

# 2017

# Soybean Management Field Days

# RESEARCH UPDATE

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[kglewen1@unl.edu](mailto:kglewen1@unl.edu)



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## Soybean Management Field Days

### On-Farm Research

Introduction

Keith Glewen, Nebraska Extension Educator

The 2017 growing season represented the seventh year replicated on-farm field research was conducted at the four Soybean Management Field Day locations. Nebraska's soybean production environment is uniquely different than many other soybean production states. The diversity of our soils, topography, elevation, length of growing season and water resources provide research and extension agronomists with unique challenges. As a result of the investment you have made by the way of checkoff dollars and the partnership your Land Grant University has with growers like yourself across the state, we are able to generate new production discovery and also to validate existing production practices.

As growers, you are increasingly challenged to grow soybeans more responsibly and to document sustainability. We are confident the results reported in this research update and the information provided at the Soybean Management Field Days this past August will be useful to that extent.

Faculty and staff representing the University of Nebraska-Lincoln greatly appreciate the financial investment you, the soybean growers of Nebraska, have made through your Checkoff contribution in supporting the research undertaken in this project. We would also like to thank the Nebraska Soybean Board for their part in support and management of this effort. Their input into the selection of

Plant	Harvest	Soil	Herbicide	Site Average Yield
5/9/2017	10/18/2017	Silty Clay Loam	Date Chem/Rate	73 bu/ac
Auburn	Pre	All except PPO*	5/9/2017 Roundup Powermaxx 33oz AMS 12 lb/100 Prowl H2O 2pt Fierce 3oz	
	Post	All except Variety & PPO	6/22/2017 Roundup Powermaxx 28oz AMS 12 lb/100 Cobra 12.5oz Outlook 12oz Pursuit 4oz NIS 0.25 % v/v	Hail Application 6/14/2017
	Variety		6/22/2017 Pursuit 4oz Cobra 12.5oz Outlook 12oz NIS 0.25 % v/v AMS 12 lb/100	
	PPO		NA None	
North Platte	5/16/2017	NA Sandy Loam	Date Chem/Rate	NA
	Pre	All except PPO*	5/9/2017 Roundup Powermaxx 33oz AMS 12 lb/100 Prowl H2O 2pt Fierce 3oz Outlook 12oz	
	Post	All	6/30/2017 Roundup Powermaxx 28oz AMS 17 lb/100 Cobra 12.5oz	Hail Application 7/6/2017
	PPO		NA None	
Ord	5/15/2017	10/20/2017 Silty Clay Loam	Date Chem/Rate	64 bu/ac
	Pre	All except PPO*	5/15/2017 Roundup Powermaxx 32oz AMS 12 lb/100 Prowl H2O 2pt Fierce 3oz	
	Post	All except Variety & PPO	6/23/2017 Roundup Powermaxx 28oz AMS 12 lb/100 Cobra 12.5oz Outlook 12oz Pursuit 4oz NIS 0.25 % v/v	Hail Application 6/27/2017
	Variety		6/23/2017 Pursuit 4oz Cobra 12.5oz Outlook 12oz Intensity 6oz NIS 0.25 % v/v AMS 12 lb/100	
Tekamah	5/8/2017	10/19/2017 Silty Clay Loam	Date Chem/Rate	76 bu/ac
	Pre	All except PPO*	5/8/2017 Roundup Powermaxx 33oz AMS 12 lb/100 Prowl H2O 2pt Fierce 3oz	
	Post	All except Variety & PPO	Roundup Powermaxx 28oz AMS 12 lb/100 Cobra 12.5oz Outlook 12oz Pursuit 4oz NIS 0.25 % v/v	Hail Application 6/13/2017
	Variety		Pursuit 4oz Cobra 12.5oz Outlook 12oz NIS 0.25 % v/v AMS 12 lb/100	
	PPO		NA None	

research topics and, in some cases, treatments was useful.

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

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



# **Effect of Soil Applied Sulfentrazone and Flumioxazin (PPO, Group 14 Herbicides) on Soybean Yield and Seedling Disease Severity**

- Authors: Nicholas J. Arneson (UNL Graduate Research Assistant), Loren J. Giesler (Nebraska Extension Plant Pathologist) and Rodrigo Werle (UNL Cropping Systems Specialist)
- Researchers: Steven Spicka (Agronomy Research Tech III), Keith Glewen (Nebraska Extension Educator)



## **INTRODUCTION**

There has been increased reliance on soil applied herbicides with residual activity to control weed species that have evolved resistance to glyphosate. Protoporphyrinogen oxidase inhibitor (PPOs, Group 14) herbicides are common components of these preemergence programs in Nebraska. However, soil applied PPO herbicides can result in seedling injury if environmental conditions are not favorable for crop establishment (Figure 1). Soybean seedling diseases caused by fungi and fungal-like organisms such as *Fusarium* spp., *Rhizoctonia solani*, and *Pythium* spp. can have significant impacts on crop stand and yield. Some of the same environmental conditions that favor PPO injury, such as saturated soils, heavy rains near emergence and cool soil temperatures also favor infection of common seedling pathogens. Figure 2 features a comparison of two soybean root systems from the trial area, one with low and one with high amounts of disease. It has been shown in previous literature that seedling damage may allow infection by soilborne plant pathogens. It is of great importance to determine if PPO herbicides affect soybean root rot severity and if there is a resulting impact on yield. This study was designed to investigate interactions between soil applied PPO herbicides and common soybean seedling diseases.



## **METHODS**

Experiments were conducted at three of the four locations of the 2017 Soybean Management Field Days. These locations were near Auburn, Ord, and Tekamah, Nebraska. There were 12 treatments (two varieties x two seed treatments x three herbicide programs) (Table 1). The experimental design was a randomized complete block design with four replications. Each experimental unit (plot) was 10 ft wide (4 rows x 30 in rows) by 30 ft long.

**Variety:** Two varieties were selected based on sensitivity ratings to sulfentrazone provided by Pioneer Hybrids®. P22T41R2 was listed as sensitive to sulfentrazone while P28T08R was rated as tolerant.

## **TAKE HOME POINTS**

- PPO herbicides can result in seedling injury and reduced stand when environmental conditions are not favorable for crop establishment
- Sulfentrazone and Flumioxazin (PPOs) did not appear to have an effect on seedling disease severity in 2017. Previous results from 2016 showed an overall increase in disease severity when PPOs were applied, however no subsequent effect on final yield
- The use of the fungicide seed treatment increased final plant population, decreased disease severity, and increased yield at several locations
- PPO treatments reduced yields by nearly 7 bushels/acre at Tekamah where the highest amount of PPO injury was observed in 2017

**Seed treatments:** A base fungicide seed treatment (Apron XL 7.5 g/100 kg seed + Maxim 4FS 2.5 g/100 kg seed + Vibrance 2.5 g/100 kg seed) was included and compared to no treatment. The fungicide selected represented several different modes of action designed to protect against multiple common fungal pathogens in Nebraska.

**Herbicide programs:** There were three herbicide programs evaluated, a glyphosate (Roundup, 32 oz/ac + 17 lb/100 gal AMS) alone treatment, a glyphosate + sulfentrazone (Spartan, 8 oz/ac) tank mix, and a glyphosate + flumioxazin (Valor, 2.5 oz/ac) tank mix, all sprayed 2-3 days after planting. The selection of the chemistry tested in this study is not an indication that these are the best products; instead, it was intended to be representative of common PPO herbicides used in Nebraska. For example, we have selected Spartan and Valor as these are commonly used soil applied herbicides. These products could be comparable to other herbicides which have sulfentrazone or flumioxazin, respectively, as their active ingredient.



**Figure 1.** Damage on soybean cotyledon and lower stem resulting from soil applied PPO herbicides.

**Figure 2.** Root rot symptom severity comparison (left: 2.5%, right: 60%).



**Table 1.** Specific treatments tested in the 2017 SMFD PPO experiment. All seed treatments were applied to the seed prior to planting and all herbicide applications were soil-applied at 15 gal/ac.

Varieties	Seed Treatment (ST)	Herbicide Program <sup>z</sup>
P22T41R2 Sensitive to PPO <sup>y</sup>	No Treatment	Glyphosate (GLY)
P28T08R Tolerant to PPO	Fungicide	GLY + Sulfentrazone (SULF)
		GLY + Flumioxazin (FLUM)

<sup>z</sup> Herbicides were soil applied 2-3 days after planting, before emergence

<sup>y</sup> Variety designation based on Pioneer Hybrids© ratings of sulfentrazone and saflufenacil sensitivity



## DATA COLLECTION

**Plant populations:** Plant populations were assessed by counting the total number of plants from the middle two rows in a 10 ft section of row for each plot. There were two early season plant population evaluations done at 13 – 23 days after planting (DAP) and 24-28 DAP. Populations were converted to plants per acre based on the representative sample counts.

**PPO injury incidence:** Incidence of injury caused by PPO application was assessed at the time of the first plant population assessment. Injury on the cotyledon was observed and rated on 0-100% scale of amount of the entire plot area exhibiting symptoms (Figure 1).

**Root rot assessment:** At V2-V4 growth stage, roots were dug from each plot and rated for root rot severity on 0-100% scale of total root area rotted. Figure 2 displays examples of soybean root systems from the trial area with root rot symptoms.

**Disease and Insect Assessments:** During the season, plots were evaluated for foliar diseases and insect defoliation on a linear percentage scale of 0-100 for disease incidence and severity. Disease incidence represents the total percentage of canopy in which damage or injury is present. Disease severity represents the overall intensity of injury or damage caused by the disease activity typically represented as necrotic plant tissue on the plants within the plot.

**Yield:** Yield was determined with a small plot combine by harvesting the two center rows of each

plot after they were cut to standard length of 30 ft. Yields were adjusted to 13% grain moisture for final reported values.

**Statistical analysis.** The experimental data was analyzed by individual sites and as a combined experiment using a randomized complete block design. All treatments were considered across all locations. Significant differences were determined based on a probability of 0.90. Additionally, treatment effects varied by location, so for most treatment comparisons the results will be presented by location and for the average responses across all three locations.



## RESULTS

Depending on the location there were differences in response for each factor being evaluated (variety, seed treatment and herbicide program). The response variable used to determine the effects of these inputs were established stand (Table 3), root rot severity (Table 5) and yield (Table 7).

### PPO Injury.

PPO injury occurred at all locations, with an individual plot incidence range of 1% to 50% of plants displaying symptoms. A low incidence (1-4%) of injury symptoms occurred in the glyphosate alone treated plots which could be the result of infection of the cotyledon by other fungal species that occur in the seed or soil such as *Cercospora* spp. The highest occurrence of PPO injury was at Tekamah. However, incidences of PPO injury at Auburn and Ord were similar just slightly lower on average (Table 2).

**Table 2.** PPO injury incidence ratings for the variety comparison at each 2017 SMFD location and overall average incidence.

Variety	Location and PPO Injury Incidence (0-100%)			
	Auburn	Ord	Tekamah	Average
Sensitive	6.8	6.8	8.6	7.4
Tolerant	<b>11.7<sup>2</sup></b>	<b>9.5</b>	<b>14.9</b>	<b>12.0</b>
Prob>F	0.0007	0.0757	0.0257	0.0002

<sup>2</sup> BOLD = values in bold represent significant increases ( $p \leq 0.10$ )

*Variety Response to PPO Herbicides.* PPO injury incidence was higher in the tolerant variety at all three locations and when averaged across all locations (Table 2). This is unexpected, however tolerant varieties can still be injured by PPO application and ratings are related to specific environmental conditions in which they are developed. It was expected to see this amount of damage in the sensitive variety. If environmental conditions were even less favorable at emergence, we would have expected more damage and even greater stand loss overall.

*Seed Treatment Effect on PPO Injury.* Fungicide seed treatment had no significant effect on PPO injury incidence at any of the three locations.

*Herbicide Effect on PPO Injury.* Sulfentrazone resulted in higher PPO injury at Auburn, Ord, and when averaged over all locations. Flumioxazin resulted in higher injury at Tekamah.

### Effects on Plant Population.

Overall, plant populations were lower than expected. Populations ranged from 40 – 76% of the initial seeding rate of 125,000 seed/acre. Plant populations were highest at Tekamah with an average stand of 86,000 plants/acre. Populations were lowest at Ord where the field experienced crusting issues at emergence with an average stand of 56,000 plants/acre.

**Table 3. Statistical significance for a treatment effect and interactions related to plant population. For a factor to be considered significant the value would need to be less than 0.10 at a 90% confidence level.**

Treatment Factor and Interaction	Probability > F for Treatment Factors Affecting Plant Population							
	Auburn		Ord		Tekamah		All	
	13 DAP <sup>2</sup>	24 DAP	23 DAP	28 DAP	14 DAP	24 DAP	First	Second
Variety	0.0990	0.3445	0.8397	0.8039	0.8515	0.4466	0.3695	0.7817
Seed Treatment	0.3465	0.0429	<0.0001	0.0004	0.0324	0.0862	<0.0001	<0.0001
Herbicide	0.0957	0.1707	0.1352	0.6624	0.8440	0.5354	0.1319	0.6541
Variety X Seed Treatment	0.8333	0.4518	0.8083	0.7134	0.8515	0.4724	0.9333	0.5612
Variety X Herbicide	0.6224	0.6073	0.6079	0.9003	0.6700	0.4466	0.3378	0.0766
Herbicide X Seed Treatment	0.3144	0.5687	0.4473	0.6369	0.4685	0.7556	0.4365	0.5095

**Table 4. Soybean populations for herbicide treatment comparisons at each 2017 SMFD location and over-all average populations.**

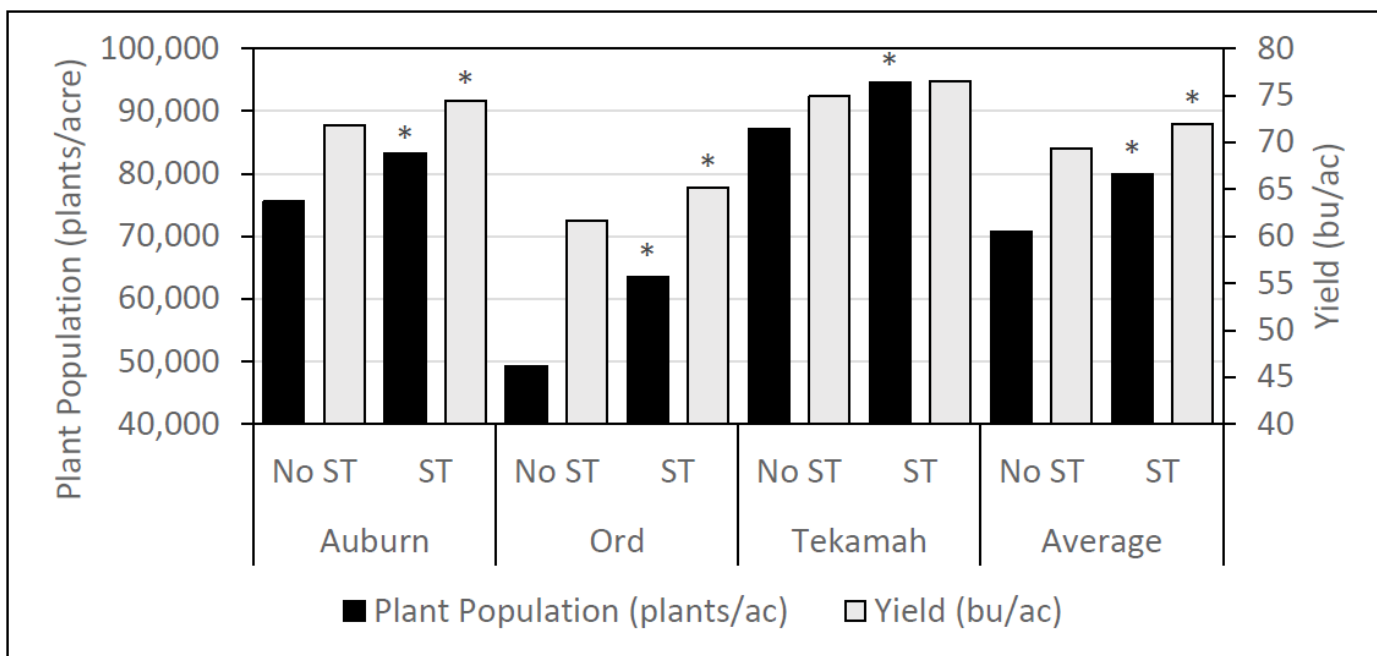
Herbicide Treatment Factor Comparisons	Location and Population (plants/ac)							
	Auburn		Ord		Tekamah		All	
	14 DAP <sup>2</sup>	26 DAP	21 DAP	35 DAP	12 DAP	25 DAP	First	Second
Glyphosate (GLY)	72,691	82,982	63,434	55,757	91,966	91,530	76,030	76,756
GLY + Sulfentrazone (SULF)	63,380	74,597	61,420	58,752	89,952	91,367	71,584	74,905
GLY + Flumioxazin (FLUM)	69,206	80,749	54,831	54,886	89,516	87,447	71,184	74,361
Prob>F	0.0957	0.1707	0.1352	0.6624	0.8440	0.5354	0.1319	0.6541

<sup>2</sup> DAP = number of days after planting

Y BOLD = values in bold represent significant increases (p≤0.10)



**Figure 3. Soybean population (25-35 DAP) and yield for seed treatment comparisons at each 2017 SMFD location and overall average populations. \* indicates significant difference at  $\alpha=.10$**

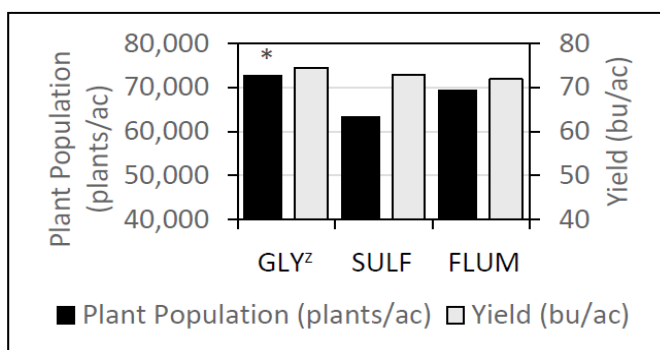


**Variety Effect on Plant Population.** The sensitive variety resulted in significantly higher plant population for the first assessment at Auburn (data not shown). At harvest the sensitive variety resulted in significantly higher plant populations at all locations and when averaged across the locations (data not shown).

**Seed Treatment Effect on Plant Population.** The fungicide seed treatment resulted in significantly higher plant populations compared to no seed treatment for the first assessment at Ord, Tekamah and when averaged across all three locations (data not shown). Fungicide resulted in significantly higher plant populations for the second assessment at all locations and also when averaged across the locations (Figure 3). At harvest the fungicide treatment resulted in significantly higher plant populations at Auburn, Ord and when averaged across the locations (data not shown).

**Herbicide Program Effect on Plant Population.** There were no significant interactions between herbicide, seed treatment, and variety for plant population. In general, there was a trend in which the glyphosate alone herbicide program resulted in higher plant populations than the two PPO tank mix programs. At Auburn, glyphosate resulted in higher plant populations for the first assessment however there was no significant effect on yield due to the herbicides (Figure 4).

**Figure 4. Soybean population (13 DAP) and yield for herbicide treatment comparisons at Auburn. \* indicates significant difference at  $\alpha=.10$**



<sup>z</sup> Table 1: Treatment list

## Effects on Root Rot Severity.

When plant root systems were evaluated for root rot the factor which most consistently affected root rot severity was variety (Table 5). The specific seedling disease pathogens that were most commonly isolated were *Fusarium* spp. at the three locations. Overall, there was low seedling disease pressure at the three locations with root rot severity ranging from 11-21%.

**Table 5. Statistical significance of treatment factors and interactions related to root rot severity. For a factor to be considered significant the value would need to be less than 0.10 at a 90% confidence level.**

Treatment Factor and Interaction	Probability > F for Treatment Factors Affecting Root Rot Severity			
	Auburn	Ord	Tekamah	Average
Variety	0.0275	0.2587	0.003	0.0072
Seed Treatment	0.0562	0.2936	0.5047	0.0362
Herbicide	0.6804	0.6866	0.1745	0.3844
Variety X Seed Treatment	0.5071	0.2269	0.8671	0.9287
Variety X Herbicide	0.5973	0.2196	0.3535	0.1003
Herbicide X Seed Treatment	0.6698	0.4987	0.7387	0.8585

**Table 6. Root rot severity ratings for variety and seed treatment factor comparisons at each 2017 SMFD location and overall average severity.**

Treatment Factor Comparisons	Location and Root Rot Severity (0-100%)			
	Auburn	Ord	Tekamah	Average
<b>Variety</b>				
Sensitive	21.3 <sup>z</sup>	12.6	19.4	17.8
Tolerant	15.4	14.9	11.5	13.9
Prob>F	0.0275	0.2587	0.003	0.0072
<b>Seed Treatment</b>				
No Treatment	20.9	14.8	16.3	17.3
Fungicide	15.8	12.7	14.6	14.4
Prob>F	0.0562	0.2936	0.5047	0.0362

<sup>z</sup> BOLD = values in bold represent significant increases (p≤0.10)

**Variety Effect on Root Rot Severity:** The sensitive variety had significantly higher root rot than the tolerant at Auburn, Tekamah and when averaged across the locations (Table 6).

**Seed Treatment Effect on Root Rot Severity:** Root rot severity was lower for fungicide compared to no treatment at Auburn and when averaged across the locations. The fungicide seed treatment reduced root rot severity by a range of 2-5 % (Table 6).

**Herbicide Program Effect on Root Rot Severity:** There were no significant herbicide treatment effects on root rot severity.



## Effects on Yield.

Overall, yields were good for the three locations with all sites averaging over 60 bu/ac. All three treatment factors had significant effects on yield at the trial locations.

**Table 7. Statistical significance for a treatment effect and interactions related to yield. For a factor to be considered significant the value would need to be less than 0.10 at a 90% confidence level.**

Treatment Factor and Interaction	Probability > F for Treatment Factors Affecting Yield			
	Auburn	Ord	Tekamah	Average
Variety	<0.0001	<0.0001	0.4734	0.8933
Seed Treatment	0.0365	0.0084	0.3492	0.0018
Herbicide	0.2183	0.8102	0.0019	0.0012
Variety X Seed Treatment	0.5249	0.7096	0.3691	0.2576
Variety X Herbicide	0.1803	0.6060	0.5094	0.1529
Herbicide X Seed Treatment	0.1982	0.9340	0.6805	0.4081

**Table 8. Yield results for herbicide treatment factor comparisons at each 2017 SMFD location and overall average yields.**

Herbicide Treatment Factor Comparisons	Location and Yield (bu/ac)			
	Auburn	Ord	Tekamah	Average
Glyphosate (GLY)	74.5	63.9	80.3	72.9
GLY + Sulfentrazone (SULF)	72.8	63.5	73.0	69.8
GLY + Flumioxazin (FLUM)	71.9	62.9	73.8	69.6
Prob>F	0.2183	0.8102	0.0019	0.0012

<sup>2</sup> BOLD = values in bold represent significant increases ( $p \leq 0.10$ )

**Variety Effect on Yield.** There was no consistent trend of yield difference between the two varieties across all locations. At Auburn, the tolerant variety yielded 7.6 bu/ac higher than the sensitive (data not shown). This difference in yield is likely attributed to the apparent difference in susceptibility to Stem Canker where there was 5.1 % compared to 2.5 % incidence in sensitive versus the tolerant variety, respectively (data not shown). While at Ord, the sensitive variety yielded 5.9 bu/ac higher than the tolerant (data not shown).

**Seed Treatment Effect on Yield.** Fungicide seed treatment resulted in an increase in yield at Auburn, Ord and when averaged across the locations. The Fungicide treatment provided a range of 0.6 - 3.5 bu/ac increase compared to no seed treatment (Figure 3).

**Herbicide Program Effect on Yield.** There was a consistent trend of the glyphosate treatment yielding higher than the PPO herbicide treatments. However, this increase was only significantly higher at Tekamah and when averaged across all locations. Weed competition effects were limited by weekly mechanical weed control.

## Disease and Insect Evaluations (Site Specific Factors Affecting Yields):

There were a range of diseases observed at low levels throughout the four locations. Frogeye leaf spot (*Cercospora sojina*) was present at Auburn and Tekamah, Stem Canker (*Diaporthe phaseolorum* var. *caulivora*) at Auburn and Ord, and Charcoal Rot (*Macrophomina phaseolina*) at Tekamah. There was some Bean Leaf Beetle (*Cerotoma trifurcata*) feeding present at Tekamah additionally. Differences observed between treatments for foliar diseases and insect feeding were not severe enough to impact yield.



### DISCUSSION

According to the results from 2017, soil applied PPO herbicides, sulfentrazone and flumioxazin, did not have an effect on root rot severity in soybeans. This is contrary to what was previously observed in 2016, in which the PPO treatments resulted in an increase in root rot severity when applied. It is important to note that even though we saw increases in root rot severity when PPOs were applied in 2016, there was no subsequent effect on yield. The differing results from 2016 to 2017 of the effect of PPOs on disease severity could be attributed to a number of factors. First, there appeared to be a wide range of seedling disease pressure among the 7 total field locations from the two years. The significant differences detected between PPOs and the glyphosate control for root rot severity occurred at locations, which on average had higher root rot severity scores compared to the 2017 locations. The largest increase in

root rot severity attributed to PPO applications in 2016 was at Cordova where there was no PPO injury observed. Whereas in 2017, all three sites had symptoms of PPO injury observed (Figure 1). For the sites that had the highest PPO injury incidence there was a significant rainfall or irrigation event at the time of emergence. For 2017, the glyphosate control treatment ranged 1.3-7.3 bu/ac more than the PPO treatments. While this yield increase is not significant, it does present a need for larger studies to evaluate these small yield differences that cannot be detected in small plot research (Table 8). Nevertheless, there is inherent variability in field plot research and thus greenhouse experiments under controlled conditions are being conducted to better understand the interaction between PPO herbicides and seedling disease severity in soybeans. In general, throughout the locations we did see a benefit from using the fungicide seed treatment. The fungicide treatment resulted in higher stand populations, decreased root rot severity, and an increase of up to 3.5 bu/ac in yield. This finding is similar to previous findings at SMFD research sites where fungicide seed treatment was found to be one of the most significant factors contributing to yield in large integrated studies from 2014-2016. Overall, these soil applied PPO herbicides appear to have a variable effect on root rot severity which is highly dependent on field disease history and weather conditions at emergence. These interactions need to be further investigated in order to gain a better understanding as to the effect of soil applied PPO herbicides, varietal sensitivity to these herbicides, and the value of fungicide seed treatments in an integrated soybean production management plan.

*Contact the authors if interested in obtaining more extensive data from this study.*



## Impact of Tillage on Seeding Rates, ET and Soil Factors Affecting Yield

- Authors: Chuck Burr (Nebraska Extension Educator Crops and Water); Troy Ingram (Nebraska Extension Educator Crops and Water); Brian Krienke (Nebraska Soils Extension Educator); Steve Melvin (Nebraska Extension Educator Crops and Water); Aaron Nygren (Nebraska Extension Educator Crops and Water); Daran Rudnick (Nebraska Extension Agriculture Water Management Specialist – Crops); and Charles Shapiro (University of Nebraska–Lincoln Emeritus Soil Scientist – Crop Nutrition)



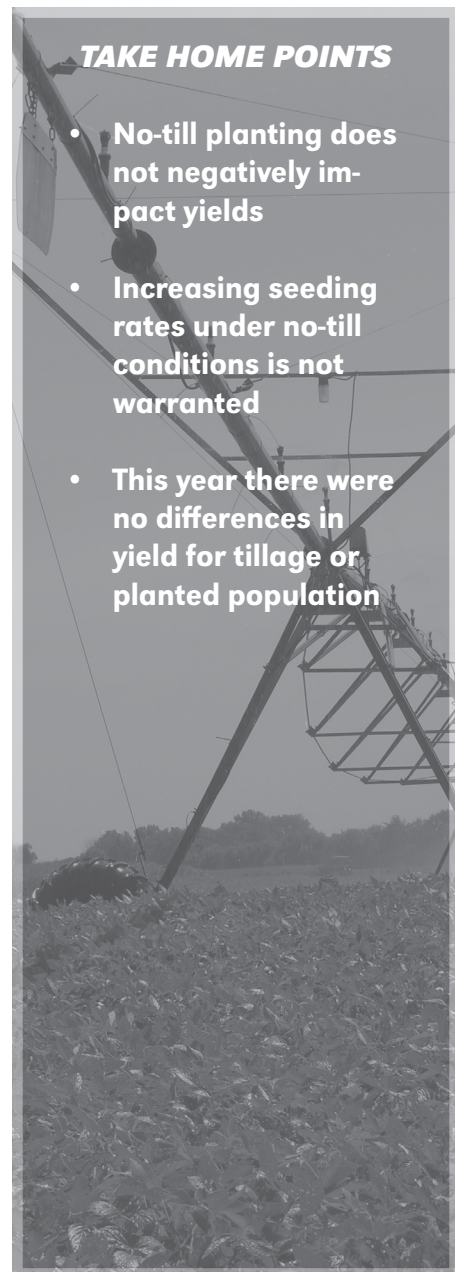
### INTRODUCTION

**Problem Addressed:** Cash grain prices continue to remain at or below profitability levels. The use of no-till has continued to increase in many areas of Nebraska, but a few producers continue to till the soil for seedbed preparation. Reducing tillage can save money by reducing the number of passes across a field. Some producers will increase seeding rates to compensate for reduced emergence due to cooler and wetter soils under no-till conditions. Cooler and wetter soils may also impact the soil nutrients available to the plants. One advantage that has been claimed for no-till is that it is a means to reduce irrigation requirements by reducing soil water evaporation and also increase the infiltration rate of rain and irrigation water leading to more water stored in the soil and available for evapotranspiration (ET), <http://extension-publications.unl.edu/assets/pdf/g2000.pdf>.

Various Nebraska On-Farm Research (NOFR) projects have consistently shown that planting 130,000-140,000 seeds per acre leads to the most economical yields, yet many growers plant much greater rates. A long term unpublished tillage study conducted by Dr. Charles Shapiro has shown no significant differences in yield from three different tillage systems (Table 9).

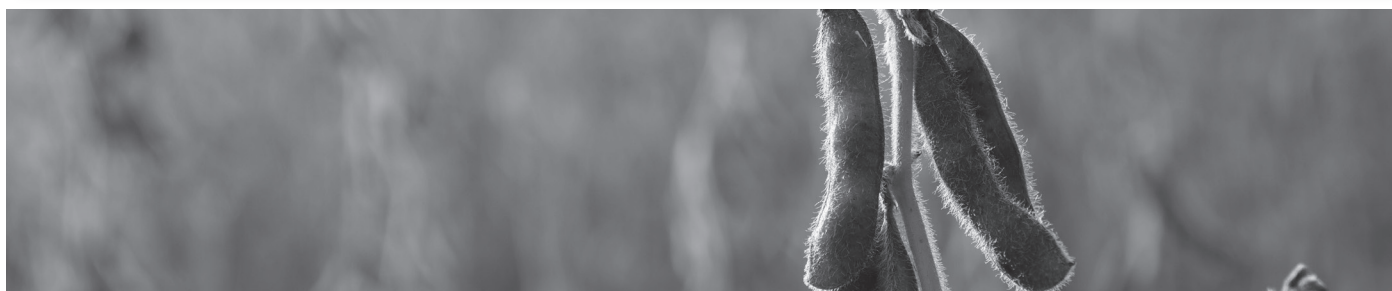
### TAKE HOME POINTS

- No-till planting does not negatively impact yields
- Increasing seeding rates under no-till conditions is not warranted
- This year there were no differences in yield for tillage or planted population



**Table 9. Yield response to tillage system at Haskell Ag Lab, Concord, NE 1986-2016.**

Tillage System	Yield, bu/ac	Harvest Population, plts/ac
Disk	44.7	147,081
No-till	44.4	152,593
Plow	44.9	150,813





**Table 10. Effect of planted population and tillage on soybean yield at three locations in Nebraska. SMFDs 2017.**

		<b>Irrigated</b>			
		<b>Auburn</b>	<b>Ord</b>	<b>Tekamah</b>	<b>Average</b>
<b>Polpuation</b>	<b>Tillage</b>	<b>Yield bu/ac</b>	<b>Yield, bu/ac</b>	<b>Yield, bu/ac</b>	<b>Yield, bu/ac</b>
Low	No Till	65	55	65	62
Medium	No Till	71	59	68	66
High	No Till	65	58	68	64
Low	Disk	64	56	69	63
Medium	Disk	67	59	68	65
High	Disk	64	58	71	64
		<b>Rainfed</b>			
Medium	No Till	50.4	55.1	67.1	57.5
Medium	Disk	47.1	56.5	67.2	57.0



## CONCLUSIONS

This study was designed to compare tilled vs. untilled soils for planting and also to determine if higher seeding rates are warranted for no-till conditions. The study was located at Auburn, Ord and Tekamah. Plots at the North Platte location were abandoned due to emergence issues as the result of unfavorable weather conditions. Main plot treatments were No Till Planting and a Disk system that disked twice before planting. The seeding rate treatments were Low 75,000 seeds per acre, Medium 125,000 seeds per acre and High 175,000 seeds per acre.

The results confirm Nebraska Extension recommendations for planting rates. There were no significant differences in either tillage, seeding rate or an interaction between the two. Average yields across the three locations ranged from 62 bu/ac to 66 bu/ac.

## Dryland

The medium seeding rate was planted on a dryland corner of the pivot at the three locations as well with the main treatment being the No Till and Disk systems. This treatment may show a difference in soil water, and ultimately yield, if the lack of residue due to tillage increases evaporative losses from the soil surface. Yields varied little between the tillage treatments and average yields were not significantly different at 57.5 and 57.0 bu/ac, respectively.



## 2017 Soybean Variety Production Study

- Authors: Rodrigo Werle (Cropping Systems Specialist), Nicholas J. Arneson (Plant Pathology Research Technologist), Keith Glewen (Cropping Systems Extension Educator), and Roger Elmore (Cropping Systems Specialist)
- Researchers: Steven Spicka (Agronomy Research Tech III)



### INTRODUCTION

In 2017, the Xtend soybean (RR2Xtend) and approved formulations for over-the-top dicamba application technology package became available to soybean producers in the United States, providing them with another tool for weed management in soybeans and a set of new genetics to choose from. Because of the higher seed prices of herbicide-tolerant soybean varieties (e.g., RR2 and RR2Xtend) when compared to conventional varieties, widespread occurrence of glyphosate-resistant weeds in Nebraska (e.g., common waterhemp, Palmer amaranth, marestail, kochia, giant ragweed, and common ragweed), concerns with dicamba off-target movement when spraying RR2Xtend acres, and premiums for non-GMO soybeans, some growers have considered including conventional soybean varieties as part of their cropping systems. Some of the challenges associated with growing conventional soybeans are: i) seed availability and variety selection, ii) misapplication and drift of glyphosate and/or dicamba to non-tolerant varieties, iii) managing weeds without using glyphosate post-emergence (which most of us have become accustomed to), and iv) continual scouting and spraying fields in a timely manner. A common question amongst producers is whether conventional varieties can yield similar to RR2 and RR2Xtend varieties, which dominate the market and have been the main focus of current breeding programs.

According to a recent survey, 30-inch row spacing has been the standard for most growers across Nebraska; however, research has shown a potential yield increase when soybeans are planted at 15-inch row spacing. Moreover, narrow-row spacing has been reported to reduce the likelihood of weed resurgence in soybeans due to the faster rate of canopy closure. The survey has also indicated that cover crops have increased in popularity amongst Nebraska growers and according to respondents, besides reduced erosion, lower weed pressure has been observed where cover crops have been adopted. Selecting soybean varieties with shorter relative maturity would allow for earlier planting of cover crops in the fall, which would enhance cover crop biomass production, soil protection, and weed suppression in the winter and spring. Thus, herbicide tolerance trait, row spacing, maturity group, and cover crops are strategies that could be better explored by growers to

### TAKE HOME POINTS

- The effect of narrow row spacing on yield was site specific; 15-inch and 30-inch soybeans were similar at Ord and Tekamah, but 15-inch yields were higher at Auburn
- Conventional varieties yielded an average of 2-3 bushels less than the RR2 and RR2Xtend varieties
- Early maturity soybean varieties (RM=2.2-2.4) yielded an average of 2 extra bushels when compared to the late season varieties (RM = 3.2)
- Combined, these results indicate that i) narrow row spacing (15-inch) present a potential for yield increase, ii) conventional varieties yielded slightly less than RR2 and RR2Xtend varieties, and iii) early season varieties yielded slightly more than late season varieties

maximize soybean yield potential while enhancing weed management. The objective of this study was to explore the impact of herbicide-tolerance trait selection, maturity group, and row spacing on soybean yield across 3 Nebraska locations.

### Research Questions?

- When treated the same, are the yields of conventional, RR2, and RR2Xtend varieties similar?
- Do these varieties respond similarly to different row spacing?
- Does maturity group play a role in the yield potential?



### METHODS

In an attempt to answer these research questions, a study was established at three of the 2017 Soybean Management Field Days locations (Auburn, Ord and Tekamah). The study was conducted as a 2x2x3 factorial with a total of 12 treatments replicated 4 times arranged on a randomized complete block design. Plots were 4 rows wide (10 ft) and 30 ft long. Treatments consisted of: i) two row spacing, ii) two maturity groups, and iii) three herbicide-tolerance traits (Table 11). Varieties were managed as conventional soybeans for weed management (i.e., no glyphosate or dicamba sprayed post-emergence).

**Table 11. Treatment list for the soybean variety production study.**

Row Spacing <sup>1</sup>	Maturity Group	Herbicide-Tolerance Trait <sup>2</sup>
15-inch	Early (2.2-2.4)	Conventional (U11-920017 & AG3253)
30-inch	Late (3.2)	RR2 (AG2431R2Y & AG3231)
		RR2 Xtend (AG24X7 & AG32X7)

<sup>1</sup> 125,000 seeds per acre was the seeding rate for the 15-inch and 30-inch treatments.

<sup>2</sup> RR2 = glyphosate-tolerant varieties and RR2Xtend = glyphosate and dicamba-tolerant varieties. No glyphosate or dicamba were sprayed post-emergence in this trial.

**Grain yield data.** Yields, in bushels per acre, were determined with a small plot combine by harvesting two center rows of each plot after they were cut to a standard length of 30 ft. Yields were adjusted to 13% grain moisture for final reported values.

**Statistical analysis.** The experimental data were analyzed to evaluate interaction and main treatment effects on yield. Significant differences were determined based on a probability of 0.95. The average and standard error value for treatments where statistical differences ( $P < 0.05$ ) were detected are shown in Table 12.



### RESULTS AND DISCUSSION

According to the statistical analysis, location by row spacing was the only significant interaction ( $P < 0.05$ ) amongst all possible interactions evaluated in this study (Table 2); therefore, simple effects for these two experimental factors were evaluated. The experimental factors herbicide tolerance trait and maturity group were significant ( $P < 0.05$ ), thus their main effects were evaluated.





**Table 12.** Yield (average in bushels per acre  $\pm$  standard error [AVG  $\pm$  SE]) response of herbicide tolerance variety traits, relative maturity groups, study locations and row spacing.

Variety Trait	AVG $\pm$ SE	Maturity Group	AVG $\pm$ SE	Location x Row Spacing	AVG $\pm$ SE
Conventional	79 $\pm$ 1 <i>b</i>	Early (2.2-2.4)	82 $\pm$ 1 <i>a</i>	Auburn at 15-inch	92 $\pm$ 2 <i>a</i>
RR2	81 $\pm$ 1 <i>a</i>	Late (3.2)	80 $\pm$ 1 <i>b</i>	Auburn at 30-inch	81 $\pm$ 2 <i>b</i>
RR2Xtend	82 $\pm$ 1 <i>a</i>		<i>P</i> = 0.019	Ord at 15-inch	80 $\pm$ 2 <i>bc</i>
	<i>P</i> = 0.022			Ord at 30-inch	78 $\pm$ 2 <i>bc</i>
				Tekamah at 15-inch	78 $\pm$ 2 <i>bc</i>
				Tekamah at 30-inch	76 $\pm$ 2 <i>c</i>
					<i>P</i> = 0.002

<sup>1</sup> Groups within the same column that do not share the same letter are significantly different ( $P < 0.05$ ). Letters, in alphabetic order, represent highest to lowest average treatment yields.

**Row Spacing and Study Location.** Soybean yield response to row spacing varied across locations (data pooled across maturity groups and herbicide-tolerance trait varieties; Table 2). The 15-inch row spacing soybeans yielded more than 30-inch at Auburn. At Ord and Tekamah, the yields were similar ( $P > 0.05$ ). Even though yield response to narrow row spacing was site-specific, 15-inch soybeans produced the same or more, never less, when compared to 30-inch soybeans. Higher yields in narrow-row spacing are likely due to faster canopy closure and higher light interception (e.g., plants “harvesting” more light for photosynthesis) due to a more even plant distribution in the field. Yields at Auburn were higher than Ord and Tekamah (average of 87, 79, and 77 bushels per acre across treatments, respectively).

**Herbicide Tolerance Variety Trait.** Conventional varieties yielded an average of 2-3 bushels less than the RR2 and RR2Xtend varieties (data pooled across maturity groups, location and row spacing; Table 2). Even though the conventional varieties yielded less, the difference was relatively small and depending on premiums offered to non-GMO soybeans and overall weed management costs, which are directly related upon the herbicide-tolerance trait selected, they may result in equal or higher profitability.

**Maturity Group.** The early maturity varieties (RM 2.2-2.4) yielded 2 bushels more than the late maturity varieties (RM 3.2; data pooled across herbicide tolerance trait, location and row spacing). Thus, growers interested in cover crops could potentially use the early maturity varieties recommended for their regions to allow a wider window for cover crop establishment in the fall without hurting soybean yield potential.

## SUMMARY

This study was conducted at three locations across Nebraska during the 2017 growing season. Fifteen-inch row spacing yielded the same or more than the standard 30-inch row spacing. The results of this study indicate an yield advantage of RR2 and RR2Xtend soybean varieties when compared to conventional soybeans. The early maturity group tested in this study (RM2.2-2.4) had a yield advantage when compared to the late maturity group (RM3.2).

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# Soybean Management Field Days

Faculty and staff involved with the on-farm research efforts include:

## NICK ARNESON

Pathology Research Technologist  
UNL Dept. of Plant Pathology  
427 Plant Science Hall  
Lincoln, NE 68583-0722  
Phone: (402) 472-6771  
nicholas.arneson@unl.edu

## VICTOR BOHUSLAVSKY

Executive Director  
Nebraska Soybean Board  
3815 Touzalin Ave., Suite 101  
Lincoln, NE 68507  
Phone: (800) 852-2326  
victor@nebraskasoybeans.org

## CALE BUHR

Market Development Coordinator  
Nebraska Soybean Board  
3815 Touzalin Ave., Suite 101  
Lincoln, NE 68507  
Phone: (800) 852-2326  
cale@nebraskasoybeans.org

## CHUCK BURR

Nebraska Extension Educator  
402 W. State Farm Road  
North Platte, NE 69101-7751  
Phone: (308)696-6783  
chuck.burr@unl.edu

## CHERYL DUNBAR

Office Manager  
Nebraska Extension in Saunders County  
1071 County Road G \* Ithaca, NE 68033  
Phone: (402) 624-8003  
cdunbar2@unl.edu

## ROGER ELMORE

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

## LOREN GIESLER

Nebraska Extension Plant Pathologist  
448 Plant Science Hall  
Lincoln, NE 68583-0722  
Phone: (402) 472-2559  
lgiesler1@unl.edu

## KEITH GLEWEN

Project Coordinator and  
Nebraska Extension Educator  
1071 County Road G  
Ithaca, NE 68033  
Phone: (800) 529-8030 or (402) 624-8030  
kglewen1@unl.edu

## JESSICA GROSKOPF

Nebraska Extension Educator, Ag Economics  
PHREC 4502 Ave I  
Scottsbluff, NE 69361-4939  
308-632-1247  
jjohnson@unl.edu

## TROY INGRAM

Nebraska Extension Educator  
801 S Street Suite 1  
Ord, NE 68862  
Phone: (308) 728-5071  
tingram5@unl.edu

## BOB KLEIN

University of Nebraska Emeritus  
Cropping Systems Specialist  
West Central Research and Extension Center  
402 West State Farm Road  
North Platte, NE 69101  
Phone: (308)696-6705  
robert.klein@unl.edu

## BRIAN KRIENKE

Nebraska Soils Extension Educator  
362C Plant Science Hall  
Lincoln, NE 68583-0915  
Phone: (402)472-5147  
krienke.brian@unl.edu

## \* GARY LESOING

Nebraska Extension Educator  
1824 N St  
Auburn, NE 68305-2395  
402-274-4755  
gary.lesoing@unl.edu

## BRAD LUBBEN

Nebraska Extension Public Policy Specialist  
FYH 207A  
Lincoln, NE 68583-0922  
402-472-2235  
blubben2@unl.edu

## JUSTIN MCMECHAN

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

## STEVEN MELVIN

Extension Educator, Cropping Systems  
PO Box 27 1510 18th St  
Central City NE 68826  
308-946-3843  
steve.melvin@unl.edu

## NEBRASKA SOYBEAN BOARD

3815 Touzalin Ave., Suite 101  
Lincoln, NE 68507  
Phone: (800) 852-2326  
info@nebraskasoybeans.org

## AARON NYGREN

Nebraska Extension Educator, Irrigation and  
Cropping Systems  
466 Rd 10 P.O. Box 389  
Schuyler, NE 68661-0389  
402-352-3821  
anygren2@unl.edu

## DELORIS PITTMAN

Marketing and Promotions Manager  
University of Nebraska Eastern Nebraska  
Research and Extension Center  
122 Mussehl Hall  
Lincoln, NE 68583-0718  
Phone: (402)472-3293  
dpittman1@unl.edu

## CHRIS PROCTOR

Nebraska Weed Management  
Extension Educator  
174 Keim Hall  
Lincoln, NE 68583-0915  
Phone: (402) 472-5411  
caproctor@unl.edu

## DARAN RUDNICK

Nebraska Extension Agriculture Water Manage-  
ment Specialist - Crops  
West Central Research and Extension Center  
402 West State Farm Road  
North Platte, 69101-7751  
Phone: (308)696-6709  
daran.rudnick@unl.edu

## CHARLES SHAPIRO

University of Nebraska-Lincoln  
Emeritus Soil Scientist - Crop Nutrition  
Haskell Agricultural  
Laboratory  
57905 866 Rd  
Concord, NE 68728-2828  
Phone: (402) 584-3803  
cshapiro@unl.edu

## TIM SHAVER

University of Nebraska  
Nutrient Management Specialist  
West Central Research and Extension Center  
402 West State Farm Road  
North Platte, NE 69101  
Phone: (308)696-6714  
tim.shaver@unl.edu

## STEVE SPICKA

Ag Research Technician  
University of Nebraska ARDC  
1071 County Road G Ithaca, NE 68033  
Phone: (402) 624-8023  
sspicka2@unl.edu

## RODRIGO WERLE

Assistant Professor - Cropping Systems  
Specialist  
University of Nebraska  
West Central Research and Extension Center  
402 West State Farm Road  
North Platte, NE 69101  
Phone: (308)696-6712  
Email: rodrigo.werle@unl.edu

## \* JOHN WILSON

Nebraska Extension Educator  
111 N. 13 St., St. 6  
Tekamah, NE 68061-1098  
402-374-2929  
jwilson3@unl.edu

## BOB WRIGHT

Nebraska Extension Entomologist  
213 Entomology Hall  
Lincoln, NE 68583-0816  
Phone: (402)472-2128  
Email: rwright2@unl.edu

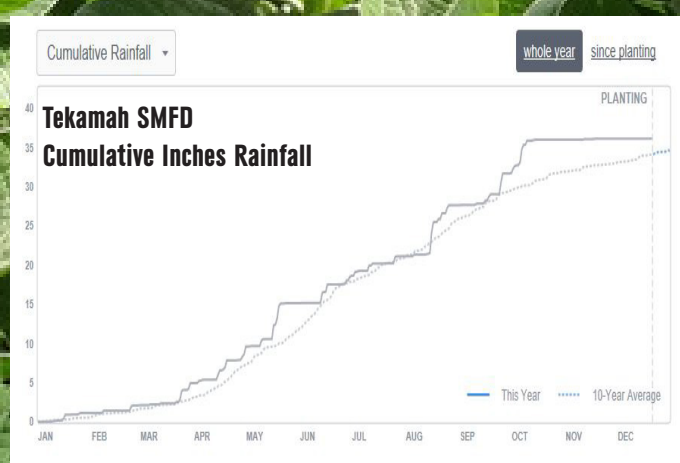
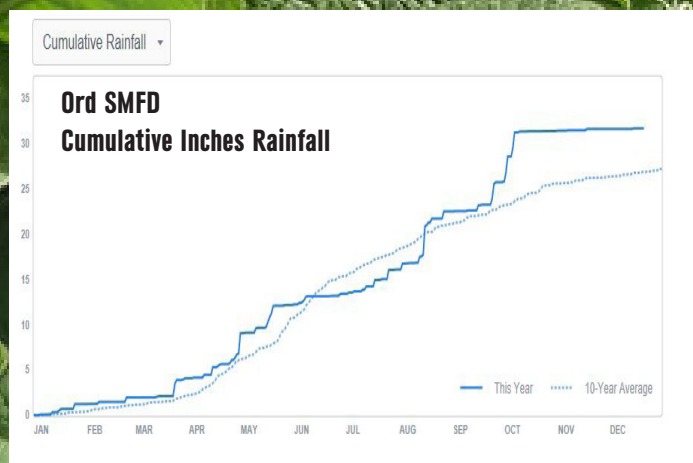
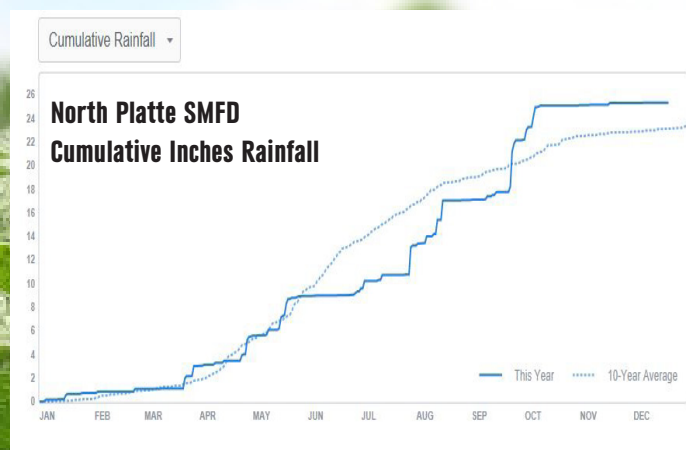
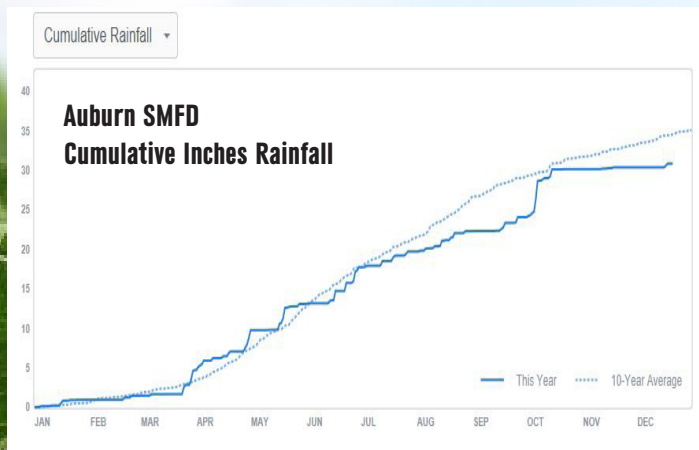
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# Soybean Management Field Days

## RESEARCH UPDATE

### Cumulative Rainfall Totals



### 2017 Soybean Management Field Days Research Locations:

**University of Nebraska West Central Research and Extension Center, North Platte, NE**  
**Tad Melia Farm, Ord, NE**  
**Jim Gerdes Farm, Auburn, NE**  
**Tim Gregerson Farm, Tekamah, NE**

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