at RyzUp SmartGrass® applied at a rate of 0.3 oz/acre with Class Act® at 1.54% v/v (0.308 gal/acre). The solution was applied at 20 gpa at V1 growth stage on soybeans. RyzUp SmartGrass active ingredients are below. RyzUp SmartGrass is not currently labeled for use in soybeans; however, there is tolerance for the active ingredient.



Product information from:
http://www.valent.com/agriculture/products/ryzupsmartgrass/label-msds.cfm

Results:

	Pods/plant (8/16/16)	Pods/plant (10/18/16)	Beans/pod (10/18/16)	Beans/plant (10/18/16)	Yield (bu/acre)†	Protein (%)	Oil (%)	Marginal Net Return‡
Check	47	35	2.5	87	65	39.9	18.6	600.49
RyzUp SmartGrass	54	41	2.5	104	65	39.9	18.4	583.63
P-Value	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

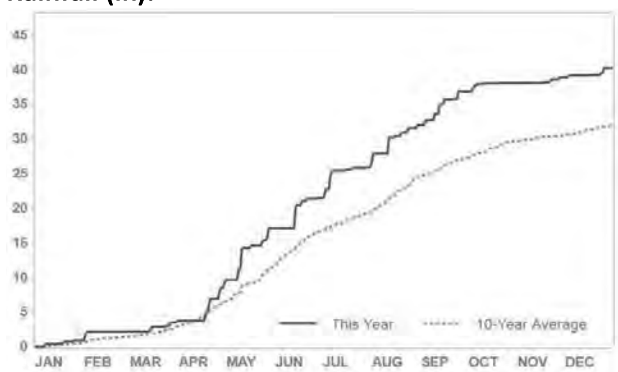
†Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $9.25/bu soybean, $6.82/ac application cost, $11.50/oz RyzUp SmartGrass, and $6.59/ac for ClassAct NG 1.54%.

Summary: Treatments were replicated but not randomized, therefore, a statistical analysis was not performed and conclusions could not be drawn. Treatment means are provided in the results table.

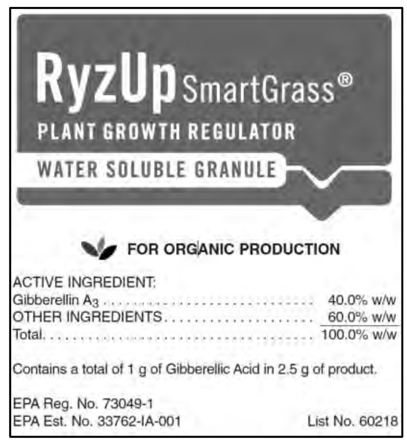
RyzUp SmartGrass® at V1 or V2 on Soybeans

Study ID: 612023201601
County: Butler
Soil Type: Muir silt loam rarely flooded; Yutan silty clay loam 6-11% slopes, eroded; Nodaway silt loam occasionally flooded; Hobbs silt loam occasionally flooded
Planting Date: 5/31/16
Population: 160,000
Hybrid: NuPride 8297 GT
Reps: 4
Previous Crop: Oats (harvested spring 2016)
Herbicides: Roundup PowerMAX® on 7/25/16
Foliar Insecticides: None
Foliar Fungicides: None

Irrigation: None
Rainfall (in):



Introduction: RyzUp SmartGrass® was applied at a rate of 0.3 oz/ac with ClassAct® NG® 2.5% v/v. The solution was applied at 10 gpa. RyzUp SmartGrass was applied at V1 or V2 growth stage to evaluate the timing of application on soybeans. RyzUp SmartGrass active ingredients are at right. RyzUp SmartGrass is not currently labeled for use in soybeans, however there is a tolerance for the active ingredient.



Product information from: *http://www.valent.com/agriculture/products/ryzupsmartgrass/label-msds.cfm*

Results:

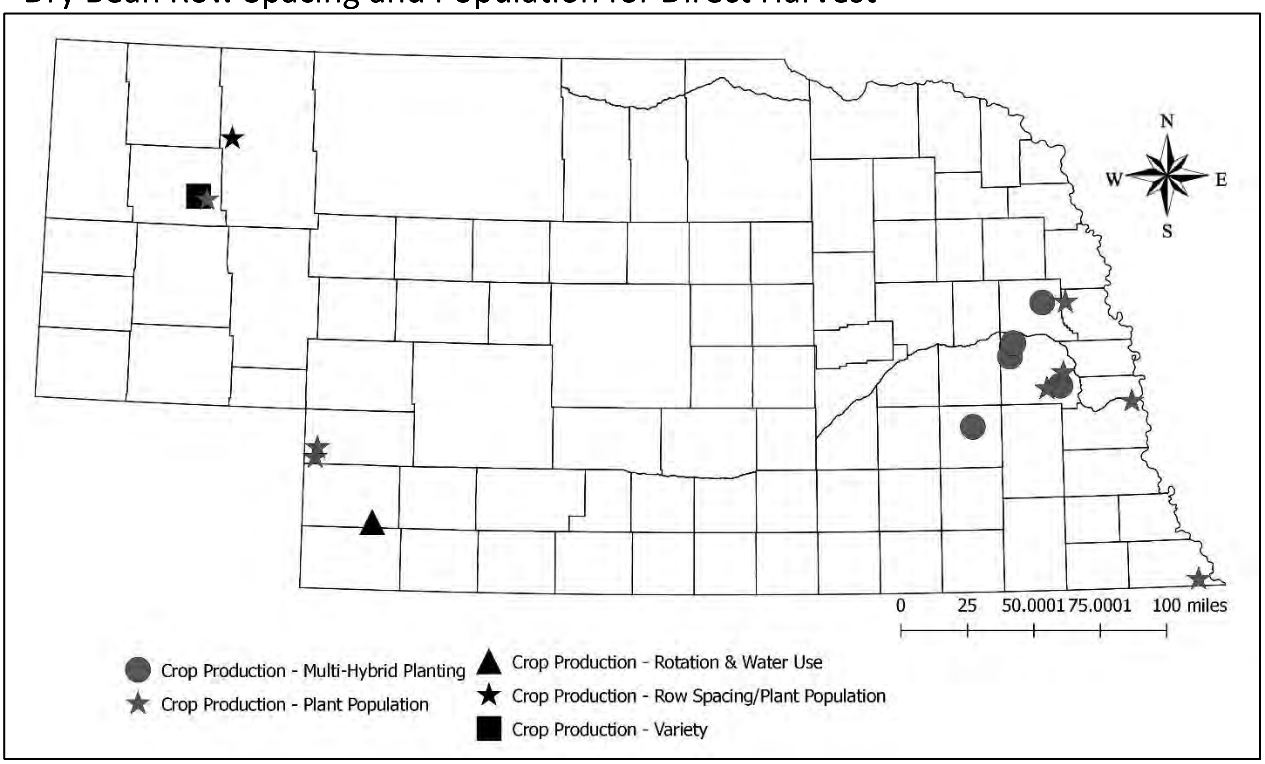
	Stem Height August 11	Trifoliate Nodes August 11	Yield (bu/acre)†	Protein (%)	Oil (%)	Seeds per lb	Marginal Net Return‡ ($/ac)
Check	14.7 B*	7.7 B	57 A	36.5 A	17.9 A	2,931 C	$527.25
RyzUp at V1	16.9 AB	8.2 A	58 A	36.0 A	17.8 A	3,117 A	$524.62
RyzUp at V2	19.3 A	8.2 A	56 A	36.1 A	18.3 A	3,026 B	$506.12
P-Value	0.018	0.013	0.699	0.303	0.320	0.002	N/A

*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 $9.25/bu soybean, $6.82/ac application cost, and $5.06/ac product cost for RyzUp SmartGrass and ClassAct NG 2.5%.

Summary: The RyzUp SmartGrass treatments had increased trifoliate nodes on August 11 when compared to the check. Variations in stem height between treatments were also observed on August 11, with the RyzUp SmartGrass application at V2 having a taller stem height than the check. At harvest, there were no differences in yield, protein, or oil between the RyzUp SmartGrass treatments and the check. Both the V1 and V2 RyzUp SmartGrass application had more seeds per lb than the check, with the V1 RyzUp SmartGrass treatment having the greatest number of seeds per lb. Because the RyzUp SmartGrass treatments did not increase yield, the untreated check resulted in the highest marginal net return.

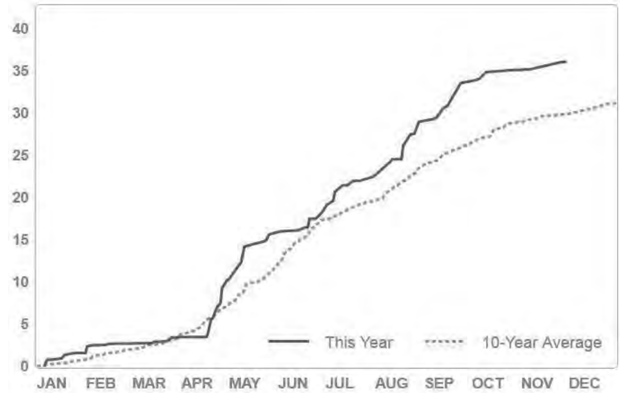
CROP PRODUCTION

- Rainfed Corn Population Study
- Soybean Seeding Rate Summary
  - Irrigated Soybean Population Study in 30" Rows
  - Rainfed Soybean Population Study in 30" Rows (2 sites)
  - Rainfed Soybean Population Study in 15" Rows (2 sites)
- Multi-hybrid Planting Considerations in Nebraska
  - Multi-Hybrid Planting for Corn Hybrid Placement (3 sites)
  - Multi-Hybrid Planting for Spatial Soybean Seed Treatments (2 sites)
- Sustainability of Replacing Summer Fallow with Grain-type Field Peas in Semiarid Cropping Systems
- Field Pea Planting Population Summary
  - Field Pea Planting Population (2 sites)
- Rainfed Dry Edible Pea Population Study
- Dry Bean Direct Harvest Variety Study
- Dry Bean Row Spacing and Population for Direct Harvest



Rainfed Corn Population Study

Study ID: 027025201601
County: Cass
Soil Type: Nodaway silt loam occasionally flooded; Colo silty clay loam occasionally flooded
Planting Date: 4/11/16
Harvest Date: 10/5/16
Row Spacing (in): 30
Hybrid: DeKalb DKC61-79RIB
Reps: 6
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** 13 oz/ac Authority® MTZ on 11/17/15 and 2 qt/ac Degree Xtra® + 32 oz/ac of Roundup PowerMAX® at 4/13/16 ***Post:*** 32 oz/ac Roundup PowerMAX and 2 oz/ac Callisto® on 5/27/16
Seed Treatment: None
Foliar Insecticides: 3.4 oz/ac Capture® LFR® and 3.6 oz/ac Xanthion® in-furrow on 4/11/16
Foliar Fungicides: 10.5 oz/ac Quilt® on 6/13/16
Fertilizer: 237.9 lb/ac 11-52-0, 74.96 lb/ac 0-0-60, and 3.25 lb/ac of Zinc Sulfate, and 17.94 lb/ac of 90% Sulfur on 11/20/15; 175 lb/ac Anhydrous Ammonia on 11/28/15; OptiStart™ Pro 9-18-6-2 Sulfur + 0.5 Zn + 0.05 Mn with N Avail in-furrow at 4/11/16.
Note: Population loss across all treatments/reps due to spring flooding
Irrigation: None
Rainfall (in):



Introduction: The purpose of this study was to determine what planting population is most profitable for corn production. The study started in 2010. The populations evaluated in 2014, 2015, and 2016 were the same, therefore 2014 and 2015 results are included for comparison. The populations chosen to be evaluated this year and in previous years were determined by the grower. The field associated with this study is sub-irrigated.

2014 and 2015 results:

Planting Population	2014 Yield (bu/ac)†	2015 Yield (bu/ac)†
28,000 seeds/acre	309 B*	239 AB*
32,000 seeds/acre	322 A	233 B
36,000 seeds/acre	321 A	233 B
40,000 seeds/acre	322 A	246 A
P-Value	0.0078	0.0117

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

2016 Results:

Planting Population	Harvest Stand Count	% of Planted Seeds Present at Harvest	Yield (bu/acre)†	Marginal Net Return‡ ($/ac)
28,000 seeds/acre	27,167 D*	97.0 AB	261 A	706.79
32,000 seeds/acre	30,667 C	95.8 B	268 A	715.64
36,000 seeds/acre	34,917 B	97.0 AB	268 A	702.92
40,000 seeds/acre	38,983 A	97.5 A	256 A	653.60
P-Value	<0.0001	0.076	0.2898	-

†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 corn and $254.40/bag seed corn (80,000 seed count).

Summary: In 2016, there was no yield difference between the seeding rates tested. In this case, planting 32,000 seeds/acre maximized marginal net return. Population loss occurred across all treatments and replications due to spring flooding. Because actual populations were slightly different than intended, we conducted a covariate analysis (to test if the actual population affected yield). Including actual treatment populations as a covariate did not affect the analysis, so the analysis presented is the original test of intended populations and their effect on yield. The percent of seeds planted which were present at harvest varied between the seeding rates tested, with the 32,000 seeds/acre treatment having a lower percent of planted seeds present at harvest than the 40,000 seeds/acre treatment.

In previous years, yield varied between the seeding rates tested. It is important to look at multiple years and locations when using this information for making production decisions. Previous research results can be found at http://cropwatch.unl.edu/on-farm-research.

Soybean Seeding Rate Summary

Previous research has been conducted to determine the economically optimum seeding rate for soybeans. The majority of these studies were conducted in irrigated conditions with 30 inch row spacing. The results of these studies are in Table 1.

Table 1. Soybean yields for planting populations of 90,000, 120,000, 150,000, and 180,000 seeds per acre for thirteen irrigated sites with 30 inch row spacing from 2006 to 2008.

		Planting Population (seeds/acre)			
Year	**County**	**90000**	**120000**	**150000**	**180000**
2006	Fillmore	66 B*	66 AB	68 A	69 A
2006	Seward	65 A	66 A	65 A	66 A
2007	Hamilton	53 A	52 A	51 A	53 A
2007	York	61 A	62 A	62 A	63 A
2007	Clay	61 A	61 A	61 A	62 A
2007	Fillmore	56 A	58 A	58 A	59 A
2007	Seward	63 A	64 A	63 A	63 A
2008	Fillmore	77 B	77 AB	78 A	78 A
2008	Seward	66 B	67 A	68 A	68 A
2008	Hamilton	69 A	70 A	71 A	71 A
2008	York	68 B	70 AB	71 AB	72 A
2008	Clay	66 A	65 A	69 A	68 A
2008	Clay	65 A	70 A	63 A	65 A
	Average:	64.4 C	65.2 B	65.4 AB	65.8 A

* Significance letters apply within site and year (same row). Values with the same letter are not significantly different at a 90% confidence level.

In 2016, five studies were conducted with the purpose of expanding this research to a rainfed production environment and 15 inch row spacing. While one site (401155201601) was pivot irrigated, no water was applied during the growing season, therefore all of these studies were conducted under rainfed conditions. A summary of these research studies, along with their row spacing, is below.

Table 2. Soybean yield at four planting populations for five rainfed sites in 2016.

			Planting Population (seeds/acre)			
Site ID	**County**	**Row Spacing (in)**	**90,000**	**120,000**	**150,000**	**180,000**
401155201601	Saunders	30	72 A*	70 A	72 A	71 A
401155201602	Saunders	30	66 A	66 A	67 A	67 A
401155201603	Saunders	30	74 B	76 AB	75 AB	76 A
610177201601	Washington	15	76 A	77 A	77 A	76 A

			Planting Population (seeds/acre)			
Site ID	**County**	**Row Spacing (in)**	**116,000**	**130,000**	**160,000**	**185,000**
416147201601	Richardson	15	66 B	67 AB	68 AB	68 A

* Significance letters apply within site. Values with the same letter are not significantly different at a 90% confidence level.

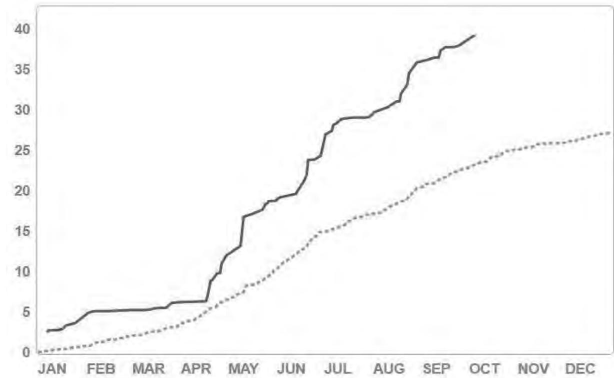
Results of the 2016 studies were consistent with previous research reported in Table 1. In some cases, small increases in yield were obtained by increasing seeding rates. When looking at multiple studies together, such as in the average in Table 1, small yield increases are realized by increasing the seeding rate, but the yield increase is not great enough to offset higher seed costs. For example, if seeding rate is reduced from 150,000 to 90,000 seeds per acre, $25.71/acre would be saved on seed cost (assuming seed cost of $60/140,000 seeds), while yield would only decrease 1 bu/acre (based on averages in Table 1).

Detailed reports of each of these studies are available in the following pages of this report.

Soybean Seeding Rate in 30" Rows

Study ID: 401155201601
County: Saunders
Soil Type: Yutan, eroded-Judson complex; Pohocco silty clay; Judson silt loam
Planting Date: 5/15/16
Harvest Date: 9/27/16
Population: various
Row Spacing (in): 30
Hybrid: Fontenelle 2.4
Reps: 4
Previous Crop: Corn
Tillage: No-Till
Herbicides: ***Pre:*** 3 oz/acre Valor® XLT, 32 oz/acre Roundup®, 16 oz/acre 2,4-D
Post: 54 oz/acre Flexstar® GT
Seed Treatment: Poncho®

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



Introduction: Previous on-farm research has demonstrated that planting rates of 80,000 to 120,000 seeds/acre generally result in the highest profitability. The purpose of this study was to determine the most profitable soybean seeding rate. The populations chosen in this study are common to growers in the area. Soybeans were planted in 30" rows on May 15, 2016.

Results:

	Early Season Stand Counts (July 1, 2016)	% of Planted Seeds Emerged	Harvest Stand Count	% of Planted Seeds Present at Harvest	Yield (bu/ac)†	Marginal Net Return‡ ($/ac)
90,000 seeds/ac	79,250 D*	88 A	80,000 D	89 A	72 A	$627.43
120,000 seeds/ac	102,000 C	85 A	101,750 C	85 A	70 A	$596.07
150,000 seeds/ac	124,250 B	83 A	121,500 B	81 A	72 A	$601.71
180,000 seeds/ac	147,250 A	82 A	148,750 A	83 A	71 A	$579.61
P-Value	<0.0001	0.225	<0.0001	0.233	0.9196	N/A

*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 $9.25/bu soybean and $60/unit seed cost (140,000 seeds/unit).

Summary: No yield increase was seen for planting higher than 90,000 seeds/acre. There was no difference in the percent of planted seeds emerged or at harvest. Based on the cost of seed, planting 90,000 seeds per acre rate maximized net returns.

Soybean Seeding Rate in 30" Rows

Study ID: 401155201602
County: Saunders
Soil Type: Judson silt loam; Aksarben silty clay loam
Planting Date: 5/15/16
Harvest Date: 10/3/16
Row Spacing (in): 30
Hybrid: NK S27-J7
Reps: 4
Previous Crop: Corn
Tillage: Field Cultivator, May 3
Herbicides: ***Pre:*** BroadAxe®, 2,4-D, and Roundup® on 5/7/16 ***Post:*** 37 oz/acre Flexstar® GT, 32 oz/acre Warrant®, 6.2 oz/acre Volunteer, and 20 oz/acre Class Act® on 6/14/16
Seed Treatment: CruiserMaxx® Vibrance®

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

Introduction: Previous on-farm research has demonstrated that planting rates of 80,000 to 120,000 seeds/acre generally result in the highest profitability. The purpose of this study was to determine the most profitable soybean seeding rate. The populations chosen in this study are common to growers in the area. Soybeans were planted in 30" rows on May 15, 2016.

Results:

	Early Season Stand Count (June 8, 2016)	% of Planted Seeds Emerged	Harvest Stand Count	% of Planted Seeds Present at Harvest	Yield (bu/ac)†	Marginal Net Return‡ ($/ac)
90,000 seeds/ac	71,667 D*	80 A	70,750 D	79 A	66 A	571.93
120,000 seeds/ac	95,417 C	80 A	93,500 C	78 A	66 A	559.07
150,000 seeds/ac	120,083 B	80 A	110,000 B	73 A	67 A	555.46
180,000 seeds/ac	146,750 A	82 A	137,500 A	76 A	67 A	542.61
P-Value	<0.0001	0.5003	<0.0001	0.279	0.407	N/A

*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 $9.25/bu soybean and $60/unit seed cost (140,000 seeds/unit).

Summary: No yield increase was seen for planting higher than 90,000 seeds/acre. There was no difference in percent of plants which emerged or were present at harvest for the four seeding rates tested. Based on the cost of seed, planting 90,000 seeds per acre rate maximized net returns.

Soybean Seeding Rate in 30" Rows

Study ID: 401155201603
County: Saunders
Soil Type: Judson silt loam; Aksarben silty clay loam
Planting Date: 5/15/16
Harvest Date: 10/3/16
Row Spacing (in): 30
Hybrid: NK S30-C1
Reps: 4
Previous Crop: Corn
Tillage: Field Cultivator, May 3
Herbicides: ***Pre:*** BroadAxe®, 2,4-D, and Roundup® on 5/7/16 ***Post:*** 37 oz/acre Flexstar® GT, 32 oz/acre Warrant®, 6.2 oz/acre Volunteer, and 20 oz/acre Class Act® on 6/14/16
Seed Treatment: CruiserMaxx® Vibrance®

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

Introduction: Previous on-farm research has demonstrated that planting rates of 80,000 to 120,000 seeds/acre generally result in the highest profitability. The purpose of this study was to determine the most profitable soybean seeding rate. The populations chosen in this study are common to growers in the area. Soybeans were planted in 30" rows on May 15, 2016.

Results:

	Early Season Stand Count (June 8, 2016)	% of Planted Seeds Emerged	Harvest Stand Count	% of Planted Seeds Present at Harvest	Yield (bu/ac)†	Marginal Net Return‡ ($/ac)
90,000 seeds/ac	74,250 D*	83 A	73,500 D	82 A	74.3 B	645.93
120,000 seeds/ac	99,750 C	83 A	90,750 C	76 AB	75.6 AB	651.57
150,000 seeds/ac	129,250 B	86 A	110,500 B	74 B	75.0 AB	629.46
180,000 seeds/ac	153,167 A	85 A	137,000 A	76 AB	76.2 A	625.86
P-Value	<0.0001	0.384	<0.0001	0.115	0.0669	N/A

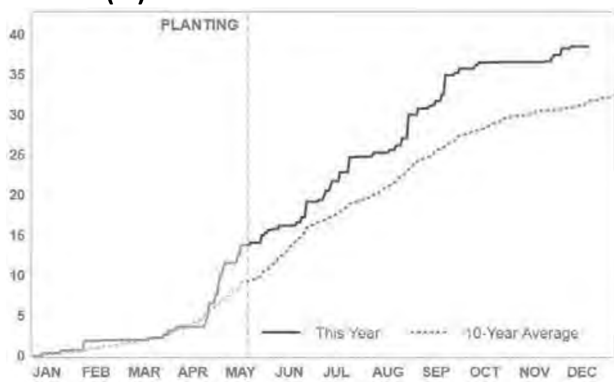
*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $9.25/bu soybean and $60/unit seed cost (140,000 seeds/unit).

Summary: Planting 90,000, 120,000 or 150,000 seeds/acre resulted in the same yield as did planting at 120,000, 150,000 or 180,000 seeds/acre. However, planting 180,000 seeds/acre resulted in higher yields than 90,000 seeds/acre. Based on the cost of seed, planting 120,000 seeds per acre rate maximized net returns.

Rainfed Soybean Population Study

Study ID: 610177201601
County: Washington
Soil Type: Belfore silty clay loam 0-2% slope; Moody silty clay loam 2-6% slopes
Planting Date: 5/15/16
Harvest Date: 10/25/16
Row Spacing (in): 15
Hybrid: Asgrow 3334
Reps: 4
Previous Crop: Corn
Tillage: No-Till
Herbicides: ***Pre:*** 4 oz/ac Sonic®, 1 oz/ac Sharpen®, and 24 oz/ac Roundup PowerMAX® on 4/15/16
Post: 6 oz/ac Select®, 16 oz/ac Flexstar®, 3 qt/ac Warrant®, and 28 oz/ac Roundup PowerMAX® on 6/10/16
Seed Treatment: Acceleron® (Metalaxyl, Pyraclostrobin, Fluxapryoxad, and Imidacloprid)

Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: Dry manure applied in fall 2015 (rate of nutrients unknown)
Irrigation: None
Rainfall (in):



Soil Samples:

ID	Soil pH 1:1	Modified WDRF BpH	OM L.O.I.	P weak Bray ppm	P strong Bray ppm	----Ammonium Acetate— ---------------ppm----------- K	Ca	Mg	Sum of Cations me/100g	% Base Saturation H	K	Ca	Mg
Rep 1	5.6	6.5	4.1	47	62	289	2699	352	22.5	23.7	3.3	60.0	13.0
Rep 2	5.8	6.6	3.9	52	73	357	2726	372	21.7	18.7	4.2	62.8	14.3
Rep 3	5.8	6.5	3.8	38	56	347	2894	405	23.1	18.9	3.9	62.6	14.6
Rep 4	5.8	6.6	4.2	49	62	313	2632	351	20.9	19.2	3.8	63.0	14.0

Introduction: Previous on-farm research has demonstrated that planting rates of 80,000 to 120,000 seeds/acre resulted in the highest profitability. Most of this research was conducted in irrigated conditions with 30" row spacing. The purpose of this study was to determine the optimal planting rate in non-irrigated conditions with 15" row spacing. Stand count locations were marked with flags so that the same area was counted for the early stand counts (June 20, 2016) and harvest stands counts (Oct. 10, 2016). These stand counts were compared to planting rate to determine the percent of planted seeds which emerged and the percent of planted seeds which were present at harvest *(Figure 1).* There were visible differences between the aerial imagery from August 31, 2016 (*Figure 3*) for the lowest seeding rate, likely attributed to minor differences in lodging.

Results:

	Early Season Stand Count (plants/ac)	% of Planted Seeds Emerged	Harvest Stand Count (plants/ac)	% of Planted Seeds Present at Harvest	Yield (bu/acre)†	Marginal Net Return‡ ($/ac)
90,000 seeds/acre	85,333 D*	95 A	83,167 D	92 A	76 A	$664.43
120,000 seeds/acre	115,000 C	96 A	111,500 C	93 A	77 A	$660.82
150,000 seeds/acre	143,167 B	95 A	136,500 B	91 A	77 A	$647.96
180,000 seeds/acre	173,583 A	96 A	165,000 A	92 A	76 A	$625.86
P-Value	<0.0001	0.5375	<0.0001	0.506	0.2757	N/A

*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 $9.25/bu soybean and $60/unit soybean seed (140,000 seeds/unit).

Figure 1. Early and harvest stand counts compared to planting rate.

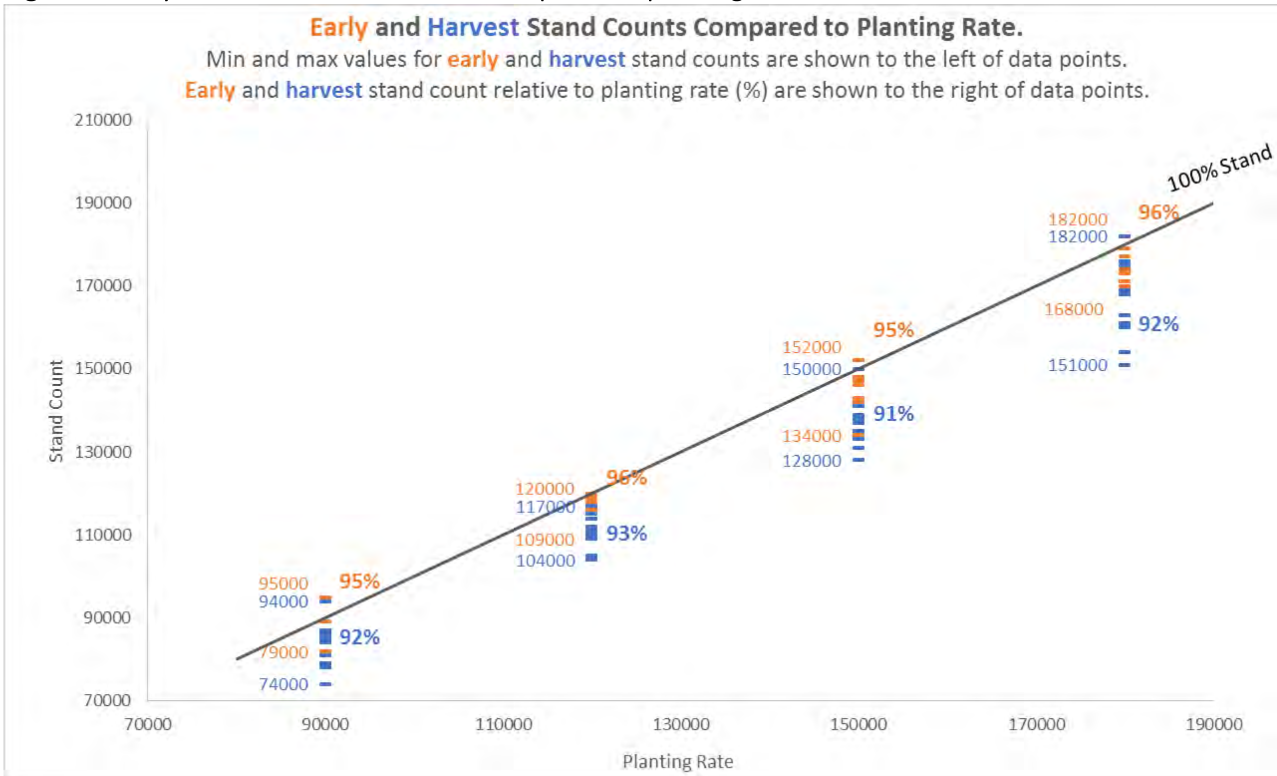


Figure 2. Aerial image with yield values overlaid.

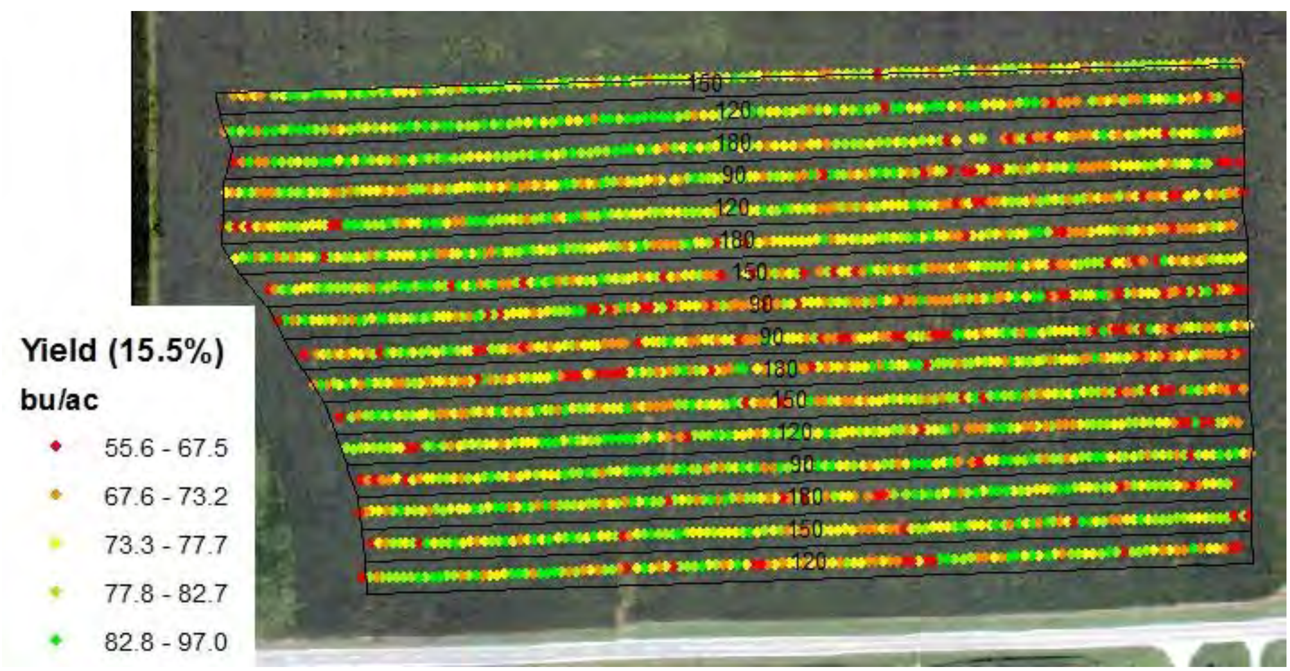
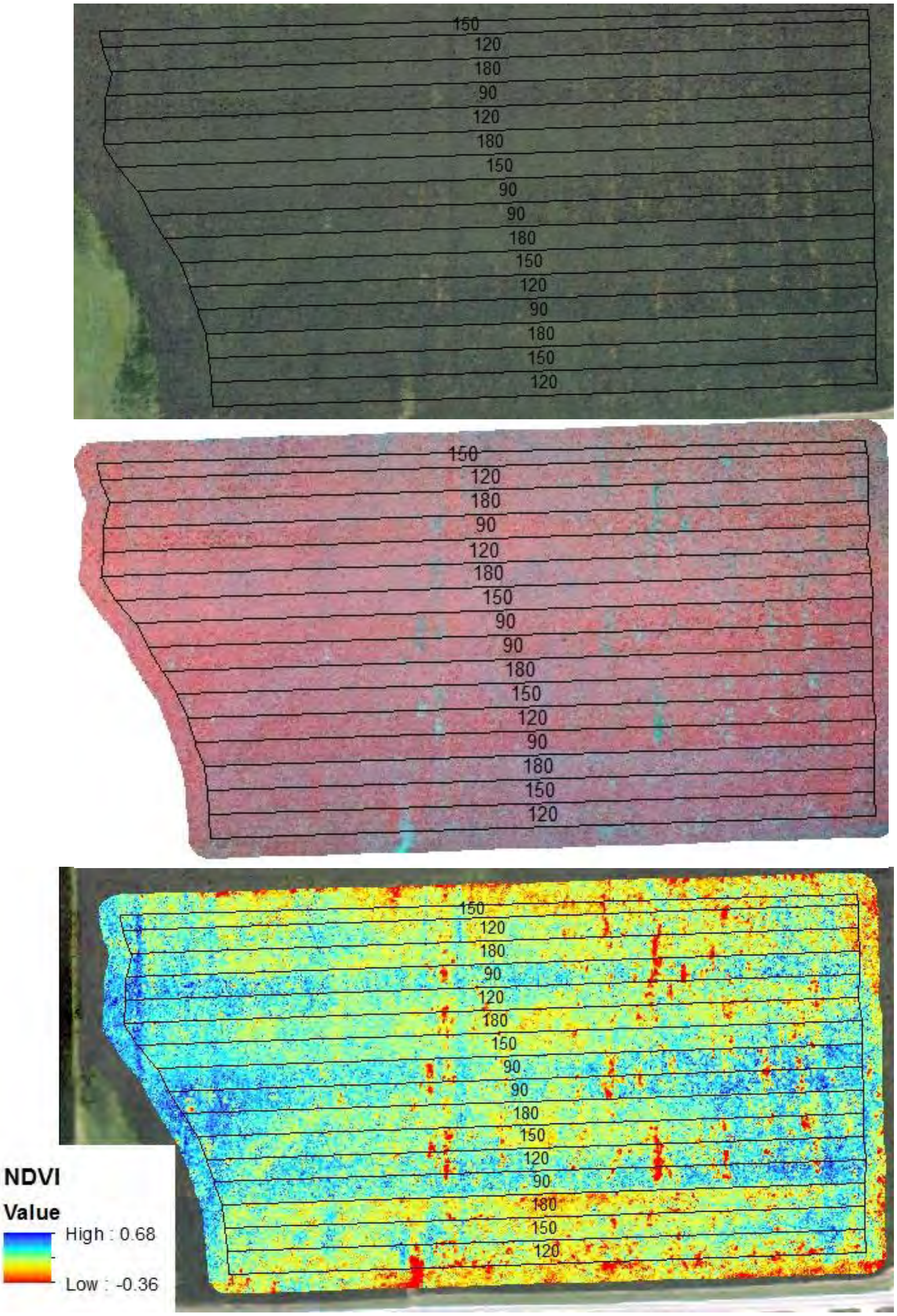


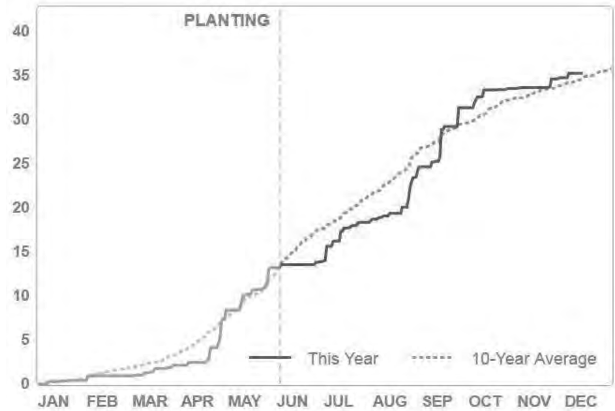
Figure 3. False color image (top) and NDVI (bottom) on August 31, 2016.



Summary: There was no yield difference for the planting populations tested. There was no difference in percent of plants which emerged or were present at harvest for the four seeding rates tested. The 90,000 seeds/acre rate, with a final stand of 83,167 plants/acre, resulted in the highest profitability due to lower seed costs. This is consistent with previous research findings.

Rainfed Soybean Population Study

Study ID: 416147201601
County: Richardson
Soil Type: Nodaway silt loam occasionally flooded; Zook silty clay loam occasionally flooded; Wabash silty clay loam occasionally flooded
Planting Date: 6/3/16
Harvest Date: 10/25/16
Row Spacing (in): 15
Hybrid: P36T86R
Reps: 4
Previous Crop: Corn
Tillage: Disk
Seed Treatment: PPST120+, PPST 2030, Gaucho®, EverGol™ Energy, Allegiance®, ILeVO® (1/2 rate)
Foliar Insecticides: 4 oz/ac Hero®
Foliar Fungicides: 4 oz/ac Priaxor®
Fertilizer: 61 lb/ac of 11-52-0, 114 lb/ac of 0-0-60
Irrigation: None
Rainfall (in):



Soil Samples: Six soil samples were taken within the study area.

Sample	O.M. --%--	pH	C.E.C.	P Bray 1	K	Mg	Ca	S	Zn	Mn	Fe	Cu	B
				---ppm---									
1	2.60	7.0	12.5	39	120	221	2043	10	2.0	108.0	154.0	1.8	0.4
2	2.60	6.6	12.6	59	117	191	1965	8	5.2	88.0	138.0	1.6	0.5
3	2.50	6.5	14.9	53	118	219	2321	9	4.2	98.0	142.0	1.8	0.4
4	1.80	6.6	14.5	28	125	234	2245	11	2.7	111.0	143.0	1.9	0.4
5	2.40	6.6	13.3	31	107	217	2073	11	2.3	95.0	147.0	1.7	0.4
6	2.00	6.9	14.9	45	129	223	2493	11	2.4	106.0	156.0	1.9	0.5

Introduction: Previous research has demonstrated that planting rates of 80,000 to 120,000 seeds/acre resulted in the highest profitability. Most of this research was conducted under irrigation with 30" row spacing. The purpose of this study was to determine the optimal planting rate in non-irrigated conditions with 15" row spacing. Target treatment rates were 116,000, 130,000, 160,000, and 185,000 seeds/acre. The actual planting rate for each treatment (rate indicated in the as-planted file) is shown in table below. The actual planting rate was used for comparison for the percent of plants emerged and present at harvest.

Results: Stand count locations were marked with flags so that the same area was counted for the early stand counts (July 1, 2016) and harvest stands counts (Oct. 25, 2016). These stand counts were compared to planting rate *(Figure 1)*. The highest planting population had the lowest percent of planted stand at harvest. An aerial image on August 21, 2016 showed greater lodging in the higher 2 planting populations *(Figure 2)*. Imagery was collected again 10 days later on August 31, 2016. False color imagery and NDVI from this second flight showed increased plant lodging with more lodging in the northern and southeastern part of the study *(Figure 3).*

Treatment (seeds/ac)	Actual Planting Rate	Early Season Stand Count (plants/ac)	% of Planted Seeds Emerged	Harvest Stand Count (plants/ac)	% of Planted Seeds Present at Harvest	Yield (bu/ac)†	Marginal Net Return‡ ($/ac)
116,000	116,645	96,167 D*	82 AB	87,667 D	75 A	66 B	560.96
130,000	129,600	109,417 C	84 A	99,417 C	77 A	67 AB	557.15
160,000	158,544	128,167 B	81 AB	113,667 B	72 AB	68 AB	553.83
185,000	185,112	147,833 A	80 B	126,333 A	68 B	68 A	544.94
P-Value		<0.0001	0.0914	<0.0001	0.0358	0.0425	N/A

*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 $9.25/bu soybean and $64.10/unit seed cost (140,000 seeds/unit).

Figure 1. Early and harvest stand counts compared to planting rate.

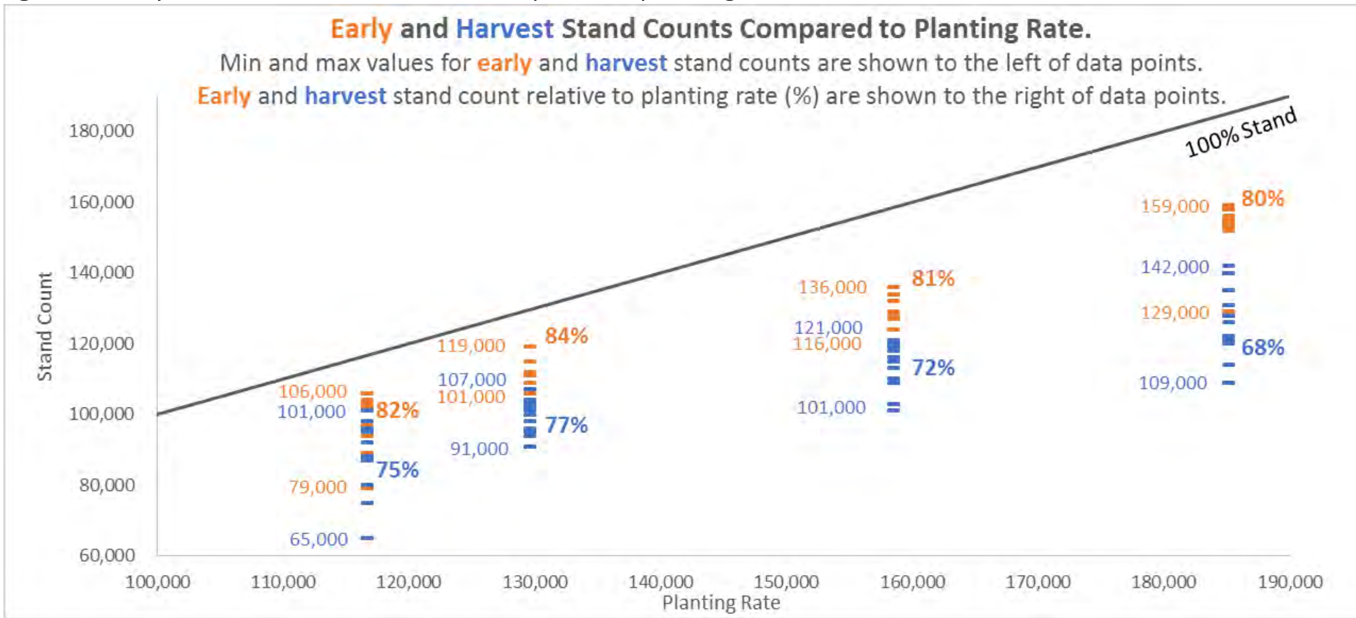


Figure 2. Aerial image from August 21, 2016 showing lodging in the 160,000 and 185,000 seeds/acre treatments.

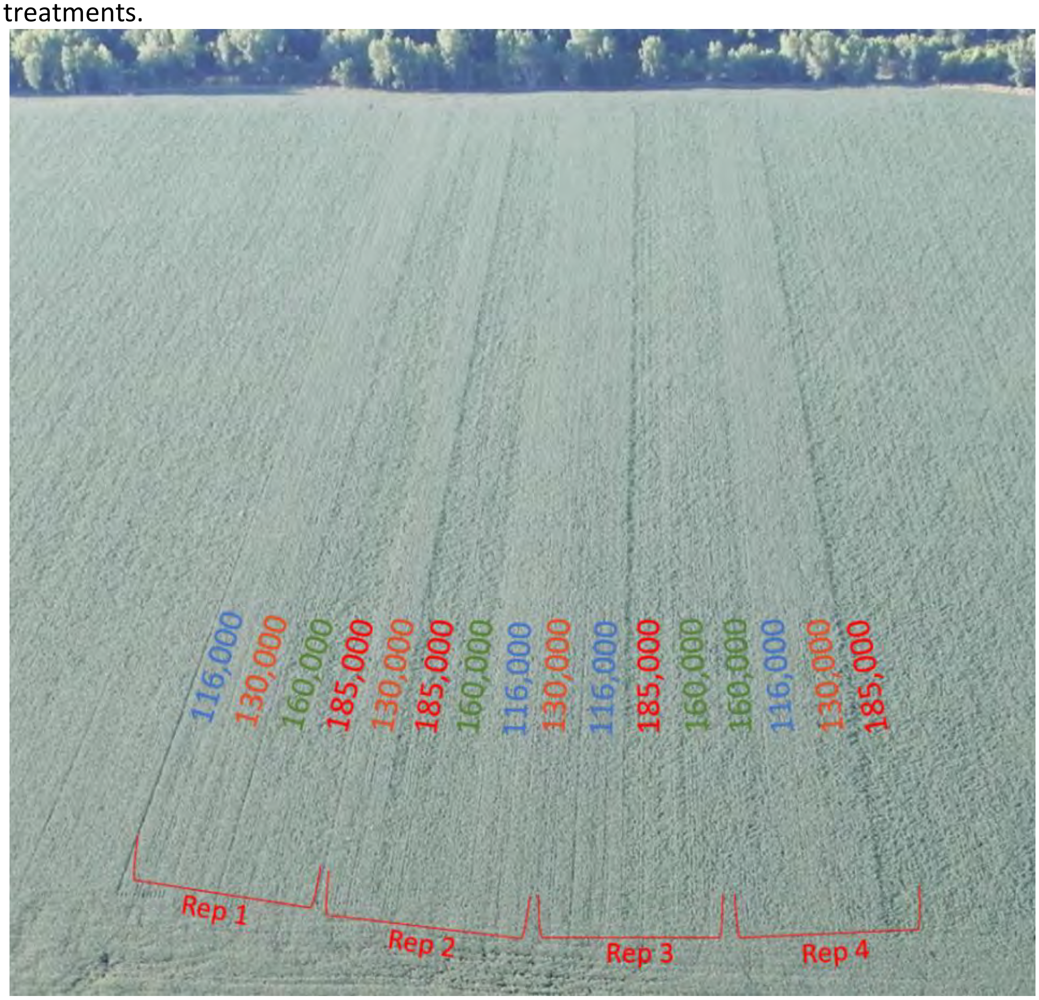
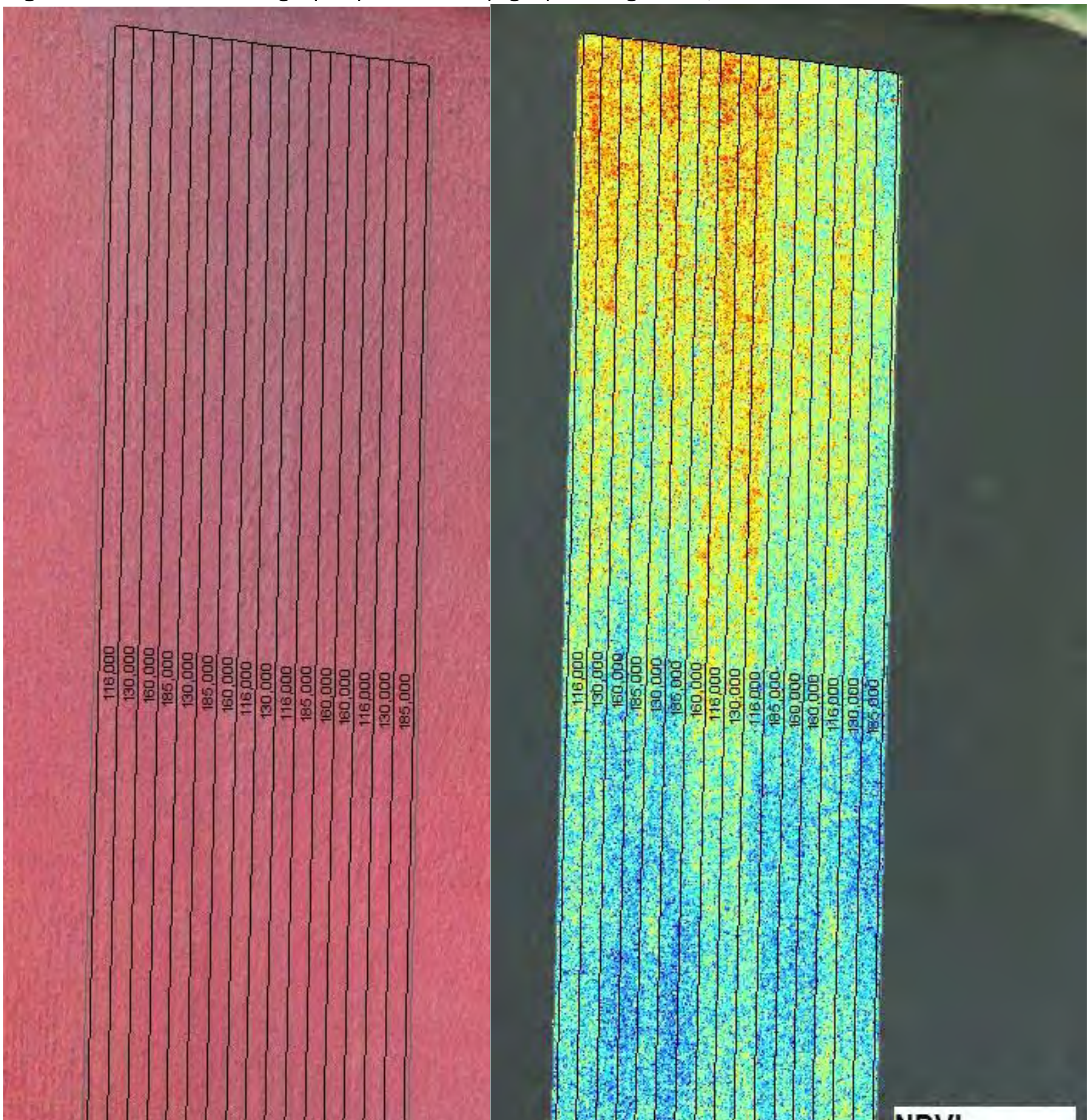


Figure 3. False color image (left) and NDVI (right) on August 31, 2016.

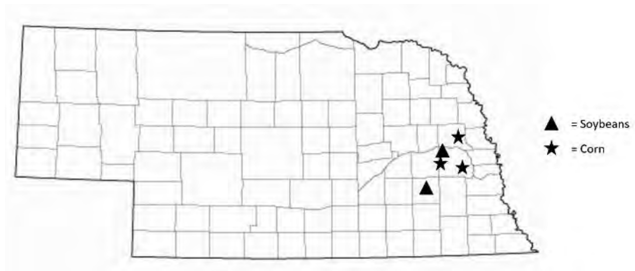


Summary: Yield increased 2 bu/acre from the lowest (116,000 seeds/acre) to the highest (185,000 seeds/acre) seeding rate. This 2 bu/acre increase is not enough to offset the additional seed cost. The 116,000 seeds/acre treatment with a final stand count of 87,667 plants/acre maximized net return. This is consistent with previous research findings. With the given soybean seed price and yields in this study, a soybean selling price greater than $15.80/bu would be needed for the 185,000 seed/acre treatment to provide a higher net return than the 116,000 seed/acre treatment. There was a greater percentage of plants present at harvest for the lowest two seeding rates compared to the highest seeding rate. Greater stand decreases for higher seeding rates have been observed in the past studies.

Multi-Hybrid Planting

Investigating Use of Multi-Hybrid Planting for Corn Hybrid Placement and Spatial Soybean Seed Treatments

The 2016 growing season marked the beginning of a collaboration by the University of Nebraska with several industry partners and producers to assess multi-hybrid planting. While the operation of multi-hybrid systems has been validated, many questions still need to be answered in order to prepare for mainstream adoption of the technology. Those considering adoption of the technology have questions pertaining to zone creation, assessment, and hybrid selection. Producers, consultants and researchers have seen the need to plant multiple hybrids or treatments across variable fields since hybrid selection is often considered one of the most important features to optimizing production. The advent of the multi-hybrid planter takes that selection to a new level by allowing hybrid selection by sub-field zone. Since the first proto-types developed at the University of South Dakota, the technology has advanced with several systems now commercially available. For this study, a Kinze 4900MH planter was used.



Multi-Hybrid Technology

The main objective of multi-hybrid planting is to switch hybrids or treatments as the planter moves across predetermined zones. These zones are mapped and assigned hybrids ahead of time based on both the characteristics of the zone and the hybrid. The planter features two seed meters in each row unit. These meters are run by electric drives, which allows for a nearly instantaneous transition between each hybrid. As the planter moves across zones, the seed meters switch off and on according to the prescription map. Two bulk tanks are mounted on the planter, each holding a different hybrid. These bulk tanks feed seed to every row unit. Multi-hybrid planters are often equipped with other features such as variable rate seeding and fertilizer capabilities, as well as variable downforce. These capabilities make multi-hybrid planters among the most complex and innovative planters on the market.

Uses for Multi-Hybrid Planting

Multi-Hybrid planting has many applications. The most common use is for planting two contrasting hybrids in adequate versus moisture limiting field conditions. Alternative uses include incorporation of a hybrid or treatment for insect and herbicide resistance, site specific applications of seed treatment, or planting two hybrids with different maturities for quicker or slower dry down. Multi-hybrid planting really could be considered multi-management planting, as many alternate uses are possible with the platform.

The research question for the corn studies was: will yields within a management zone be increased by switching from an offensive to a defensive hybrid based on management zones? For the soybean studies, the research question was: will treating portions of the field at higher risk for sudden death syndrome (SDS) with ILeVO® result in higher yields and reduced input costs?

Field Sites

Corn and soybean fields were selected in eastern Nebraska in Seward, Saunders, and Dodge Counties.

Corn fields selected were determined to be highly variable in both yield and productivity. This often related back to varying soil types present. A total of fifteen different soil types were present in this study. Two contrasting hybrids were selected for the fields, one with a drought tolerant trait for portions of the field typically under water limiting conditions, and a potentially more productive hybrid for portions of the field maintaining adequate moisture. One population rate was selected for each field. These hybrids and populations were selected in a joint effort by the producer, seed consultant, and the researchers.

Soybean sites were selected for the presence of sudden death syndrome (SDS). This disease is caused by a soil borne fungus, *Fusarium solani f. sp. glycines*. Sudden death syndrome can result in yield restrictions in infected plants. Additionally presence of soybean cyst nematode can result in more severe manifestation of SDS. ILeVO is a seed treatment marketed by Bayer Crop Science for SDS and nematode activity. This study focused on the site specific placement of the ILeVO product in portions of the field historically subjected to SDS.

Creation of Management Zones

Zones were created using Management Zone Analyst (MZA) Version 1.0 (USDA ARS, University of Missouri, Columbia, MO), a software developed by the University of Missouri. This program uses fuzzy clustering to group spatial data into like regions of the field. Fuzzy clustering allows partial membership to multiple zones giving a more accurate representation of soil and agronomic distribution of data. Output from MZA provides the user with the optimum number of zones for the field through two performance indices. The goal when developing these zones is to reduce overall variation across the field. Each zone should have less variation than the field as a whole. Various data layers were utilized in each field, depending on the correlation between available layers for clustering. Available data layers included multiple years of historical yield, deep and shallow electrical conductivity, aerial imagery, and topographic attributes. Following this process, management zones were created for each study site. The number of management zones varied among sites depending on the optimum classification suggested by performance indices. Characteristics and behaviors of the clusters were assessed and a hybrid assigned to the zone.

2016 Growing Season Challenges

The 2016 growing season was a challenging year for multi-hybrid planting research. For this year, rainfall was 3.4 to 9.8 inches above the 10-year average across the corn studies, making a drought tolerant hybrid unnecessary. Generally, this resulted in no significant difference between the hybrids selected for the field. A summary of three sites evaluating multi-hybrid corn planting is provided in Table 1. In some instances, the offensive hybrid should have been planted across the whole field. These factors make it challenging to appropriately assess zone creation. However, because water was not a limiting factor, an assessment of the overall yield loss by planting a defensive hybrid was available. In two field sites, the defensive hybrid yield was not significantly different from the yield of the offensive hybrid suggesting under these circumstances, there were no significant negative consequences for planting a defensive hybrid in a "wet" year. Further years of study, encompassing a wide range of growing season weather conditions, will be needed to verify zone delineation for the study sites. Detailed reports of each of these studies are available in the following pages of this report.

Table 1. Summary of defensive and offensive hybrid yield response within defensive and offensive management zones for three sites.

Study ID	County	Inches of rain above 10-year average	Management Zone	Defensive Yield (bu/ac)	Offensive Yield (bu/ac)
150053201601	Dodge	9.8	Defensive Zone	231 A	233 A
			Offensive Zone	240 A	244 A
108155201602	Saunders	3.4	Defensive Zone	225 B	231 A
			Offensive Zone	230 B	240 A
560155201601	Saunders	9.5	Defensive Zone	211 A	209 A
			Offensive Zone	212 A	212 A

* Significance letters apply within site and zone. Values with the same letter are not significantly different at a 95% confidence level.

Each of the study fields planted to soybeans had a late onset of Sudden Death Syndrome, potentially reducing the overall impact the disease had on final yield. Additionally, flooding at one field site resulted in a late planting date, a strategy typically employed to reduce overall impact of SDS. Varying levels of disease were present in all the fields. A summary of the two sites comparing standard versus standard and ILeVO seed treatment is provided in Table 2. Detailed reports of each of these studies are available in the following pages of this report.

Table 2. Summary of standard seed treatment and ILeVO seed treatment within a management zone with higher sudden death syndrome risk (standard plus ILeVO seed treatment zone) and a management zone with lower sudden death syndrome risk (standard seed treatment zone).

Study ID	County	Inches of rain above 10-year average	Management Zone	Standard + ILeVO® Yield (bu/ac)	Standard Treatment Yield (bu/ac)
180155201601	Saunders	9.5	Standard + ILeVO Zone	75 A	72 A
			Standard Treatment Zone	77 A	74 A
560155201601	Saunders	2.7	Zones not delineated	68 A	64 B

* Significance letters apply within site and zone. Values with the same letter are not significantly different at a 95% confidence level.

Summary

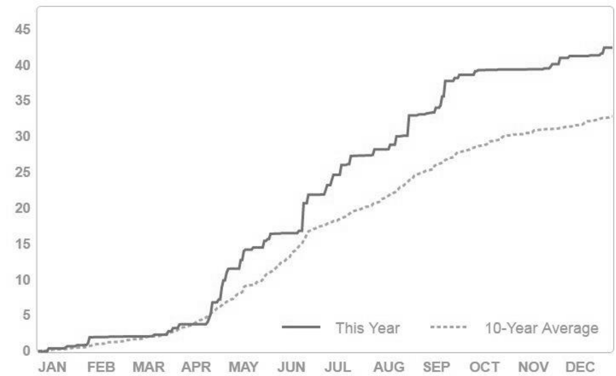
Given the growing season conditions experienced in 2016, it was challenging to get definitive results pertaining to zone delineation or hybrid selection. It is difficult to say whether zones should be restructured to meet the constraints of the 2016 growing season, or tested in additional growing seasons that may be considered more "average". Further analysis examining historical yield data from comparative weather years should be analyzed to examine potentially better zones for a season like 2016. Ideally, zones should be stable across a wide variety of growing season conditions including above average moisture years as well as average or below average growing seasons. Several years of management zone assessment will need to take place before definitive zones can be created that would provide an ideal fit.

Continuing On

This study will be completed again in the 2017 growing season. Six corn fields, and four soybean fields in Saunders and Dodge Counties will be included in the study. Corn fields will again be planted with drought tolerant versus high performing hybrids. Soybean fields will be site specifically applying ILeVO for treatment of Sudden Death Syndrome. This additional data will assist researchers in determining what data layers are necessary for accurate zone structuring and hybrid selection.

Multi-Hybrid Planting for Corn Hybrid Placement

Study ID: 150053201601
County: Dodge
Soil Type: Moody silty clay loam; Fillmore silt loam; Nora silt loam; Crofton silt loam
Planting Date: 5/6/16
Harvest Date: 11/5/16
Population: 30,000
Row Spacing (in): 30
Reps: 9
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** 2 oz/ac Sharpen®, 22 oz/ac Roundup PowerMAX® on April 16 ***Post:*** 1.25 qt/ac Resicore®, 32 oz/ac Roundup PowerMAX on June 2
Seed Treatment: Acceleron®
Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: 135 lb N/ac as 32% UAN with coulter unit on April 9, 40 lbs N/ac as 32% UAN and ATS mix with coulter unit on June 11 at V6 growth stage
Irrigation: None
Rainfall (in): Gauge = 32.65” for April-Sept.



Soil Tests:

ID	Soil pH 1:1	OM LOI-%	P - Bray P1 (ppm)	K – AA (ppm)	Zn - DTPA
1 through 6	6.0-6.4	3.0-4.1	36-56	221-421	1.7-2.8

Introduction: Using a multi-hybrid planter, hybrids can ideally be placed to optimize production in stable management zones. This study compares two contrasting hybrids, one with a drought tolerant trait and one geared towards high production, placed in defined management zones *(Figure 1)*.

- The drought tolerant/**defensive hybrid**, Channel 211-00DGVT2PRIB, was placed in portions of the field that typically had lower water retention (dark grey).
- The **offensive hybrid**, Channel 209-51VT2PRIB, was placed in portions of the field that normally maintained adequate moisture across the growing season (light grey).
- Check strips of the opposing hybrid were placed in each zone as shown in Figure 1.

Management Zone Creation: Four years of yield data were used for clustering in Management Zone Analyst Version 1.0 (USDA ARS, University of Missouri, Columbia, MO).

Figure 1. Management zones for defensive hybrid (dark grey), and offensive hybrid (light grey) with check strips of the opposing hybrid.

Results: Within each zone, success of the offensive and defensive hybrid were evaluated by comparing the yield of the check strips to the yield in an adjacent strip of the hybrid assigned to that zone. Data were analyzed using the GLIMMIX procedure in SAS 9.4 (SAS Institute Inc., Cary, NC). Mean separation was performed with Fisher's LSD.

Treatment	Channel 211 (defensive hybrid) Yield (bu/acre)†	Channel 209 (offensive hybrid) Yield (bu/acre)†	P-Value
Defensive Zone	231 A*	233 A	0.326
Offensive Zone	240 A	244 A	0.062

†Bushels per acre corrected to 15.5% moisture.
*Values with the same letter are not significantly different at a 95% confidence interval. Letters apply within zone.

Summary: There was no difference between hybrid yields in the defense or offensive zone, however the p-value for the offensive zone is approaching significance. Several factors affecting this field should be noted. A wind event on July 5th resulted in green snap and lodging of hybrids. The hybrids responded differently to this stress. Channel 211 was more susceptible to green snap at the timing of the wind event, and consequently was affected more than Channel 209. Additionally, this field site received above average rainfall. Channel 211 was selected for its drought tolerant traits; at this field site, water was not a limiting factor, so there was not a benefit from planting a drought tolerant hybrid. There was a price difference between the two hybrids used. Channel 211 cost $232/bag and Channel 209 cost $245/bag.

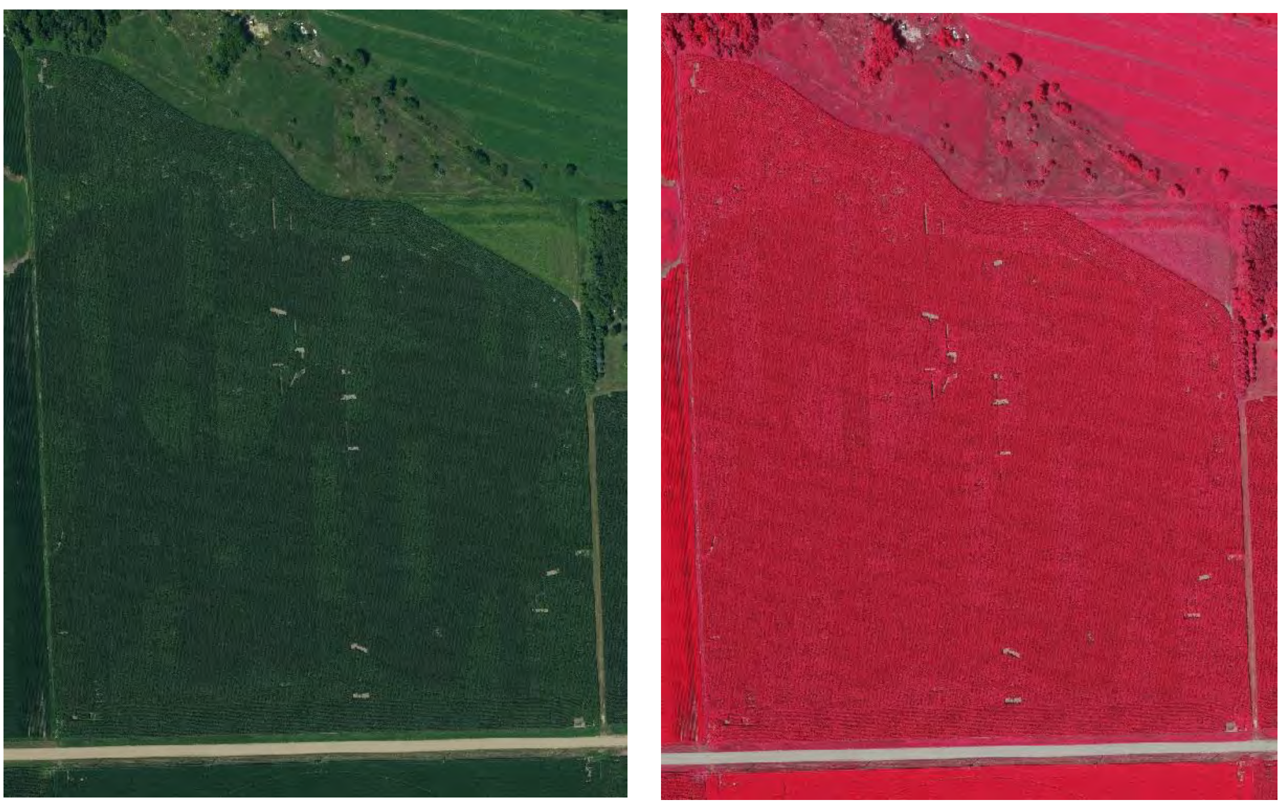


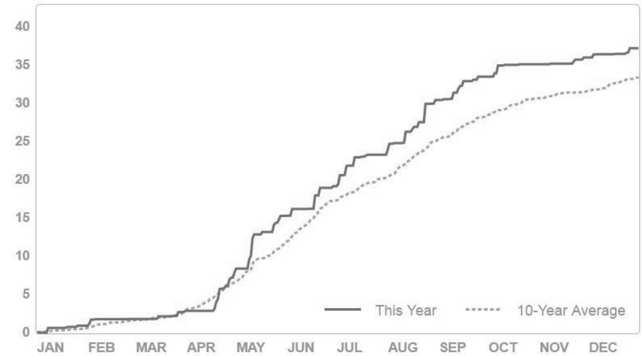
Figure 2. True color (left), and false color (right) imagery of the plot area.

Aerial imagery collected on July 31, 2016 shows the delineation of zones as well as check strips interspersed throughout. The green snap is evident in the northwest corner in Channel 211, with lesser impact on Channel 209.

Multi-Hybrid Planting for Corn Hybrid Placement

Study ID: 108155201602
County: Saunders
Soil Type: Filbert silt loam; Fillmore silt loam; Scott silt loam; Tomek silt loam; Yutan silty clay loam
Planting Date: 4/15/16
Harvest Date: 11/3/16
Population: 27,800
Row Spacing (in): 30
Reps: 13
Previous Crop: Soybeans
Tillage: No-Till

Irrigation: None
Rainfall (in):



Introduction: Using a multi-hybrid planter, hybrids can ideally be placed to optimize production in stable management zones. This study compares two contrasting hybrids, one with a drought tolerant trait and one geared towards high production, placed in defined management zones *(Figure 1)*.

- The drought tolerant/**defensive hybrid**, Pioneer 1498, was placed in portions of the field that typically had lower water retention (dark grey).
- The **offensive hybrid**, Pioneer 1257, was placed in portions of the field that normally maintained adequate moisture across the growing season (light grey).
- Check strips of the opposing hybrid were placed in each zone as shown in Figure 1.

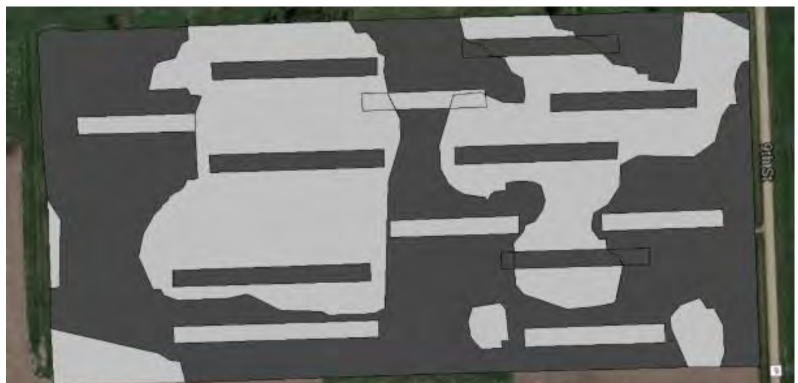


Figure 1. Management zones for defensive hybrid (dark grey), and offensive hybrid (light grey) with check strips of the opposing hybrid.

Management Zone Creation: Four data layers were used: 3 years of yield data, and deep electrical conductivity. These layers were clustered using Management Zone Analyst Version 1.0 (USDA ARS, University of Missouri, Columbia, MO).

Results: Within each zone, success of the offensive and defensive hybrid was evaluated by comparing the yield of the check strips to the yield in an adjacent strip of the hybrid assigned to that zone. Data were analyzed using the GLIMMIX procedure in SAS 9.4 (SAS Institute Inc., Cary, NC). Mean separation was performed with Fisher's LSD.

Treatment	P1498 (defensive hybrid) Yield (bu/acre)†	P1257 (offensive hybrid) Yield (bu/acre)†	P-:Value
Defensive Zone	225 B*	231 A	0.044
Offensive Zone	230 B	240 A	0.008

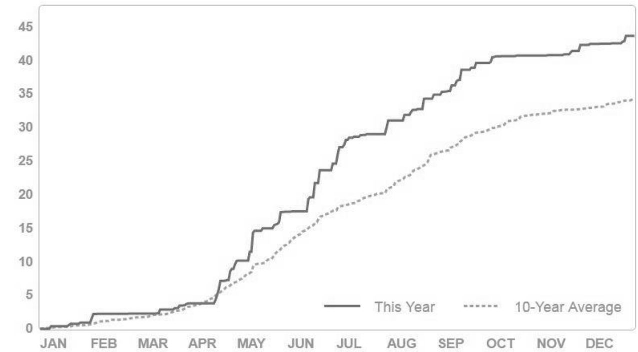
†Bushels per acre corrected to 15.5% moisture.
*Values with the same letter are not significantly different at a 95% confidence interval. Letters apply within zone.

Summary: At this location P1257 performed best in both the defensive and offensive zone. There was an average of 8 bu/acre difference between P1498 and P1257 in both zones. Above average precipitation likely contributed to the lack of difference in hybrid response within zones. Additional years of data need to be collected in order to verify zone delineation and hybrid selection.

Multi-Hybrid Planting for Corn Hybrid Placement

Study ID: 560155201601
County: Saunders
Soil Type: Nodaway silt loam; Pohocco silty clay loam; Steinauer clay loam; Yutan; eroded-Aksarben silty clay loams
Planting Date: 4/26/16
Harvest Date: 10/11/16-10/13/16
Population: 28,000
Row Spacing (in): 30
Reps: 6
Previous Crop: Soybeans

Irrigation: None
Rainfall (in):



Introduction: Using a multi-hybrid planter, hybrids can ideally be placed to optimize production in stable management zones. This study compares two contrasting hybrids, one with a drought tolerant trait and one geared towards high production, placed in defined management zones *(Figure 1)*.

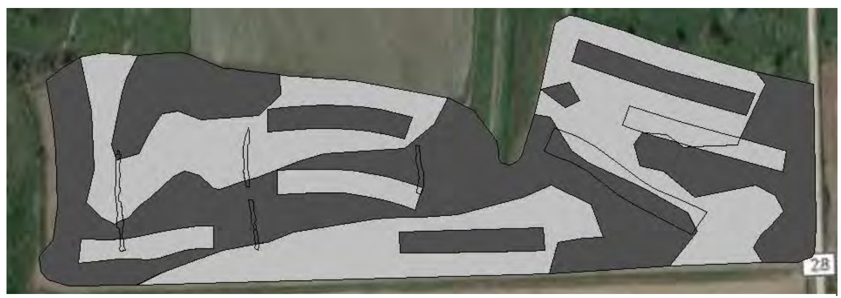


Figure 1. Management zones for defensive hybrid (dark grey), and offensive hybrid (light grey) with check strips of the opposing hybrid.

- The drought tolerant/**defensive hybrid**, Pioneer 1271, was placed in portions of the field that typically had lower water retention (dark grey).
- The **offensive hybrid**, Pioneer 1197, was placed in portions of the field that normally maintained adequate moisture across the growing season (light grey).

Management Zone Creation: Four data layers were used: 3 years of yield data, and deep electrical conductivity. These layers were clustered using Management Zone Analyst Version 1.0 (USDA ARS, University of Missouri, Columbia, MO).

Results: Within each zone, success of the offensive and defensive hybrid were evaluated by comparing the yield of the check strips to the yield in an adjacent strip of the hybrid assigned to that zone. Data were analyzed using the GLIMMIX procedure in SAS 9.4 (SAS Institute Inc., Cary, NC).

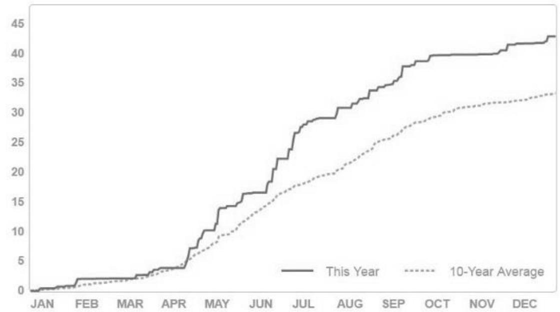
Treatment	P1271 (defensive hybrid) Yield (bu/acre)†	P1197 (offensive hybrid) Yield (bu/acre)†	P-Value
Defensive Zone	211 A*	209 A	0.843
Offensive Zone	212 A	212 A	0.919

†Bushels per acre corrected to 15.5% moisture.
*Values with the same letter are not significantly different at a 95% confidence interval. Letters apply within zone.

Summary: At this location, there was no difference in yield for the two hybrids in either zone. Lack of yield difference between hybrids and zones indicates zone structure or hybrid selection may need to be adjusted. Further years of data should be collected for verification and to guide restructuring of zones.

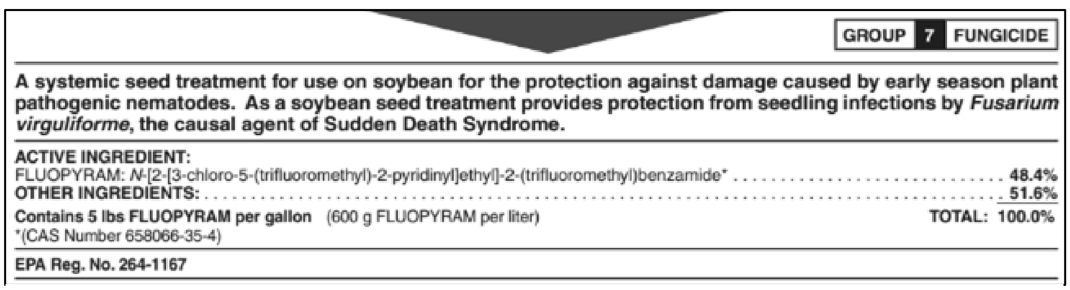
Multi-Hybrid Planting for Spatial Soybean Seed Treatments

Study ID: 180155201601
County: Saunders
Soil Type: Nodaway silt loam; Yutan eroded-Judson Complex
Planting Date: 5/15/16
Harvest Date: 10/13/16
Population: 165,000
Row Spacing (in): 30
Hybrids: Pioneer 31T11
Reps: 6
Previous Crop: Corn
Tillage: No-till
Herbicides: Pre: 2.8 oz/ac Enlite®, 1.7 lb/ac AMS, 30 oz/ac Durango®, 0.66 pt 2,4-D **Post:** 30 oz/ac Durango, 6 oz/ac Select®, 6 oz/ac Marvel™
Foliar Insecticides: Hero® 4 oz/ac
Foliar Fungicides: Priaxor® 4 oz/ac
Irrigation: None
Rainfall (in):



Introduction: Sudden Death Syndrome (SDS) is caused by the soil borne fungus *Fusarium solani f. sp. glycines*. While this is a relatively new disease for Nebraska soybean farmers, there are several locations in the state where significant percentages of fields are being affected. In fields where SDS is present and soybean cyst nematode is also present, the disease can be more severe. There are not clear guidelines to determine at what point a field will have enough increase in yield to justify treatment and, therefore, on-farm research projects like this one are needed.

ILeVO® is a seed treatment marketed by Bayer CropScience for SDS and also has nematode activity (product information at right). This field was selected due to the presence of SDS in the 2014 soybean crop. Two treatments were selected to test the efficacy of the ILeVO seed treatment.



GROUP 7 FUNGICIDE

A systemic seed treatment for use on soybean for the protection against damage caused by early season plant pathogenic nematodes. As a soybean seed treatment provides protection from seedling infections by *Fusarium virguliforme*, the causal agent of Sudden Death Syndrome.

ACTIVE INGREDIENT:
FLUOPYRAM: *N*-[2-[3-chloro-5-(trifluoromethyl)-2-pyridinyl]ethyl]-2-(trifluoromethyl)benzamide* 48.4%
OTHER INGREDIENTS: 51.6%
Contains 5 lbs FLUOPYRAM per gallon (600 g FLUOPYRAM per liter) **TOTAL: 100.0%**
*(CAS Number 658066-35-4)

EPA Reg. No. 264-1167

Product information from: *http://www.agrian.com/pdfs/ILeVO_Label1.pdf*

A: Standard soybean treatment (for this study PPST 2030® + Evergol Energy® + Gaucho® + Allegiance® was used)

B: Standard soybean treatment plus ILeVO at a rate of 1.18 fl oz/140,000 seed unit

The additional capabilities of the Multi-Hybrid planter allowed for site specific application of ILeVO in the portions of the field that historically show the effects of SDS *(Figure 1)*. This site specific application of ILeVO can reduce input costs while still effectively managing SDS pressure.

Figure 1. Management zones for soybean treated with ILeVO (dark grey) and without ILeVO (light grey) with check strips of the opposing seed treatment.

- Seed treated with the grower's standard seed treatment was placed in portions of the field where yield loss due to SDS was not typically seen (light grey).
- Seed treated with standard seed treatment plus ILeVO was placed in portions of the field that typically had yield reductions due to SDS (dark grey).
- Check strips of the opposing seed treatment strategy were placed in each zone as shown in Figure 1.

Management Zone Creation: Three years of yield data displaying portions of low yields due to SDS were used for clustering.

Results: Within each zone, success of the ILeVO treated and untreated seed were evaluated by comparing the yield of the check strips to the yield in an adjacent strip of the treatment assigned to that zone. Yield data were analyzed using the GLIMMIX procedure in SAS 9.4 (SAS Institute Inc., Cary, NC).

Foliar disease symptoms were assessed using Southern Illinois University at Carbondale's Method of SDS scoring. The disease symptoms were assessed using a 1 to 9 scoring system, with a score of 1 indicating the least symptoms and 9 indicating premature death. In addition, the overall incidence of affected plants was determined. These two scores were combined to create the disease index (DX). DX = disease incidence x disease severity/9. Disease assessments were conducted on August 31, 2016 and September 8, 2016.

Treatment	Disease Severity	Disease Incidence (%)	Disease Index (DX)	Disease Severity	Disease Incidence (%)	Disease Index (DX)
	-----------Aug 31, 2016-----------			-----------Sept. 8, 2016-----------		
Standard Treatment + ILeVO	1	1	0.11	1.07	7.14	0.84
Standard Treatment	1.5	5.7	1.28	2.3	11	2.56

Treatment	Standard + ILeVO® Yield (bu/acre)†	Standard Treatment Yield (bu/acre)	P-Value
Standard Treatment + ILeVO® Zone	75 A	72 A	0.355
Standard Treatment Zone	77 A	74 A	0.243

†Bushels per acre corrected to 13% moisture.

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

Treatment	Standard + ILeVO® Marginal Net Return ($/ac)‡	Standard Treatment Marginal Net Return ($/ac)
Standard Treatment + ILeVO® Zone	678.58	650.83
Standard Treatment Zone	712.25	684.50

‡Marginal Net Return calculated using $9.25/bu soybeans and $15.17/ac ILeVO seed treatment cost ($10.19/oz).

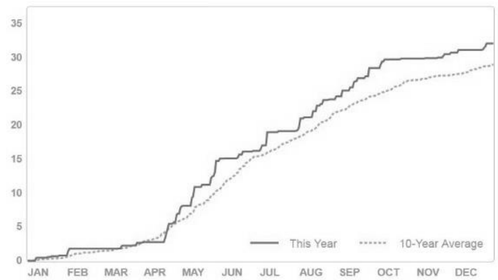
Summary: At this site, there was no difference in grain yield for the ILeVO versus standard seed treatment in either the ILeVO treatment zone or the standard seed treatment zone. While not enough disease ratings were collected to do any statistical analysis, general trends could suggest that the Standard + ILeVO treatment had lower disease severity, incidence, and index on both dates than the Standard treatment. Overall, the disease ratings observed would be considered low. Both treatments appeared to have an increase in the disease index at the later sampling date.

This study sponsored in part by: Bayer CropScience LP

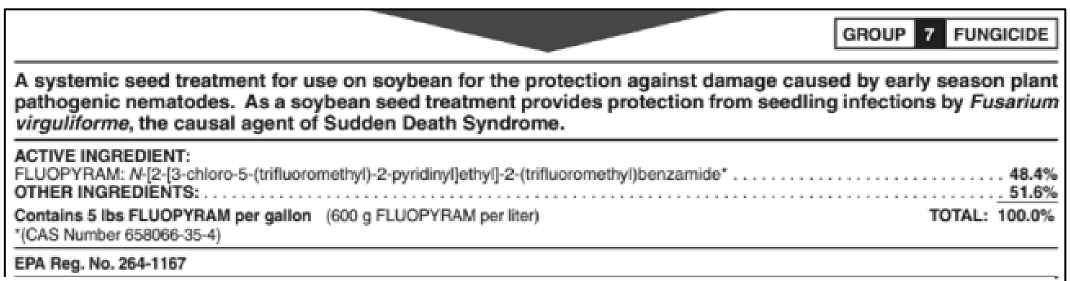
Multi-Hybrid Planting for Spatial Soybean Seed Treatments

Study ID: 614159201601
County: Seward
Soil Type: Muir silt loam; Muir silty clay loam; Hobbs silt loam
Planting Date: 6/7/16
Harvest Date: 10/11/16, 10/19/16
Population: 170,000
Row Spacing (in): 30
Hybrids: Pioneer 31T11
Reps: 11
Previous Crop: Corn
Tillage: Conventional Till

Seed Treatment: none, other than those being studied
Irrigation: 4"
Rainfall (in):



Introduction: Sudden Death Syndrome (SDS) is caused by the soil borne fungus *Fusarium solani f. sp. glycines*. While this is a relatively new disease for Nebraska soybean farmers, there are several locations in the state where significant percentages of fields are being affected. In fields where SDS is present and soybean cyst nematode is also present, the disease can be more severe. There are not clear guidelines to determine at what point a field will have enough increase in yield to justify treatment and, therefore, on-farm research projects like this one are needed.



GROUP 7 FUNGICIDE

A systemic seed treatment for use on soybean for the protection against damage caused by early season plant pathogenic nematodes. As a soybean seed treatment provides protection from seedling infections by *Fusarium virguliforme*, the causal agent of Sudden Death Syndrome.

ACTIVE INGREDIENT:
FLUOPYRAM: *N*-[2-[3-chloro-5-(trifluoromethyl)-2-pyridinyl]ethyl]-2-(trifluoromethyl)benzamide* 48.4%
OTHER INGREDIENTS: 51.6%
Contains 5 lbs FLUOPYRAM per gallon (600 g FLUOPYRAM per liter) **TOTAL: 100.0%**
*(CAS Number 658066-35-4)

EPA Reg. No. 264-1167

Product information from: *http://www.agrian.com/pdfs/ILeVO_Label1.pdf*

ILeVO® is a seed treatment marketed by Bayer CropScience for SDS and also has nematode activity (label at right). This field was selected due to the presence of SDS in the 2014 soybean crop. Two treatments were selected to test the efficacy of the ILeVO® seed treatment.

A: Standard soybean treatment (for this study PPST 2030® + Evergol Energy® + Gaucho® + Allegiance® was used)

B: Standard soybean treatment plus ILeVO at a rate of 1.18 fl oz/140,000 seed unit

The additional capabilities of the Multi-Hybrid planter allow for site specific application of ILeVO in the portions of the field that historically show the effects of SDS. This site specific application of ILeVO can reduce input costs while still effectively managing SDS pressure.

Management Zone Creation: Historical yield data showing the possible extent of Sudden Death Syndrome was not available for this field site, therefore a traditional strip trial method was used *(Figure 1)*. This will allow for future delineation of management zones after determining the extent of SDS throughout treated and untreated strips.

Figure 1. Strip trial design for soybean treated with ILeVO (dark grey) and without ILeVO (light grey).

Results: Yield of ILeVO treated and untreated seed were evaluated. Data were analyzed using the GLIMMIX procedure in SAS 9.4 (SAS Institute Inc., Cary, NC).

Foliar disease symptoms were assessed using Southern Illinois University at Carbondale's Method of SDS scoring. The disease symptoms were assessed using a 1 to 9 scoring system, with a score of 1 indicating the least symptoms and 9 indicating premature death. In addition, the overall incidence of affected plants was determined. These two scores were combined to create the disease index (DX). DX = disease incidence x disease severity/9. Disease assessments were conducted on 8/31/16 and 9/8/16.

Treatment	Disease Severity	Disease Incidence (%)	Disease Index (DX)	Disease Severity	Disease Incidence (%)	Disease Index (DX)
	---------------Aug 31, 2016------------			--------------Sept. 8, 2016--------------		
Standard Treatment + ILeVO®	0.25	1	0.0028	0.96	4.42	0.47
Standard Treatment	1.82	7.16	1.44	2.44	15.32	4.14
P Value	N/A	N/A	N/A	N/A	N/A	N/A

Treatment	Yield (bu/acre)†	Marginal Net Return ($/ac)‡
Standard Treatment + ILeVO®	68 A	613.37
Standard Treatment	64 B	592.00
P-Value	0.0033	N/A

†Bushels per acre corrected to 13% moisture.

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

‡ Marginal Net Return based on $9.25/bu soybeans, $15.63/acre ILeVO seed treatment cost ($10.19/oz).

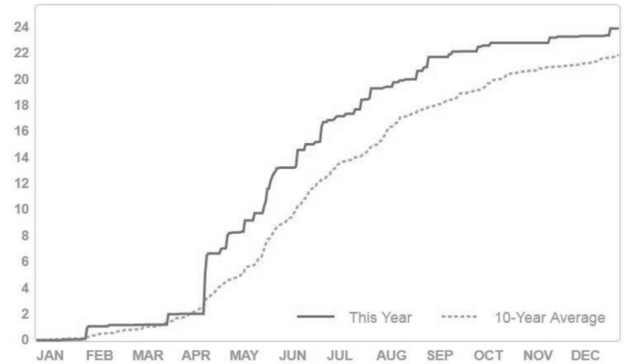
Summary: The standard + ILeVO treated seed had higher grain yields than the standard treatment. The increase in yield covered the additional seed treatment cost and resulted in higher marginal net return. Disease ratings were not collected for all replications, therefore, no statistical analysis could be performed. All disease observations recorded are considered low disease levels.

This study sponsored in part by: Bayer CropScience LP

Sustainability of Replacing Summer Fallow with Grain-type Field Peas in Semiarid Cropping Systems

Study ID: 174029201602
County: Chase
Soil Type: Blackwood loam
Reps: 8
Tillage: No-Till

Rainfall (in):



Objective: Grain-type field peas are a cool season grain crop (mid-March to late-July) that are typically grown as an alternative for no-till summer fallow in semiarid cereal-based no-till cropping systems, such as wheat-corn-fallow or wheat-fallow. The objective of this study was to compare the impact of field peas versus no-till summer fallow on the following parameters:

1. Soil nutrient cycling, soil microbial activity, soil water infiltration
2. Beneficial insects and microorganisms
3. Water use (e.g., evapotranspiration)
4. Yield of succeeding wheat crop
5. Profitability

Research site and experiment: This two-year rotation study was conducted on a cooperator's field located in Chase County near Enders, NE from March-2015 until July-2016. The field site has been historically operated under no-till in a wheat-corn-fallow rotation with Blackwood loam as the predominant soil type.
The strip trial was set as pairwise (side-by-side) comparison of field peas versus summer fallow with 8 replications (total of 16 strips evaluated, each being 60 ft × 2,650 ft long) *(Figure 1)*. Field peas cultivar Salamanca was inoculated (Cell Tech liquid inoculate) and drilled (10-inch drill) in strips at 180 lb/ac seeding rate on March 27, 2015. There was good establishment and nodulation, and the field pea crop was harvested on July 20, 2015. Winter wheat was planted across the whole field on Sep 14, 2015 and was harvested in strips on July 15, 2016 to evaluate the rotational effects of the treatments on wheat yield and yield quality.

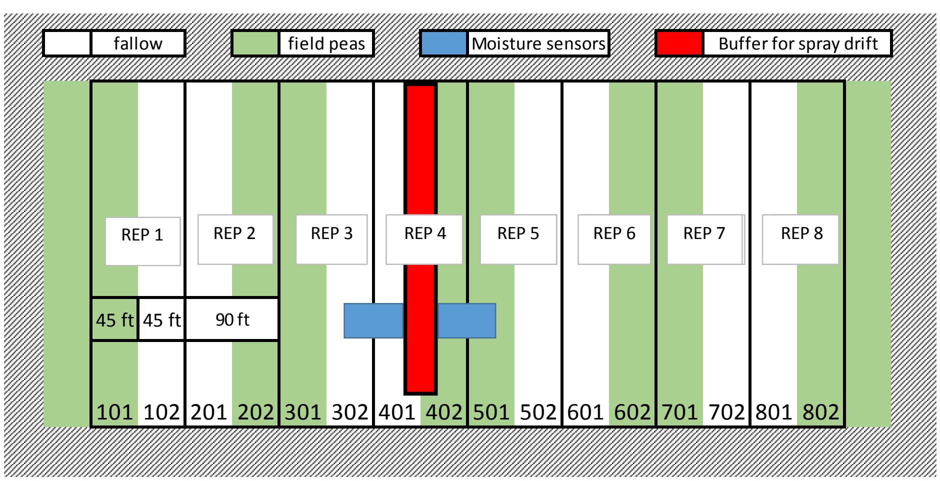


Figure 1. Plot layout of field pea and fallow strips.

Results:

Soil nutrient cycling, soil microbial activity, and soil water infiltration

Concentrations of soil nutrients (N, P, and K) did not differ between field peas and fallow at any time during the 2-year rotation study *(Table 1)*.

- Solvita test after wheat planting in the fall and in the spring had higher soil-microbial activity and annual nitrogen (N) release in areas of the field where field peas were grown. Solvita test did not differ between field peas and fallow after wheat harvest in 2016 *(Table 1)*.
- Rotational benefit from N being fixed from field peas may already have been scavenged by wheat or is likely to be seen in the next cash crop (corn/sorghum).
- The initial soil water infiltration (1 inch; *Figure 2)* was collected after wheat harvest by taking 4 subsamples in 6 replications. To infiltrate 1 inch of water it took on average 174 seconds for fallow treatment as compared to 87 seconds for the field peas treatment.

Figure 2. Soil water infiltration test conducted following wheat harvest.

Table 1. Seasonal changes in soil nitrate (NO_3), phosphorous (P), potassium (K), and microbial activity (Solvita test) for the field peas and fallow treatments in 2015 in Chase County.

Date*	Treatment	Depth	NO3-N		P	K	Solvita	
		inches	ppm	lb/ac	ppm	ppm	CO_2-C ppm	lb of N /ac/year
Mar. 27, 2015	Baseline	0-8	8.5	20	23	389		
		0-8	8.1	19	26	365		
Sep. 14, 2015	Field pea	0-4	16.5	20	69	515		
		5-8	11.1	13	33	451		
	Fallow	0-4	19.3	23	61	598		
		5-8	8.8	11	21	488		
Oct. 16, 2015	Field pea	0-12	16.8	60	24	424	52.3	42
		12-24	11.2	40	14	361		
		24-36	12.0	43	13	442		
	Fallow	0-12	26.4	95	90	431	27.7	22
		12-24	9.7	35	9	340		
		24-36	13.0	47	9	519		
Mar. 16, 2016	Field pea	0-12	2.6	9	37	514	71.6	57
		12-24	1.5	5	9	344		
		24-36	2.9	10	2	452		
	Fallow	0-12	2.0	7	41	457	59.7	48
		12-24	2.2	8	4	338		
		24-36	1.8	6	4	506		
Aug. 30, 2016	Field pea	0-4	10.6	13	46	609	11.7	9
		0-12	4.0	14	22	552	8.5	7
		12-24	0.1	0	2	347		
		24-36	0.1	0	2	428		
	Fallow	0-4	7.4	9	70	623	14.0	11
		0-12	4.0	14	37	479	14.0	11
		12-24	1.3	5	11	323		
		24-36	1.1	4	2	449		

*Mar. 27, 2015 (prior to field pea planting), Sep. 14, 2015 (after field pea harvest, before wheat planting), Oct. 15, 2016 (fall after wheat plating), Mar. 16, 2016 **(**wheat in spring), Aug. 30, 2016 (after wheat harvest).

Beneficial insects and microbes

Beneficial microbial analysis showed that more diverse species were recovered in the wheat plants following field peas as compared to following fallow *(Table 2)*. Extraction of mycorrhiza spores showed an average count of 16.5 in pea rhizosphere compared to average count of 8 from the fallow plots. There was no significant difference in terms of foliar disease levels between wheat samples following peas compared to wheat samples following fallow, although non-pathogenic *Fusarium* species were recovered from the root of samples from both treatments.

Planting field peas positively affected the diversity of microorganisms that could be beneficial on the next year's wheat. The beneficial bacteria recovered from the wheat has the potential to stop or reduce the impact of field pea disease/pathogens.

Table 2. Isolates recovered from wheat rhizosphere.

Wheat after fallow	Wheat after field pea
Bacillus megaterium	*Bacillus megaterium*
(multiple strains)	*Bacillus pumilus*
	Lysinibacillus fusiformis

In 2015, field peas supported higher numbers of insects and more diversity of insects than fallow *(Table 3)*. In particular, there were a greater number of beneficial predators (wolf spiders, rove beetles, hoverflies), parasitoid wasps, and decomposers (dung beetles and carrion beetles), but also a greater number of potential pests (click beetles and leafhoppers). In 2016, aphids were lower and some natural enemies (crab spiders and parasitoid wasps) were higher in wheat following field peas *(Table 3)*.

Table 3. Numbers of beneficial insects and potential pests in fallow and field pea treatments. Cells highlighted in grey signify significantly higher insect numbers at 0.05 significance level.

Insect group	Species	Fallow	Field pea
	----------Pitfall traps 2015----------		
Predators	Wolf Spiders	2.1 B*	4.8 A
	Flat Bark Beetles	1.7 B	20.6 A
	Rove Beetles	6.3 B	17.0 A
	Ants	1.1 B	4.0 A
Parasitoids	Chalcid Wasps	0.7 B	1.5 A
Decomposers	Dung Beetles	0.1 B	2.6 A
	Carrion Beetles	1.9 B	20.6 A
	Minute Brown Scavenger Beetles	53.2 A	15.9 B
Potential Pests	Click Beetles (adult wireworms)	2.3 B	8.6 A
	Sap Beetles	10.2 B	110.2 A
	Leafhoppers	0.4 B	10.4 A
	Bark Lice	31.7 A	1.9 B
	---------- Sweep nets 2015 ----------		
Predators	Crab Spiders	0.0 B	1.4 A
	Long-jawed Orb Weaver Spiders	0.0 B	0.8 A
	Hover Flies	0.0 B	0.9 A
Insect group	**Species**	**Wheat after fallow**	**Wheat after field pea**
	---------- Pitfall traps 2016 ----------		
Potential Pests	Aphids	31.8 A	1.6 B
	---------- Sweep nets 2016 ----------		
Predators	Crab Spiders	2.0 B	3.1 A
	Parasitoid Wasps	1.3 B	2.0 A

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

Water use and crop yield

Water use data indicated that field peas used 10.9 inches of water to produce 36 bu/ac yield, which resulted in crop water productivity of 3.3 bushel per acre-inch, Table 4. Whereas, fallow used 6.0 inches of water without producing any grain. Available soil water at wheat planting (top 4 foot) was 3.2 inches less after field peas as compared to fallow treatment, which resulted in a 18 bu/ac yield penalty in wheat at the end of the season. Seasonal soil water dynamics are summarized in Figure 3. Note that the soil water level for the wheat after field peas (green line) was below the 50% of field capacity line for most of the growing season which likely led to the lower yield compared to the wheat after fallow treatment *(Figure 3b)*.

Table 4. Grain yield, seasonal evapotranspiration (ET), and soil water status at the beginning and end of the growing season for the field pea (3 feet soil profile) and wheat (4 feet soil profile) treatments; yields with different letters indicate significantly different wheat yield.

Period	Treatment	beginning soil water	ending soil water	ET	Yield (bu/ac)
3-27-15 to 7-20-15	Field peas	6.0	3.0	10.9	36
	Fallow	6.0	6.0	6	
9-14-15 to 07-15-16	Wheat after field peas	5.8	3.5	NA	74 B
	Wheat after fallow	8.0	4.3	NA	92 A

3-27-2015 field peas planted, 7-20-2015 field peas harvested, 9-14-2015 wheat planted, 7-15-16 wheat harvested

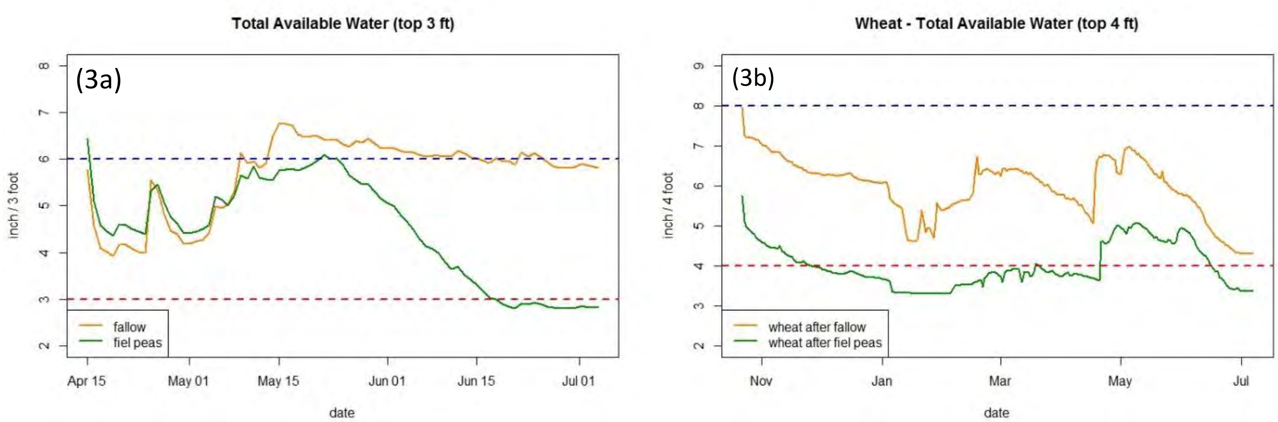


Figure 3a and 3b. Seasonal dynamics in soil water availability for field peas in the top 3 foot soil profile and wheat in the top 4 foot soil profile. An estimate of field capacity (FC; blue line) and 50% of FC (red line; level of soil water at which most crops exhibit drought stress) are shown for the Blackwood loam soil.

Profitability

Table 5 shows the input costs for the field pea-wheat and fallow-wheat rotations. At current price of wheat at $3/bu and field peas at $6/bu, field pea-wheat has a $62/acre profitability advantage over fallow-wheat rotation *(Table 6)*. Based off of the results of this study, wheat prices need to be higher to provide a profitability advantage of fallow over field pea.

Table 5. Input costs ($/ac) for field pea-wheat and fallow-wheat rotation

Input	Product	Rate	Field pea ($/ac)	Fallow ($/ac)
insurance	crop insurance	$69.41/ac	7.22	NA
planting			11.23	NA
spraying			4.23	NA
seed	Salamanca	3.3 bu/ac	45.00	NA
inoculant	Cell-tech dry and liquid		12.00	NA
Herbicide mix			28.20	NA
herbicide	Sharpen	1.5 oz/ac		
herbicide	Pendimethalin	1.5 oz/ac		
herbicide	RT3 (Round-up)	22 oz/ac		
harvest			24.10	NA
spraying			4.23	NA
Herbicide mix			14.92	NA
herbicide	Honcho (Round-up)	labeled		
herbicide	Latigo (generic 2,4-D)	labeled		
spraying			NA	4.23
Herbicide mix			NA	14.92
herbicide	Honcho (Round-up)	labeled		
herbicide	Latigo (generic 2,4-D)	labeled		
spraying			NA	4.23
Herbicide mix			NA	14.92
herbicide	Honcho (Round-up)	labeled		
herbicide	Latigo (generic 2,4-D)	labeled		
spraying			NA	4.23
Herbicide mix			NA	14.92
herbicide	Honcho (Round-up)	labeled		
herbicide	Latigo (generic 2,4-D)	labeled		
insurance	after fallow	$138.31/ac	NA	7.45
insurance	after field pea	$89.71/ac	10.54	NA
fertilizer	dry mix + application		30.50	30.50
planting			11.23	11.23
starter	fertilizer 10-34-0 + mix	3 gal/ac	23.00	23.00
seed	Winterhawk cert/treat	65 bu/ac	15.20	15.20
Fertilizer/Herbicide			35.91	35.91
fertilizer	10-20-0-0.5	10 gal/ac		
herbicide	Affinity + Barrage	36.4 + 3.55 oz/ac		
harvest	NA	NA	24.10	24.10
Total costs			301.61	204.84

Table 6. Field pea-wheat profitability advantage over fallow-wheat rotation (shaded) for a given range of wheat and field pea market prices.

		Field pea ($/bu)						
		4.00	5.00	6.00	7.00	8.00	9.00	10.00
Wheat ($/bu)	3.00	-10	26	62	98	134	170	206
	4.00	-29	7	43	79	115	151	187
	5.00	-48	-12	24	60	96	132	168
	6.00	-67	-31	5	41	77	113	149
	7.00	-86	-50	-14	22	58	94	130
	8.00	-105	-69	-33	3	39	75	111
	9.00	-124	-88	-52	-16	20	56	92
	10.00	-143	-107	-71	-35	1	37	73

Conclusions: Field peas have potential to be used as an alternative to no-till summer fallow in wheat-fallow and wheat-corn-fallow rotations to increase the sustainability of crop production in western Nebraska. Preliminary results show that replacing fallow with field peas can increase soil microbial activity and soil water infiltration, provide habitat for greater number of beneficial insects and microorganisms, have more efficient cropping system water use, and be more profitable than no-till summer fallow.

Weather conditions throughout the experiment favored growth and production of field peas, thereby more research is needed to replicate this study in dry years to capture worst case scenarios. No-till summer fallow remains an important water conservation practice in western Nebraska.

Field Pea Planting Population Summary Report
2015 – 2016

This summary combines planting population data from a report in 2015 (175135201501) and two reports in 2016 (624135201601, 175135201601).

Study Objective: Grain-type field peas are a cool season grain crop (mid-March to late-July) typically grown as an alternative to no-till summer fallow in semiarid cereal-based no-till cropping systems such as wheat-corn-fallow and/or wheat-fallow. Very little information is available on how field peas respond to different the agronomic practices in semiarid Nebraska. **The objective of this study was to determine economically optimal planting (EOP) population to grow field peas in western Nebraska.** The EOP can be defined as a population that maximizes profit made on investment, which in this case is seed.

Research Sites and Experimental Design: Three studies investigating the effects of different planting populations on field pea grain yield were conducted in 2015 (one study) and 2016 (two studies) under an established no-till system at three different sites in Perkins County. The experiment was set up as a randomized complete block design with seven treatments (seeding rates) replicated four times. The choice of seeding rates was based on current recommended plant population of 310,000 plants/acre and three populations under and over that recommendation.

Drills were calibrated for seeding rate (seed/lb) by dividing targeted plant population (plants/acre) by a multiplier of seeding weight (seed/lb) and percent germination rate for each particular field pea cultivar (DS Admiral in 2015, Salamanca in 2016). Studies were planted in strips that varied depending on the size of the planter (40 or 45 feet wide). Each strip was 300 feet long. Plant population data (plants ft^{-2}) was collected after the crop had an established stand (V3-V5 growth stage). Plant population counts were recorded in each strip by conducting four independent counts each consisting of a 25 ft^2 area. Grain yield data were collected by harvesting the middle 30 feet of each strip and a grain cart with built-in scale was used to record grain weight. A subsample of grain was taken from each strip for grain moisture content. Final grain yields were adjusted to 12% moisture for each strip. Yield response to actual plant population (plants/acre) was modeled using asymptotic regression model.

Results:
Data were analyzed using R: A language and environment for statistical computing. R Development Core Team (2016). R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, http://www.R-project.org.

Overall, yield response to plant population was linear at low densities (0 to 150,000 plants/acre), then continued to increase with decreasing rate (150,000-200,000 plants/acre), beginning to plateau at about 200,000 plants/acre, and reached its maximum at approximately 310,000 plants/acre *(Figure 1)*. Yield in 2015 was higher (33 bu/ac yield) than in 2016 (25-26 bu/ac yield) regardless of population density. Although yield response at populations higher than 310,000 plants/ac was seldom observed, there is an indication that for yield goals higher than 30 bu/ac increasing seeding rate may be justified.

Assumptions for calculating EOP:

- Field peas variety has 2,100 seeds/lb, test weight of 60 lb/bu at 12% moisture, and 90% germination
- Hail event or some other factor that may reduce stand count after emergence does not occur
- Price to purchase certified field pea seed = $15/bu
- Price of field peas on the market = $7/bu

According to the results of our three site-year study and using the aforementioned assumptions, the economically optimal population (i.e. maximum profit) for field peas is 220,000 plants/acre, which corresponds to a 116 lb of seed/acre seeding rate *(Figure 2)*. A penalty of $0.19/acre may occur for each additional pound of seed planted over this EOP. The current practice of many farmers in Central Great Plains is 180 to 200 lb/acre; therefore, EOP may save them up to $16/acre. Planting higher populations to maximize yield potential is not always the best economic strategy due to the asymptotic nature of yield response to planting density.

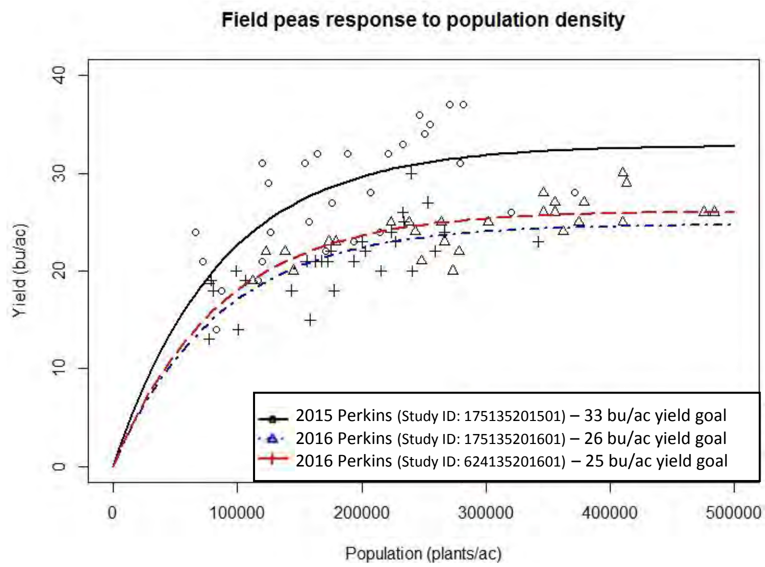


Figure 1. Field pea response to population density for three site years.

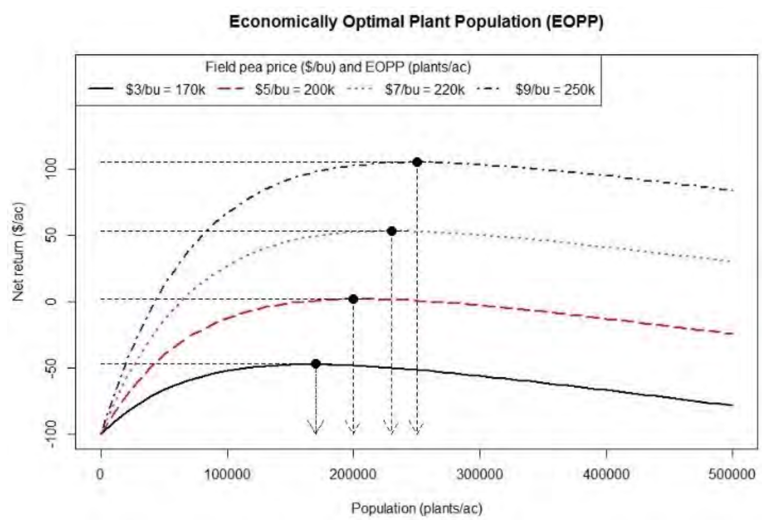


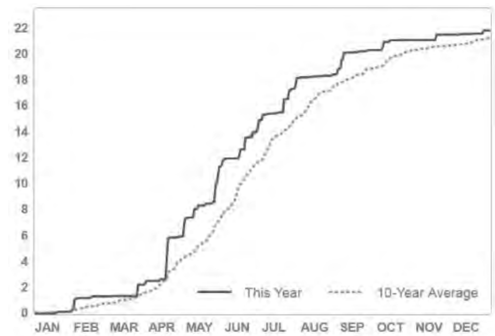
Figure 2. Economically optimum population: profitability as affected by field pea population and price of field peas on the market.

Conclusion: Although this study shows the potential for reduction in field pea population without lowering profits, these results are yet to be confirmed in additional production years and/or locations and should be considered cautiously until further research is completed and results validated. Current recommendations for field peas seeding rates range from 180 to 200 lb/ac. UNL has been awarded a Research and Extension SARE grant for additional field pea research (2017-2020).

Field Pea Planting Population

Study ID: 175135201601
County: Perkins
Soil Type: Mace silt loam, 1-3% slopes; Rosebud-Canyon loams, 1-3% slopes
Reps: 4
Variety: Salamanca
Tillage: No-Till

Rainfall (in):



Study Objective: Grain-type field peas are a cool season grain crop (mid-March to late-July) typically grown as an alternative to no-till summer fallow in a semiarid cereal-based no-till cropping system such as wheat-corn-fallow and/or wheat-fallow. Very little information is available on how field peas respond to different agronomic practices in semiarid Nebraska. **The objective of this study was to determine the economically optimal planting (EOP) population to grow field peas in western Nebraska.** The EOP can be defined as a population that maximizes profit made on investment, which in this case is seed.

Research Sites and Experimental Design: The study investigating the effects of different planting populations on field pea grain yield was conducted in 2016 under an established no-till system in Perkins County. The experiment was set up as a randomized complete block design with seven treatments (seeding rates) replicated four times. The choice of seeding rates was based on current recommended plant population of 310,000 plants/acre and three populations under and over that recommendation.

The drill was calibrated for seeding rate (seed/lb) by dividing targeted plant population (plants/acre) by multiplier of seeding weight (seed/lb) and percent germination rate for the field pea cultivar Salamanca. The study was planted in strips that were 40 feet wide and 300 feet long. Plant population data (plants/ft^2) was collected after the crop had an established stand (V3-V5 growth stage). Population counts were conducted in each strip by conducting four counts from a 25 ft^2 area. Grain yield data was collected by harvesting the middle 30 feet of each strip; a grain cart with built-in scale was used to record grain weight; and a subsample of grain was taken from the combine to record grain moisture content. Final grain yield was adjusted to 12% moisture for each strip. Yield response to actual plant population (plants/acre) was modeled using asymptotic regression model.

Results:
Data were analyzed using R: A language and environment for statistical computing. R Development Core Team (2016). R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, http://www.R-project.org.

Yield response to plant population increased linearly from 15-20 bu/ac at low densities (0 to 150,000 plants/acre), then continued to increase from 20-24 bu/ac with decreasing rate at medium densities (150,000-200,000 plants/acre), then started to plateau from 24-26 bu/ac at about 200,000 plants/acre, and reached its maximum at approximately 310,000 plants/acre *(Figure 1)*. Yield response at populations higher than 310,000 plants/ac was seldom observed; therefore, the effects of plant population for yield goals higher than 26 bu/ac need to be further investigated.

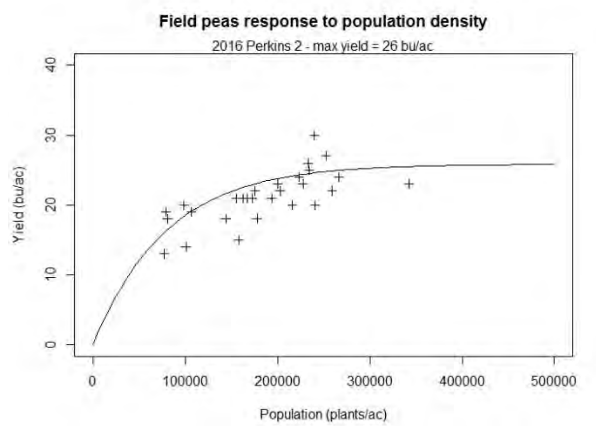


Figure 1. Field pea response to population density for three site years.

Assumptions for calculating EOP:

- Field pea variety has 2,100 seeds/lb, test weight of 60 lb/bu at 12% moisture, and 90% germination
- Hail event or some other factor that may reduce stand count after emergence does not occur
- Price to purchase certified field pea seed = $15/bu
- Price of field peas on the market = $7/bu

According to the results of this study and using the aforementioned assumptions, the economically optimal population (i.e., maximum profit) for field peas is 220,000 plants/acre, which corresponds to a 116 lb of seed/acre seeding rate *(Figure 2)*. A penalty of $0.19/acre may occur for each additional pound of seed planted over this EOP. The current practice of many farmers in Central Great Plains is 180 to 200 lb/acre; therefore, EOP may save farmers up to $16/acre. Planting higher populations to maximize yield potential is not always the best economic strategy due to the asymptotic nature of yield response to planting density.

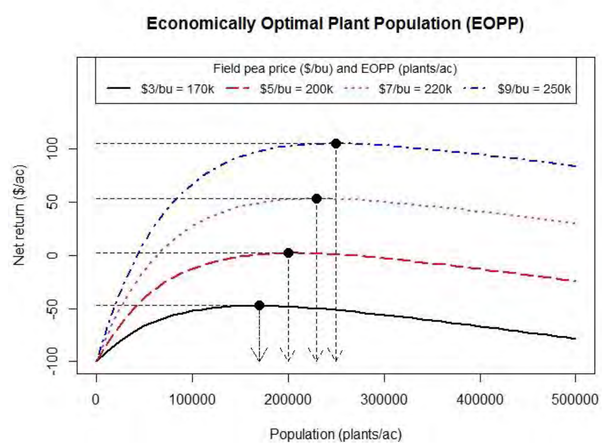


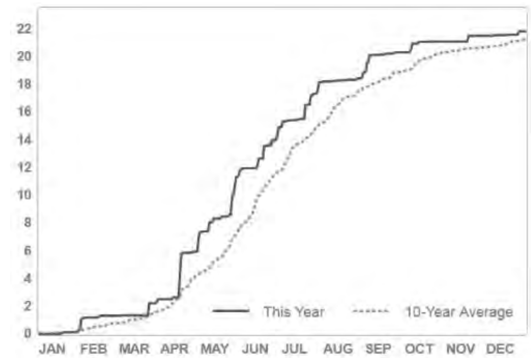
Figure 2. Economically optimum population: profitability as affected by field pea population and price of field peas

Conclusion: Although this study shows the potential for reduction in field pea population without lowering profits, these results are yet to be confirmed in additional production years and/or locations and should be taken with caution until further research is completed and the results have been validated. Current recommendations for field peas seeding rates range from 180 to 200 lb/ac. UNL has been awarded a Research and Extension SARE grant for additional field pea research (2017-2020).

Field Pea Planting Population

Study ID: 624135201601
County: Perkins
Soil Type: Mace silt loam, 0-1% slope
Variety: Salamanca
Tillage: No-Till

Rainfall (in):



Study Objective: Grain-type field peas are a cool season grain crop (mid-March to late-July) typically grown as an alternative to no-till summer fallow in a semiarid cereal-based no-till cropping systems such as wheat-corn-fallow and/or wheat-fallow. Very little information is available on how field peas respond to different agronomic practices in semiarid Nebraska. **The objective of this study was to determine the economically optimal planting (EOP) population to grow field peas in western Nebraska.** The EOP can be defined as a population that maximizes profit made on investment, which in this case is seed.

Research Sites and Experimental Design: The study investigating the effects of different planting populations on field pea grain yield was conducted in 2016 (two studies) under an established no-till system in Perkins county. The experiment was set up as a randomized complete block design with seven treatments (seeding rates) replicated four times. The choice of seeding rates was based on current recommended plant population of 310,000 plants/acre and three populations under and over that recommendation.

The drill was calibrated for seeding rate (seed/lb) by dividing targeted plant population (plants/acre) by a multiplier of seeding weight (seed/lb) and percent germination rate for the field pea cultivar Salamanca. The study was planted in strips that were 40 feet wide and 300 feet long. Plant population data (plant/ft^2) was collected after the crop had an established stand (V3-V5 growth stage). Population counts were conducted in each strip by conducting four counts from a 25 ft^2 area. Grain yield data was collected by harvesting the middle 30 feet of each strip; a grain cart with built-in scale was used to record grain weight; and a subsample of grain was taken from the combine to record grain moisture content. Final grain yield was adjusted to 12% moisture for each strip. Yield response to actual plant population (plants/acre) was modeled using asymptotic regression model.

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Overall, yield response to plant population increased linearly from 15-20 bu/ac at low densities (0 to 150,000 plants/acre), then continued to increase from 20-24 bu/ac with decreasing rate at medium densities (150,000-200,000 plants/acre), ten started to plateau from 24-25 bu/ac at about 200,000 plants/acre, and reached its maximum at approximately 310,000 plants/acre *(Figure 1)*. Yield response at populations higher than 310,000 plants/ac was seldom observed; therefore, the effects of plant population for yield goals higher than 25 bu/ac need to be further investigated.

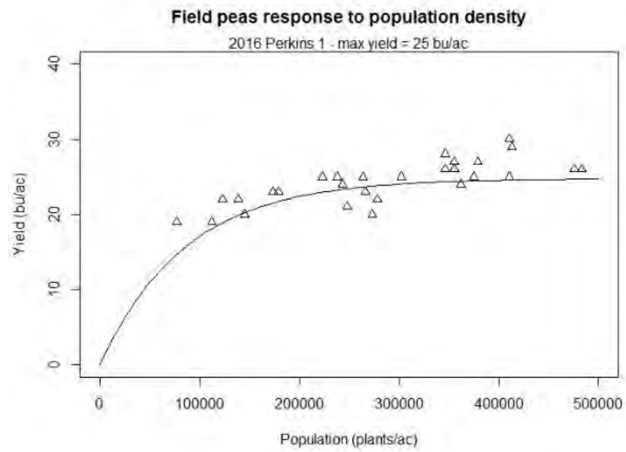

Figure 1. Field pea response to population density for three site years.

Assumptions for calculating EOP:

- Field pea variety has 2100 seeds/lb, test weight of 60 lb/bu at 12% moisture, and 90% germination
- Hail event or some other factor that may reduce stand count after emergence does not occur
- Price to purchase certified field pea seed = $15/bu
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According to the results of this study and using the aforementioned assumptions, the economically optimal population (i.e., maximum profit) for field peas is 220,000 plants/acre, which corresponds to a 116 lb of seed/acre seeding rate *(Figure 2)*. A penalty of $0.19/acre may occur for each additional pound of seed planted over this EOP. The current practice of many farmers in Central Great Plains is 180 to 200 lbs/acre; therefore, EOP may save farmers up to $16/acre. Planting higher populations to maximize yield potential is not always the best economic strategy due to the asymptotic nature of yield response to planting density.

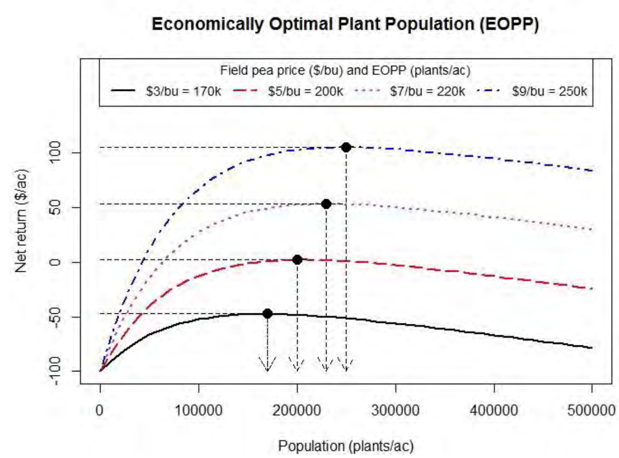
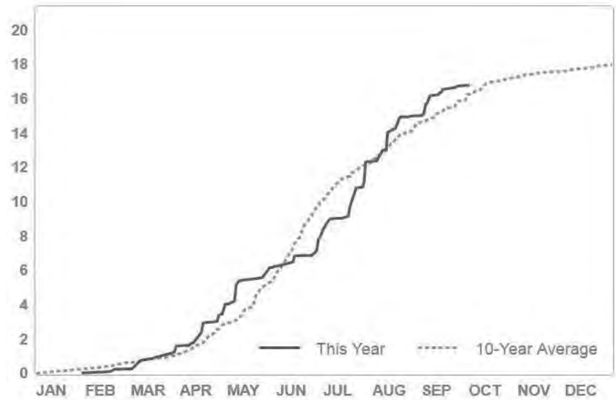


Figure 2. Economically optimum population: profitability as affected by field pea population and price of field peas

Conclusion: Although this study shows the potential for reduction in field pea population without lowering profits, these results are yet to be confirmed in additional production years and/or locations and should be taken with caution until further research is completed and results have been validated. Current recommendations for field peas seeding rates range from 180 to 200 lb/ac. UNL has been awarded a Research and Extension SARE grant for additional field pea research (2017-2020).

Non-Irrigated Dry Edible Pea Population Study

Study ID: 600013201601
County: Box Butte
Soil Type: Keith loam; Creighton very fine sandy loam
Planting Date: 4/12/16
Harvest Date: 7/15/16
Population: varies
Row Spacing (in): 7.5
Hybrid: Midas
Reps: 4
Previous Crop: Wheat
Tillage: Straight line pre-plant disking, 2 times
Herbicides: ***Pre:*** 2 oz/acre Sharpen® on 4/20/16
Post: Dessicant of 2 oz/acre Sharpen® and 8 oz/acre Destiny® crop oil on 7/12/16
Seed Treatment: Inoculated with N-Charge® peat base and Primo GX2 in small seeder attachment
Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: 16 lb/acre N, 20 lb/acre P, 10 lb/acre S, 4 lb/acre Zn, and humic acid as dry fertilizer in March
Note: Very dry June created crop stress and low yields.
Irrigation: None
Rainfall (in):



Introduction: Dry edible pea production has been on the increase for several years with 40,000 to 50,000 acres grown annually in the western Nebraska region. This study evaluated three different populations of dry edible peas under dryland farming conditions to help evaluate the optimal population, looking at both yield and economic return. Midas was the pea variety planted and we evaluated target field populations of 300,000, 350,000 and 400,000 live peas per acre. The peas were planted with a 30 foot Great Plains drill in 7.5 inch rows. The three population levels were replicated 4 times in plots 30 feet wide by 2,600 feet long. There are approximately 1.8 acres in each plot. The plots were planted in a randomized complete block design on April 12.

Stand counts were taken on May 16 and 17 when peas were approximately 2 inches tall. Pod height measurements to determine the percent of pods 2 inches above the soil were estimated at harvest time. In all treatments approximately 95% of the pods were 2 inches above the soil surface or more. Low hanging pods are a major cause of harvest loss in the direct harvest process.

The plots were harvested on July 15 using a Case IH 8230 combine equipped with a MacDon FD70, 40 ft flex draper head. A total of nine, individual square foot counts along the plot area were taken on July 27th to estimate harvest loss during combining. A sample of peas was taken from each plot and analyzed for quality by New Alliance Bean Company in Alliance.

Results:

Treatment (seeds/ac)	Early Season Stand Count (plants/ac)	Harvest Loss (bu/ac)	Damaged (%)	Split (%)	Cracked Seed Coat (%)	Density (lbs/bu)	Moisture (%)	Yield (bu/ac) †	Marginal Net Return‡ ($/ac)
300,000	292,914 C*	1.4 A	1.2 A	0.6 A	1.8 B	63.3 A	11.6 A	21 B	103.74
350,000	372,721 B	0.7 A	1.2 A	0.5 A	3.2 A	63.3 A	11.3 A	20 B	84.95
400,000	448,171 A	1.3 A	1.2 A	0.4 A	2.4 AB	62.6 A	11.1 A	23 A	94.81
P-Value	<0.0001	0.142	0.946	0.299	0.083	0.561	0.257	0.0359	-

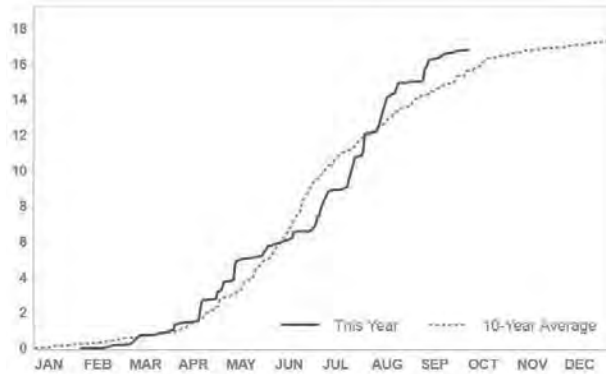
*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 14% moisture and clean yield.
‡Marginal net return based on $7/bu field pea price and seed prices of $14.77 per 100,000 seeds. Because the early season stand counts were higher in some cases than the target seeds per acre, the early season stand count values are likely more representative of actual treatment costs, therefore the stand count value was used to determine the seed cost for each treatment.

Summary: Except for the lowest targeted population the drill settings used by the grower delivered more seed than planned. The actual stand counts are in the table and cost and return marginal analysis is based on these actual stands. Due to a very warm and dry June, yields were poor due to crop stress during flowering. Dryland yields for dry edible beans typically exceed 30 bu/acre. In this case the peas planted at the higher rate did yield significantly more but only by 3 bu/acre. This seeding rate (400,000 plants/acre) yielded the highest at 23 bu/acre; however, it was not economical due to high seed cost. A better return on higher populations may be realized with more moisture during the growing season, however more research is needed with adequate moisture conditions. Harvest losses were in an acceptable range due to good pod height and timely harvest.

Dry Bean Direct Harvest Variety Study

Study ID: 152013201601
County: Box Butte
Soil Type: Alliance loam; Keith loam
Planting Date: 6/7/16
Harvest Date: 9/16/16
Population: ~120,000
Row Spacing (in): 15
Hybrid: Being Tested
Reps: 4
Previous Crop: Corn
Tillage: Disked once and rolled before planting
Herbicides: ***Pre:*** 30 oz/acre Prowl®, 15 oz/acre Outlook®, and 30 oz/acre Roundup® on 6/4/16
Post: 4 oz/acre Raptor®, 25 oz/acre Basagran®, and 10 oz/acre Select® on 6/28/16;
Desicant/harvest aid: 35 oz/acre Roundup®, 2 oz/acre Sharpen®, and 10 gallons 32% N on 9/6/16

Seed Treatment: Apron XL®, Maxim®, Rancona®, Dynasty®
Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: 35 lb/acre nitrogen
Irrigation: Pivot, Total: 8"
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.

This study evaluated four Pinto bean varieties all suitable for direct harvest. The varieties: Sinaloa, Torreon, LaPaz and Monterrey were replicated four times in plots 525 feet by 30 feet. The plots were planted in a randomized complete block design on June 7 with a Case IH 5400 Soybean Drill. Row spacing was 15 inches and seed was planted 1.5 inches deep. Stand counts were taken on June 21 when beans were approximately three inches tall. The plots were fertilized, sprinkler irrigated and treated identically. Pod height measurements to determine the percent of pods above two inches were taken on Sept 14. Low hanging pods are a major cause of harvest loss in the direct harvest process.

The plots were harvested on Sept. 16 using a Case IH 7088 combine equipped with a MacDon FD70, 30 foot flex draper head. The center 30 feet of the 40 foot plot was harvested. The harvested plot area was 0.362 acres per treatment per rep. The beans from each plot were weighed using a Par-Kan weigh wagon with a Weigh-Tronix scale. Nine square foot counts along the plot area were taken the day of harvest to estimate harvest loss during combining. A sample of beans was taken from each plot and analyzed for quality by Kelley Bean Company in Scottsbluff. All bean samples graded USDA #1, and the moistures were between 13.8 and 14.9%. The dry beans direct harvested in the surrounding field were Pinto variety Sinaloa with an average yield of 39.8 bu/acre.

Results:

	Early Season Stand Count	Pods >2" above ground (%)	Harvest Loss (bu/ac)	Small (%)	Moisture (%)	Density (lb/bu)	Seeds per lb	Yield (bu/ac) †	Marginal Net Return‡ ($/ac)
LaPaz	119,797 A*	85 A	2.5 B	4.8 B	14.9 A	61.4 A	1,590 A	43 A	693.00
Monterrey	116,893 AB	83 A	2.4 B	4.1 B	14.6 A	61.2 A	1,560 AB	43 A	695.03
Sinaloa	98,887 C	85 A	2.6 B	7.1 A	13.9 B	61.1 A	1,505 B	44 A	724.50
Torreon	106,002 BC	85 A	3.6 A	3.3 B	13.8 B	61.2 A	1,349 C	45 A	737.76
P-Value	0.005	0.462	0.018	0.001	0.0003	0.646	<0.0001	0.2817	-

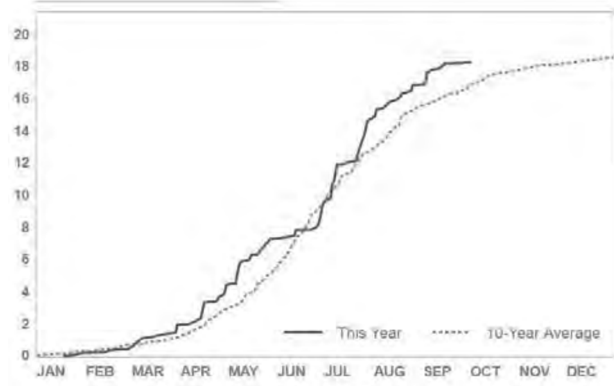
*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 14% moisture and adjusted for clean yield (% splits, % small, and % foreign material removed).
‡Marginal net return based on $30/cwt ($18/bu at 60lb/bu). Seed cost was the same for all varieties planted, however seed size varies, such that the same drill setting results in different seeding rates. To account for this, seed costs were adjusted for actual stands. Torreon cost $72.24/ac, Monterrey cost $78.97/ac, LaPaz cost $81.00/ac, and Sinaloa cost $67.50/ac.

Summary: Torreon, Monterrey, La Paz and Sinaloa are all Pinto dry bean varieties with upright characteristics suitable for direct harvest. There were no significant yield differences between treatments with yields ranging from 43 to 45 bu/acre. These yields are good but not exceptional for Western Nebraska.

The stand counts are significantly different between varieties due to seed size and seed movement through the drill. Adjustments to the drill were not made between varieties. It is interesting to note that varieties with significantly lower populations yielded similarly to those at higher populations. More studies are needed to evaluate the relationship between seeding rate and yield. Dry beans have the capacity to compensate under reduced plant stands. The results also showed a significant difference in harvest loss ranging from 2.4 to 3.6 bu/acre. Greater losses in Torreon may be due to a drier pod and a slightly higher yield. Harvest losses are well within the acceptable range of 2 to 4 bu/acre. A hail event on August 11 created a fair amount of damage and affected the yield. The hail was partially responsible for pod heights being in the 80's instead of the 90's when looking at percent of pods two inches or more above the soil. Good pod height is very important in minimizing direct harvest loss.

Dry Bean Row Spacing and Population for Direct Harvest

Study ID: 601161201601
County: Sheridan
Soil Type: Johnstown loam 0-2% slope; Keith loam gravelly substratum, 1-3% slope
Planting Date: 6/7/16
Harvest Date: 9/29/16
Hybrid: Sinaloa pinto beans
Reps: 6
Previous Crop: Oat and turnip cover crop
Tillage: Deep rip/disk, then field cultivator with vertical tillage on 6/2/16
Herbicides: ***Pre:*** 14 oz/acre Outlook® and 32 oz/acre Sonalan® on 6/8/16 ***Post:*** 21 oz/acre Varisto™ (Raptor® and Basagran®), 9.6 oz/acre non-ionic surfactant, and 2.5 lb/acre AMS
Seed Treatment: None
Foliar Insecticides: None
Foliar Fungicides: 2 lb/acre copper on 8/13/16
Fertilizer: 30 lb/acre N, 55 lb/acre P, 5 lb/acre S, 2 lb/acre Zn, 2 lb/acre Mn on 6/5/16;
25 lb/acre N, 3 lb/acre K, 5 lb/acre S chemigated on 7/20/16
Irrigation: Pivot, Total: 8"
Rainfall (in):



Introduction: The purpose of this study was to compare dry edible beans (Sinaloa variety) planted in 30 inch rows with a target population of 90,000 plants per acre with beans drilled in 7.5 inch rows with a target population of 120,000 plants per acre. These are two common planting scenarios for growers in western Nebraska. The two planting treatments were evaluated in a direct harvest bean production system looking at yield, harvest loss, pod height and other agronomic characteristics.

The treatments were replicated six times in plots 1240 feet by 48 feet (1.37 acres). The plots were planted in a randomized complete block design on June 7. The drilled treatment went in with a 30 foot Landoll 5531 drill (2 passes) to achieve a 60 foot width. The planted 30 inch row treatment went in with a 60 foot White Model 8824 Planter with 2020 Precision Plant seed meters.

The plots were harvested on September 29 using a Case IH 2388 combine equipped with a Case IH 1020 24 foot flex auger header. The field was treated with 2 pints of Gramoxone® and 2 gal of 32% N on September 20th as a harvest aid. One round was taken to harvest the center 48 feet of the 60 foot plots. Each harvested plot was weighed across the scales at Kelley Bean, Mirage Flats. Samples from each plot were analyzed for bean quality parameters. Pod height measurements were taken on Sept. 23 to determine the percent of pods two inches or greater above the soil surface. Harvest loss estimates were determined by taking counts in 12 one square foot frames randomly chosen in the harvested area but equally representing left side of header, center of header and right side of the header area behind the combine.

Results:

	Early Season Stand Count	Pods >2" above ground (%)	Harvest Loss (bu/ac)	Split (%)	Small (%)	Moisture (%)	Density (lb/bu)	Seeds per lb	Yield (bu/ac) †	Marginal Net Return‡ ($/ac)
7.5" row spacing at 120,000 plants/ac	122,169 A*	95 A	5.0 B	0.6 B	4.8 A	11.9 A	62.6 A	1,400 A	51 A	835.00
30" row spacing at 90,000 plants/ac	94,310 B	92 B	6.0 A	1.2 A	1.6 B	11.1 B	61.7 B	1,307 B	44 B	727.88
P-Value	0.0001	0.014	0.045	0.0001	0.001	0.001	0.019	0.005	0.0005	-

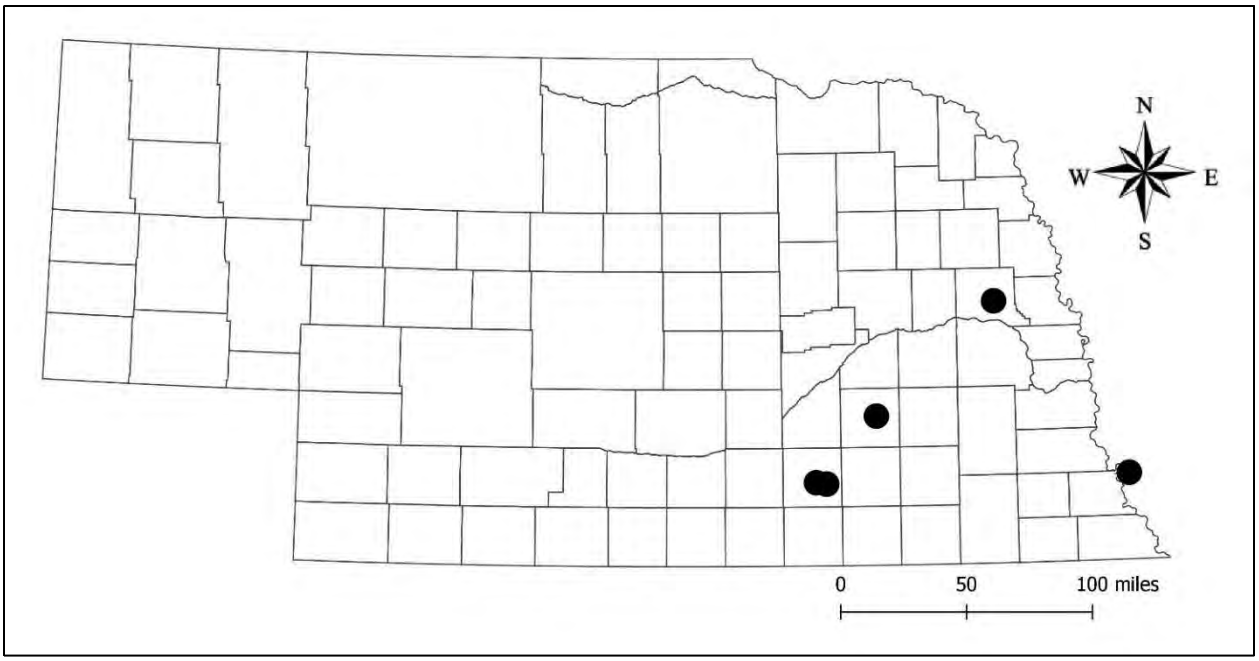
*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 14% moisture and is adjusted for clean yield (% splits, % small, and % foreign material removed).
‡Marginal net return based on $30/cwt ($18/bu at 60lb/bu) and input costs of $83.00/ac for the 7.5 inch, 120,000 seeds/ac and $64.12/ac for the 30 inch, 90,000 seeds/ac. Costs are adjusted for actual stand counts.

Summary:

1) Actual stand counts based on live plant counts were above but fairly close to the target populations of 90,000 and 120,000 plants per acre.
2) 95% of the pods in the 7.5 inch row spacing and 120,000 plants/acre treatment were two inches or more above the soil as compared to 91.6% in the 30 inch row spacing and 90,000 plants/acre treatment.
3) Harvest loss was significantly higher (6 bu/acre) in the 30 inch row spacing and 90,000 plants/acre treatment probably due to pod height. The beans in the 30 inch row spacing and 90,000 plants/acre treatment were also drier by 0.8 percentage points, which can contribute to greater harvest loss. Generally speaking, the harvest losses of 5 and 6 bu/acre are high. There was some longitudinal soil ridging in the field of 1 to 2 inches which will hold the header up contributing to greater harvest loss. This ridging may have been due to a pre-plant cultivation.
4) Percent splits were significantly higher in the 30 inch row spacing at 90,000 plants/acre treatment. This may be due to lower moisture and less plant material moving through the combine while harvesting this treatment.
5) Percent small beans were significantly higher in the 7.5 inch row spacing with 120,000 plants/acre treatment. This may be due in part to closer plants and more competition.
6) The percent moisture was significantly higher in the 7.5 inch rows with a higher population. The grower observed that the beans planted in 7.5 inch rows at the higher population matured 5 or 6 days later than the lower population in 30 inch rows.
7) The seed size was significantly smaller and the bushel weight was significantly heavier in the beans harvested from the 7.5 inch plots.
8) Beans harvested in the higher population, 7.5 inch rows yielded significantly more (7 bu/acre) than the beans planted at lower populations in the 30 inch rows. Yields were based on clean beans after splits, percent small beans, and foreign material were subtracted.
9) The marginal net return was about $107.00 per acre more for beans planted in 7.5 inch rows at a population of 120,000 plants/acre as compared with 30 inch rows at 90,000 plants/acre.

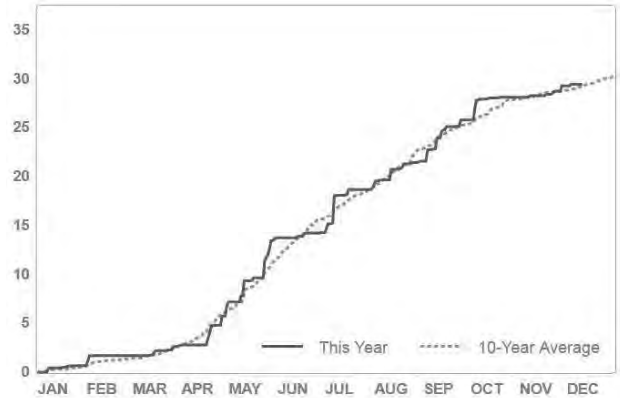
CROP PROTECTION

- Prevathon® and Steward® Insecticide Treatments for Soybean Stem Borer
- Fungicide Application on Irrigated Corn at V10
- ILeVO® Seed Treatment for Sudden Death Syndrome – 3 studies



Prevathon® and Steward® Insecticide Treatments for Soybean Stem Borer

Study ID: 026185201601
County: York
Soil Type: Hastings silt loam 0-1% slope; Hastings silt loam 1-3% slope
Planting Date: 5/16/16
Harvest Date: 9/29/16
Population: 140,000
Row Spacing (in): 30
Hybrid: Pioneer P31T11
Reps: 3
Previous Crop: Seed Corn
Tillage: Ridge-Till
Herbicides: ***Pre:*** Burndown: 22 oz/ac Roundup PowerMAX®, 6 oz/ac 2,4-D LV6, and 0.5 oz/ac Aim® on 4/25/16; Planting: 4 oz/ac Authority® First and 1 pt/ac Dual II® on 5/16/16 ***Post:*** 40 oz/ac Roundup PowerMAX and 10 oz/ac Cobra® on 6/16/16
Seed Treatment: PPST 120, Trilex, and Allegiance
Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: None
Irrigation: Pivot
Rainfall (in):



Introduction: The objective of this study was to look at the impact of DuPont™ Prevathon® insecticide and DuPont™ Steward® insecticide on soybeans for control of stem borer. Product information is listed below. There were three treatments: (1) Prevathon applied at a rate of 20 fl oz/acre, (2) Prevathon at a rate of 14 fl oz/acre and Steward at a rate of 6 fl oz/acre, and (3) an untreated check. The treatments were applied on June 27; the timing was 7-10 days after the accumulation of 1250 GDD. Using heat units to direct application timing, rather than applying based on growth stage, allowed applications to coincide with the time period with maximize effectiveness – when adult beetles are present but egg laying has not yet begun.

DuPont™ Prevathon®

Active Ingredient RynaXypyr®

Contains 0.43 lb. active ingredient per gallon.

Active Ingredient	*By Weight*
Chlorantraniliprole 3-Bromo-N-[4-chloro-2-methyl-6-[(methylamino)carbonyl]phenyl]-1-(3-chloro-2-pyridinyl)-1H-pyrazole-5-carboxamide	5%
Other Ingredients	95%
TOTAL	100%

Product information from: *http://www.dupont.com/products-and-services/crop-protection/corn-protection/products/prevathon.html*

DuPont™ Steward® EC

Emulsifiable Concentrate
Contains 1.25 lbs. Active Ingredient per gallon.

Active Ingredient	*By Weight*
Indoxacarb (S)-methyl 7-chloro-2,5-dihydro-2-[[(methoxycarbonyl)[4-(trifluoromethoxy)phenyl]amino]carbonyl]indeno[1,2-e][1,3,4]oxadiazine-4a(3H)-carboxylate	15.84%
Other Ingredients	84.16%
TOTAL	100%

Product information from: *http://www.dupont.com/products-and-services/crop-protection/soybean-protection/products/steward-ec.html*

The south half of the field received a later application of Prevathon (14 fl oz/acre), Steward (6 fl oz/acre), and DuPont™ Approach® fungicide (6 fl oz/acre) on July 25, 2016. This application crossed all three main treatments in the study. For this reason, yield, moisture, and Dectes stem borer infestation were analyzed separately for the north and south half of the field.

Stem borer infestation observations *(Figure 1)* were made by splitting stems 90 days after treatment (DAT) and are reported below.

Figure 1. Dectes stem borer in split soybean stem.

Results:

South half of field (additional later application of Prevathon, Steward, and Approach on July 25, 2016 across all treatments listed in table):

	Yield (bu/acre)†	Moisture (%)	Dectes Stem Borer Infestation % (90 DAT)	Marginal Net Return‡ ($/ac)
Check	74 A	13.3 A	13 A	684.50
Prevathon	75 A	13.2 A	5 B	657.24
Prevathon + Steward	74 A*	13.0 A	3 B	642.37
P-Value	0.8567	0.6894	0.0006	N/A

†Bushels per acre corrected to 13% moisture.
*Values with the same letter are not significantly different at a 90% confidence level.
‡Marginal net return based on $9.25/bu soybeans, $1.48/oz Prevathon, $2.42/oz Steward, and $6.82 application cost.

North half of field (no additional later application):

	Yield (bu/acre)†	Moisture (%)	Dectes Stem Borer Infestation % (90 DAT)	Marginal Net Return‡ ($/ac)
Check	71 A	12.4 A	31 A	656.75
Prevathon	71 A	12.8 A	12 B	620.24
Prevathon + Steward	71 A*	12.5 A	12 B	614.62
P-Value	0.8529	0.209	0.0353	N/A

†Bushels per acre corrected to 13% moisture.
*Values with the same letter are not significantly different at a 90% confidence level.
‡Marginal net return based on $9.25/bu soybeans, $1.48/oz Prevathon, $2.42/oz Steward, and $6.82 application cost.

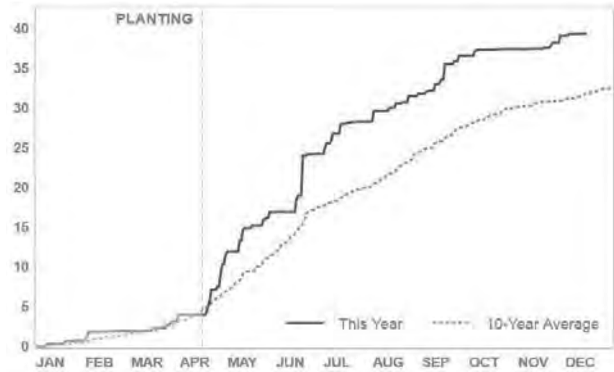
Summary: South half (with additional later application of Prevathon, Steward, and Approach across all treatments): There were no yield or moisture differences, however Dectes stem borer infestation was reduced in the Prevathon and Prevathon + Steward treatments.

North half (no late application): There were no yield or moisture differences, however Dectes stem borer infestation was reduced in the Prevathon and Prevathon + Steward treatments.

These results indicate that the treatments are effectively reducing infestation numbers, however there were no significant differences in yield for either of the locations within the field. No conclusions can be drawn about the effectiveness of the later application of Steward, Prevathon, and Approach because this application was not replicated or randomized.

Fungicide Application on Irrigated Corn at V10

Study ID: 004053201602
County: Dodge
Soil Type: Moody silty clay loam 0-2% slope; Moody silty clay loam 2-6% slopes
Planting Date: 4/15/16
Harvest Date: 10/31/16
Population: 34,000
Row Spacing (in): 30
Hybrid: Hoegemeyer 8295
Reps: 4
Previous Crop: Corn
Tillage: Fall disk and spring turbo till
Herbicides: ***Pre:*** 2.4 qt/ac Keystone® LA on 4/16/16 ***Post:*** 32 oz/ac Roundup®, 0.5 lb/ac Atrazine, 0.75 oz/ac Armezon™ on 6/2/16
Seed Treatment: Poncho® 250
Foliar Insecticides: 3 oz/ac Capture® LFR® on 4/15/16
Foliar Fungicides: 10 oz/ac Headline AMP® on 7/15/16
Fertilizer: 115 lb/ac 11-52-0 in fall; 5 gal/ac 10-34-0 at planting; 70 lb N/ac as 32-0-0 on 4/16/16; 2 gal ac 12-0-0-26 on 4/16/16; 140 lb N/ac as 32-0-0 on 6/9/16
Irrigation: Pivot, Total: 3"
Rainfall (in):



Introduction: Due to the early appearance of northern corn leaf blight (NCLB) in 2014 and 2015, an early foliar fungicide application was assessed in 2016. Priaxor® was applied at a rate of 4 oz/acre at V10 on June 21, 2016 as an on-farm research study. The whole field was sprayed with 10 oz/acre Headline AMP on July 15, 2016. In 2016, early disease pressure was very low during June and early July, especially from NCLB.

Results:

	Harvest Stand Count (plants/ac)	Moisture (%)	Yield (bu/acre)†	Marginal Net Return‡ ($/ac)
Check	24,083 A*	14.7 A	238 A	$725.90
Fungicide Application at V10	25,875 A	14.7 A	235 B	$696.75
P-Value	0.2668	0.5331	0.0248	N/A

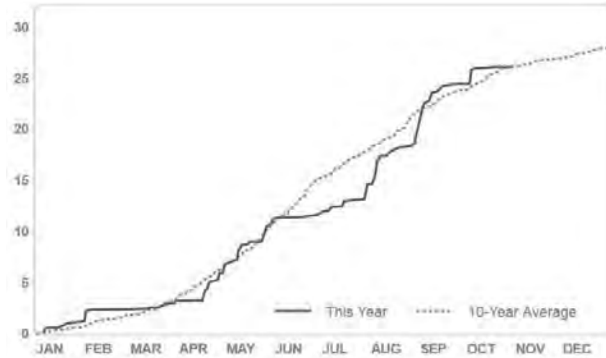
*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $20/ac fungicide application plus product.

Summary: A small but significant 3 bu/acre yield reduction occurred with the fungicide application at V10. No other information or observations help explain the slight yield reduction. However, the data does suggest that in the absence of early season foliar fungal disease pressure, a fungicide application did not return a profit.

ILeVO® Seed Treatment for Sudden Death Syndrome

Study ID: 605035201601
County: Clay
Soil Type: Hastings silt loam;
Planting Date: 4/28/16
Harvest Date: 9/22/16
Population: 185,000
Row Spacing (in) 30
Hybrid: Fontanelle 64R20
Reps: 4

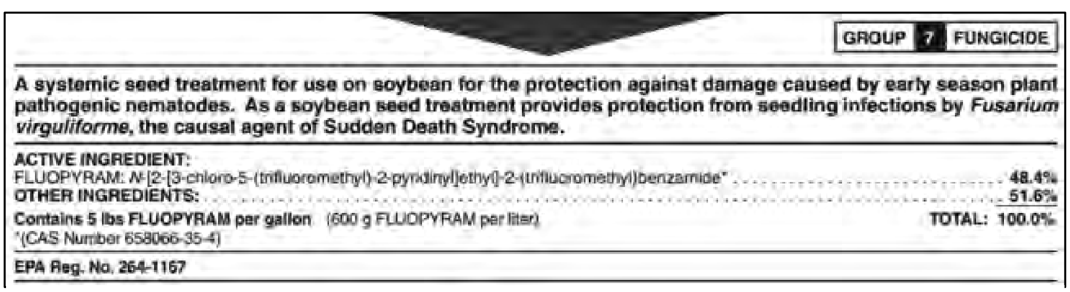
Irrigation: Pivot, Total:
Rainfall (in):



Soil Sample Results:

ID	Soil pH 1:1	Modified WDRF BpH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	FIA Nitrate ppm N	Nitrate Lb N/A for 0-8 in	M-P3 ppm P	----Ammonium Acetate--- -------------ppm-------------				Sum of Cations me/100g	% Base Saturation				
								K	Ca	Mg	Na		H	K	Ca	Mg	Na
Rep 1	6.4	6.9	0.33	None	16.7	40	71	489	2127	241	54	16.4	13	8	66	12	2
Rep 2	6.5	7.0	0.28	None	13.9	34	42	529	2415	308	56	16.8	4	8	72	15	2
Rep 3	6.4	7.0	0.32	None	14.3	35	30	484	2429	346	49	17.4	5	8	70	17	1
Rep 4	6.4	7.0	0.34	None	18.6	45	48	454	2145	242	49	14.8	5	8	72	14	2

Introduction: Sudden Death Syndrome (SDS) is caused by the soil borne fungus *Fusarium solani f. sp. glycines*. While this is a relatively new disease for Nebraska soybean farmers, there are several locations in the state where significant percentages of fields are being affected. Disease symptoms can be more severe in fields where both SDS and soybean cyst nematode are present. There are not clear guidelines to determine at what point a field will have enough increase in yield to justify treatment, therefore, on-farm research projects like this one are needed.


GROUP 7 FUNGICIDE

A systemic seed treatment for use on soybean for the protection against damage caused by early season plant pathogenic nematodes. As a soybean seed treatment provides protection from seedling infections by *Fusarium virguliforme*, the causal agent of Sudden Death Syndrome.

ACTIVE INGREDIENT:
FLUOPYRAM: N-[2-[3-chloro-5-(trifluoromethyl)-2-pyridinyl]ethyl]-2-(trifluoromethyl)benzamide* 48.4%
OTHER INGREDIENTS: 51.6%
Contains 5 lbs FLUOPYRAM per gallon (600 g FLUOPYRAM per liter) **TOTAL: 100.0%**
*(CAS Number 658066-35-4)

EPA Reg. No. 264-1167

Product information from: *http://www.agrian.com/pdfs/ILeVO_Label1.pdf*

ILeVO® is a seed treatment marketed by Bayer CropScience for SDS and also has nematode activity (label at right). This field was selected due to the presence of SDS in the 2014 soybean crop. Two treatments were selected to test the efficacy of the ILeVO® seed treatment.

A: Standard soybean treatment (for this study Acceleron® Fungicide and Insecticide)

B: Standard soybean treatment plus ILeVO® at a rate of 1.18 fl oz/140,000 seed unit

Phosphorus samples (above) were taken because low phosphorus has been linked to higher severity of SDS. Soybean cyst nematode (SCN) samples were also taken early in the growing season in each treatment and replication because of the relationship between SDS and SCN *(Table 1)*. This information is intended to provide a base population level for the trial.

Table 1. Soybean cyst nematode samples for each treatment and replication.

	Soybean Cyst Nematode (SCN) - (# eggs/100 cc soil)
Standard	0 A
Standard + ILeVO	0 A
P-Value	-

Results:

Foliar disease symptoms were assessed using Southern Illinois University at Carbondale's Method of SDS scoring. The disease symptoms were assessed using a 1 to 9 scoring system, with a score of 1 indicating the least symptoms and 9 indicating premature death. In addition, the overall incidence of affected plants was determined. These two scores were combined to create the disease index (DX). DX = disease incidence x disease severity/9. Disease assessments were conducted on 8/15/16 at stage R5.6 and 9/1/16 at stage R6.2 *(Table 2).*

Table 2. SDS ratings taken on Aug. 15, 2016 and Sept. 1, 2016.

	Disease Incidence (%)	Disease Severity	Disease Index (DX)	Disease Incidence (%)	Disease Severity	Disease Index (DX)
	----------------Aug. 15, 2016---------------			------------------Sept. 1, 2016----------		
Standard	8.5 A*	2.75 A	3 A	29.6 A	5.00 A	19 A
Standard + ILeVO	0.9 B	0.75 B	0 B	9.6 B	2.50 B	3 B
P-Value	0.0302	0.0098	0.0702	0.0007	0.002	0.0008

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

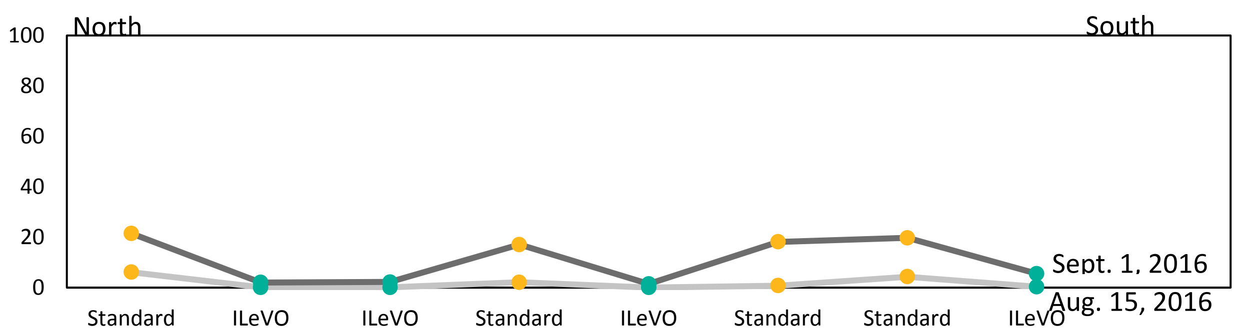


Figure 1. Disease index average by treatment from Aug. 15, 2016 and Sept. 1, 2016. Disease index scale ranges from 0 to 100.

Aerial imagery was captured on 9/10/16. True color imagery is shown in Figure 2 and false color imagery is shown in Figure 3. Imagery was used to calculate the normalized difference vegetation index (NDVI). This index is correlated with the greenness of the plant and plant health. NDVI values for the 3 treatments *(Figure 4)* were compared *(Table 3)*. Pivot tracks were removed from the NDVI image before analysis as shown in Figure 4.

Figure 2. True color image of study area with treatments labeled.

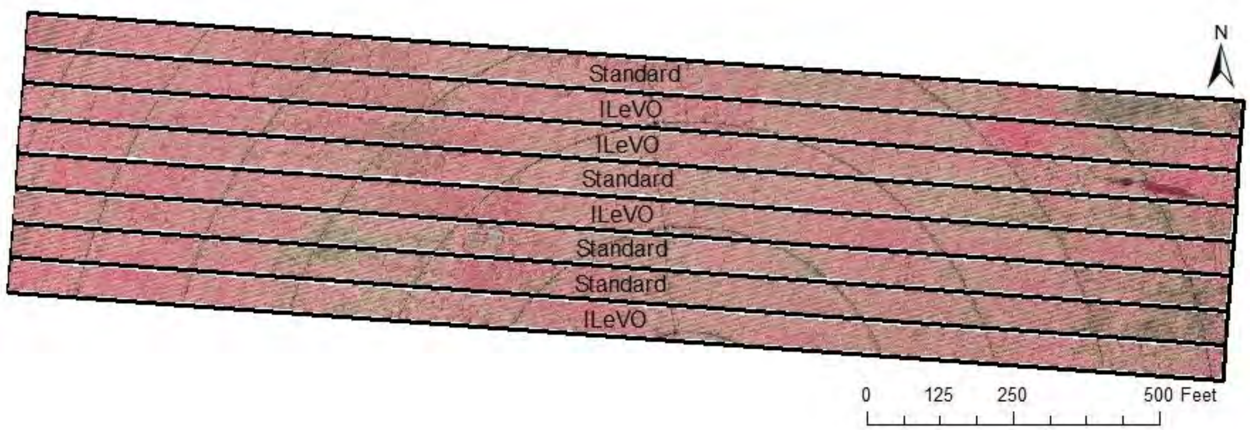


Figure 3. False color image of the study area with treatments labeled. Brighter red indicates more green vegetation.

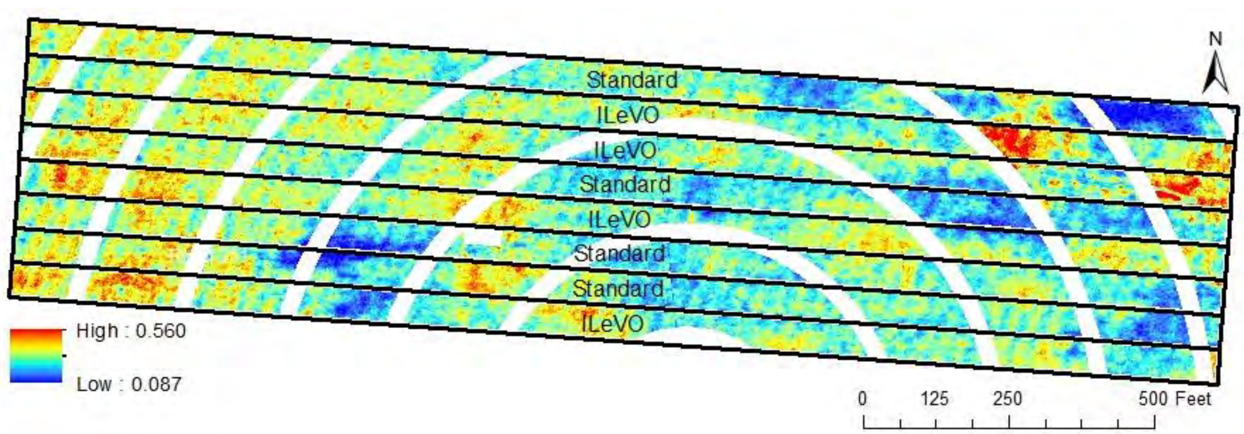


Figure 4. Normalized difference vegetation index (NDVI) for each treatment.

Table 3. NDVI average by treatment from aerial imagery on Sept. 10, 2016.

	NDVI
Standard	0.231 B
Standard + ILeVO	0.253 A
P-Value	0.01

Yield was recorded using a yield monitor. Yield data was cleaned to remove areas corresponding with pivot tracks and data values below 40 bu/ac and above 110 bu/ac. Averages for each treatment strip are shown in Figure 5. Averages by treatment are shown in Table 4; averages by treatment for each soil series in the field are shown in Table 5.

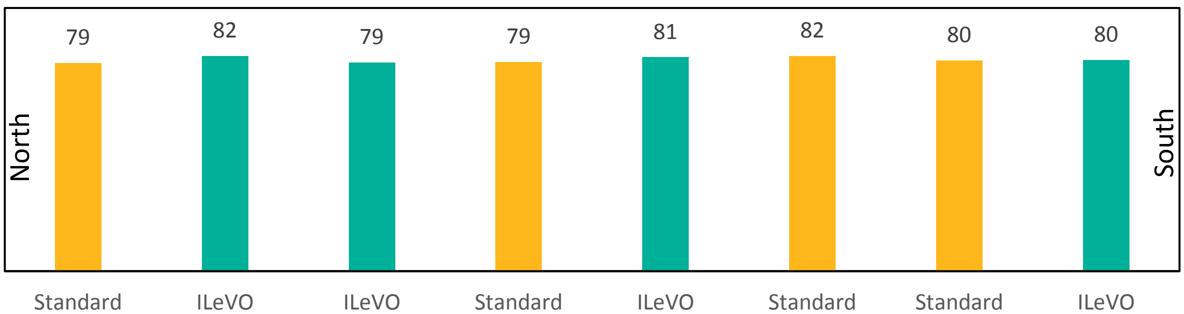


Figure 5. Yield average by treatment (bu/ac) from north to south.

Table 4. Harvest stand counts, yield from yield monitor, and marginal net return.

	Yield (bu/acre)†	Harvest Stand Count	Marginal Net Return‡ ($/ac)
Standard	80 A	116,500 A	740.00
Standard + ILeVO	81 A	110,000 A	732.24
P-Value	0.4931	0.2485	N/A

†Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $9.25/bu soybean and $17.01/ac for ILeVO seed treatment (based on $10.91/oz and application rate of 1.18 fl oz/140,000 seed unit).

Yield difference is not statistically different at 10% significance level.

Yield was summarized by soil series as shown in Figure 6 and Table 4.

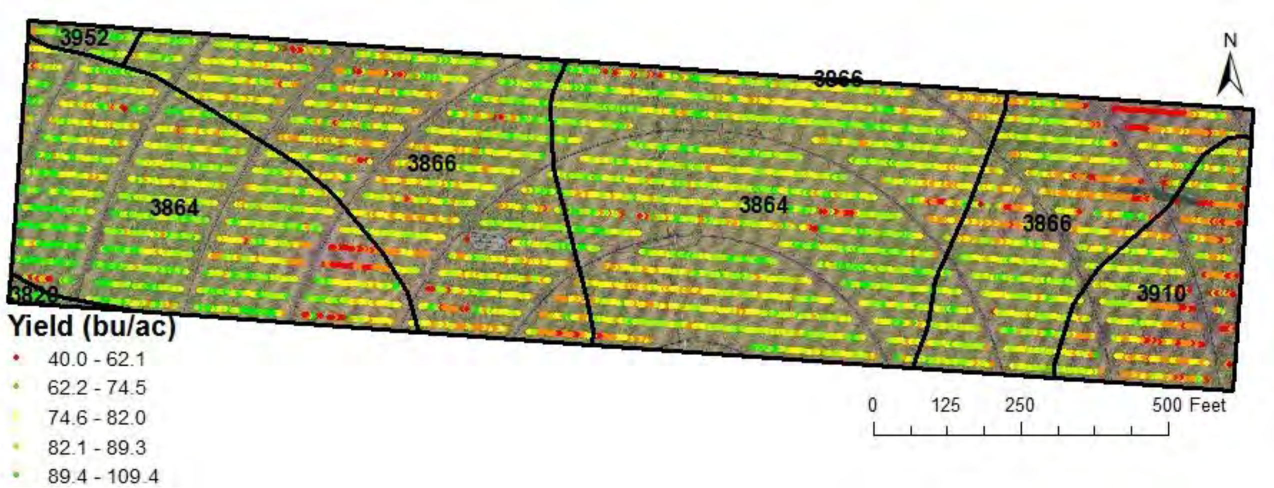


Figure 6. Yield data with soil map unit.

Table 5. Yield data with soil map unit.

Map Symbol	Map Unit	Standard	ILEVO	Standard	ILEVO
		Percent of Trial		Yield (bu/acre)	
3820	Butler silt loam, 0 to 1% slopes	0%	1%		92.2
3864	Hastings silt loam, 0 to 1% slopes	53%	53%	82.0	82.3
3866	Hastings silt loam, 1 to 3% slopes	36%	37%	78.4	79.1
3910	Scott silt loam, frequently ponded	9%	9%	72.2	76.1
3952	Fillmore silt loam, frequently ponded	2%	0%	87.7	

*Yield differences for map units with small areas may not be representative.

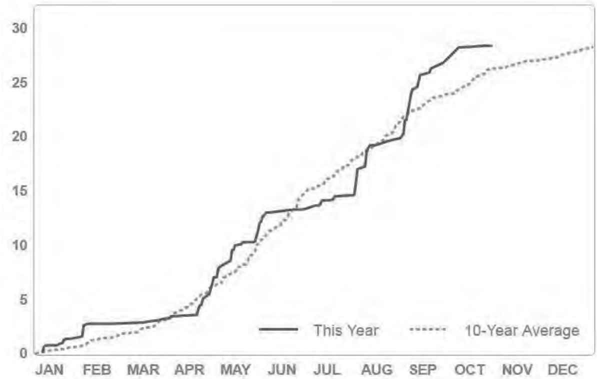
Summary: At this site, SDS disease incidence and severity was greater for the standard treatment than for the ILeVO treatment, but disease pressure was considered to be low for both treatments. At the time of the second disease rating, this difference between the treatments was greater. Normalized difference vegetative index was calculated from aerial imagery and showed higher NDVI values for the ILeVO treatment. Yield data did not show a significant difference between the standard and ILeVO treatments. When looking only at the eastern ~1/3 of the field, where symptoms were visually more severe, the ILeVO seed treatment had a greater yield response (for example, in the soil map unit 3910 in Table 5). Disease severity, timing of development, and amount of the field affected all contribute to the likelihood of seeing a positive effect from the ILeVO seed treatment. Additional studies are needed to determine areas likely to see a response to the seed treatment and to establish thresholds for treatment.

This study was sponsored in part by: Bayer CropScience LP

ILeVO® Seed Treatment for Sudden Death Syndrome

Study ID: 606035201601
County: Clay
Soil Type: Hastings silt loam; Butler silt loam; Crete silt loam
Planting Date: 5/5/16
Harvest Date: 9/30/16
Population: 160,000
Row Spacing (in): 30
Hybrid: Fontanelle 29N04
Reps: 4
Previous Crop: Corn
Tillage: Disked 4/16/16
Herbicides: ***Pre:*** 32 oz/ac Roundup® and 4.5 oz/ac Authority® First on 5/6/16

Fertilizer: 160 lb/ac 11-52-0
Irrigation: Pivot
Rainfall (in):

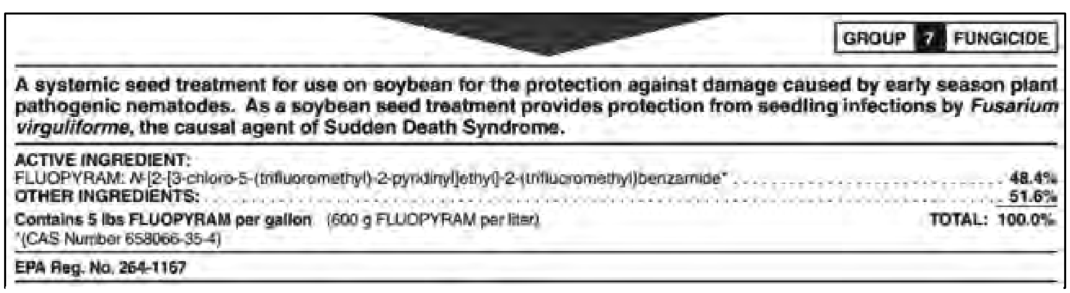


Soil Sample Results:

ID	Soil pH 1:1	Modified WDRF BpH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	FIA Nitrate ppm N	Nitrate Lb N/A for 0-8 in	M-P3 ppm P	----Ammonium Acetate--- --------------ppm--------------				Sum of Cations me/100g	% Base Saturation				
								K	Ca	Mg	Na		H	K	Ca	Mg	Na
Rep 1	6.3	6.9	0.32	None	16.0	38	63	470	2142	242	49	14.9	5	8	72	13	2
Rep 2	6.4	7.0	0.31	None	11.9	28	30	516	2478	410	52	18.1	4	7	69	19	1
Rep 3	6.4	7.0	0.29	None	16.0	38	57	465	2397	369	46	17.4	5	7	69	17	1
Rep 4	6.2	6.8	0.19	None	15.2	37	54	506	2340	308	48	16.7	5	8	71	15	1

Introduction: Sudden Death Syndrome (SDS) is caused by the soil borne fungus *Fusarium solani f. sp. glycines*. While this is a relatively new disease for Nebraska soybean farmers, there are several locations in the state where significant percentages of fields are being affected. Disease symptoms can be more severe in fields where both SDS and soybean cyst nematode (SCN) are present. There are not clear guidelines to determine at what point a field will have enough increase in yield to justify treatment, therefore, on-farm research projects like this one are needed.

ILeVO® is a seed treatment marketed by Bayer CropScience for SDS and also has nematode activity (label at right). This field was selected due to the presence of SDS in the 2014 soybean crop. Three treatments were selected to test the efficacy of the ILeVO seed treatment.


GROUP 7 FUNGICIDE

A systemic seed treatment for use on soybean for the protection against damage caused by early season plant pathogenic nematodes. As a soybean seed treatment provides protection from seedling infections by *Fusarium virguliforme*, the causal agent of Sudden Death Syndrome.

ACTIVE INGREDIENT:
FLUOPYRAM: *N*-[2-[3-chloro-5-(trifluoromethyl)-2-pyridinyl]ethyl]-2-(trifluoromethyl)benzamide* 48.4%
OTHER INGREDIENTS: 51.6%
Contains 5 lbs FLUOPYRAM per gallon (600 g FLUOPYRAM per liter) **TOTAL: 100.0%**
*(CAS Number 658066-35-4)

EPA Reg. No. 264-1167

Product information from: *http://www.agrian.com/pdfs/ILeVO_Label1.pdf*

A: Untreated check

B: Standard soybean treatment (for this study Trilex® 2000 Fungicide + Poncho®/VOTiVO® + Precise Seed Finisher was used)

C: Standard soybean treatment plus ILeVO at a rate of 1.18 fl oz/140,000 seed unit

Phosphorus samples (above) were taken because low phosphorus has been linked to higher severity of SDS. Soybean cyst nematode samples were also taken early in the growing season in each treatment and replication because of the relationship between SDS and SCN *(Table 1)*. This information is intended to provide a base population level for the trial.

Table 1. Average soybean csyt nematode samples for each treatment.

	Soybean Cyst Nematode (SCN) – (# eggs/100 cc soil)
Check	0 A
Standard	0 A
Standard plus ILeVO	0 A
P-Value	-

Results:

Foliar disease symptoms were assessed using Southern Illinois University at Carbondale's Method of SDS scoring. The disease symptoms were assessed using a 1 to 9 scoring system, with a score of 1 indicating the least symptoms and 9 indicating premature death. In addition, the overall incidence of affected plants was determined. These two scores were combined to create the disease index (DX). DX = disease incidence x disease severity/9. Disease assessments were conducted on 9/1/16 at stage R5.8 and 9/16/16 at stage R6 *(Table 2)*.

Table 2. SDS ratings taken on Sept. 1, 2016 and Sept. 16, 2016.

	Disease Severity	Disease Incidence (%)	Disease Index (DX)	Disease Severity	Disease Incidence (%)	Disease Index (DX)
	-----------------Sept. 1, 2016---------------			-----------------Sept. 16, 2016---------------		
Check	1.58 A*	1.4 A	0.4 A	1.92 A	2.4 A	0.7 A
Standard	1.17 A	1.3 A	0.4 A	1.33 A	1.7 A	0.5 A
Standard plus ILeVO	1.17 A	1.9 A	0.4 A	1.50 A	1.9 A	0.5 A
P-Value	0.541	0.6665	0.9606	0.4717	0.6581	0.6954

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

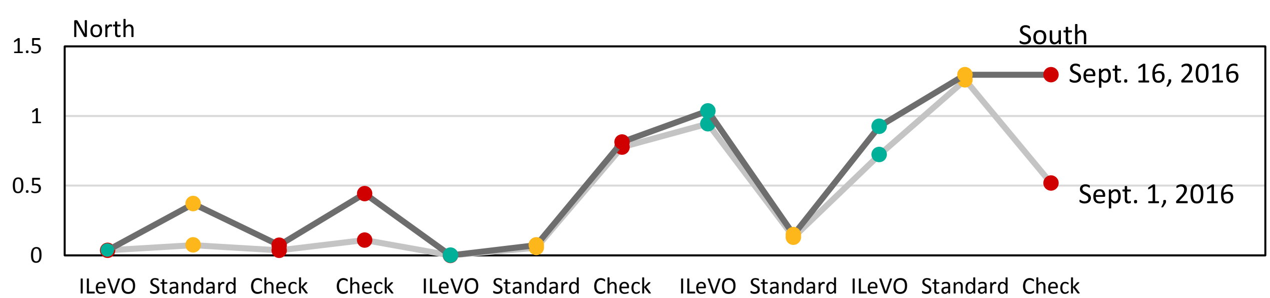


Figure 1. Disease index average by treatment from Sept. 1, 2016 and Sept. 16, 2016. Disease index scale ranges from 0 to 100.

Aerial imagery was captured on 9/10/16. True color imagery is shown in Figure 2 and false color imagery is shown in Figure 3. Imagery was used to calculate the normalized difference vegetation index (NDVI). This index is correlated with the greenness of the plant and plant health. NDVI values for the 3 treatments *(Figure 4)* were compared *(Table 3)*. Pivot tracks, other drainage areas, and a 10 foot buffer between treatments were removed before analysis *(Figure 4)*.

Figure 2. True color image of study area with treatments labeled.

Figure 3. False color image of study area with treatments labeled. Brighter red indicates more green vegetation.

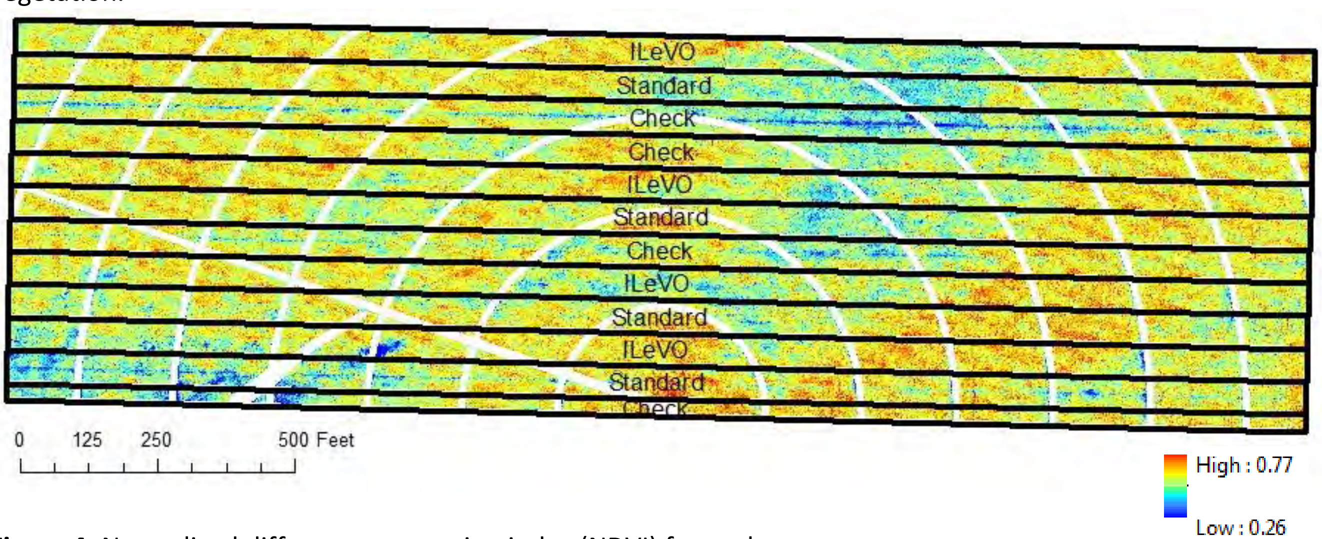


Figure 4. Normalized difference vegetation index (NDVI) for each treatment.

Table 3. NDVI average by treatment from aerial imagery on Sept. 10, 2016.

	NDVI
Check	0.60 A
Standard	0.60 A
Standard plus ILeVO	0.61 A
P-Value	0.2268

Yield was recorded using a weigh wagon. Averages for each treatment strip are shown in Figure 5. Averages by treatment are shown in Table 4.

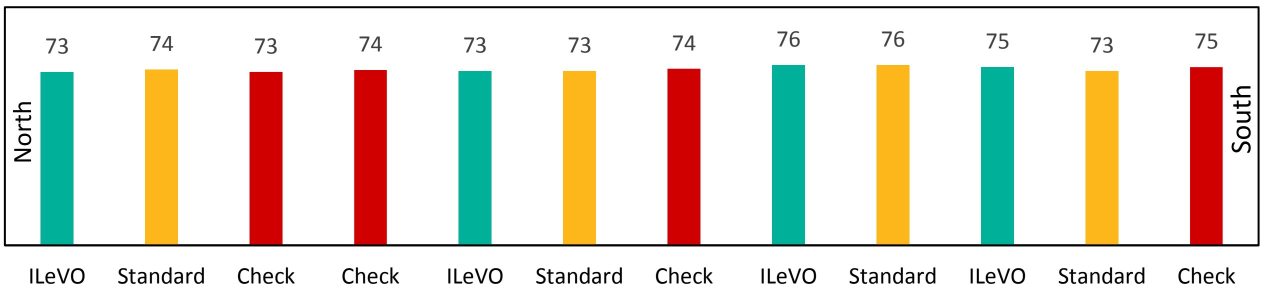


Figure 5. Yield average by treatment (bu/ac) from north to south.

Table 4. Yield from weigh wagon, and marginal net return.

	Yield (bu/ac)	**Marginal Net Return‡ ($/ac)**
Check	74 A	684.50
Standard	74 A	671.70
Standard plus ILeVO	74 A	656.98
P-Value	0.8893	N/A

†Bushels per acre corrected to 13% moisture
*Values with the same letter are not significantly different at a 90% confidence level.
‡Marginal net return based on $9.25/bu soybeans, $12.80/ac for standard seed treatments, and $14.72/ac for ILeVO seed treatment (based on $10.91/oz and application rate of 1.18 fl oz/140,000 seed unit).

Yield difference is not statistically different at 10% significance level.

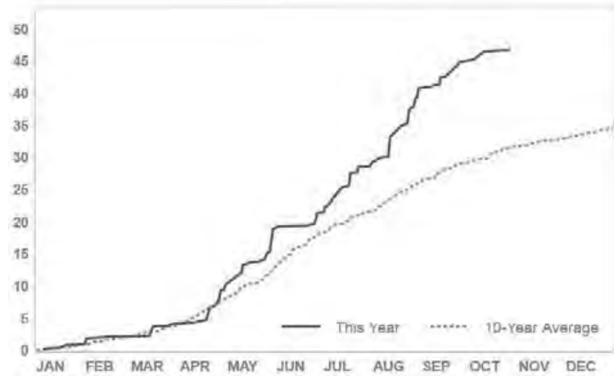
Summary: At this site, very low SDS disease incidence and severity was noted throughout the growing season. This very low disease level resulted in no yield difference between the treatments with ILeVO and without. Additionally, the standard treatment did not provide a yield benefit over the check.

This study was sponsored in part by: Bayer CropScience LP

ILeVO® Seed Treatment for Sudden Death Syndrome

Study ID: 607127201601
County: Nemaha
Soil Type: Dockery silt loam; McPaul silt loam
Planting Date: 5/19/16
Harvest Date: 10/22/16
Population: 140,000
Row Spacing (in): 30
Hybrid: Asgrow 3936
Reps: 4
Previous Crop: Corn
Tillage: No-Till
Herbicides: Authority®, Roundup PowerMax®, Cobra®
Foliar Insecticides: None
Foliar Fungicides: None

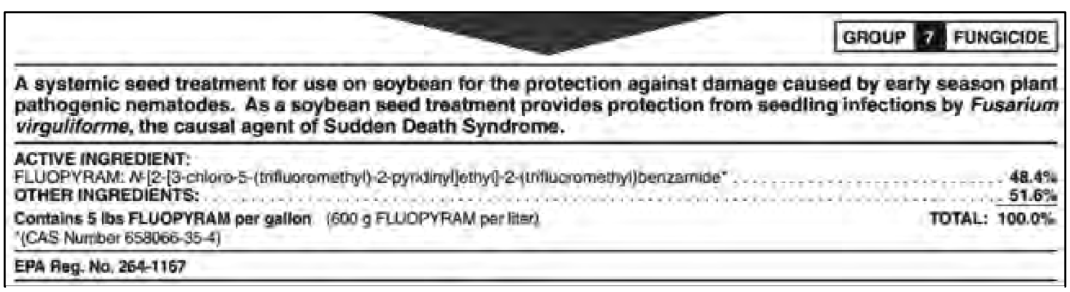
Fertilizer: None
Irrigation: None
Rainfall (in):



Soil Sample Results:

ID	Soil pH 1:1	Modified WDRF BpH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	FIA Nitrate ppm N	Nitrate Lb N/A for 0-8 in	M-P3 ppm P	----Ammonium Acetate--- -------------ppm------------- K	Ca	Mg	Na	Sum of Cations me/100g	% Base Saturation H	K	Ca	Mg	Na
Rep 1	6.1	6.9	0.19	None	21.3	51	18	218	1857	391	32	14.1	6	4	66	23	1
Rep 2	6.1	7.0	0.19	None	20.9	50	19	214	1880	375	24	14.3	8	4	65	22	1
Rep 3	5.7	6.9	0.14	None	18.4	44	22	207	1877	394	24	14.7	10	4	63	22	1
Rep 4	5.8	6.7	0.14	None	17.9	43	22	232	1809	389	22	15.6	17	4	58	21	1

Introduction: Sudden Death Syndrome (SDS) is caused by the soil borne fungus Fusarium solani f. sp. glycines. While this is a relatively new disease for Nebraska soybean farmers, there are several locations in the state where significant percentages of fields are being affected. Disease symptoms can be more severe in fields where both SDS and soybean cyst nematode (SCN) are present. There are not clear guidelines to determine at what point a field will have enough increase in yield to justify treatment, therefore, on-farm research projects like this one are needed.


GROUP 7 FUNGICIDE

A systemic seed treatment for use on soybean for the protection against damage caused by early season plant pathogenic nematodes. As a soybean seed treatment provides protection from seedling infections by *Fusarium virguliforme*, the causal agent of Sudden Death Syndrome.

ACTIVE INGREDIENT:
FLUOPYRAM: N-[2-[3-chloro-5-(trifluoromethyl)-2-pyridinyl]ethyl]-2-(trifluoromethyl)benzamide* 48.4%
OTHER INGREDIENTS: 51.6%
Contains 5 lbs FLUOPYRAM per gallon (600 g FLUOPYRAM per liter) **TOTAL: 100.0%**
*(CAS Number 658066-35-4)

EPA Reg. No. 264-1167

Product information from: *http://www.agrian.com/pdfs/ILeVO_Label1.pdf*

ILeVO® is a seed treatment marketed by Bayer CropScience for SDS and also has nematode activity (label at right). This field was selected due to the presence of SDS in the 2014 soybean crop. Three treatments were selected to test the efficacy of the ILeVO® seed treatment.

A: Untreated check

B: Standard soybean treatment (for this study Cruiser Maxx® Fungicide and Insecticide)

C: Standard soybean treatment plus ILeVO® at a rate of 1.18 fl oz/140,000 seed unit

Phosphorus samples (above) were taken because low phosphorus has been linked to higher severity of SDS. Soybean cyst nematode samples were also taken early in the growing season in each treatment and replication because of the relationship between SDS and SCN *(Table 1)*. This information is intended to provide a base population level for the trial.

Table 1. Average soybean cyst nematode counts for each replication.

	Soybean Cyst Nematode (SCN) - (# eggs/100 cc soil)
Check	0 A
Standard	0 A
Standard plus ILeVO	0 A
P-Value	-

Results: Foliar disease symptoms were assessed using Southern Illinois University at Carbondale's Method of SDS scoring. The disease symptoms were assessed using a 1 to 9 scoring system, with a score of 1 indicating the least symptoms and 9 indicating premature death. In addition, the overall incidence of affected plants was determined. These two scores were combined to create the disease index (DX). DX = disease incidence x disease severity/9. Disease assessments were conducted on 8/24/16 at stage R5.2 and 9/6/16 at stage R5.9 *(Table 2)*.

Table 2. SDS ratings taken on Aug. 24, 2016 and Sept. 6, 2016.

	Disease Incidence (%)	Disease Severity	Disease Index (DX)	Disease Incidence (%)	Disease Severity	Disease Index (DX)
	----------------Aug. 24, 2016------------------			----------------Sept. 6, 2016-------------------		
Check	6.7 A	2.67 AB	2 A	18.8 A	5.67 A	12 A
Standard	6.7 A	3.17 A	2 A	22.1 A	5.83 A	14 A
Standard plus ILeVO	4.4 A*	1.83 B	1 A	8.0 B	5.42 A	5 B
P-Value	0.285	0.0298	0.1111	0.0013	0.3742	0.0007

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

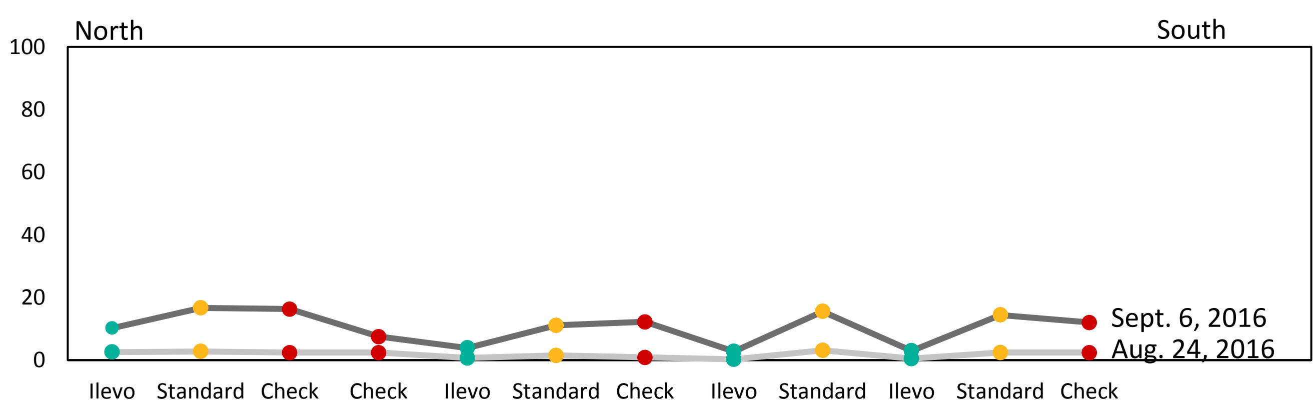


Figure 1. Disease index average by treatment from Aug. 24, 2016 and Sept. 6, 2016. Disease index scale ranges from 0 to 100.

Aerial imagery was captured on September 20, 2016. True color imagery is shown in Figure 2 and false color imagery is shown in Figure 3. Imagery was used to calculate the normalized difference vegetation index (NDVI). This index is correlated with the greenness of the plant and plant health. NDVI values for the 3 treatments *(Figure 4)* were compared *(Table 3)*. Areas where plant stand had been eliminated due to crop residue carried by water were removed from the NDVI image before analysis and a 10 foot buffer was applied between treatments as shown in Figure 4.

Figure 2. True color image of study area with treatments labeled.

Figure 3. False color image of study area with treatments labeled. Brighter red indicates more green vegetation.

Figure 4. Normalized difference vegetation index (NDVI) for each treatment.

Table 3. NDVI average by treatment from aerial imagery on Sept. 20, 2016.

	NDVI
Check	0.641 B
Standard	0.638 C
Standard plus ILeVO	0.645 A
P-Value	0.0008

Yield was recorded using a yield monitor. Yield data was cleaned using Yield Editor 2.0 (USDA-ARS, Columbia, MO). Averages for each treatment strip are shown in Figure 5. Averages by treatment are shown in Table 4.

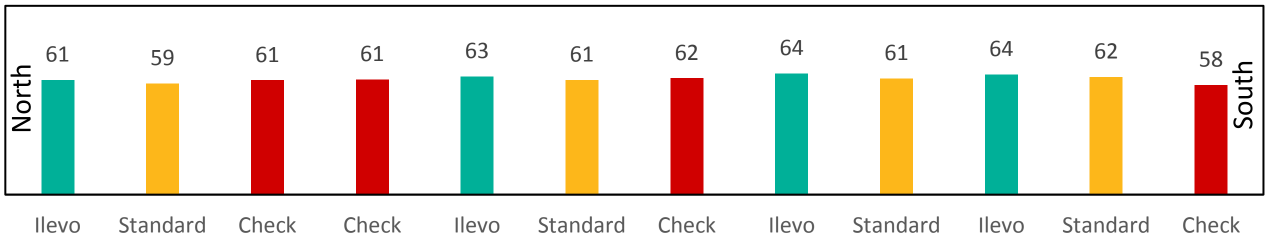


Figure 5. Yield average by treatment (bu/ac) from north to south.

Table 4. Harvest stand counts, yield from yield monitor, and marginal net return.

	Harvest Stand Count	Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Check	82,833 A	60 A	555.00
Standard	81,667 A	61 A	550.25
Standard plus ILeVO	86,250 A	63 A	555.87
P-Value	0.8291	0.1101	N/A

†Yield corrected to 13% moisture
‡Marginal net return based on $9.25/bu soybeans, $14/140,000 seed unit for Cruiser Maxx treatment (in this study also $14/ac), and $12.88/140,000 seed unit for ILeVO treatment (in this study also $12.88/ac).

Yield was summarized by soil series as shown in Figure 6 and Table 5.

Figure 6. Yield data with soil map unit.

Table 5. Yield by treatment and soil map unit.

Map Symbol	Map Unit	Check	Standard	ILEVO	Check	Standard	ILEVO
		Percent of Trial			Yield (bu/acre)		
13551	McPaul silt loam, 0 to 2 percent slopes, occasionally flooded	19%	16%	11%	58.5	61.4	63.9
66029	Dockery silt loam, 0 to 2 percent slopes, occasionally flooded	81%	84%	89%	60.7	60.6	62.6

*Yield differences for map units with small areas may not be representative.

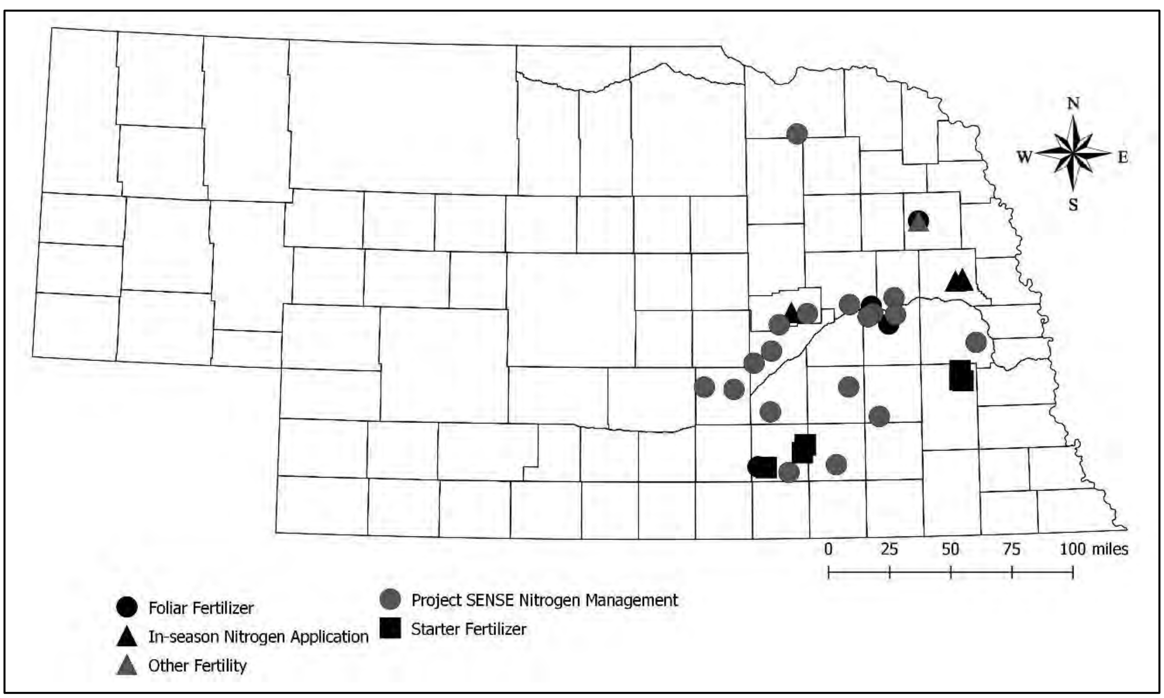
Summary: At this site, SDS disease incidence and severity developed late in the growing season and was considered low throughout the year. NDVI from aerial imagery was significantly different with the ILeVO treatment having higher NDVI than the standard treatment and the check. There was no yield difference between the treatments with ILeVO and without. Additionally, the standard treatment did not provide a yield benefit over the check. More research on the disease severity, timing of disease symptoms, and spatial distribution throughout the field is needed to aid in determining where an economic response to ILeVO can be expected.

This study was sponsored in part by: Bayer CropScience LP

FERTILITY AND SOIL MANAGEMENT

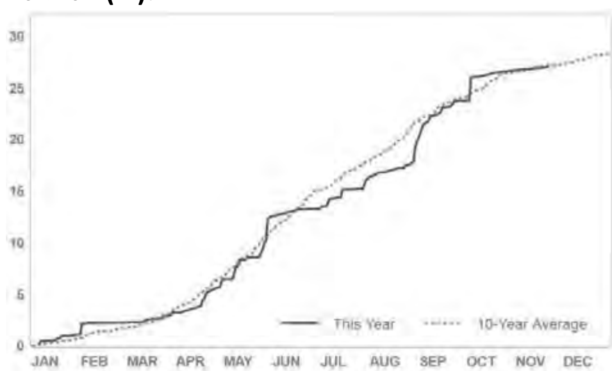
- Starter Fertilizers
  - Nature's Formula Bio-Sure Grow at Planting vs Nature's Formula Bio-Sure Grow at Planting and Sidedress vs Check on Corn
  - Nature's Formula Bio-Sure Grow at Planting vs Nature's Formula Bio-Sure Grow at Planting and Sidedress vs Check on Soybeans
  - Comparing Two Starter Fertilizers and an Untreated Check on Corn
  - Starter Fertilizer on Rainfed Corn
  - 10-34-0 and TJ Micromix® Starter Fertilizer on Rainfed Corn
  - 2x2 Starter Fertilizer on Rainfed Corn
- Foliar Fertilizers
  - Ag Concepts® Enhance on Irrigated Soybeans
  - Soa Soap Foliar Application on Corn
  - Alfalfa Response to Foliar Fertilizers*
  - Conklin® Kip Cullers' Nutrient Compass Foliar Fertilizer on Soybeans
- Other Fertility – Calcium
  - Kugler KQ Calcium Chloride on Soybeans
- In-Season N Management
  - Sidedress Application of 10-34-0 on Soybeans
  - Sidedress Nitrogen Application Rate Comparison
  - Sidedress Nitrogen Application with the Climate FieldView™ Advisor (Corn on Corn)
  - Sidedress Nitrogen Application with the Climate FieldView™ Advisor (Corn Following Soybeans)
- Project SENSE N Management – 18 locations

*Indicates small plot study conducted on-farm.



Nature's Formula Bio-Sure Grow at Planting vs Nature's Formula Bio-Sure Grow at Planting and Sidedress vs Check on Corn

Study ID: 011035201602
County: Clay
Soil Type: Crete silt loam 1-3% slope; Hastings silty clay loam 3-7% slopes, eroded; Fillmore silt loam frequently ponded
Planting Date: 4/25/16
Harvest Date: 10/28/16
Population: 34,000
Row Spacing (in): 30
Hybrid: Dekalb 61-79RIB
Reps: 8
Previous Crop: Soybean
Tillage: No-Till
Herbicides: Acuron™, AATrex®, and Touchdown Total®
Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: 5 gal/ac starter with 1 qt/ac zinc; 225 lb N/ac and 1 pt/ac Agrotain® Ultra
Irrigation: Pivot, Total: Unknown
Rainfall (in):



Soil Sample (0-10 inches):

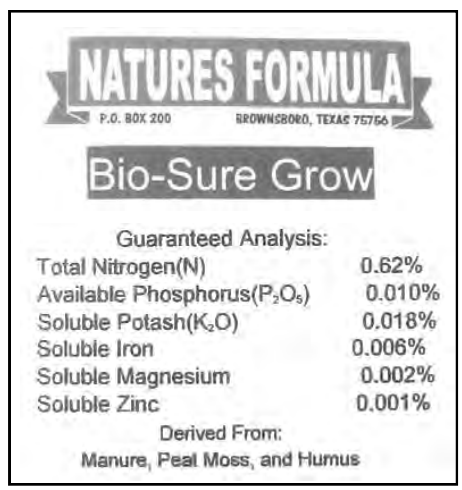
Soil pH 1:1	Buffer pH	Soluble Salts 1:1 mmho/cm	CEC	Excess Lime Rating	OM LOI-%	Nitrate-N ppm N	Nitrate-N Lbs N/A	M3 Phos ppm	Ammonium Acetate ---------ppm-------- K	Ca	Mg	Na	S	DTPA ---------ppm--------- Zn	Fe	Mn	Cu
6.2	6.9	0.24	13	NO	2.8	6	18	19	335	1730	216	71	10	1.3	150	59.6	1.1

Introduction: This study is looking at using Nature's Formula Bio-Sure Grow as a starter and as a sidedress in addition to the grower's normal starter fertilizer of 10-34-0 with zinc. A product label is at right. Nature's Formula Bio-Sure Grow is advertised as an all-natural organic humus and manure extract that is put through a proprietary process to suspend the micro nutrients within the solution. The product claims to be a natural quick response formulation of Nitrogen, Phosphorus, and Potassium. The three treatments being tested are:

A: 10-34-0 + Zinc (check)

B: 10-34-0 + Zinc + Bio-Sure Grow at planting in furrow

C: 10-34-0 + Zinc + Bio-Sure Grow at planting in furrow + Bio-Sure Grow at sidedress (V5).

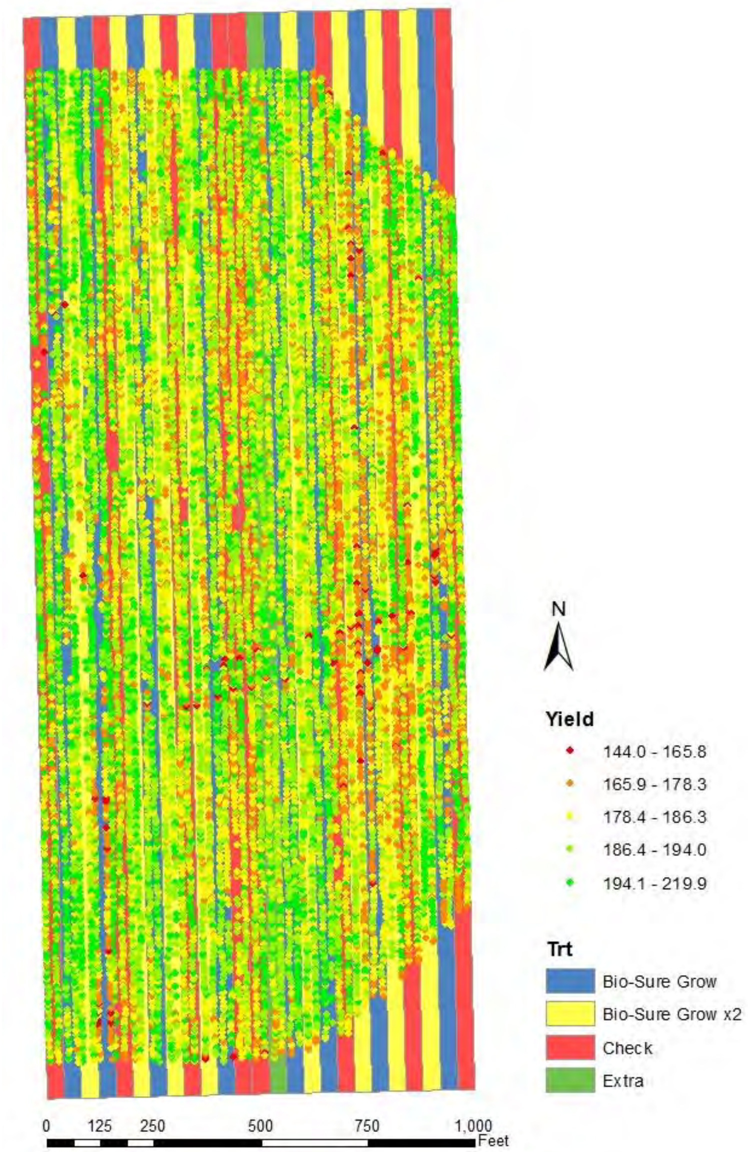


Product information from: *http://www.agenviromgmt.com/shop/natures-fluid*

Results:

	Harvest Stand Count (4 reps)	Stalk Rot (%) (4 reps)	Moisture (%)	Yield (bu/acre)†	Marginal Net Return‡ ($/ac)
Check	33,750 A	11 A	15.1 A	188 A	573.40
Bio-Sure Grow at Planting	31,375 A	11 A	15.1 A	187 A	555.35
Bio-Sure Grow at Planting and Sidedress	33,000 A	6 A	15.1 A	187 A	532.22
P-Value	0.179	0.697	0.609	0.610	-

†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 price, $15/ac product cost, and $8.13/ac sidedress application cost. No additional cost for product application at planting as this is the standard practice for this grower.

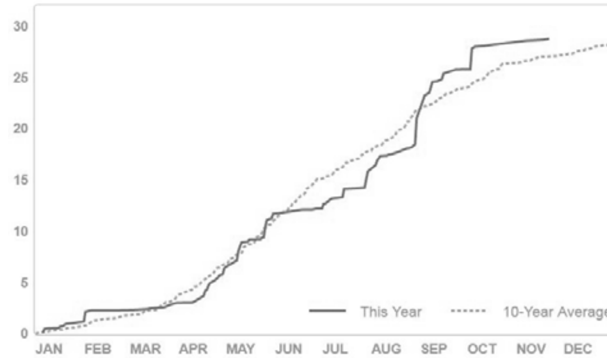


Summary: Using Bio-Sure Grow at planting, or at both planting and sidedress, did not result in increased yield compared to using the starter fertilizer alone. Due to additional product and application costs, the grower's standard management of starter fertilizer resulted in the highest marginal net return.

Nature's Formula Bio-Sure Grow at Planting vs Nature's Formula Bio-Sure Grow at Planting and Sidedress vs Check on Soybeans

Study ID: 011035201601
County: Clay
Soil Type: Butler silt loam
Planting Date: 5/6/16
Harvest Date: 10/1/16
Population: 140,000
Row Spacing (in): 30
Hybrid: Asgrow 2431
Reps: 4
Previous Crop: Corn
Tillage: No-Till
Herbicides: 2-4,D and Roundup
Foliar Insecticides: None
Foliar Fungicides: None

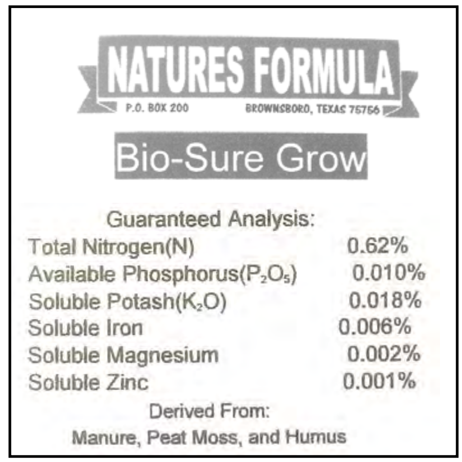
Fertilizer: 11-52-0
Irrigation: None
Rainfall (in):



Introduction: This study is looking at using Nature's Formula Bio-Sure Grow at planting in-furrow and at sidedress. Product information is at right. Nature’s Formula Bio-Sure Grow advertises as an all-natural organic humus and manure extract that is put through a proprietary process to suspend the micro nutrients within the solution. The product claims to be a natural quick response formulation of nitrogen, phosphorus, and potassium.

The three treatments being tested are:

A: Check
B: Bio-Sure Grow at planting in furrow
C: Bio-Sure Grow at planting in furrow + Bio-Sure Grow at sidedress.

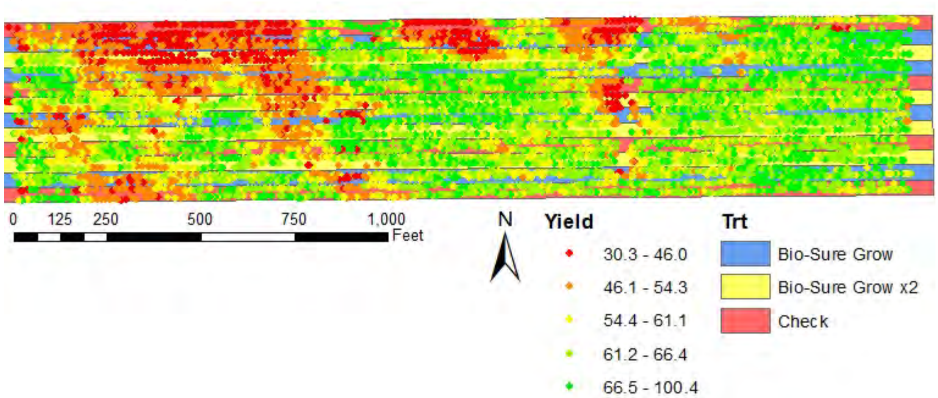


Product information from: *http://www.agenviromgmt.com/shop/natures-fluid*

Results:

	Yield (bu/acre)†	Moisture (%)	Marginal Net Return‡ ($/ac)
Check	59 A*	12.6 A	545.75
Nature's Formula Bio-Sure Grow at Planting	59 A	12.5 A	530.75
Nature's Formula Bio-Sure Grow at Planting and Sidedress	61 A	12.3 A	526.12
P-Value	0.318	0.640	-

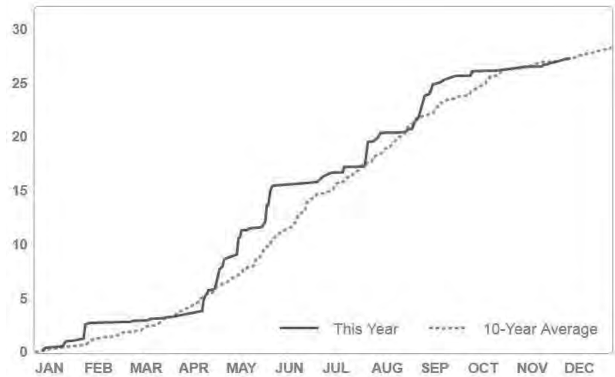
†Bushels per acre corrected to 13% moisture.
*Values with the same letter are not significantly different at a 90% confidence level.
‡Marginal net return based on $9.25/bu soybean price, $15/ac product cost, and $8.13/ac sidedress application cost. No additional cost for product application at planting as it did not involve an additional trip.



Summary: Using the Nature's Fertilizer Bio-Sure Grow did not result in a yield increase when compared with the check. Due to additional product and application costs, the check resulted in the highest marginal net return.

Comparing Two Starter Fertilizers and an Untreated Check on Corn

Study ID: 441035201602
County: Clay
Soil Type: Hastings silt loam 0-1% slope; Crete silt loam 0-1% slope; Fillmore silt loam frequently ponded
Planting Date: 5/6/16
Harvest Date: 10/21/16
Population: 34,000
Row Spacing (in): 30
Hybrid: DeKalb 60-69 RIB
Reps: 4
Previous Crop: Soybean
Tillage: No-Till
Herbicides: Lexar®, Roundup PowerMAX®, ClassAct® on 5/15/16
Seed Treatment: Acceleron® 250
Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: 61 lb/ac 11-52-0, 5 lb/ac zinc, 15 lb/ac sulfur in fall 2015; 146 lb/ac 46-0-0 on 4/15/16; 100 lb/ac 32-0-0 through pivot
Irrigation: Pivot, Total: 7.2
Rainfall (in):



Soil Sample:

Soil pH 1:1	Buffer pH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	OM LOI-%	Nitrate-N ppm N	0-8" Nitrate-N Lbs N/A	Phos ppm	Ammonium Acetate ---------ppm-------- K	Ca	Mg	Na	S	DTPA ---------ppm--------- Zn	Fe	Mn	Cu
5.6	6.6	0.14	NONE	2.2	7	17	35	453	1490	229	16	12	0.6	54.0	14.0	0.6

Introduction: The objective of this study is to determine if in-furrow starter fertilizers would affect yield, even when soil test P levels are high. Two starter fertilizer products were compared to an untreated check. The two starters used were: 10-34-0 at 6 gal/acre (7 lb/acre actual N and 24 lb/acre actual P) and 9-24-3 at 3 gal/acre (3 lb/acre actual N, 8 lb/acre actual P, and 1 lb/acre actual K). The starter fertilizer was applied in-furrow.

Results:

	Harvest Stand Count	Stalk Lodging (%)	Test Weight (lb/bu)	Moisture (%)	Yield (bu/acre)†	Marginal Net Return‡ ($/ac)
Check	32,500 A*	35 A	62 A	17.1 B	242 A	$738.10
Starter (6 gal 10-34-0)	31,000 A	35 A	62 A	17.3 A	241 A	$717.22
Starter (3 gal 9-24-3)	32,000 A	49 A	62 A	17.8 A	243 A	$724.65
P-Value	0.7182	0.2124	0.812	0.0174	0.2192	N/A

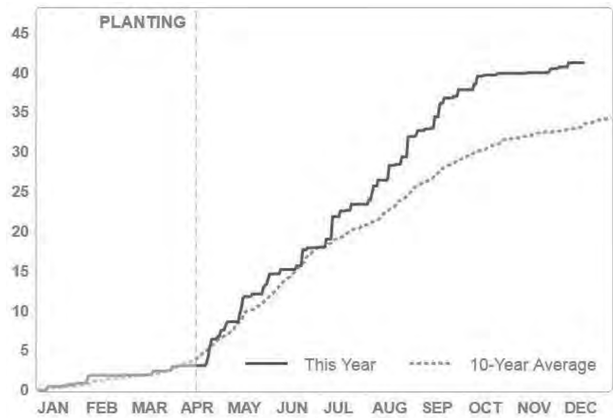
*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn, $17.83/ac product cost for 10-34-0, and $16.50/ac product cost for 9-24-0.

Summary: Soil test P levels were high and 61 lb/acre of 11-52-0 was applied the previous fall, amounting to 32 lb of P_2O_5/acre. The starter fertilizer products did not result in differences in stand, stalk lodging, test weight, or yield. This is consistent with previous research which has documented that when soil test P levels are adequate, there is little chance of yield response to starter fertilizer. The two starter treatments did increase grain moisture at harvest. Due to additional product costs, the check resulted in the highest marginal net return.

10-34-0 Starter Fertilizer on Rainfed Corn

Study ID: 030109201601
County: Lancaster
Soil Type: Aksarben silty clay loam 6-11% slopes; Aksarben silty clay loam 2-6% slopes
Planting Date: 4/11/16
Harvest Date: 9/26/16
Population: 30000
Row Spacing (in): 30
Hybrid: Dekalb 62-98
Reps: 8
Previous Crop: Soybean
Tillage: No-Till
Herbicides: 4 pt/ac Halex® GT
Foliar Insecticides: None
Foliar Fungicides: None

Fertilizer: 160 lb/ac actual N as fall applied NH3
Irrigation: None
Rainfall (in):



Soil Test: (Soil was sampled on a 2.5 acre grid. The following eight samples were within the area of the research study. These points are not correlated to each replication or treatment strip.)

O.M.	C.E.C.	Ca	pH	BpH	Mg	P1	P2	K	S	Zn
--%--		ppm			Ppm	---------------------ppm---------------------				
2.4	28.70	2757	5.4	6.3	687	16	25	368	14	0.9
3.2	26.50	3272	6.3	6.6	746	44	98	420	16	1.3
2.3	32.30	3093	5.4	6.2	820	12	19	309	12	0.4
2.2	30.30	3195	5.7	6.4	845	16	38	356	10	0.4
2.2	25.70	2432	5.3	6.2	586	10	21	269	14	0.3
2.1	28.20	2733	5.4	6.3	689	9	15	298	13	0.3
2.3	27.10	2178	5.0	6.0	545	14	18	220	14	0.4
2.0	23.90	2288	5.3	6.3	523	16	26	273	14	0.4

Approximately 27 ton/ac bio-solids were applied in fall 2013 for the 2014 corn crop; this resulted in approximately 130 lb N/ac applied.

Introduction: The objective of this study was to determine if using 5 gal/acre of 10-34-0 starter fertilizer (6 lb/acre actual N and 20 lb/acre actual P) at planting resulted in higher yield and profit.

Results:

	Moisture (%)	Yield (bu/acre)†	Marginal Net Return‡ ($/ac)
Check	17.5 A*	219 A	667.95
Starter (5 gal 10-34-0)	17.3 B	219 A	652.20
P-Value	0.0035	0.8844	N/A

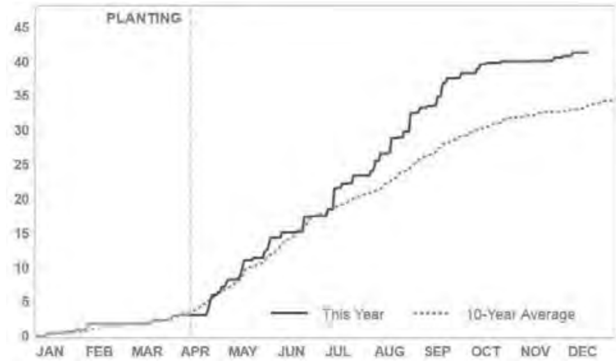
*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $15.75/ac starter fertilizer cost.

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.

10-34-0 and TJ Micromix® Starter Fertilizer on Rainfed Corn

Study ID: 030109201602
County: Lancaster
Soil Type: Aksarben silty clay loam 2-6% slopes; Aksarben silty clay loam 6-11% slopes; Crete silty clay loam 1-3% slope; Judson silt loam 2-6% slopes
Planting Date: 4/7/16
Harvest Date: 10/10/16
Population: 30,000
Row Spacing (in): 30
Hybrid: Dekalb 61-88
Reps: 8
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** 1.5 qt/ac Bicep® ***Post:*** 3 oz/ac Callisto® plus 32 oz/ac RoundUp PowerMAX®

Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: 150 lb/ac actual N as fall applied NH3
Irrigation: None
Rainfall (in):



Soil Test:

O.M.	pH	BpH	C.E.C.	Total NO3 (0-8")	Total NO3 (8-24")	P Bray 1	P Bray 2	K	Mg	Ca	S	%K	%Mg	%Ca	%H	%Na
--%--				lb/ac	lb/ac	-----------------------	ppm	-----------------------				-------Percent Base Saturation-------				
2.8	5.5	6.4	26.1	36	19	24	41	240	546	2799	35	2.4	17.4	53.6	26.0	0.6

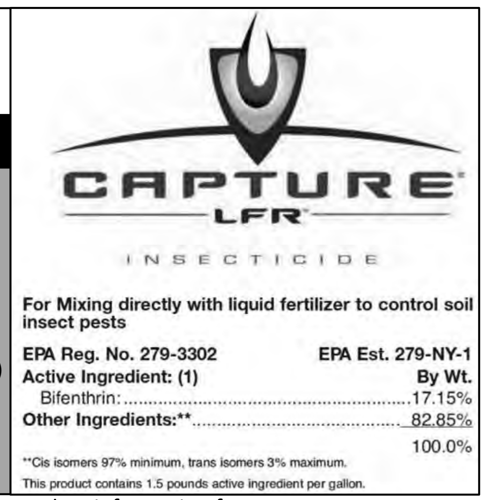
Approximately 27 ton/ac bio-solids were applied eight to ten years ago. The field received bio-solid cake material two times prior to 2007.

Introduction: The objective of this study was to determine if using 5 gal/acre of 10-34-0 starter fertilizer (6 lb/acre actual N and 20 lb/acre actual P) with Capture® LFR® insecticide and TJ Micromix® Liquid at planting resulted in higher yield and profit. Product information is at right.

TJ Micromix® Liquid
CORN

Guaranteed Analysis

Boron (B) 0.08%
Copper (Cu)..0.25%
0.25%...Chelated Copper (Cu)
Iron (Fe)...0.50%
0.50%...Chelated Iron (Fe)
Manganese (Mn)..................................0.42%
0.42%...Chelated Manganese (Mn)
Zinc (Zn)...2.14%
2.14%...Chelated Zinc (Zn)



Product information from: *http://www.fmccrop.com/Portals/_default/Media/PDF/fmc-capture-lfr-label.pdf?C*

Results:

	Moisture (%)	Yield (bu/acre)†	Marginal Net Return‡ ($/ac)
Check	15.0 A	201 A	613.05
Starter (5 gal 10-34-0) with Capture and Micromix	14.8 B	203 A	593.98
P-Value	0.0691	0.4087	N/A

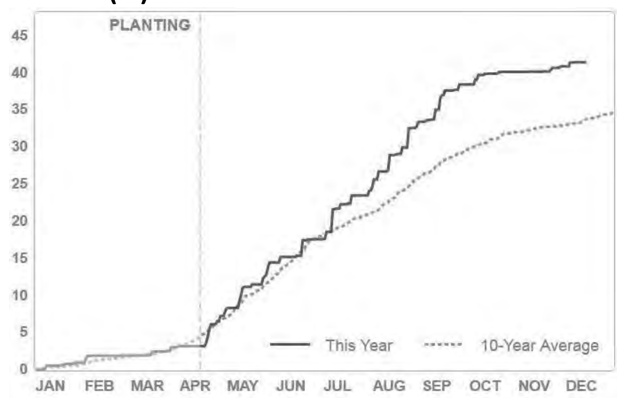
*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $25.17/ac starter fertilizer, Capture, and Micromax cost.

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. Because Capture was added to the starter fertilizer treatment, this is a confounding variable, making it impossible to draw conclusions about the starter fertilizer treatment.

2x2 Starter Fertilizer on Rainfed Corn

Study ID: 030109201603
County: Lancaster
Soil Type: Yutan silty clay loam 6-11% slopes, eroded; Judson silt loam 2-6% slopes; Aksarben silty clay loam 2-6% slopes; Mayberry silty clay loam 3-6% slopes, eroded
Planting Date: 4/14/16
Harvest Date: 11/2/16
Population: 30,000
Row Spacing (in): 30
Hybrid: Dekalb 67-58
Reps: 8
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** 1.5 qt/ac Bicep ***Post:*** 3 oz/ac Callisto® and 32 oz/ac Roundup PowerMAX®

Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: 160 lb/ac actual N fall applied NH3
Irrigation: None
Rainfall (in):



Soil Test:

O.M.	pH	BpH	C.E.C.	Total NO3 (0-8")	Total NO3 (8-24")	P Bray 1	P Bray 2	K	Mg	Ca	S	%K	%Mg	%Ca	%H	%Na
--%--				lb/ac	lb/ac	------------------------ppm------------------------						--------Percent Base Saturation-------				
3.0	5.7	6.5	20.4	53	29	87	134	203	413	2403	31	2.6	16.9	58.9	20.9	0.7

Approximately 27 ton/ac bio-solids were applied in 2009 on half of the field. The field has received a bio-solid application 3-4 times in the last 25 years.

Introduction: The objective of this study was to determine if using 10 gal/acre of 32% N (35 lb/acre actual N) applied 2 x 2 at planting resulted in higher yield and profit.

Results:

	Moisture (%)	Yield (bu/acre)†	Marginal Net Return‡ ($/ac)
Check	15.5 A	214 B	$652.70
Starter (10 gal 32% 2x2)	15.5 A	217 A	$646.35
P-Value	0.563	0.0538	N/A

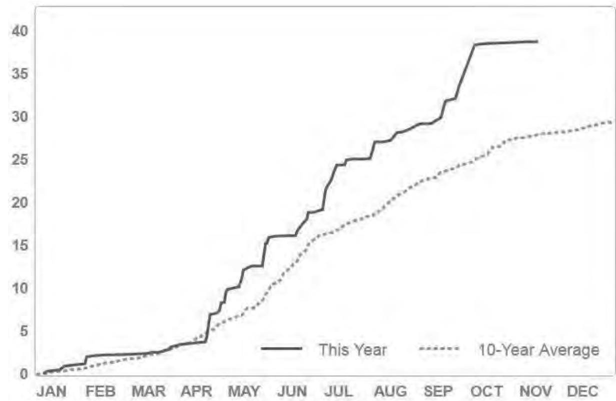
*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $15.50/acre starter fertilizer cost.

Summary: The 32% nitrogen treatment resulted in a 3 bu/acre increase over the unfertilized check. With current prices, the increase in yield did not cover the increased treatment cost.

Ag Concepts® Enhance on Irrigated Soybeans

Study ID: 085141201601
County: Platte
Soil Type: Boel fine sandy loam occasionally flooded
Planting Date: 5/4/16
Harvest Date: 9/27/16
Population: 132,000
Row Spacing (in): 30
Hybrid: Asgrow 24-31
Reps: 4
Previous Crop: Corn
Tillage: Ridge-Till
Herbicides: ***Pre:*** Roundup®, Sharpen®, Enlite® ***Post:*** Roundup®, Select®
Seed Treatment: Acceleron®
Foliar Insecticides: ImidicLoprid
Foliar Fungicides: AxoyProp Extra

Fertilizer: 100 lb/ac Mesz® (12-40-0-10-1 Zn) and 75 lb/ac Potash; 7 gal/ac 8-20-3-6-0.4 as starter; 1 pt/ac Kugler MicroMax® sprayed on post.
Note: SDS pressure in first replication.
Irrigation: Gravity, Total: ~8"
Rainfall (in):



Soil Sample:

ID	Soil pH	BpH	Soluble Salts 1:1 mmho/ cm	Excess Lime Rating	% OM LOI	FIA ppm N	N (0-8 in) Lb/A	P ppm	Ammonium Acetate ---------ppm--------- K	Ca	Mg	Na	S ppm	DTPA ---------ppm--------- Zn	Fe	Mn	Cu	B ppm	Cl ppm	Sum of Cations (me/ 100 g)	% Base Saturation H	K	Ca	Mg	Na
North	6.4	6.9	0.16	NONE	1.0	9.6	23	24	193	870	84	11	8	4.8	23.3	5.6	0.56	0.08	8.2	6.5	14	8	66	11	1
South	6.5	6.9	0.23	NONE	1.3	15.7	38	38	332	1103	119	12	21	6.5	34.3	6.3	1.17	0.18	17.3	8.1	9	11	67	12	1

Introduction: Ag Concepts® Enhance is a foliar fertilizer product which includes humic acid (product information at right). The objective of this study was to evaluate Enhance uptake mechanisms through tissue and soil. To examine Enhance uptake, the product was applied as a pre-plant soil applied fertilizer sprayed on May 4, 2016 and foliarly on June 27, 2016 with post-herbicide application. For both applications, the rate was 64 oz Enhance with 35 gal/ac of water.

Plant tissue samples were taken at R2 on July 7, 2016. Petiole and trifolate samples of the uppermost fully expanded trifoliate were separated and tested *(Table 1)*. Yield was recorded using a yield monitor and weigh wagon *(Figure 1 and 2, Table 2)*.

Product information from:
http://www.kellysolutions.com/erenewals/documentsubmit/KellyData/ND%5CFertilizer%5CProduct%20Label%5CENHANCE_7_28_4_2_1_2013_5_22_45_PM.pdf

Guaranteed Analysis:

Total Nitrogen (N)……………………………………………7.00%
6.67% Ammonical Nitrogen
0.33% Urea Nitrogen
Available Phosphate (P_2O_2)………………………… …28.00%
Soluble Potash (K_2O)……………………………………..4.00%
Copper (Cu)………………………………… ……………..0.05%
0.05% Chelated Copper
Iron (Fe)………………………………………………………..0.15%
0.05% Chelated Iron
Manganese (Mn)………………………………… …………0.10%
0.10% Chelated Manganese
Zinc (Zn)……………………………………………… ……..0.10%
0.10% Chelated Zinc

Derived From:
Ammonium PolyPhosphate; Phosphoric Acid; Mono Ammonium Phosphate; Mono Potassium Phosphate; Potassium Hydroxide; Potassium Tri Poly Phosphate; Tetra Potassium Pyro Phosphate; Iron from Hydroxyethylenediaminetriacetate (FeHEDTA); and Copper, Manganese, and Zinc from Ethylenediaminetetraacetate (EDTA).
Also Contains Non Plant Food Ingredients:
0.35% Humic Acids from Leonardite
0.275% Kelp from Ascophyllum Nodosum

Results:

Table 1. Trifoliate and petiole nutrient samples at R2 on July 7, 2016.

	Trifoliate				Petiole			
	Check	Foliar Enhance	Pre-Plant Enhance	P-Value	Check	Foliar Enhance	Pre-Plant Enhance	P-Value
N %	6.06 A*	5.69 A	5.86 A	0.5173	2.05 A	1.97 A	2.17 A	0.7067
P %	0.54 A	0.50 B	0.53 AB	0.0948	0.47 A	0.42 A	0.46 A	0.4669
K %	2.52 A	2.47 A	2.48 A	0.8237	5.87 A	5.53 A	5.75 A	0.1876
S %	0.33 A	0.32 A	0.33 A	0.9012	0.16 A	0.16 A	0.16 A	0.8091
Ca %	1.33 A	1.37 A	1.32 A	0.657	1.21 A	1.30 A	1.25 A	0.657
Mg %	0.42 A	0.42 A	0.40 A	0.0899	0.29 A	0.31 A	0.31 A	0.6055
Cl %	0.10 A	0.10 A	0.10 A	0.6699	0.06 A	0.06 A	0.06 A	0.7703
Zn ppm	63 A	52 A	58 A	0.3811	27 A	25 A	26 A	0.9016
Fe ppm	114 A	116 A	117 A	0.9539	58 A	67 A	65 A	0.4038
Mn ppm	95 A	94 A	91 A	0.6405	33 A	32 A	34 A	0.8801
Cu ppm	9.85 A	9.33 A	9.63 A	0.8367	7.1 A	7.3 A	6.9 A	0.9162
B ppm	39 A	39 A	38 A	0.1253	28 A	29 A	28 A	0.3983
Mo ppm	1.00 AB	0.80 B	1.20 A	0.0293	0.82 A	0.76 A	1.06 A	0.1097

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

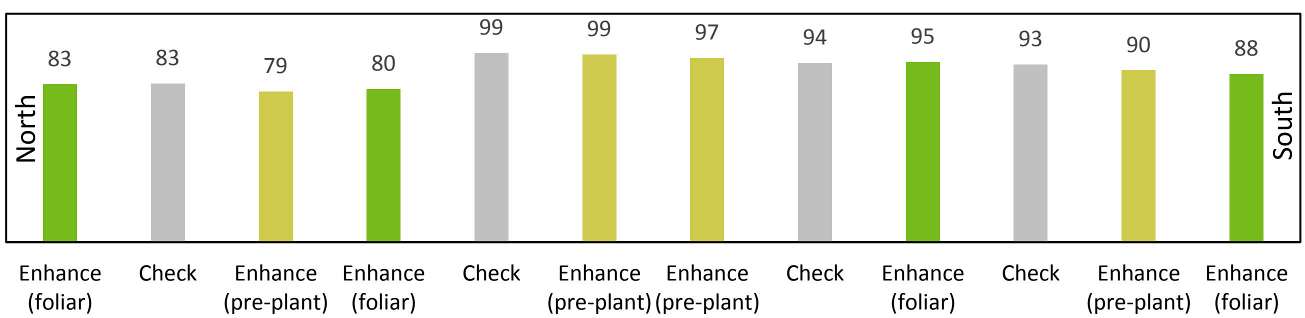


Figure 1. Yield average by treatment (bu/ac) from north to south.

Figure 2. Yield monitor data by treatment.

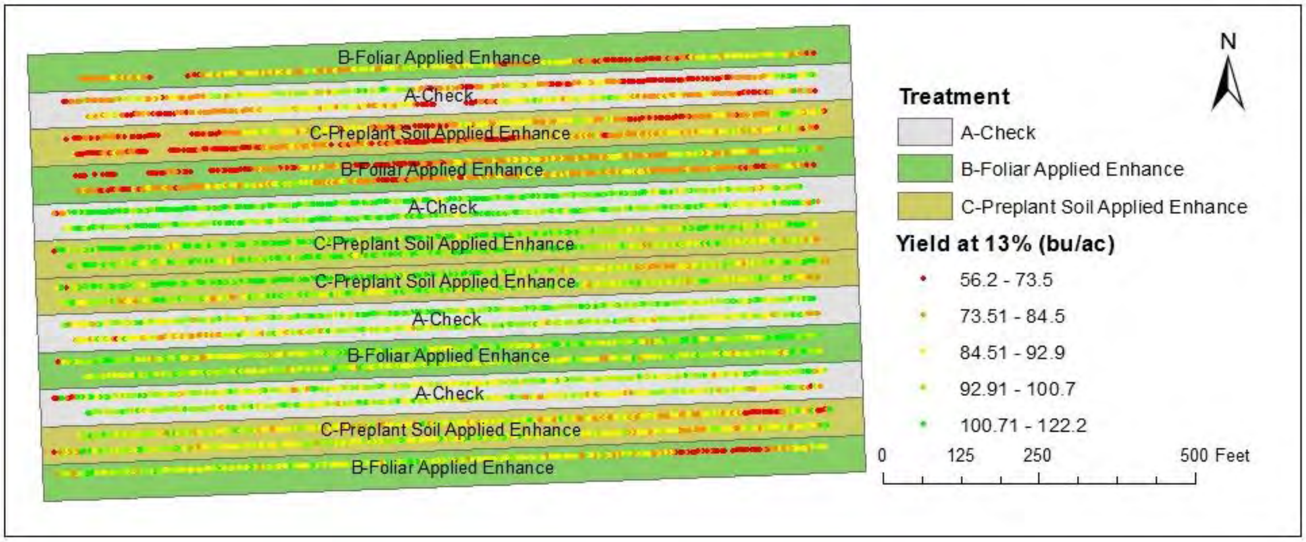


Table 2. Yield and moisture from yield monitor, harvest stand counts, and net return.

	Yield (bu/acre)†	Moisture (%)	Harvest Stand Count	Marginal Net Return‡ ($/ac)
Check	93 A*	11.3 A	106,000 A	$860.25
Foliar Enhance	87 A	11.2 A	106,250 A	$784.14
Pre-Plant Enhance	91 A	11.3 A	108,750 A	$821.14
P-Value	0.3386	0.724	0.5208	-

*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 $9.25/bu soybean price, $0.195/oz product cost, and $8.13 application cost.

Summary: Trifolate and petiole samples did not detect increased nutrient uptake when Enhance was applied as a pre-plant or foliar.

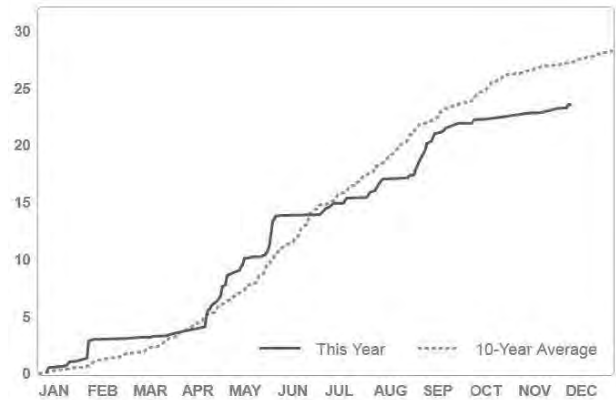
Yield was not increased by soil or foliar application of Enhance. Yield monitor data is reported here; weigh wagon data was also collected and produced the same conclusion. Sudden death syndrome (SDS) was present in the first replication. To evaluate the effect of SDS on treatments, the data were analyzed without the first replication. Results showed a higher yield for treatments but no statistical differences were found.

This study was sponsored in part by: Ag Concepts® Corp.

Soa Soap Foliar Application on Corn

Study ID: 441035201601
County: Clay
Soil Type: Crete silt loam 0-1% slope; Hastings silt loam 3-7% slopes
Planting Date: 5/5/16
Harvest Date: 10/21/16
Population: 34,000
Row Spacing (in): 30
Hybrid: Dekalb 60-69 RIB
Reps: 4
Previous Crop: Corn
Tillage: Conventional Till
Herbicides: ***Pre:*** Roundup® and 2,4-D on 4/25/16 ***Post:*** Lexar®, Roundup PowerMAX®, and Class Act® on 5/15/16
Seed Treatment: Acceleron® 250
Foliar Insecticides: None
Foliar Fungicides: None

Fertilizer: 32 lb/ac 11-52-0, 5 lb/ac zinc, and 15 lb/ac sulfur in Fall 2015; 240 lb/ac 46-0-0 and 3 gal/ac 9-24-3 on 5/1/16
Irrigation: Gravity, Total: 12"
Rainfall (in):



Soil Sample:

Soil pH 1:1	Buffer pH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	OM LOI-%	Nitrate-N ppm N	0-8" Nitrate-N Lbs N/A	Phos ppm	Ammonium Acetate ppm K	Ca	Mg	Na	S	DTPA ppm Zn	Fe	Mn	Cu
6.0	6.9	0.17	NO	2.2	14	34	29	395	1832	222	27	12	2.5	45.9	13.2	0.6

Introduction: Soa Soap was sprayed on crop at a rate of 5 oz/ac when the crop was at V7 growth stage. The application of soa soap was compared with no application. Soa Soap product was analyzed by Midwest Laboratories, Inc.® Analysis is on the right.

		Analysis (as received)	Analysis (dry weight)	Total content, lb/gal (as received)
Nitrogen				
Total Nitrogen	%		7.94	0.340
Organic Nitrogen	%			0.318
Ammonium Nitrogen	%			0.023
Nitrate Nitrogen	%			---
Major and Secondary Nutrients				
Phosphorus	%		---	---
Phosphorus as P_2O_5	%		---	---
Potassium	%		---	---
Potassium as K_2O	%		---	---
Sulfur	%		0.17	0.007
Calcium	%		0.06	0.003
Magnesium	%		0.04	0.002
Sodium	%		0.705	0.030
Micronutrients				
Zinc	ppm		45	---
Iron	ppm		---	---
Manganese	ppm		---	---
Copper	ppm		---	---
Boron	ppm		---	---
Other Properties				
Moisture	%			
Total Solids	%			
C:N Ratio			---	
Total Carbon	%		85.63	
Chloride	%		---	
pH		10.30		
Density	lb/gal	9.16		

Results:

	Harvest Stand Count	Lodging (%)	Test Weight (lb/bu)	Moisture (%)	Yield (bu/acre)†	Marginal Net Return‡ ($/ac)
Check	31,500 A*	10 A	62 A	16.1 A	224 A	$683.20
Soa Soap 5 oz/ac	31,250 A	4 A	62 A	16.1 A	223 A	$669.42
P-Value	0.8675	0.1411	0.9547	0.9421	0.6393	N/A

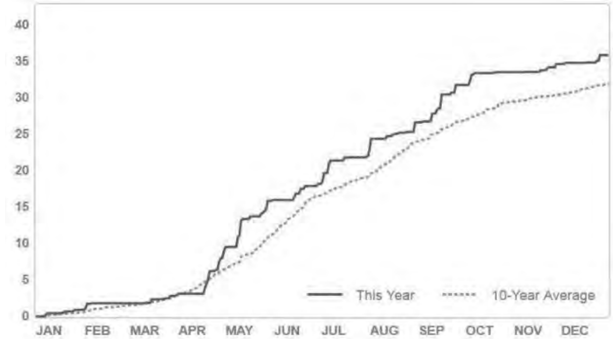
*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn, Soa Soap product cost of $3.91 and application cost of $6.82.

Summary: There was no difference in harvest stand count, stalk lodging, test weight, moisture, or yield between the check and the soa soap application. The check resulted in the highest net return since the additional cost of product and application was not recovered.

Alfalfa Response to Foliar Fertilizers

Study ID: 613023201601
County: Butler
Soil Type: Hastings silt loam 0-1% slope
Planting Date: August 2011
Harvest Date: 7/7/16
Hybrid: NexGro 6497R Genuity RR
Reps: 4

Irrigation: Pivot
Rainfall (in):



Soil Sample Results:

ID	Soil pH 1:1	WDRF Buffer pH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lbs N/A	Mehlich P-III ppm P	Sulfate-S ppm S	Boron-ppm B	Ammonium Acetate (ppm)				CEC me/100g	% Base Saturation				
											K	Ca	Mg	Na		H	K	Ca	Mg	Na
1	6.3	6.8	0.30	NONE	3.5	11.4	27	69	14	0.90	296	2565	336	15	19.0	13	4	68	15	0

Introduction: Several foliar fertilizer products were applied to alfalfa: Aspen Brix®, Aspen Ceres K®, and Aspen Engergizer®. The product active ingredients are below. Treatments were applied on June 18 (8 days after previous cutting), with 4-6" of regrowth. It had rained approximately 1 inch before dawn that day, and also had been irrigated in the previous 48 hours. Products were applied in a 28 gpa solution. This was a small plot study conducted on-farm. Plots were 25 foot long.

Aspen Brix®

GUARANTEED ANALYSIS:

Total Nitrogen (N) 6.00%, Phosphorous (P) 4.0%, Potassium (K) 2.0%, Sulfur (S) 2.0%
Derived From: Urea, orthophosphate, potassium hydroxide, and sulfuric acid.

Aspen Ceres K®

GUARANTEED ANALYSIS:

0-0-15

Total Nitrogen (N) 0.00%, Available Phosphoric Acid (P_2O_5), Soluble Potash (K_2O) Derived From: Potassium Chloride, Chlorine (CL) not more than 10%
Also Contains Nonplant Food Ingredient: Organic Acids

Aspen Energizer®

GUARANTEED ANALYSIS:

Total Nitrogen (N) 5.00% (1.20% Ammoniacal Nitrogen, 3.80% Urea Nitrate, Available Phosphoric Acid (P_2O_5) 4.00%, Soluble Potash (K_2O) 2.00%, Manganese (Mn) 2.00% (2.00% Chelated Manganese

Product Information from: *http://www.aspenveterinaryresources.com/Products/Product-items*

Results:

	Yield (lb hay/ac)	Relative Feed Value	Relative Feed Quality	Total Digestible Nutrients	Marginal Net Return‡ ($/ac)
Check	2,772 A*	130 B	148 A	51.3 AB	$117.32
Aspen Ceres K (1 gal/ac)	2,798 A	143 A	164 A	52.2 A	$109.41
Aspen Brix (1 gal/ac)	2,918 A	135 AB	150 A	50.8 B	$110.49
Aspen Energizer (1 qt/ac)	2,888 A	141 AB	165 A	51.8 AB	$116.98
Aspen Brix (1 gal/ac) + Aspen Energizer (1 qt/ac)	2,822 A	140 AB	161 A	51.8 AB	$101.16
P-Value	0.178	0.054	0.120	0.036	N/A

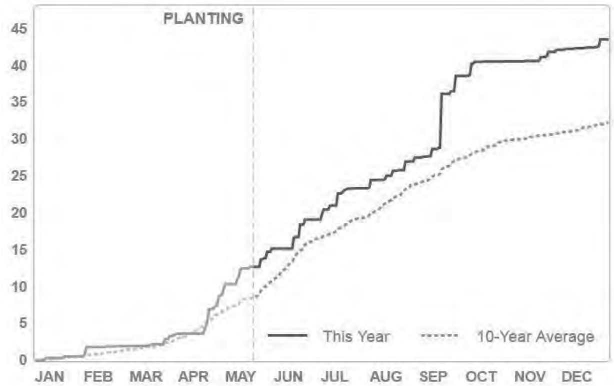
*Values with the same letter are not significantly different at a 90% confidence level.
‡Marginal net return based on $84.64/ton alfalfa hay,$9/gal Aspen Ceres K, $13/gal Aspen Brix, and $5.25/qt Aspen Energizer. No application cost was added as producers would likely apply these products through a center pivot system.

Summary: There was no difference in yield or relative feed quality between the check and the foliar fertilizer treatments tested. Aspen Ceres K resulted in higher relative feed value than the check. None of the fertilizers tested resulted in greater total digestible nutrients than the check. Due to no yield difference and the cost of products applied, the highest marginal net return was realized for the untreated check. It should be noted that the marginal net return was calculated using a price per ton ($84.64/ton) and does not take into account alfalfa quality; price used may be adjusted to make this applicable to individual situations.

Conklin® Kip Cullers' Nutrient Compass Foliar Fertilizer on Soybeans

Study ID: 319039201602
County: Cuming
Soil Type: Moody silty clay loam 2-6% slopes
Planting Date: 5/20/16
Harvest Date: 10/3/16
Population: 130,000
Row Spacing (in): 36
Hybrid: Curry 1252
Reps: 4
Previous Crop: Corn
Tillage: No-Till

Irrigation: None
Rainfall (in):



Soil Sample Results:

pH	P (ppm)	K (ppm)	S (ppm)	Zn (ppm)	OM	CEC	Base Saturation			
							K%	Mg%	Ca%	H%
6.1	15	219	16	0.7	1.9	23.1	2.4	21.3	62.4	13.9

Introduction: This study is looking at the effects of Conklin® Kip Cullers' Nutrient Compass Foliar Fertilizer on Soybeans. The product was applied at a rate of 1 qt/acre in a 10 gal/acre solution on the evening of June 16, 2016 when soybeans were at V4 growth stage. Product information is at right.

KIP CULLERS NUTRIENT COMPASS

Guaranteed Analysis: 3-4-8
Total Nitrogen (N) 3.0%
0.4% Ammoniacal Nitrogen
1.9% Urea Nitrogen
0.7% Other Water Soluble Nitrogen
Available Phosphate (P_2O_5) 4.0%
Soluble Potash (K_2O) 8.0%
Sulfur (S) 1.4%
1.4 % combined Sulfur (S)
Boron (B) 0.04%
0.04% Boron from Boric Acid (B)
Manganese (Mn) 1.7%
1.7% Chelated Manganese (Mn)
Molybdenum (Mo) 0.0009%
0.0009% Molybdenum from Sodium Molybdate (Mo)
Zinc (Zn) 0.8%
0.8% Chelated Zinc (Zn)
Plant nutrients derived from: ammonia, urea, potassium hydroxide, phosphoric acid, potassium thiosulfate, boric acid, manganese oxide (EDTA), sodium molybdate, zinc oxide (EDTA).

Product information from:
http://www.conklin.com/eblast/ag/KipCullers_NutrientCompass_label.pdf

Results:

	Yield (bu/acre)†	Marginal Net Return‡ ($/ac)
Check	65	$601.25
Kip Culler's Nutrient Compass Foliar Fertilizer	66	$595.68
P-Value	N/A	N/A

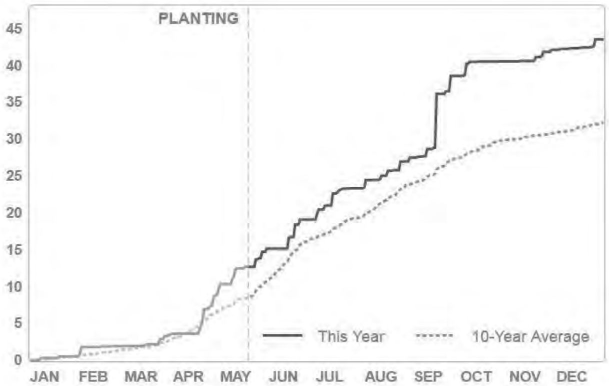
†Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $9.25/bu soybean, $8/ac product cost, and $6.82 application cost.

Summary: The treatments in this study were replicated but not randomized therefore no conclusions can be drawn.

Kugler KQ Calcium Chloride on Soybeans

Study ID: 319039201601
County: Cuming
Soil Type: Moody silty clay loam 2-6% slopes
Planting Date: 5/19/16
Harvest Date: 10/4/16
Population: 130,000
Row Spacing (in): 36
Hybrid: Curry 1252
Reps: 4
Previous Crop: Corn
Tillage: No-Till

Irrigation: None
Rainfall (in):



Introduction: Kugler KQ Calcium Chloride was applied at a rate of 1 gal/acre in a 7 gal/acre solution on April 4, 2016. Product information is below. The field was grid sampled in 2009. pH was between 5.8 and 6.1 and buffer pH was between 6.5 and 6.7. Lime was applied at a rate of just over 2 ton/acre. No lime or calcium was applied since then until April 4, 2016 for this study. Soil tests were also taken in the fall of 2015; pH was 6.3. Base saturations were as follows:

K% = 2.3, Mg% = 21.5, Ca% = 66.0, and H% = 10.2.

KUGLER

GUARANTEED ANALYSIS:

Calcium (Ca) 12%

Derived from Calcium Chloride

Appearance	Colorless
Odor	Mild
pH	7.0
Specific gravity	1.32

Results:

	Yield (bu/acre)†	Marginal Net Return‡ ($/ac)
Check	66	$610.50
Kugler KQ Calcium Chloride	68	$617.18
P-Value	N/A	N/A

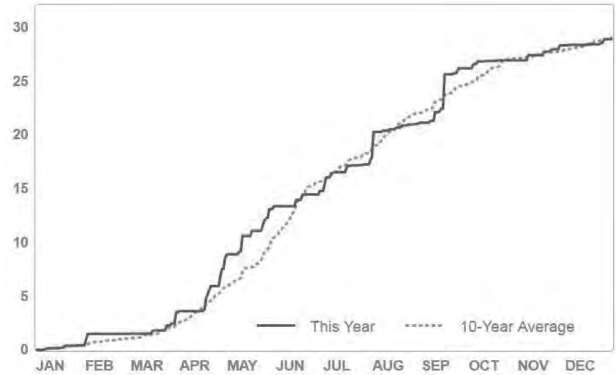
†Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $9.25/bu soybean, $5/ac product cost, and $6.82/ac application cost.

Summary: This study was replicated but not randomized, therefore no conclusions can be drawn.

Sidedress Application of 10-34-0 on Soybeans

Study ID: 220125201601
County: Nance
Soil Type: Hall silt loam 0-1% slope
Planting Date: 6/1/16
Row Spacing (in): 30
Hybrid: Innotech IS2636
Reps: 5
Previous Crop: Corn
Tillage: Strip-till
Herbicides: 44 oz/ac Roundup PowerMAX®, 0.3 oz/ac FirstRate®, 14.5 oz/ac ClassAct® NG®, 3 oz/ac Interlock®, 8.1 oz/ac Superb® HC applied in 15 gpa on 5/23/16

Irrigation: Gravity
Rainfall (in):



Introduction: This study is comparing a sidedress application of 10-34-0 to an untreated check. The application to the soybean crop was made on July 9, 2016 at R1 growth stage.

Results:

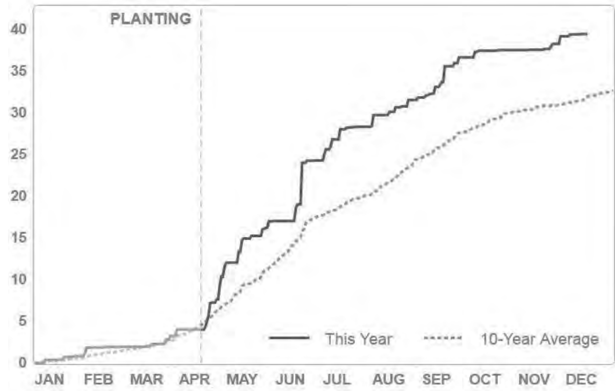
	Yield (bu/acre)†	Seeds per lb	Protein (%)	Oil (%)	Marginal Net Return‡ ($/ac)
Check	76	2,189	36.7	21.3	$702.71
Sidedress 10-34-0	77	2,178	36.0	21.0	$672.16
P-Value	N/A	N/A	N/A	N/A	N/A

†Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $9.25/bu soybean, $8.13/ac fertilizer application, and $3.35/gal 10-34-0.

Summary: Plots were replicated but not randomized, therefore a statistical analysis was not performed and conclusions could not be drawn. Treatment means are provided in the results table.

Sidedress Nitrogen Application Rate Comparison

Study ID: 004053201601
County: Dodge
Soil Type: Moody silty clay loam 0-2% slope; Moody silty clay loam 2-6% slopes
Planting Date: 4/15/16
Harvest Date: 10/31/16
Population: 34,000
Row Spacing (in): 30
Hybrid: Hoegemeyer 8470
Reps: 4
Previous Crop: Soybean
Tillage: Turbo-till
Herbicides: ***Pre:*** 2.4 qt/ac Keystone® LA on 4/16/16 ***Post:*** 32 oz/ac Roundup®, 0.75 oz/ac Armazon™; 0.5 lb/ac Atrazine on 6/2/16
Seed Treatment: Poncho 250
Foliar Insecticides: 3 oz/ac Capture® LFR®
Foliar Fungicides: 10 oz/ac Headline AMP® 7/15/16
Fertilizer: 70 lb/ac 32-0-0 on 4/16/16 and variable sidedress amounts
Irrigation: Pivot, Total applied: 3"
Rainfall (in.):



Introduction: The objective of this study was to evaluate sidedress N rates. The producer's normal sidedress N rate is 140 lb N/ac. To test this rate, the producer compared 110 lb N/ac and 170 lb N/ac. Sidedress application treatments were made on June 9, 2016 with 32% UAN. The UNL N rate calculator suggested a sidedress rate around 80 lb N/ac.

Results:

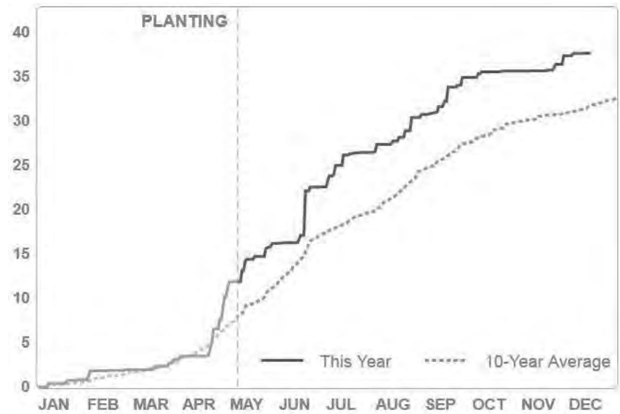
	Harvest Stand Count (plants/acre)	Moisture (%)	Yield (bu/acre)†	Marginal Net Return‡ ($/ac)
110 lb N/ac Sidedress	27,333 A*	15.1 A	247 A	707.15
140 lb N/ac Sidedress	28,708 A	15.1 A	250 A	703.70
170 lb N/ac Sidedress	28,083 A	15.5 A	249 A	688.05
P-Value	0.1903	0.3622	0.5325	N/A

*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 $3.05/bu corn and $0.42/lb N.

Summary: There was no yield difference between the three sidedress N rates tested in 2016. The lowest N rate resulted in the highest net return.

Sidedress Nitrogen Application with the Climate FieldView™ Advisor - Corn on Corn

Study ID: 359053201601
County: Dodge
Soil Type: Kennebec silt loam; Kennebec and Colo soils; Zook silt loam; Zook silty clay loam; Alcester silty clay loam
Planting Date: 5/6/16
Harvest Date: 11/1/16
Population: 28,300
Row Spacing (in): 30
Hybrid: Pioneer 1197AMXT
Reps: 4
Previous Crop: Corn
Tillage: No-Till
Herbicides: ***Pre:*** 5 oz/ac Corvus®, 1 lb/ac Atrazine, 8 oz/ac 2,4-D with 32% and ATS on 5/7/16 ***Post:*** 3 oz/ac Status®, 32 oz/ac Roundup®, 40 oz/ac Warrant®, and 1 qt/100 gal crop oil on 6/17/16
Seed Treatment: Amplify-D® Seed Treatment
Foliar Insecticides: 10 oz/ac Capture® LFR® with starter on 5/6/16;
3.2 oz/ac Lambda-Cy® Gold by plane on 8/2/16
Foliar Fungicides: 9 oz/ac Affiance® fungicide with post herbicide on 6/17/16;
10 oz/ac Affiance® fungicide on 8/2/16
Fertilizer: 75 lb N/ac as 32% (10%ATS) with herbicide; 5 gal/ac 6-24-6 starter and 0.5 pt/ac Zinc, 0.7 pt/ac Copper, 0.5 pt/ac Ca, 10 oz/ac Soil X-cyto with starter.
Note: The field was flooded twice when the Maple Creek came out of its banks.
Irrigation: None
Rainfall (in):



Introduction: The objective of this study was to evaluate the Climate FieldView™ Nitrogen Advisor Tool. Nitrogen Advisor is built on a detailed process model that takes into account the major physical, chemical, and biological processes that affect nitrogen in agricultural fields. The model takes into account a field's soil, weather and management conditions in order to make daily calculations of nitrogen gains, losses and transformations, all of which are specific to that field. The tool calculated an in-season N recommendation of 65 lb N/ac. To test this recommendation, three N treatments were used: the Climate FieldView rate, the Climate FieldView rate + 30 lb N/ac, and the Climate FieldView rate - 30 lb N/ac. Sidedress application treatments were made on June 11, 2016 with 32% UAN and 10% ATS. Additionally, 0.5 pt/ac zinc, 0.7 pt/ac Mn, 2 pt/ac B, and 0.7 pt/ac Mg were included in the fluid fertilizer mixture. There was additional S, Zn, Mn, B, and Mg applied with the +30 lb N/acre rate and less with the -30 lb N/acre, which could confound the N rate treatments.

Results:

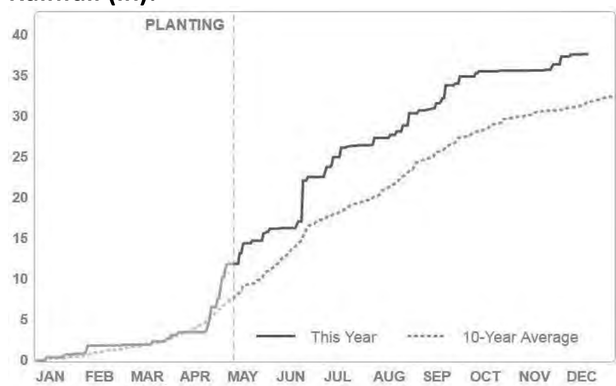
Sidedress N Treatment§	Harvest Stand Count (plants/ac)	Moisture (%)	Yield (bu/acre)†	Marginal Net Return‡ ($/ac)
Climate FieldView Rate - 30 lb N/ac (35 lb N/ac)	23,917 A	14.0 A	196 A	580.65
Climate FieldView Rate (65 lb N/ac)	24,083 A	14.0 A	201 A	581.20
Climate FieldView Rate + 30 lb N/ac (95 lb N/ac)	24,042 A	14.2 A	201 A	566.50
P-Value	0.988	0.228	0.819	N/A

*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 $3.05/bu corn and $0.49/lb nitrogen fertilizer cost.
§Sidedress rates are in addition to 78 lb N/ac already applied

Summary: There was no population, moisture, or yield difference between the treatments. The recommended nitrogen rate using the UNL N rate calculator (pre-season model) was 136 lb N/ac and Climate FV Nitrogen Advisor recommended a total of 142 lb N/ac for the season. Therefore, both the UNL N Rate and Climate FV Nitrogen Advisor recommended similar N rates for the season.

Sidedress Nitrogen Application with the Climate FieldView^{TM} Advisor - Corn Following Soybeans

Study ID: 359053201602
County: Dodge
Soil Type: Moody silty clay loam
Planting Date: 5/5/16
Harvest Date: 11/1/16
Population: 29,173
Row Spacing (in): 30
Hybrid: Croplan 6065VT2P/RIB
Reps: 4
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** Burndown: 24 oz/ac Roundup®, 1 oz/ac Vida, 10 oz/ac 2,4-D, 1 qt/100 gal Hel-Fire® on 4/16/16;
5 oz/ac Corvus®, 1 lb/ac Atrazine, 8 oz/ac 2,4-D on 5/6/16 ***Post:*** 1 pt/ac Soil Boost + AMS, 3 oz/ac Status®, 40 oz/ac Warrant®, and 32 oz/ac Roundup on 6/16/16
Seed Treatment: Amplify-D® Seed Treatment
Foliar Insecticides: 4 oz/ac Capture® LFR® with starter on 5/5/16; 3.2 oz/ac Lambda-Cy® Gold by plane on 7/12/16
Foliar Fungicides: 9 oz/ac Affiance® fungicide with post herbicide on 6/6/16; 10.5 oz/ac Quilt Xcel® fungicide and 3.2 oz/ac Lambdacy Gold + Crop Oil by plane on 7/12/16
Fertilizer: 75 lb N/ac as 32% (10%ATS) with herbicide; 5 gal/ac 6-24-6 starter and 3 pt/ac Mn, 0.5 pt/ac Ca, 10 oz/ac Soil X-CYTO® with starter and variable sidedress rates
Note: Fremont Biosolids were applied on this farm 3 years ago at 10 ton/ac.
Irrigation: None
Rainfall (in):



Introduction: The objective of this study was to evaluate the Climate FieldView^{TM} Nitrogen Advisor Tool. Nitrogen Advisor is built on a detailed process model that takes into account the major physical, chemical, and biological processes that affect nitrogen in agricultural fields. The model takes into account a field's soil, weather and management conditions in order to make daily calculations of nitrogen gains, losses and transformations, all of which are specific to that field. The tool's calculated in-season N recommendation was 60 lb N/acre. To test this recommendation, three N treatments were used: the Climate FieldView rate, the Climate FieldView rate + 30 lb N/acre, and the Climate FieldView rate - 30 lb N/acre. Sidedress application treatments were made on June 10, 2016 with 32% UAN and 10% ATS. Additionally, 0.5 pt/acre Mn, 2 pt/acre B were included in the fluid fertilizer mixture. There was additional S, Mn, and B applied with the +30 lb N/acre rate and less with the -30 lb N/acre, which could confound the N rate treatments.

Results:

Sidedress N Treatment§	Harvest Stand Count (plants/ac)	Moisture (%)	Yield (bu/acre)†	Marginal Net Return‡ ($/ac)
Climate FieldView Rate - 30 lb N/ac (30 lb N/ac)	29,208 A	13.4 B	224 A	668.50
Climate FieldView Rate (60 lb N/ac)	29,167 A*	13.5 AB	226 A	659.90
Climate FieldView Rate + 30 lb N/ac (90 lb N/ac)	28,417 B	13.6 A	239 A	684.85
P-Value	0.0232	0.0723	0.2006	N/A

*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 $3.05/bu corn and $0.49/lb nitrogen fertilizer.
§Sidedress rates are in addition to 78 lb N/ac already applied

Summary: There were minor differences in population and moisture. Although there were up to 15 bu/acre yield variations between treatments, they were not statistically significant due to variability in response. The recommended nitrogen rate using the UNL N rate calculator (pre-season model) was 117 lb N/acre and Climate FV Nitrogen Advisor recommended a total of 137 lb N/acre for the season. Therefore, the UNL N Rate and Climate FV Nitrogen Advisor recommended N rates were within 20 lb N/acre.

Project SENSE

Sensors for Efficient N use and Stewardship of the Environment

The Nebraska On-Farm Research Network launched a new project in 2015 focused on improving the efficiency of nitrogen fertilizer use. Project SENSE (Sensors for Efficient Nitrogen Use and Stewardship of the Environment) is a three-year project that looks at using crop canopy sensors to direct variable-rate, in-season nitrogen application in corn. Seventeen on-farm research sites were selected in 2015 and 19 sites were selected in 2016 (Figure 1). These sites were located in five Natural Resource Districts: Central Platte, Little Blue, Lower Loup, Lower Platte North, and Upper Big Blue. 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 which direct crop nitrogen status at early growth stages are promising as a way to improve nitrogen fertilizer efficiency.

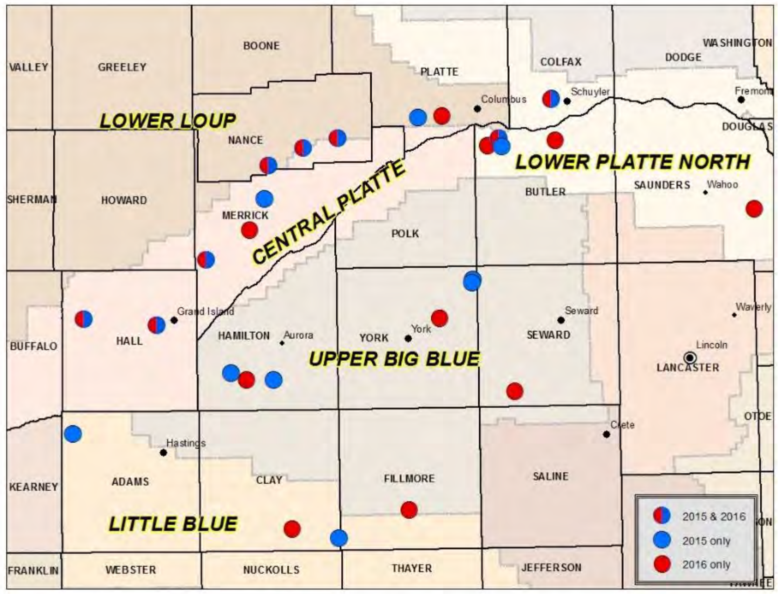


Figure 1: Locations of Project SENSE on-farm research sites in 2015 (17 sites) and 2016 (19 sites).

Managing Variability with Sensors

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 2). 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

Figure 2: Active crop canopy sensor positioned over corn canopy.

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.

Equipment and Experimental Design

Figure 3: 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 drop nozzles in order to apply UAN fertilizer to the crop as it was sensed (Figure 3).

Project SENSE plots were arranged in a randomized complete block design with six replications. The grower's normal N management was compared to 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 pre-tassel, 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 average difference in yield (bu/acre) was 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 and 2016 All Site 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. Results of on-farm research experiment sites were summarized.

Over all sites combined, the Project SENSE N management resulted in a reduction of 40 lb and 34 lb of N/acre when compared to the grower N management for 2015 and 2016 respectively. This resulted in a loss of 5 bu/ac in 2015 and 3 bu/ac in 2016. NUE and marginal net return was greater for the Project SENSE N management in both years. Summaries for each site in 2016 are presented in the following pages of this report.

2015 Summary (17 sites)

	N Rate (lb/ac)	Yield (bu/ac)†	PFPn§	Lb N/bu	Marginal Net Return ($/ac)‡
Grower N Management	195	227 A*	66 B	0.88 A	701.80
Project SENSE N Management	155	222 B	86 A	0.71 B	709.55
P-Value	*N/A*	*<.0001*	*<.0001*	*<.0001*	*N/A*

*Values with the same letter are not significantly different at a 95% confidence level.
†Bushels per acre are corrected to 15.5% moisture.
‡Marginal net return based on $3.65/bu corn and $0.65/lb N fertilizer. Cost of applicator and equipment is not included in this calculation.
§Partial factor productivity of N (lb grain/lb N fertilizer).

2016 Summary (19 sites)

	N Rate (lb/ac)	Yield (bu/ac)†	PFPn§	Lb N/bu	Marginal Net Return ($/ac)‡
Grower N Management	188	202 A*	63 B	0.95 A	530.44
Project SENSE N Management	154	199 B	75 A	0.79 B	537.48
P-Value	*N/A*	*<.0001*	*<.0001*	*<.0001*	*<.0001*

*Values with the same letter are not significantly different at a 95% confidence level.
†Bushels per acre are corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $0.45/lb N fertilizer. Cost of applicator and equipment is not included in this calculation.
§Partial factor productivity of N (lb grain/lb N fertilizer).

Profitability and efficiency of Project SENSE N management was compared to the grower's standard management *(Figure 2).* 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. At the majority of the sites Project SENSE had higher profit and greater efficiency (top right quadrant).

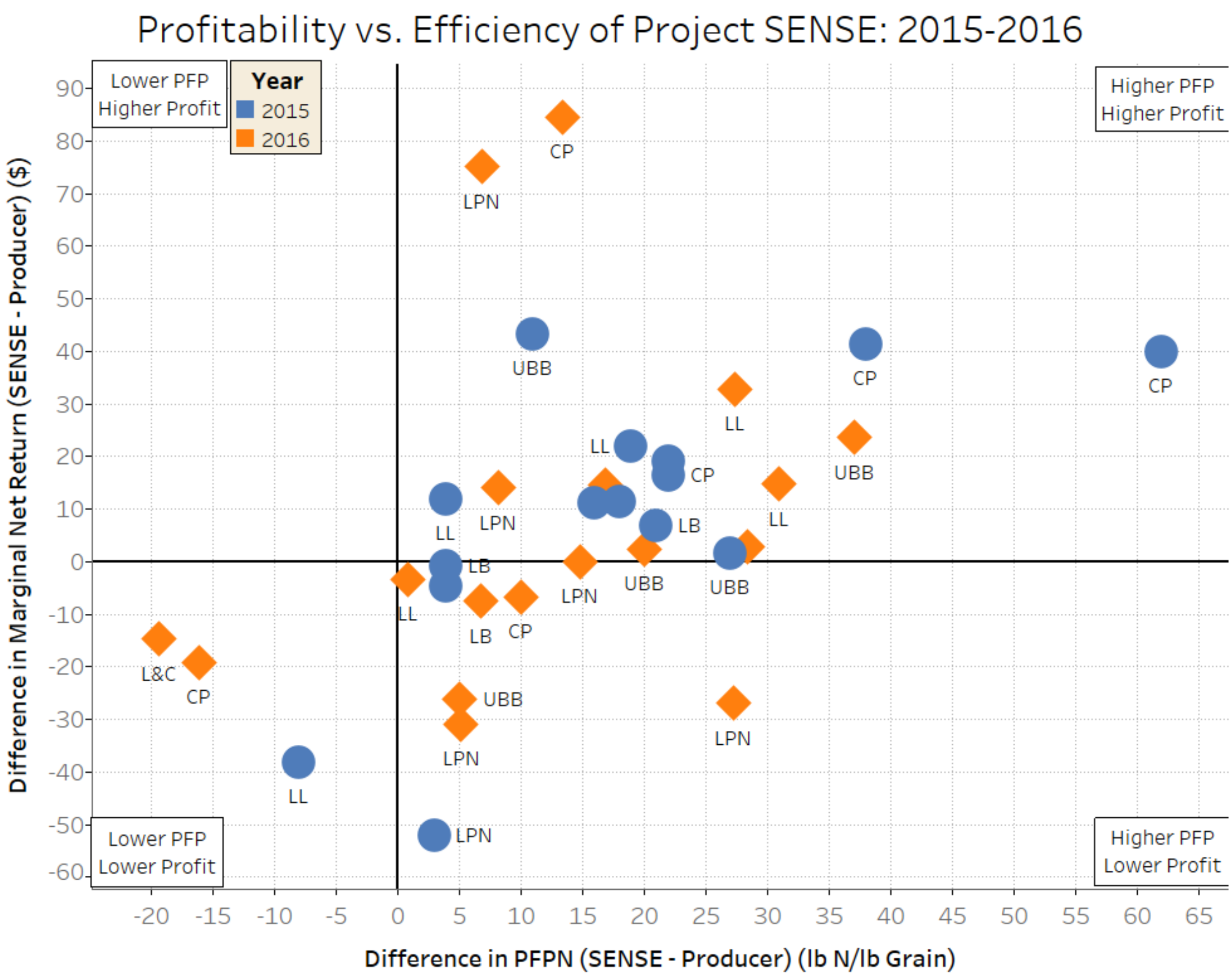


Figure 4. Profitability and efficiency of Project SENSE N management compared to the grower's management.

Continuing On

Project SENSE will continue in 2017 with a goal of 20 on-farm research experiment sites. 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

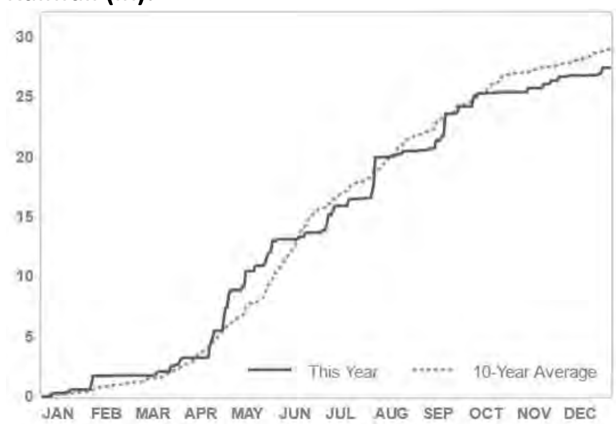
Nebraska CornBoard

USDA

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

Study ID: 021125201601
County: Nance
Soil Type: Loretto-Thurman complex 1-3% slope; Thurman loamy fine sand 2-6% slopes, eroded; Thurman loamy fine sand 2-6% slopes; Thurman loamy fine sand 1-3% slope
Planting Date: 5/10/16
Harvest Date: 10/31/16
Population: 28,600
Hybrid: P1197
Reps: 6
Previous Crop: Soybean
Tillage: No-Till
Irrigation: Pivot

Rainfall (in):



Soil Sample Results: Soil samples were taken in three locations within the research study area and do not correspond to specific treatments or replications.

ID	Soil pH 1:1	WDRF Buffer pH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lbs N/A	Mehlich P-III ppm P	Sulfate-S ppm S	Zn (ppm)	Ammonium Acetate (ppm) K	Ca	Mg	Na	CEC me/100g	% Base Saturation H	K	Ca	Mg	Na
1	6.0	6.8	0.16	NONE	0.9	25.8	62	38	12	2.64	128	749	72	4	6.2	24	5	61	10	0
2	5.8	6.8	0.21	NONE	1.1	33.9	81	25	11	3.48	155	666	77	3	6.0	27	7	55	11	0
3	5.6	6.7	0.21	NONE	1.6	29.8	71	40	12	2.74	255	839	87	5	8.9	37	7	47	8	0

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 to the grower's standard N management.

Grower Nitrogen Treatment: The grower applied 70 lb N/acre pre-plant. An additional 75 lb N/acre was applied in-season. The total N applied was 145 lb N/acre.

Project SENSE Nitrogen Treatment: For the SENSE treatment strips, 70 lb N/acre was applied at planting. Crop canopy sensing and application occurred on June 29, 2016 at V10 growth stage. Across all Project SENSE treatments, the average N rate applied in-season was 72 lb N/acre. The total N rate was 142 lb N/acre.

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.

	Total N rate (lb/ac)	Yield (bu/acre)†	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
Grower N Management	145	186 A*	72 A	0.78 A	502.82 A
Project SENSE N Management	142	185 A	73 A	0.77 A	499.42 A
P-Value	N/A	0.520	0.712	0.815	0.670

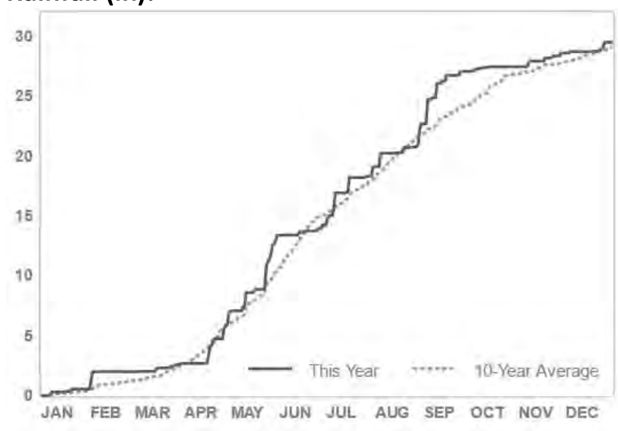
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $0.45/lb nitrogen fertilizer.
*Values with the same letter are not significantly different at a 95% confidence level.

Summary:
-Wind damage was noted at this site.
-Project SENSE N application was 2 lb N/acre lower than the grower's N application.
-There was no yield difference between the two management strategies.
-There was no difference in N use efficiency between the two management strategies.
-There was no difference in marginal net return between the two management strategies.

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

Study ID: 073081201601
County: Hamilton
Soil Type: Hastings silt loam 0-1% slope; Crete silt loam 0-1% slope; Hastings silty clay loam 7-11% slopes, eroded
Planting Date: 5/6/16
Harvest Date: 10/11/16
Population: 33,000
Hybrid: P1105AM
Reps: 6
Previous Crop: Corn
Tillage: Reduced Tillage

Irrigation: Pivot
Rainfall (in):



Soil Sample Results: Soil samples were taken in three locations within the research study area and do not correspond to specific treatments or replications.

ID	Soil pH 1:1	WDRF Buffer pH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lbs N/A	Mehlich P-III ppm P	Sulfate-S ppm S	Zn (ppm)	Ammonium Acetate (ppm) K	Ca	Mg	Na	CEC me/100g	% Base Saturation H	K	Ca	Mg	Na
6	5.9	6.7	0.37	NONE	3.0	6.3	15	26	14	1.0	406	2658	589	36	22.0	12	5	60	22	1
14	6.0	6.7	0.21	NONE	3.2	4.3	10	30	10	2.0	473	1698	237	17	14.3	18	8	59	14	1
18	5.9	6.7	0.15	NONE	3.2	2.5	6	53	9	1.5	313	1681	241	21	14.5	22	6	57	14	1

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 to the grower's standard N management.

Grower Nitrogen Treatment: Starter fertilizer provided 9 lb N/acre. The initial grower N rate was 150 lb N/acre on June 24, 2016 around V8-V9. An additional 60 lb N/acre was applied. Total N applied was 219 lb N/acre.

Project SENSE Nitrogen Treatment: Starter fertilizer provided 9 lb N/acre. For the SENSE treatment strips 150 lb N/acre was applied on June 24, 2016 around V8-V9. Crop canopy sensing and application occurred on July 11, 2016 at V13 growth stage. Across all Project SENSE treatments, the average N rate applied in-season was 30 lb N/acre. The total N rate was 189 lb N/acre.

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.

	Total N rate (lb/ac)	Yield (bu/acre)†	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
Grower N Management	219	222 A*	57 B	0.99 A	577.44 A
Project SENSE N Management	189	209 B	62 A	0.91 B	551.29 B
P-Value	N/A	<0.0001	<0.0001	<0.0001	<0.0001

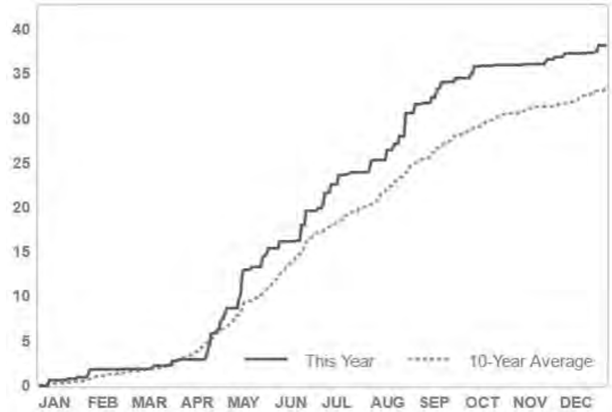
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $0.45/lb nitrogen fertilizer.
*Values with the same letter are not significantly different at a 95% confidence level.

Summary:
-Project SENSE N application was 30 lb N/acre lower than the grower's N application.
-The grower's N management resulted in a 13 bu/acre yield increase compared to the Project SENSE N management.
-Project SENSE N management resulted in higher N use efficiency than the grower's N application.
-The grower's N management resulted in $26/acre higher marginal net return than the Project SENSE N management.

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

Study ID: 108155201601
County: Saunders
Soil Type: Yutan silty clay loam 2-6% slopes, eroded; Filbert silt loam 0-1% slope; Tomek silt loam 0-2% slope
Planting Date: 5/5/16
Harvest Date: 10/31/16
Population: 31,000
Hybrid: P1197AM
Reps: 6
Previous Crop: Soybean
Tillage: No-Till

Irrigation: Pivot
Rainfall (in):



Soil Sample Results: Soil samples were taken in three locations within the research study area and do not correspond to specific treatments or replications.

ID	Soil pH 1:1	WDRF Buffer pH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lbs N/A	Mehlich P-III ppm P	Sulfate-S ppm S	Zn (ppm)	Ammonium Acetate (ppm) K	Ca	Mg	Na	CEC me/100g	% Base Saturation H	K	Ca	Mg	Na
1	6.2	6.8	0.29	NONE	3.8	10.7	26	29	9	1.2	394	2990	608	27	23.1	9	4	64	22	1
2	6.0	6.7	0.31	NONE	4.0	12.4	30	53	10	2.1	462	2474	480	25	20.6	14	6	60	19	1
4	6.0	6.6	0.25	NONE	4.1	16.6	40	111	9	3.3	517	1568	221	19	14.8	25	9	53	12	1

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 to the grower's standard N management.

Grower Nitrogen Treatment: The grower N rate was 75 lb N/acre applied prior to planting on March 17, 2016 as anhydrous ammonia. A sidedress rate of 99 lb N/acre was applied on June 27, 2016 at V10 growth stage. Total N applied was 174 lb N/acre.

Project SENSE Nitrogen Treatment: For the SENSE treatment strip, 75 lb N/acre was applied prior to planting on March 17, 2016 as anhydrous ammonia. Crop canopy sensing and application occurred on June 27, 2016 at V10 growth stage. Across all Project SENSE treatments, the average N rate applied in-season was 68.5 lb N/acre. The total N applied was 144 lb N/acre.

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.

	Total N rate (lb/ac)	Yield (bu/acre)†	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
Grower N Management	174	239 A*	77 B	0.73 A	650.45 A
Project SENSE N Management	144	234 A	92 A	0.61 B	650.38 A
P-Value	N/A	0.058	<0.0001	<0.0001	0.991

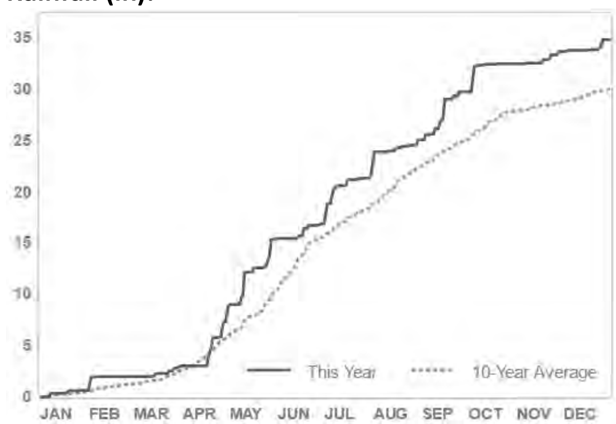
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $0.45/lb nitrogen fertilizer.
*Values with the same letter are not significantly different at a 95% confidence level.

Summary:
-The Project SENSE N application was 30 lb N/acre lower than the grower's N application. Fertilizer injury was seen on all treatments after application.
-Yield was not different between the two treatments.
-Nitrogen use efficiency was higher for the Project SENSE N management.
-There was no difference in marginal net return.

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

Study ID: 201125201601
County: Nance
Soil Type: Thurman loamy fine sand 2-6% slopes; Valentine-Thurman complex 3-9% slopes; Thurman loamy fine sand 1-3% slope
Planting Date: 5/26/16
Harvest Date: 11/15/16
Population: 30,000
Hybrid: CRM (days) 110
Reps: 6
Previous Crop: Potato
Tillage: Disk

Irrigation: Pivot
Rainfall (in):



Soil Sample Results: Soil samples were taken in three locations within the research study area and do not correspond to specific treatments or replications.

ID	Soil pH 1:1	WDRF Buffer pH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lbs N/A	Mehlich P-III ppm P	Sulfate-S ppm S	Zn (ppm)	Ammonium Acetate (ppm) K	Ca	Mg	Na	CEC me/100g	% Base Saturation H	K	Ca	Mg	Na
1	5.7	6.6	0.08	NONE	1.5	2.9	7	32	18	3.3	131	737	77	7	8.4	4.3	4	45	8	0
2	6.3	6.6	0.10	NONE	1.9	5.3	13	50	20	3.7	241	981	81	7	10.3	40	6	47	7	0
3	5.5	6.6	0.06	NONE	1.2	2.3	5	37	18	2.5	117	585	55	6	7.5	51	4	39	6	0

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 to the grower's standard N management.

Grower Nitrogen Treatment: The total N applied was 213 lb N/acre.

Project SENSE Nitrogen Treatment: For the SENSE treatment strips, 77 lb N/acre as a base rate at planting. Crop canopy sensing and application occurred on July 18, 2016 at VT growth stage. Across all Project SENSE treatments, the average N rate applied in-season was 55 lb N/acre. The total N rate was 132 lb N/acre.

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.

	Total N rate (lb/ac)	Yield (bu/acre)†	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
Grower N Management	213	203 A	53 B	1.05 A	523.88 B
Project SENSE N Management	132	196 B	84 A	0.67 B	538.48 A
P-Value	N/A	0.1197	0.0001	<0.0001	0.282

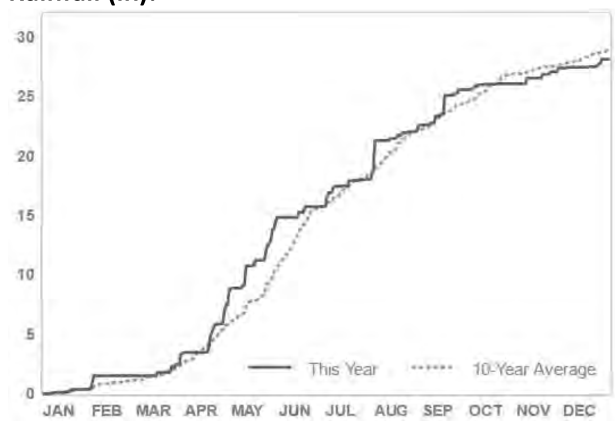
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $0.45/lb nitrogen fertilizer.
*Values with the same letter are not significantly different at a 95% confidence level.

Summary:
-Rye cover crop was present prior to planting corn.
-Project SENSE N application was 81 lb N/acre lower than the grower's N application.
-There was slight visible N stress in the Project SENSE treatments at the time of application.
-There was no yield difference between the two management strategies.
-Project SENSE N management resulted in higher N use efficiency than the grower's N application.
-Project SENSE N management resulted in higher marginal net return than the grower’s N application.

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

Study ID: 202125201601
County: Nance
Soil Type: Detroit silt loam 0-1% slope; Hord very fine sandy loam 1-3% slope; Hord fine sandy loam 0-1% slope
Planting Date: 5/1/16
Harvest Date: 11/4/16
Population: 34,000
Hybrid: CRM (days) 116
Reps: 6
Previous Crop: Soybean
Tillage: Reduced Tillage

Irrigation: Pivot
Rainfall (in):



Soil Sample Results: Soil samples were taken in three locations within the research study area and do not correspond to specific treatments or replications.

ID	Soil pH 1:1	WDRF Buffer pH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lbs N/A	Mehlich P-III ppm P	Sulfate-S ppm S	Zn (ppm)	Ammonium Acetate (ppm)				CEC me/100g	% Base Saturation				
											K	Ca	Mg	Na		H	K	Ca	Mg	Na
1	6.5	6.9	0.19	NONE	2.6	15.1	36	30	8	2.51	451	1436	157	16	10.9	11	11	65	12	1
2	6.4	7	0.21	NONE	2.2	27.3	65	51	10	2.76	412	1272	122	15	8.9	4	12	72	11	1
3	6.3	6.9	0.16	NONE	1.8	21	50	32	8	0.95	287	1266	195	53	9.7	8	8	65	17	2

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 to the grower's standard N management.

Grower Nitrogen Treatment: The total N applied was 203 lb N/acre.

Project SENSE Nitrogen Treatment: For the SENSE treatment strips, 78 lb N/acre was applied at planting. Crop canopy sensing and application occurred on June 28, 2016 at V13 growth stage. Across all Project SENSE treatments, the average N rate applied in-season was 53 lb N/acre. The total N rate was 131 lb N/acre.

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.

	Total N rate (lb/ac)	Yield (bu/acre)†	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
Grower N Management	203	179 A*	49 B	1.14 A	453.48 B
Project SENSE N Management	131	179 A	77 A	0.73 B	486.25 A
P-Value	N/A	0.961	<0.0001	<0.0001	0.003

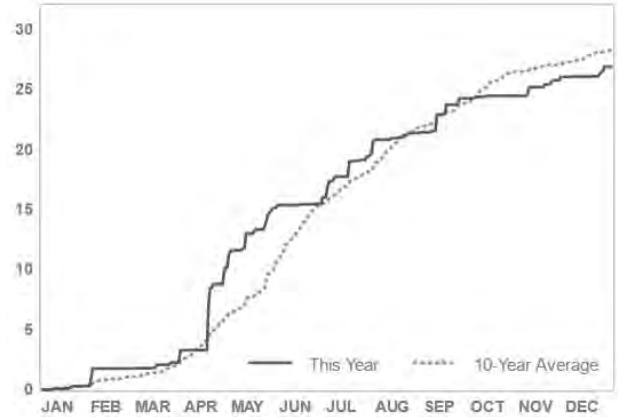
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $0.45/lb nitrogen fertilizer.
*Values with the same letter are not significantly different at a 95% confidence level.

Summary:
-Project SENSE N application was 72 lb N/acre lower than the grower's N application.
-There was no yield difference between the two management strategies.
-Project SENSE N management resulted in higher N use efficiency than the grower's N application.
-Project SENSE N management resulted in $33/acre higher marginal net return than the grower's N management due to reduced N application with no yield reduction.

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

Study ID: 205079201601
County: Hall
Soil Type: Hord silt loam 0-1% slope; Hord silt loam 1-3% slope
Planting Date: 5/5/16
Harvest Date: 10/15/16
Population: 32,000
Hybrid: P1197AMT
Reps: 6
Previous Crop: Corn
Tillage: No-Till

Irrigation: Pivot
Rainfall (in):



Soil Sample Results: Soil samples were taken in three locations within the research study area and do not correspond to specific treatments or replications.

ID	Soil pH 1:1	WDRF Buffer pH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lbs N/A	Mehlich P-III ppm P	Sulfate-S ppm S	Zn (ppm)	Ammonium Acetate (ppm) K	Ca	Mg	Na	CEC me/100g	% Base Saturation H	K	Ca	Mg	Na
1	6.9	7.2	0.25	NONE	2.8	22.5	54	36	10	3.10	295	1875	192	15	11.8	0	6	79	14	1
2	7.2	7.2	0.16	NONE	2.8	17.4	42	28	10	2.48	288	2363	243	21	14.7	0	5	80	14	1
3	6.7	7.2	0.17	NONE	2.5	19.3	46	19	12	3.59	227	2133	212	19	13.1	0	4	81	14	1

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 to the grower's standard N management. This is the second year this study was conducted on this field, with treatment strips in the same location both years.

Grower Nitrogen Treatment: The initial grower N rate was 30 lb N/acre prior to planting. An additional application of 130 lb N/acre on June 11, 2016 at V3-V4. Total N applied was 160 lb N/acre.

Project SENSE Nitrogen Treatment: For the SENSE treatment strips, 30 lb N/acre was applied prior to planting. An additional application of 60 lb N/acre was made on June 11, 2016 at V3-V4. Crop canopy sensing and application occurred on July 1, 2016 at V11 growth stage. Across all Project SENSE treatments, the average N rate applied in-season was 43 lb N/acre. The total N rate was 133 lb N/acre.

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.

	Total N rate (lb/ac)	Yield (bu/acre)†	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
Grower N Management	160	234 A*	82 B	0.69 A	640.98 B
Project SENSE N Management	133	235 A	99 A	0.57 B	655.53 A
P-Value	N/A	0.213	<0.0001	<0.0001	0.0002

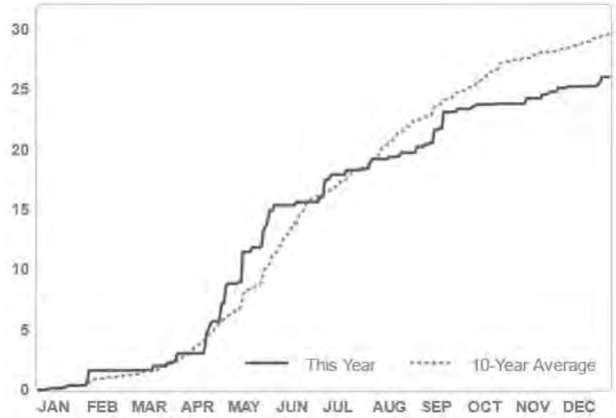
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $0.45/lb nitrogen fertilizer.
*Values with the same letter are not significantly different at a 95% confidence level.

Summary:
-Project SENSE N application was 27 lb N/acre lower than the grower's N application.
-There was no yield difference between Project SENSE N management and the grower's N management.
-Project SENSE N management resulted in higher N use efficiency than the grower's N application.
-Project SENSE N management resulted in $15/acre higher marginal net return than the grower's N management due to reduced N application with no yield reduction.

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

Study ID: 207121201601
County: Merrick
Soil Type: Brocksburg loam 0-2% slope; Blendon fine sandy loam 0-2% slope
Planting Date: 5/4/16
Harvest Date: 10/23/16
Population: 32,500
Hybrid: CRM (days) 113
Reps: 6
Previous Crop: Soybean
Tillage: No-Till

Irrigation: Pivot
Rainfall (in):



Soil Sample Results: Soil samples were taken in three locations within the research study area and do not correspond to specific treatments or replications.

ID	Soil pH 1:1	WDRF Buffer pH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lbs N/A	Mehlich P-III ppm P	Sulfate-S ppm S	Zn (ppm)	Ammonium Acetate (ppm) K	Ca	Mg	Na	CEC me/100g	% Base Saturation H	K	Ca	Mg	Na
1	6.4	6.9	0.17	NONE	1.2	10.2	24	17	11	2.3	168	963	102	7	7.1	14	6	68	12	0
2	6.4	6.9	0.16	NONE	1.5	10.2	24	11	16	1.7	127	1205	131	12	8.5	12	4	70	13	1
3	6.3	6.7	0.12	NONE	1.4	8.6	21	17	14	1.35	147	772	95	8	7.8	35	5	50	10	0

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 to the grower's standard N management.

Grower Nitrogen Treatment: The initial grower N rate was 50 lb N/acre at or prior to planting. An additional application of 90 lb N/acre was made in early June. Total N applied was 140 lb N/acre.

Project SENSE Nitrogen Treatment: For the SENSE treatment strips, 80 lb N/acre was applied at or prior to planting. Crop canopy sensing and application occurred on June 29, 2016 at V10 growth stage. Across all Project SENSE treatments, the average N rate applied in-season was 91 lb N/acre. The total N rate was 171 lb N/acre.

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.

	Total N rate (lb/ac)	Yield (bu/acre)†	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
Grower N Management	140	212 A*	85 A	0.66 B	584.23 A
Project SENSE N Management	171	211 A	69 B	0.81 A	565.03 B
P-Value	N/A	0.183	<0.0001	<0.0001	0.003

†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $0.45/lb nitrogen fertilizer.
*Values with the same letter are not significantly different at a 95% confidence level.

Summary:
-Project SENSE N application was 31 lb N/acre higher than the grower's N application.

-There was no yield difference between Project SENSE N management and the grower's N management.

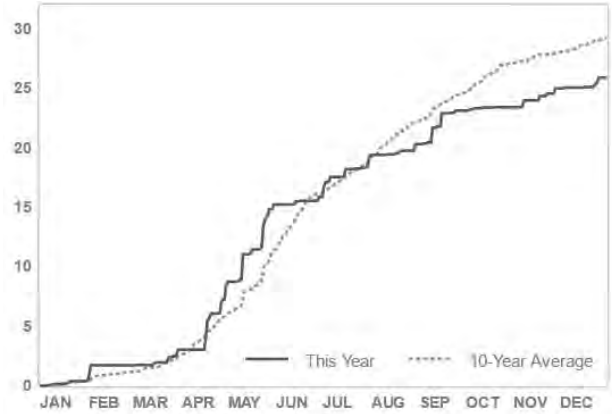
-The grower's N management resulted in higher N use efficiency than Project SENSE N management.

-The grower's N management resulted in $19/acre higher marginal net return than the Project SENSE N management.

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

Study ID: 208121201601
County: Merrick
Soil Type: Leshara silt loam occasionally flooded; Silver Creek complex saline-alkali, rarely flooded
Planting Date: 4/26/16
Harvest Date: 10/20/16
Population: 34,000
Hybrid: CRM (days) 116
Reps: 4
Previous Crop: Corn
Tillage: No-Till

Irrigation: SDI
Rainfall (in):



Soil Sample Results: Soil samples were taken in three locations within the research study area and do not correspond to specific treatments or replications.

ID	Soil pH 1:1	WDRF Buffer pH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lbs N/A	Mehlich P-III ppm P	Sulfate-S ppm S	Zn (ppm)	Ammonium Acetate (ppm) K	Ca	Mg	Na	CEC me/100g	% Base Saturation H	K	Ca	Mg	Na
1	7.3	7.2	0.32	NONE	2.2	22.1	53	48	9	1.78	365	1816	229	27	12.0	0	8	75	16	1
2	6.9	7.2	0.47	NONE	2.3	25.7	62	32	8	1.45	572	2253	393	30	16.1	0	9	70	20	1
3	6.5	7.0	0.21	NONE	2.3	18.9	45	30	8	1.61	428	1593	278	24	11.7	2	9	68	20	1

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 to the grower's standard N management. This is the second year this study was conducted on this field, with four treatment strips in the same location both years.

Grower Nitrogen Treatment: The grower N rate was split between 120 lb N/acre prior to planting and 160 lb N/acre applied during the season. Total N application was 280 lb N/acre.

Project SENSE Nitrogen Treatment: For the SENSE treatment strips, 120 lb N/acre was applied prior to planting. Crop canopy sensing and application occurred on July 1, 2016 at V11 growth stage. Across all Project SENSE treatments, the average N rate applied in-season was 93 lb N/acre.

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.

	Total N rate (lb/ac)	Yield (bu/acre)†	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
Grower N Management	280	210 A*	42 B	1.33 A	514.23 A
Project SENSE N Management	213	198 B	52 A	1.08 B	507.47 A
P-Value	N/A	0.008	0.001	0.001	0.277

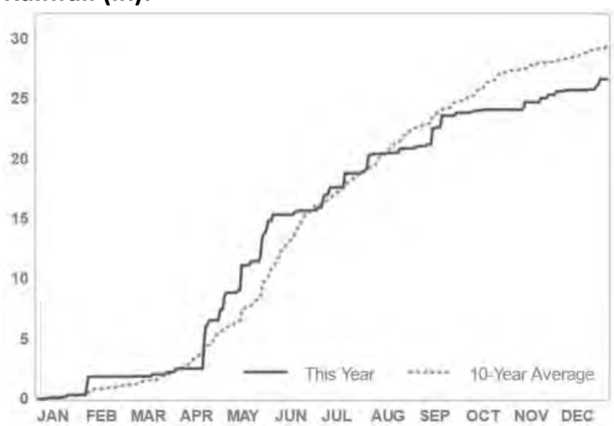
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $0.45/lb nitrogen fertilizer.
*Values with the same letter are not significantly different at a 95% confidence level.

Summary:
-Project SENSE N application was 67 lb N/acre lower than the grower's N application.
-Project SENSE N management had 12 bu/acre lower yield compared to the grower's N management.
-Project SENSE had higher N use efficiency than the grower's management.
-There was no significant difference in marginal net return between the two treatments.

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

Study ID: 209079201601
County: Hall
Soil Type: Jansen fine sandy loam overblown, leveled
Planting Date: 4/27/16
Harvest Date: 10/23/16
Population: 33,000
Hybrid: CRM (days) 115
Reps: 6
Previous Crop: Corn
Tillage: Reduced Tillage

Irrigation: Pivot
Rainfall (in):



Soil Sample Results: Soil samples were taken in three locations within the research study area and do not correspond to specific treatments or replications.

ID	Soil pH 1:1	WDRF Buffer pH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lbs N/A	Mehlich P-III ppm P	Sulfate-S ppm S	Zn (ppm)	Ammonium Acetate (ppm) K	Ca	Mg	Na	CEC me/100g	% Base Saturation H	K	Ca	Mg	Na
1	7.0	7.2	0.13	NONE	1.2	6.9	17	109	12	2.05	109	944	89	13	5.8	0	5	81	13	1
2	6.2	6.8	0.13	NONE	2.1	8.0	19	299	13	4.86	285	1145	102	9	9.1	20	8	63	9	0
3	6.7	7.2	0.14	NONE	2.3	6.7	16	274	11	6.69	201	1314	115	12	8.1	0	6	81	12	1

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 to the grower's standard N management. This is the second year this study was conducted on this field, with treatment strips in the same location both years.

Grower Nitrogen Treatment: Total N applied was 225 lb N/acre.

Project SENSE Nitrogen Treatment: For the SENSE treatment strips, 75 lb N/acre was applied prior to planting. Crop canopy sensing and application occurred on July 1, 2016 at V11 growth stage. Across all Project SENSE treatments, the average N rate applied in-season was 119 lb N/acre. The total N rate was 194 lb N/acre.

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.

	Total N rate (lb/ac)	Yield (bu/acre)†	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
Grower N Management	225	150 B*	37 B	1.50 A	355.78 B
Project SENSE N Management	194	173 A	51 A	1.12 B	440.27 A
P-Value	N/A	0.001	0.003	0.002	0.0004

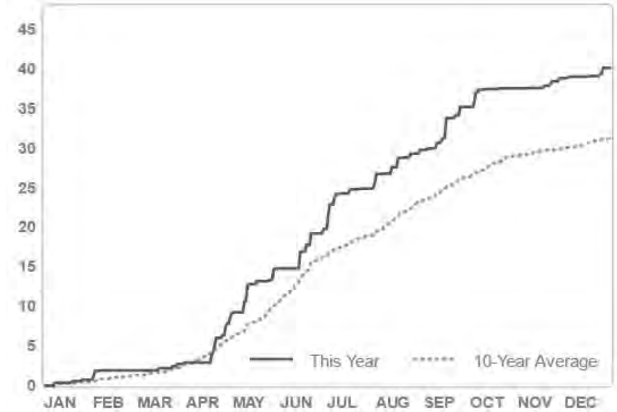
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $0.45/lb nitrogen fertilizer.
*Values with the same letter are not significantly different at a 95% confidence level.

Summary:
-Insect and wind damage was noted during the season.
-Project SENSE N application was 31 lb N/acre lower than the grower's N application.
-Project SENSE N management had a 23 bu/acre yield increase over the grower's N management.
-Project SENSE N management resulted in higher N use efficiency than the grower's N application.
-Project SENSE N management resulted in $84/acre higher marginal net return than the grower's N management due to reduced N application and increased yield.

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

Study ID: 210037201601
County: Colfax
Soil Type: Lawet silt loam rarely flooded
Planting Date: 5/10/16
Harvest Date: 10/29/16
Population: 32,500
Hybrid: G07B39
Reps: 6
Previous Crop: Corn
Tillage: Reduced Tillage

Irrigation: Pivot
Rainfall (in):



Soil Sample Results: Soil samples were taken in three locations within the research study area and do not correspond to specific treatments or replications.

ID	Soil pH 1:1	WDRF Buffer pH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lbs N/A	Mehlich P-III ppm P	Sulfate-S ppm S	Zn (ppm)	Ammonium Acetate (ppm)				CEC me/100g	% Base Saturation				
											K	Ca	Mg	Na		H	K	Ca	Mg	Na
1	8.3	7.2	0.33	HIGH	6.3	6.6	16	68	7	1.76	313	5032	1062	16	34.9	0	2	72	25	0
2	8.3	7.2	0.31	HIGH	5.4	6.7	16	102	8	2.06	385	5306	908	14	35.1	0	3	75	22	0
3	8.3	7.2	0.38	HIGH	5.7	6.8	16	82	5	1.92	371	5158	1140	19	36.3	0	3	71	26	0

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 to the grower's standard N management. This is the second year this study was conducted on this field, with treatment strips in the same location both years.

Grower Nitrogen Treatment: The initial grower N rate was 75 lb N/acre. A sidedress application of 100 lb N/acre was applied around V5-V6. Total N application was 175 lb N/acre.

Project SENSE Nitrogen Treatment: For the SENSE treatment strips 75 lb N/acre was applied at planting. Crop canopy sensing and application occurred on July 12, 2016 at V14 growth stage. Across all Project SENSE treatments, the average N rate applied in-season was 30 lb N/acre. Total N rate was 105 lb N/acre.

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.

	Total N rate (lb/ac)	Yield (bu/acre)†	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
Grower N Management	175	176 A*	56 B	0.99 A	458.81 A
Project SENSE N Management	105	157 B	84 A	0.67 B	431.80 B
P-Value	N/A	<0.0001	<0.0001	<0.0001	0.001

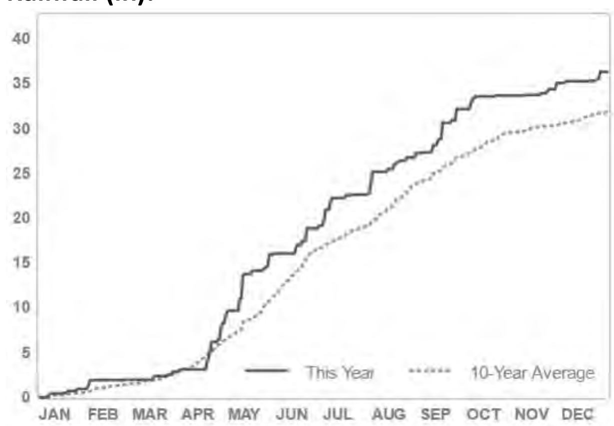
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $0.45/lb nitrogen fertilizer.
*Values with the same letter are not significantly different at a 95% confidence level.

Summary:
-Project SENSE N application was 70 lb N/acre lower than the grower's N application.
-Greensnap and lodging occurred on July 5.
-Project SENSE N management had 19 bu/acre lower yield compared to the grower's N management.
-Project SENSE had higher N use efficiency than the grower's management.
-The grower's N management resulted in $27/acre higher marginal net return than the Project SENSE N management.

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

Study ID: 211023201601
County: Butler
Soil Type: Muir silt loam 1-3% slope; Muir silt loam rarely flooded
Planting Date: 4/26/16
Harvest Date: 10/27/16
Population: 34,000
Hybrid: Mycogen 2C799
Reps: 6
Previous Crop: Soybean
Tillage: Reduced Tillage

Irrigation: Pivot
Rainfall (in):



Soil Sample Results: Soil samples were taken in three locations within the research study area and do not correspond to specific treatments or replications.

ID	Soil pH 1:1	WDRF Buffer pH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lbs N/A	Mehlich P-III ppm P	Sulfate-S ppm S	Zn (ppm)	Ammonium Acetate (ppm)				CEC me/100g	% Base Saturation				
											K	Ca	Mg	Na		H	K	Ca	Mg	Na
1	6.9	7.2	0.48	LOW	3.7	14.5	35	22	13	2.31	303	4061	257	14	23.3	0	3	87	9	0
2	6.5	6.8	0.15	NONE	2.4	7.1	17	22	12	2.67	315	1525	153	9	12.1	20	7	62	11	0
3	6.6	7.2	0.15	NONE	2.3	9.8	23	19	12	2.71	218	1546	176	11	9.8	0	6	79	15	0

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 to the grower's standard N management.

Grower Nitrogen Treatment: The initial grower N rate was 67 lb N/acre at or prior to planting. A sidedress application of 143 lb N/acre was applied early June 2016 at V5. Total N applied was 210 lb N/acre.

Project SENSE Nitrogen Treatment: For the SENSE treatment strips, 67 lb N/acre was applied at or prior to planting. Crop canopy sensing and application occurred on June 24, 2016 at V9 growth stage. Across all Project SENSE treatments, the average N rate applied in-season was 107 lb N/acre. The total N rate was 174 lb N/acre.

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.

	Total N rate (lb/ac)	Yield (bu/acre)†	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
Grower N Management	210	151 A*	40 B	1.39 A	366.43 B
Project SENSE N Management	174	150 A	49 A	1.16 B	380.30 A
P-Value	N/A	0.615	0.001	0.0003	0.042

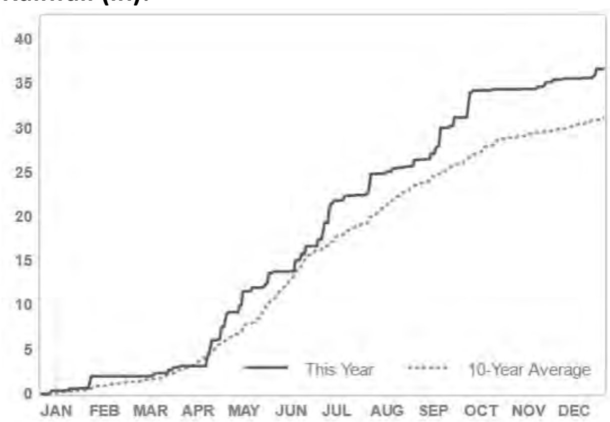
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $0.45/lb nitrogen fertilizer.
*Values with the same letter are not significantly different at a 95% confidence level.

Summary:
-Project SENSE N application was 36 lb N/acre lower than the grower's N application.
-No visual yellowing of Project SENSE treatment strips at the time of in-season application.
-Greensnap on July 13 resulted in approximately 50% snapped plants. Plants were at VT growth stage.
-There was no yield difference between the two management strategies.
-Project SENSE had higher N use efficiency than the grower's management due to reduced N use and similar yields.
-Project SENSE had a $14/acre higher marginal net return due to decreased N use with no yield reduction.

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

Study ID: 212023201601
County: Butler
Soil Type: Gibbon silty clay loam occasionally flooded; Thurman loamy fine sand 2-6% slopes
Planting Date: 5/4/16
Harvest Date: 10/20/16
Population: 34,000
Hybrid: Mycogen 2C799
Reps: 6
Previous Crop: Corn
Tillage: Reduced Tillage

Irrigation: Pivot
Rainfall (in):



Soil Sample Results: Soil samples were taken in three locations within the research study area and do not correspond to specific treatments or replications.

ID	Soil pH 1:1	WDRF Buffer pH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lbs N/A	Mehlich P-III ppm P	Sulfate-S ppm S	Zn (ppm)	Ammonium Acetate (ppm)				CEC me/100g	% Base Saturation				
											K	Ca	Mg	Na		H	K	Ca	Mg	Na
1	7.4	7.2	0.26	NONE	2.0	8.3	20	6	11	0.92	165	2715	146	11	15.3	0	3	89	8	0
2	8.2	7.2	0.34	HIGH	5.2	15.8	38	23	8	1.94	159	5710	363	14	32.0	0	1	89	9	0
3	8.3	7.2	0.39	HIGH	5.6	10.2	24	20	15	1.54	142	6097	352	30	33.9	0	1	90	9	0

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 to the grower's standard N management. This is the second year this study was conducted on this field, with treatment strips in the same location both years.

Grower Nitrogen Treatment: The initial grower N rate was 67 lb N/acre at or prior to planting. A sidedress application of 143 lb N/acre was applied on June 8, 2016 at V5. Total N applied was 210 lb N/acre.

Project SENSE Nitrogen Treatment: For the SENSE treatment strips, 67 lb N/acre was applied at or prior to planting. Crop canopy sensing and application occurred on June 24, 2016 at V9 growth stage. Across all Project SENSE treatments, the average N rate applied in-season was 109 lb N/acre. The total N rate was 176 lb N/acre.

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.

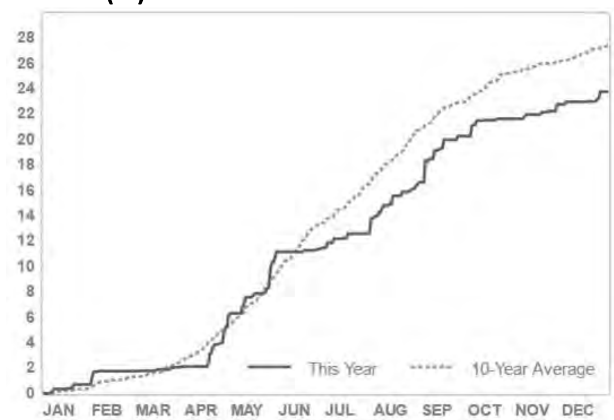
	Total N rate (lb/ac)	Yield (bu/acre)†	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
Grower N Management	210	183 A*	49 A	0.87 A	462.96 A
Project SENSE N Management	176	168 B	54 A	0.96 A	432.03 B
P-Value	N/A	0.005	0.121	0.121	0.040

†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $0.45/lb nitrogen fertilizer.
*Values with the same letter are not significantly different at a 95% confidence level.

Summary:
-Project SENSE N application was 34 lb N/acre lower than the grower's N application.
-At the time of crop canopy sensing, all the Project SENSE treatment strips were visibly yellow.
-Yield for Project SENSE N management was 15 bu/acre less than for the grower's management.
-There was no difference in N use efficiency.
-The grower's N management had a $31/acre higher marginal net return.

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

Study ID: 617035201601
County: Clay
Soil Type: Hastings silt loam 0-1% slope; Butler silt loam 0-1% slope; Hastings silty clay loam 7-11% slopes, eroded
Planting Date: 4/24/16
Harvest Date: 10/28/16
Population: 34,000
Row Spacing (in) 30
Hybrid: Channel 217-41DGBT2PRIB
Reps: 6
Previous Crop: Soybean
Tillage: Strip Till - 4/1/16
Herbicides: 4 oz/ac Diflexx™, 20 oz/ac Durango®, 3 qt/ac Lexar® on 5/3/16
Seed Treatment: Acceleron® (Metalaxyl, Clothiandin 250, Trifloxystrobin, Ipconazole)
Foliar Insecticides: None
Foliar Fungicides: 10 oz/ac Headline AMP® on 7/21/16
Fertilizer: 13 gal/ac 30-15-0-5 and 2x2 with planter (approx. 5 lb N/acre) on 4/24/16
Irrigation: Pivot, Total: 6
Rainfall (in):



Soil Sample Results: Soil samples were taken in three locations within the research study area and do not correspond to specific treatments or replications.

ID	Soil pH 1:1	WDRF Buffer pH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lbs N/A	Mehlich P-III ppm P	Sulfate-S ppm S	Zn (ppm)	Ammonium Acetate (ppm)				CEC me/100g	% Base Saturation				
											K	Ca	Mg	Na		H	K	Ca	Mg	Na
1	6.0	6.9	0.46	NONE	3.4	46	110	12	8	1.15	398	2198	224	30	15.4	9	7	71	12	1
2	6.1	6.9	0.51	NONE	3.1	45.2	108	14	12	0.88	288	2104	195	24	13.9	6	5	76	12	1
3	6.2	6.9	0.46	NONE	3.0	53.5	129	8	9	0.9	316	1968	200	20	13.7	9	6	72	12	1

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 to the grower's standard N management.

Grower Nitrogen Treatment: The grower N was applied prior to and at planting. The average total N applied was 160 lb N/acre.

Project SENSE Nitrogen Treatment: For the SENSE treatment strips, 100 lb N/acre was applied prior to and at planting. Crop canopy sensing and application occurred on June 30, 2016 at V11 growth stage. Across all Project SENSE treatments, the average N rate applied in-season was 46 lb N/acre. The total N rate was 146 lb N/acre.

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.

	Total N rate (lb/ac)	Yield (bu/acre)†	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
Grower N Management	160	257 A*	90 B	0.62 A	711.51 A
Project SENSE N Management	146	252 B	97 A	0.58 B	703.94 A
P-Value	N/A	0.0062	0.0003	0.0002	0.056

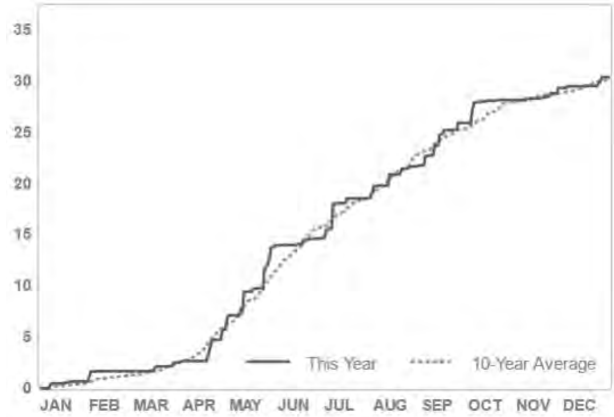
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $0.45/lb nitrogen fertilizer.
*Values with the same letter are not significantly different at a 95% confidence level.

Summary:
-Project SENSE N application was 14 lb N/acre lower than the grower's N application.
-The grower's N management resulted in 5 bu/acre yield increase compared to the Project SENSE N management.
-Project SENSE N management resulted in higher N use efficiency than the grower's N application.
-There was no difference in marginal net return between the two management strategies.

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

Study ID: 618185201601
County: York
Soil Type: Hastings silt loam 0-1% slope; Fillmore silt loam frequently ponded
Planting Date: 4/22/16
Harvest Date: 10/17/16
Population: 35,000
Hybrid: CRM (days) 108
Reps: 6
Previous Crop: Soybean
Tillage: No-Till

Irrigation: Pivot
Rainfall (in):



Soil Sample Results: Soil samples were taken in three locations within the research study area and do not correspond to specific treatments or replications.

ID	Soil pH 1:1	WDRF Buffer pH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lbs N/A	Mehlich P-III ppm P	Sulfate-S ppm S	Zn (ppm)	Ammonium Acetate (ppm) K	Ca	Mg	Na	CEC me/100g	% Base Saturation H	K	Ca	Mg	Na
1	6.1	6.5	0.33	NONE	3.4	40.0	96	23	10	0.75	294	1413	204	16	15.0	36	5	47	11	0
2	5.3	6.3	0.31	NONE	3.5	34.8	83	19	11	1.18	445	1679	239	14	18.9	39	6	44	11	0
3	5.7	6.4	0.20	NONE	3.4	11.0	26	16	11	0.87	291	1728	262	20	17.6	34	4	49	12	0

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 to the grower's standard N management.

Grower Nitrogen Treatment: The initial grower N rate was 75 lb N/acre on March 14, 2016 as anhydrous ammonia. An additional 131 lb N/acre was applied on June 13, 2016 at V7. Total N applied was 206 lb N/acre.

Project SENSE Nitrogen Treatment: For the SENSE treatment strips, 75 lb N/acre was applied on March 14, 2016 as anhydrous ammonia. Crop canopy sensing and application occurred on June 27, 2016 at V11 growth stage. Across all Project SENSE treatments, the average N rate applied in-season was 52 lb N/acre. The total N rate was 127 lb N/acre.

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.

	Total N rate (lb/ac)	Yield (bu/acre)†	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
Grower N Management	206	229 A*	62 B	0.90 A	604.29 B
Project SENSE N Management	127	225 A	99 A	0.57 B	627.80 A
P-Value	N/A	0.059	<0.0001	<0.0001	0.0044

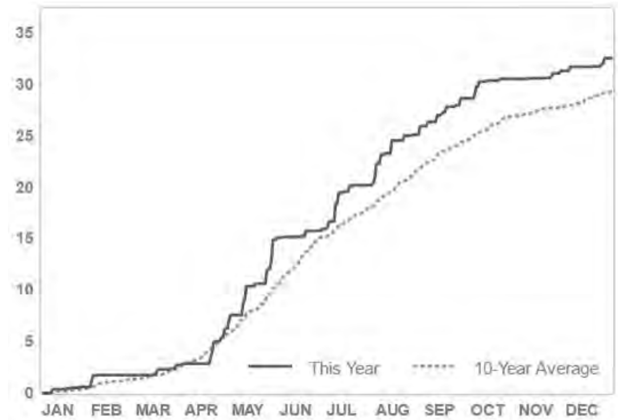
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $0.45/lb nitrogen fertilizer.
*Values with the same letter are not significantly different at a 95% confidence level.

Summary:
-Project SENSE N application was 79 lb N/acre lower than the grower's N application.
-There was no yield difference between the two management strategies.
-Project SENSE N management resulted in higher N use efficiency than the grower's N application.
-Project SENSE N management resulted in $24/acre higher marginal net return than the grower's N management due to reduced N application with no yield reduction.

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

Study ID: 619159201601
County: Seward
Soil Type: Deroin silty clay loam 6-11% slopes, eroded; Hastings silty clay loam 3-7% slopes, eroded; Deroin silty clay loam 11-30% slopes, severely eroded
Planting Date: 5/19/16
Harvest Date: 10/20/16
Population: 30,000
Hybrid: G07B39-3111A
Reps: 6
Previous Crop: Corn
Tillage: No-Till

Irrigation: Pivot
Rainfall (in):



Soil Sample Results: Soil samples were taken in three locations within the research study area and do not correspond to specific treatments or replications.

ID	Soil pH 1:1	WDRF Buffer pH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lbs N/A	Mehlich P-III ppm P	Sulfate-S ppm S	Zn (ppm)	Ammonium Acetate (ppm)				CEC me/100g	% Base Saturation				
											K	Ca	Mg	Na		H	K	Ca	Mg	Na
6	5.8	6.8	0.19	NONE	2.5	2.6	6	14	11	0.73	218	2096	527	25	17.7	12	3	59	25	1
14	5.9	6.7	0.24	NONE	3.6	5.0	12	9	12	0.98	433	2232	520	16	19.5	14	6	57	22	0
16	6.7	7.2	0.37	NONE	3.3	5.3	13	23	11	0.61	405	3458	834	26	25.4	0	4	68	27	0

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 to the grower's standard N management.

Grower Nitrogen Treatment: The initial grower N rate was 75 lb N/acre June 6, 2016 around V1-V2. An additional 74 lb N/acre was applied on June 30, 2016 at V7. On July 19, 2016, a final application of 70 lb N/acre was made at VT growth stage. Total N applied was 219 lb N/acre.

Project SENSE Nitrogen Treatment: For the SENSE treatment strips 75 lb N/acre was applied on June 6, 2016 around V1-V2. Crop canopy sensing and application occurred on July 19, 2016 at VT growth stage. Across all Project SENSE treatments, the average N rate applied in-season was 68 lb N/acre. The total N rate was 143 lb N/acre.

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.

	Total N rate (lb/ac)	Yield (bu/acre)†	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
Grower N Management	219	171 A*	44 B	1.28 A	422.95 A
Project SENSE N Management	143	161 B	64 A	0.89 B	425.31 A
P-Value	N/A	0.005	0.001	0.001	0.691

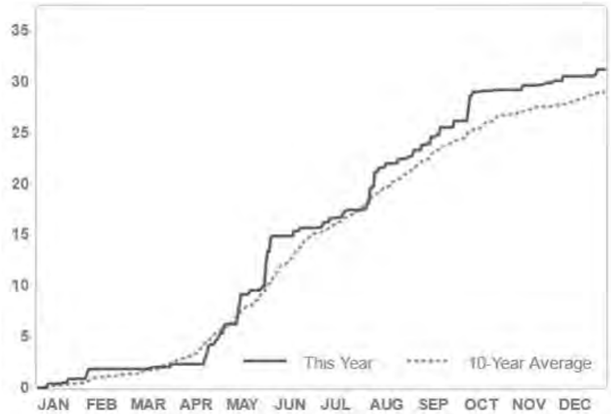
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $0.45/lb nitrogen fertilizer.
*Values with the same letter are not significantly different at a 95% confidence level.

Summary:
-Poor emergence was noted.
-Project SENSE N application was 76 lb N/acre lower than the grower's N application.
-The grower's N management resulted in a 10 bu/acre yield increase compared to the Project SENSE N management.
-Project SENSE N management resulted in higher N use efficiency than the grower's N application.
-There was no significant difference in marginal net return between the two management strategies.

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

Study ID: 620059201601
County: Fillmore
Soil Type: Crete silt loam 0-1% slope; Butler silt loam 0-1% slope; Fillmore silt loam 0-1% slope
Planting Date: 4/24/16
Harvest Date: 9/26/16
Population: 32,000
Hybrid: Mycogen 2V717
Reps: 6
Previous Crop: Soybean
Tillage: Reduced Tillage

Irrigation: Pivot, Total: 6.7
Rainfall (in):



Soil Sample Results: Soil samples were taken in three locations within the research study area and do not correspond to specific treatments or replications.

ID	Soil pH 1:1	WDRF Buffer pH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lbs N/A	Mehlich P-III ppm P	Sulfate-S ppm S	Zn (ppm)	Ammonium Acetate (ppm)				CEC me/100g	% Base Saturation				
											K	Ca	Mg	Na		H	K	Ca	Mg	Na
1	5.8	6.7	0.47	NONE	3.5	36.2	87	28	19	0.85	355	3804	742	48	29.7	11	3	64	21	1
2	5.7	6.6	0.32	NONE	3.1	29	70	17	14	0.97	242	2316	308	32	19.0	22	3	61	13	1
3	5.8	6.7	0.56	NONE	3.8	50.9	122	51	21	2.46	278	3040	397	26	22.2	13	3	68	15	1

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 to the grower's standard N management.

Grower Nitrogen Treatment: The initial grower N rate was 75 lb N/acre prior to or at planting. An additional application of 73 lb N/acre mid-June around V5-V6. Total N applied was 148 lb N/acre.

Project SENSE Nitrogen Treatment: For the SENSE treatment strips, 75 lb N/acre was applied prior to or at planting. Crop canopy sensing and application occurred on June 30, 2016 at V11 growth stage. Across all Project SENSE treatments, the average N rate applied in-season was 35 lb N/acre. The total N rate was 110 lb N/acre.

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.

	Total N rate (lb/ac)	Yield (bu/acre)†	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
Grower N Management	148	237 A*	90 B	0.62 A	656.84 A
Project SENSE N Management	110	233 B	118 A	0.47 B	659.56 A
P-Value	N/A	0.014	<0.0001	<0.0001	0.474

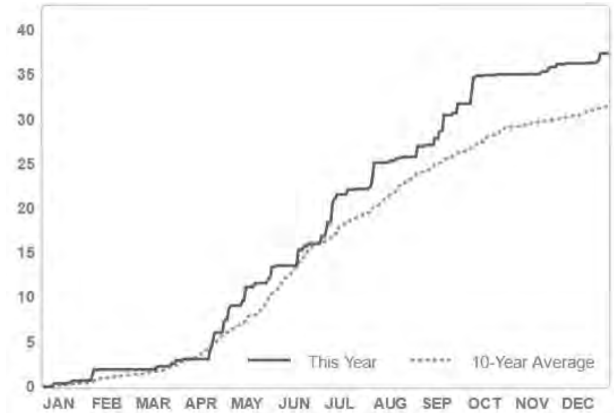
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $0.45/lb nitrogen fertilizer.
*Values with the same letter are not significantly different at a 95% confidence level.

Summary:
-Project SENSE N application was 38 lb N/acre lower than the grower's N application.
-The grower's N management resulted in a 4 bu/acre yield increase compared to the Project SENSE N management.
-Project SENSE N management resulted in higher N use efficiency than the grower's N application.
-There was no significant difference in marginal net return between the two N management strategies.

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

Study ID: 621023201601
County: Butler
Soil Type: Brocksburg sandy loam 0-2% slope
Planting Date: 4/24/16
Harvest Date: 10/22/16
Population: 32,000
Row Spacing (in) 30
Hybrid: P33D53AM
Reps: 6
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** 1 pt/ac 2-4,D and 1 qt/ac Atrazine
Post: 3 qt/ac Halex® GT and 1 qt/ac Atrazine
Seed Treatment: Poncho® 1250 + VOTiVO®
Foliar Insecticides: None
Foliar Fungicides: Headline AMP® 10 oz/ac at VT

Note: Greensnap, 25-30%
Irrigation: Pivot, Total: 12
Rainfall (in):



Soil Sample Results: Soil samples were taken in three locations within the research study area and do not correspond to specific treatments or replications.

ID	Soil pH 1:1	WDRF Buffer pH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lbs N/A	Mehlich P-III ppm P	Sulfate-S ppm S	Zn (ppm)	Ammonium Acetate (ppm) K	Ca	Mg	Na	CEC me/100g	% Base Saturation H	K	Ca	Mg	Na
6	6.4	6.9	0.10	NONE	0.9	6.8	16	340	7	21.8	73	697	55	6	5.2	19	4	68	9	0
14	5.6	6.9	0.09	NONE	0.9	6.8	16	16	11	3.2	96	488	48	4	4.4	30	6	55	9	0
22	5.6	6.9	0.09	NONE	0.7	5.1	12	32	9	2.9	69	406	44	4	4.0	35	4	51	9	0

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 to the grower's standard N management.

Grower Nitrogen Treatment: The grower N rate was 168 lb N/acre.

Project SENSE Nitrogen Treatment: For the SENSE treatment strips, 73 lb N/acre was applied on May 4, 2016, after planting, but before emergence. Crop canopy sensing and application occurred on June 24, 2016 at V10 growth stage. Across all Project SENSE treatments, the average N rate applied in-season was 98 lb N/acre. Total N applied was 171 lb N/acre.

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.

	Total N rate (lb/ac)	Yield (bu/acre)†	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
Grower N Management	168	184 B*	61 B	0.92 A	552.88 B
Project SENSE N Management	171	208 A	68 A	0.82 B	627.92 A
P-Value	N/A	<0.0001	0.0006	0.0007	<0.0001

†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $0.45/lb nitrogen fertilizer.

Summary:
-Project SENSE N application was 3 lb N/acre higher than the grower's N application.
-Yield for Project SENSE N management was 24 bu/acre greater than for the grower's management.
-Project SENSE had higher N use efficiency than the grower's management.
-Project SENSE had a $75/acre higher marginal net return due to increased yield with only a small increase in N fertilizer.

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

Study ID: 622107201601
County: Knox
Soil Type: Bazile loam 2-6% slopes; Trent silt loam 0-2% slope; Thurman loamy fine sand 2-6% slopes; Ortello fine sandy loam 2-6% slopes
Planting Date: 5/5/16
Harvest Date: 11/3/16
Population: 32,000
Hybrid: Stine 9734
Reps: 4
Previous Crop: Soybean
Tillage: No-Till

Irrigation: Pivot
Rainfall (in):

Soil Sample Results: Soil samples were taken in four locations within the research study area and do not correspond to specific treatments or replications.

ID	Soil pH 1:1	WDRF Buffer pH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lbs N/A	Mehlich P-III ppm P	Sulfate-S ppm S	Zn (ppm)	Ammonium Acetate (ppm) K	Ca	Mg	Na	CEC me/100g	% Base Saturation H	K	Ca	Mg	Na
1	6.4	6.8	0.16	NONE	3.1	6.6	16	11	12	2.66	182	2385	306	25	17.0	11	3	70	15	1
2	6.0	6.7	0.13	NONE	3.9	4.9	12	13	13	1.25	211	2319	294	19	17.6	17	3	66	14	0
3	5.9	6.6	0.21	NONE	3.3	6.6	16	23	10	0.99	182	2021	265	29	17.1	25	3	58	13	1
4	6.0	6.9	0.09	NONE	1.1	2.4	6	20	11	0.68	64	977	117	13	7.1	14	2	69	14	1

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 to the grower's standard N management and to the UNL N recommendation algorithm. In this study, the grower's N management was also using OptRx sensors on a dry spreader.

Grower Sensor Nitrogen Treatment: The grower initial N rate was 85 lb N/acre applied prior to planting. The grower applied sidedress on June 26, 2016 at V8 growth stage with a dry spreader. Nitrogen rates were determined using crop canopy sensors and the average rate applied was 53 lb N/acre. Total N application was 138 lb N/acre.

Project SENSE Nitrogen Treatment: For the SENSE treatment strips, 85 lb N/acre was applied prior to planting. Crop canopy sensing and application occurred on June 28, 2016 at the V11 growth stage. Across all Project SENSE treatments, the average N rate applied in-season was 94 lb N/acre. Total N application was 179 lb N/acre.

UNL Algorithm Nitrogen Treatment: The rate was determined using the UNL N Algorithm. The recommended application rate was 180 lb N/acre.

Results:

	Total N rate (lb/ac)	Yield (bu/acre)†	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
UNL Algorithm N Management	180	203 B	63 B	0.89 A	539.17 B
Grower Sensor N Management	138	209 A*	85 A	0.66 B	576.03 A
Project SENSE N Management	179	210 A	66 B	0.85 A	561.20 A
P-Value	N/A	<0.0001	0.0002	<0.0001	0.004

†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.05/bu corn and $0.45/lb nitrogen fertilizer.
*Values with the same letter are not significantly different at a 95% confidence level.

Summary:

-The Project SENSE N application was 41 lb/acre higher than the grower's N application.
-The UNL N Algorithm rate was very close to the Project SENSE N rate.
-There was no yield difference between Project SENSE N management and the grower's N management.
-The grower's management had higher N use efficiency due to lower N fertilizer rates.
-Both the grower and Project SENSE N management had a higher marginal net return than the UNL algorithm.

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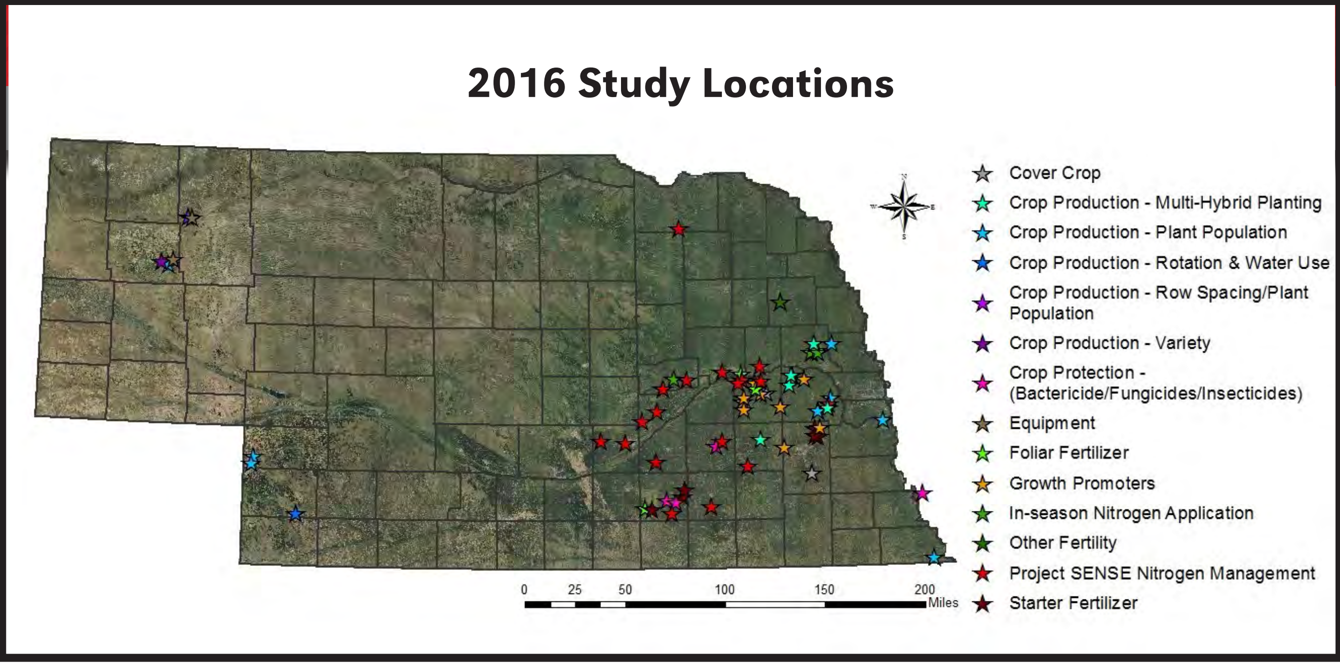

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