2015 Soybean Management Field Days

RESEARCH UPDATE

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University of Nebraska–Lincoln

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Institute of Agriculture and Natural Resources

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Soybean Management Field Days On-Farm Research
Introduction

Keith Glewen, Nebraska Extension Educator

The 2015 growing season represented the fifth year replicated on-farm field research was conducted at the four Soybean Management Field Day locations. Why the need for conducting on-farm research at these locations?

The answer to the above question is due to the fact many practical questions regarding soybean production and natural resource sustainability are not being answered by current federal and industry funded crop research programs. In addition, the diversity of soybean growing environments in Nebraska, changes in climate and advancements in production technologies are causing growers to question many long-held assumptions associated with soybean production. Add to this, today's consumer are asking questions about how and where their food comes from, the increasing world demand for soybeans, and the importance natural resources such as soil and water has on meeting this growing demand. Subsequently, growers are increasingly challenged to grow soybeans more responsibly and to document sustainability.

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

We would also like to thank each of the four collaborating soybean growers who provided their farm as a research location.

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.

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	Plant	Harvest	Soil	Herbicide		Site Average
	5/12/2015	10/8/2015	Silt Loam Hall and Nord	Date	Chem/Rate	Yield (bu/ac)
ALDA				5/20/2015	Roundup 28 oz	61
					AMS 17 lb/100 gal	
					Intensity 6 oz	
					Herbimax 1 qt	
					Outlook 21 oz	
				7/1/2015	Roundup 32 oz	
					AMS 17 lb/100 gal	
					Intensity 21 oz	
					NIS 0.25% v/v	
	4/29/2015	10/15/2015	Silty Clay Loam Tomek	4/16/2015	Sharpen 1 oz	64
GREENWOOD				5/22/2015	Roundup 28 oz	
					AMS 17 lb/100 gal	
					Intensity 6 oz	
					Herbimax 1 qt	
					Outlook 21 oz	
				7/2/2015	Roundup 32 oz	
					AMS 17 lb/100 gal	
					Intensity 21 oz	
					NIS 0.25% v/v	
	4/30/2015	10/9/2015	Silt Loam Kenesaw	3/21/2015	2,4-D LV4 8oz	85
HOLDREGE					Banvel 4 oz	
					Enlite 2.8 oz	
					Crop Oil 1%	
				5/21/2005	Roundup 28 oz	
					AMS 17 lb/100 gal	
					Herbimax 1 qt	
					Outlook 21 oz	
				7/1/2015	Roundup 32 oz	
					AMS 17 lb/100 gal	
					Intensity 21 oz	
					NIS 0.25% v/v	
	5/19/2015	10/7/2015	Silty Clay Loam Belfore & Nora	4/22/2015	Sharpen 1 oz	68
WAKEFIELD				5/22/2015	Roundup 28 oz	
					AMS 17 lb/100 gal	
					Intensity 6 oz	
					Herbimax 1 qt	
					Outlook 21 oz	
				7/2/2015	Roundup 32 oz	
					AMS 17 lb/100 gal	
					Intensity 21 oz	
					NIS 0.25% v/v	

Effect of Early Season Nitrogen on Soybeans

Authors: Charles Shapiro (UNL Extension Soil Scientist – Crop Nutrition),
Brian Krienke (Nebraska Extension Educator -- Soils)
Josh Miller (UNL Graduate Research Assistant and Doctor of Plant Health student)

TAKE HOME POINTS:

- SMFD field day sites in 2015 had mostly adequate fertility for high yields. Organic matter, surface nitrate, Mehlich III P, and soil K averaged: 3.3%, 40 (lbs/ac), 58 (ppm) and 477 (ppm), respectively.
- Soil textures ranged from silty clay loam to silt loams with no coarse textured sites.
- Nitrogen additions had slightly greater yields (not significant) but varied by location and timing and source with an average of 1.6 bu for 100 lbs N/ac and 3.4 bu/ac for 200 lbs N/ac split applied every two weeks. These yield increases at present prices would not be profitable.
- At Alda, the 100 lbs N as urea at planting treatment, and 40 lbs phosphate/ac treatment, both significantly increased yields 10 bu/ac.
- At Greenwood, the 200 lbs urea split applied every two weeks increased yields 7.3 bu/ac.
- Residual soil nitrate at the end of the season was at normal levels and none of the applied nitrogen increased nitrate levels to 48 inches.
- Nitrogen additions and source did not affect protein or oil in any practical amount.

INTRODUCTION

The desire to achieve high yields in soybeans continues to challenge researchers and producers, alike. There are many ideas on what is holding back yields, and what might increase them. It is impossible to test all the ideas in one study, yet there may be combination effects that are missed in a single factor study, so there is a place for both types of studies.

In 2014 the significant yield increases from applied N were seen in the locations that had the higher yields (Belgrade (78 bu/ac) and Shickley (82 bu/ac). This is consistent with the idea that soybeans need extra nitrogen when their yield potential is greater than what symbiotic nitrogen fixation and soil nitrogen can supply, generally thought of as above 60 bu/ac. Yields were slightly increased, but soybean quality was minimally affected. The greatest yield increase was 8 bushels at Shickley with 100 lbs N/ac. This equates to 12.5 lbs added N for each bushel increase. Soybeans contain about 4.9 lbs of N per bushel in the total plant and remove about 3.8 lbs of N/bushel, so this was a very inefficient use of nitrogen with only 30 percent recovery. This was the best case of all the sites. In 2014 our goal was to improve upon the 2013 results which gave us a 5 bushel increase with 300-400 lbs of nitrogen applied. In 2014 we increased yields an average of 3 bu/ac with 100 lbs of N/ac.

In the 2015 SMFD fertility study, there were two objectives, the first was to compare nitrogen rates, sources, and timing. Based on the 2014 results supporting potential yield increases with early applied N, we focused on applying N early in the season at 100 lbs N/acc, splitting that dose over time, and comparing urea to a poly coated urea source that released slowly over the first 60 days. The intent of these treatments was to supply N while minimally inhibiting nodule activity. Although the slow release nitrogen treatment did not increase yields in 2014, current literature has reported positive results, so a different source of slow release nitrogen was used for 2015. The idea is to postpone when the soybean plant has access to the nitrogen and not release a large nitrogen surge, which would cause a momentary pause in the root nodule growth and inhibit yield. We compared this to split applications of urea to mimic the slow release pattern.

The second objective was to test conventional sources of other macronutrients. In single additions, without added N we tested P, K, and S. In addition there was one treatment with all the nutrients (N, P, K, and S.)

METHODS

Treatment Application

This study was a small trial that was conducted in conjunction with the larger Integrated Study reported in Section II of this publication. The nutrient component of the large factorial study tested the effect of three foliar package treatments near flowering. The foliar package contained N-Rage® and Soy Grow® and was applied alone or combined with a fungicide or a fungicide and insecticide. In this study we focused on trying to increase yields with a combination of treatments. The experiment was a randomized complete block design with 4 replications. Nitrogen (N) rates were applied at 0, 100 and 200 lbs/ac as listed in the Table 1. The two N sources used were 46% N as urea and ESN® (a poly coated urea with slow release properties, 44-0-0). All initial treatments (trt) were applied near the V2 stage. Most of the cultural practices were similar to the ones in the factorial study. Plot dimensions were 10 ft by 30 ft long consisting of 4 rows on 30 in spacing. Split applications were applied every two weeks in five doses. All fertilizers were weighed out per plot, split into four sub units and hand applied. Field cultural practices were conducted as described in the section about the factorial experiment.

Data Collection

Before experiment initiation a composite soil sample was taken from the experimental area. This consisted of 10 cores taken at random and composited. The results, from Ward Laboratory (Kearney, NE) are presented in Table 9. Harvest was as described in the Integrated Study for the 30 inch row soybeans. Seed samples were taken at harvest and analyzed at the UNL wheat quality lab for protein and oil content. After harvest at each site, soil samples were taken from selected treatments (control, 100 and 200 lbs N urea split, ESN at flowering and the N, P, K, S treatment) using a Giddings hydraulic soil probe (Giddings Machine Company, Inc., Windsor, CO). Two 1" cores were taken and composited from the 0-8, 8-24, and 24-48 inch depths. Samples were analyzed by Ward Laboratories (Kearney, NE).

Analysis

The data from each experiment was analyzed as separate experiments, and an overall analysis with each site as a location was conducted using SAS. An LSD was calculated to separate the means at each location.

A simple marginal analysis was done to determine the overall profitability of these treatments. The cost of the treatments were calculated based on urea at $ 0.51/lb N; ESN at $ 0.63/lb N; gypsum at $ 0.90 /lb S; triple supper phosphate at \$0.45/lb P_2O_5; potassium chloride at 0.30/lb K_2O. No additional application costs were included. Soybeans were valued at \$8.90/bu.

Table 1. Treatments applied to the General Soil Fertility SMFD study in 2015 and the overall cost of the treatments and income change for the average yields of four locations.

TRT #	Total N rate lbs N/ac	Nitrogen Source/ac	Timing	Treatment cost $/acre[1]	Income change (Income – cost) $/acre
1	0	-	-	-	$ -
2	100	Urea	Planting	$ 51.00	$ (31.42)
3	100	Urea	Split	$ 51.00	$ (40.32)
4	200	Urea	Split	$ 102.00	$ (71.74)
5	100	ESN	Planting	$ 63.00	$ (67.45)
6	100	ESN	Flowering	$ 63.00	$ (32.74)
7	0	Gypsum (20 lbs S)	Planting	$ 18.00	$ (17.11)
8	0	TSP (40 lbs P_2O_5)	Planting	$ 18.00	$ 4.25
9	0	KCL (100 lbs K_2O)	Planting	$ 30.00	$ (31.78)
10	100	Gypsum, TSP,KCL	Planting	$ 66.00	$ (65.11)

[1]The cost of the cost of the treatments were calculated based on urea at $ 0.51/lb N; ESN at $ 0.63/lb N; Gypsum at $ 0.90 /lb S; triple supper phosphate at \$0.45/lb P_2O_5; potassium chloride at 0.30/lb K_2O. No additional application costs were included. Soybeans were valued at \$8.90/bu. Average yield from Table 4.

__Table 2. Cultural practices at the 2015 general fertility soybean study.__

Item	Alda	Greenwood	Holdrege	Wakefield
Previous crop	Corn	Corn	Corn	Corn
Tillage	Disk	No-till	Disk	Turbo-till
Planting date	5/12/2015	4/29/2015	4/30/2015	5/19/2015
Variety/pop	Mycogen 5N286R2 2.8RM @144k	Mycogen 5N286R2 2.8RM @144k	Mycogen 5N286R2 2.8RM @144k	Mycogen 5N286R2 2.8RM @144k
Initial Fert. App.	5/22/2015	5/21/2015	5/22/2015	5/21/2015
Subsequent Fert Apps.	2nd – 6/5/15	2nd – 6/3/15,	2nd - 6/5/15	2nd – 6/3/15,
	3rd – 6/19/15	3rd – 6/19/15,	3rd - 6/18/15	3rd – 6/19/15,
	4th – 7/2/15	4th – 7/1/15,	4th - 7/2/15	4th – 7/1/15,
	5th – 7/16/15	5th – 7/16/15,	5th - 7/16/15,	5th – 7/16/15,
	Flowering – 7/16/16	Flowering – 7/16/15	Flowering – 7/16/15	Flowering – 7/16/15
Other chemicals applied/date	5/20/15 – Roundup @ 28 oz + AMS @ 17 lb/100 gal + Intensity @ 6 oz + Herbimax @ 1 qt + Outlook @ 21 oz	4/16/15 – Sharpen @ 1 oz	3/21/15 - 2,4-D LV4 @ 8 oz + Banvel @4 oz + Enlite @ 2.8 oz + Crop Oil @ 1% (applied by grower prior to site selection)	4/22/15 – Sharpen @ 1 oz
	7/1/15 – Roundup @ 32 oz + Intensity @ 21 oz + NIS @ 0.25 v/v + AMS @ 17 lb/100 gal	5/22/15 – Roundup @ 28 oz + Intensity @ 6 oz + AMS @ 17 lb/100 gal + Outlook @ 21 oz	5/21/15 – Roundup @ 28 oz + Intensity @ 6 oz + AMS @17 lb/100 gal + Herbimax @ 1 qt + Outlook @ 21 oz	5/22/15 – Roundup @ 28 oz + AMS @ 17 lb/100 gal + Intensity @ 6 oz + Herbimax @ 1 qt + Outlook @ 21 oz
		7/2/15 – Roundup @ 32 oz + Intensity @ 21 oz + NIS @ 0.25% v/v + AMS @ 17 lb/100 gal	7/1/15 – Roundup @ 32 oz + Intensity @ 21 oz + NIS @ 0.25% v/v +AMS @ 17 lb/100 gal	7/2/15 – Roundup @ 32 oz + AMS @ 17 lb/100 gal + Intensity @ 12 oz + NIS @ 0.25 v/v
	7/16/15 –Stratego YLD 4.0 oz + Leverage 360 2.8 oz + NRage @ 2 gal + Soygrow @ 1 pt	7/17/15 –Stratego YLD 4.0 oz + Leverage 360 2.8 oz + NRage @ 2 gal + Soygrow @ 1 pt	7/16/15 –Stratego YLD 4.0 oz + Leverage 360 2.8 oz + NRage @ 2 gal + Soygrow @ 1 pt	7/17/15 –Stratego YLD 4.0 oz + Leverage 360 2.8 oz + NRage @ 2 gal + Soygrow @ 1 pt
Irrigation & Precip (in) 6/1-9/30	19.6	18.0	17.3	14.5
Crop water use (in)	16.0	13.1	18.0	15.9
Harvest date/soil sampling	10/8/2015	10/15/2015	10/9/2015	10/7/2015

RESULTS

Statistical analysis was performed to identify treatment effects on yield, grain protein, grain oil, grain fiber, and residual soil nitrate. At this site, the complete set of yields and statistics are reported in Table 4. Yields were similar for all sites except Holdrege, with Holdrege yielding an average of 85 bu/ac and the other sites averaging 59 bu/ac. In both the early soil tests, the effect of N rate varied between locations with only a few significant increases compared to the control. At Alda the 100 lbs urea (trt 2) and the 100 lbs ESN at flowering (trt 6) increased yields 9 and 8 bu/acre, respectively. At Greenwood, only the 200 lbs N rate of urea, split through the season increased yields by 7 bu/ac. The use of the slow release N source consistently had greater yields, on average 4 bu across the four experimental sites. This is different than in 2014 where yields were reduced by a different slow release material.

The grain quality was not affected greatly, although there were a few significant effects. Average protein was near 34% for all sites, oil averaged near 19% for all sites. Protein and oil differed slightly at each location, but the differences were not of practical significance. This is similar to what we found in 2013 and 2014.

The only nutrient that might be considered low was phosphorus at Alda (7 ppm Mehlich P III). At this site the two P treatments increased yield, by 10 bu/ac. At the other sites, soil P and K levels were greater than the critical level and these treatments did not increase yield. Both the early site soil tests and the after harvest soil tests indicate that zinc and boron were sufficient. Neither zinc nor boron were part of the treatment set. The pH was in an acceptable range for soybean production at all sites. Table 7 shows the effect of treatments on soil nitrate levels from the combined 0-48 inch sample reported as lbs N as nitrate/ac. There are slight differences by location, with a range of profile N, from 24 lbs/ac nitrate nitrogen at Greenwood to 56 lbs N/ac at Holdrege, but the effect of all nitrogen treatments on end of season residual N was less than 10 lbs N/ac. The individual layers are not reported due to the low levels and lack of differences.

DISCUSSION

It is interesting to note that in 2015 the significant yield increases were seen in the locations that had yields lower than the 60 bu suggested as the break point for needing additional nitrogen. The greatest yielding site (Holdrege) was not affected by any treatments. The literature tends to support the need for late season nitrogen for soybeans, although this may reflect 'publication bias,' where it is easier to publish significant differences than no difference results. The results we have found in previous SMFD nitrogen studies showed some positive effects of 100 lbs nitrogen early. In 2015 the slow release nitrogen at flowering treatment (trt 6) averaged 4 bu more compared to the control treatment (trt 1), but this was not statistically significant.

The response to P was at a low soil P site, and the lack of response at those testing high is in keeping with long standing research. The yield response at the one responsive site was enough to make the treatment profitable over the four sites, the only treatment that was not an average loss. In times of low crop prices, the most profitable strategy is to fertilize based on established response data.

Over the years we have conducted numerous soybean nitrogen trials and the response is in the range of 0-4 bushels, it is not consistent, and unless the nitrogen is free, not profitable. There may be cases where nitrogen is needed, but they are isolated situations, such as breaking out pasture or fields where inoculation has failed.

Table 3. General fertility level of soybean nitrogen study after harvest 2015. (Mean of treatment 1 and 10, 4 replications each, ppm unless noted. Low values in bold)

(0-8" sample)				
	Alda	**Greenwood**	**Holdrege**	**Wakefield**
CEC (me/100g)	16	16	24	25
% H Sat	12	16	0	11
% K Sat	7	7	4	4
% Ca Sat	66	64	80	65
% Mg Sat	14	12	14	19
% Na Sat	1	1	2	1
pH	6.3	6.4	7.4	6.4
Buffer pH	6.8	6.8	-	6.8
1:1 S Salts (mmho/cm)	0.3	0.2	0.5	0.3
OM (%)	2.6	4.0	2.4	3.7
Nitrate (ppm)	8	4	13	5
Nitrate (lbs/8 in)	19	9	31	12
P (Mehlich 3)	**7**	82	108	42
K	432	455	394	405
Sulfate-S	17	14	24	15
Zn	1.8	2.1	3.2	3.1
Fe	37	88	13	76
Mn	16	15	2.5	27
Cu	0.84	0.86	0.97	1.7
Ca	2051	2052	3804	3278
Mg	253	242	381	562
Na	54	28	81	46
Boron	0.6	0.6	0.6	0.6

Table 4: Effect of six nitrogen treatments on soybean yield (bu/ac). 2015.

(Bold numbers are significantly different than the control, trt 1.)

TRT #	Total N rate lbs N/ac	Nitrogen Source	Timing	Alda	Greenwood	Holdrege	Wakefield	Means
1	0	None		53	56	86	61	64
2	100	Urea	Planting	**62**	56	85	62	66
3	100	Urea	Split	58	59	84	61	65
4	200	Urea	Split	54	**63**	87	65	68
5	100	ESN	Planting	55	57	83	58	64
6	100	ESN	Flowering	**61**	60	88	62	68
7	0	Gypsum (20 lbs S)	Planting	56	57	84	60	64
8	0	TSP (40 lbs P_2O_5)	Planting	**64**	56	83	64	67
9	0	KCL (100 lbs K_2O)	Planting	56	58	83	58	64
10	100	Gyp, TSP,KCL	Planting	**61**	55	85	57	64
Means				58	58	85	61	65
	Treatments (Trt)		Prob > F	0.16	0.06	0.25	0.64	Loc 0.0001
								Trt 0.1
								Trt x Loc 0.22
			CV (%)	10	5.9	3.7	9.2	7.1
			LSD 0.05	8	5	5	8	NA

Table 5: Effect of six nitrogen treatments on soybean seed protein (%). 2015.

TRT #	Total N rate lbs N/ac	Nitrogen Source	Timing	Alda	Greenwood	Holdrege	Wakefield	Means
1	0	None		35.3	34.8	34.4	34.2	34.7
2	100	Urea	Planting	35.0	34.6	34.5	34.5	34.7
3	100	Urea	Split	35.1	34.4	33.8	34.7	34.5
4	200	Urea	Split	35.1	33.9	33.7	34.0	34.2
5	100	ESN	Planting	35.4	34.9	33.8	34.1	34.6
6	100	ESN	Flowering	35.2	34.2	33.3	34.6	34.3
7	0	Gypsum	Planting	35.6	34.9	34.1	33.9	34.6
8	0	TSP	Planting	34.9	34.9	33.7	34.1	34.4
9	0	KCL	Planting	35.9	35.1	34.0	34.0	34.7
10	100	Gyp, TSP,KCL	Planting	34.4	34.0	34.2	34.7	34.3
Means				**35.2**	**34.6**	**33.9**	**34.3**	**34.5**
	Treatments (Trt)		Prob. > F	0.09	0.04	0.63	0.86	Loc 0.0001
								Trt NS
								Trt x Loc NS
			CV (%)	1.7	1.6	2.4	2.5	2.1
			LSD 0.05	0.9	0.8	1.2	1.2	NA

Table 6: Effect of nitrogen treatments on soybean seed oil (%). 2015.

TRT #	Total N rate lbs N/ac	Nitrogen Source	Timing	Alda	Greenwood	Holdrege	Wakefield	Means
1	0	None		19.2	18.9	19.6	19.5	19.3
2	100	Urea	Planting	19.2	19.0	19.5	19.6	19.3
3	100	Urea	Split	19.1	19.2	19.5	19.7	19.4
4	200	Urea	Split	19.3	19.6	19.6	19.5	19.5
5	100	ESN	Planting	19.2	19.0	19.6	19.6	19.3
6	100	ESN	Flowering	19.0	19.2	19.8	19.4	19.4
7	0	Gypsum	Planting	19.2	18.9	19.5	19.2	19.2
8	0	TSP	Planting	19.0	18.9	19.5	19.5	19.2
9	0	KCL	Planting	19.3	18.9	19.5	19.4	19.3
10	100	Gyp, TSP,KCL	Planting	19.4	19.0	19.5	19.5	19.3
Means				**19.2**	**19.0**	**19.6**	**19.5**	**19.3**
	Treatments (Trt)		Prob. > F	0.14	0.0002	0.55	0.14	Loc 0.0001
								Trt 0.002
								Trt x Loc 0.002
			CV (%)	1.0	1.0	0.9	1.1	1.0
			LSD 0.05	0.3	0.3	0.2	0.3	NA

Table 7: Effect of nitrogen treatments on end of season profile (0-48") soil nitrate (lbs/ac). 2015.
(Bold numbers are significantly different then the control, trt 1.)

TRT #	Total N rate lbs N/ac	Nitrogen Source	Timing	Alda	Greenwood	Holdrege	Wakefield	Means
1	0	None		41.8	22.5	52.8	40.0	39.3
2	100	Urea	Planting	-	-	-	-	-
3	100	Urea	Split	54.8	21.8	52.3	33.3	40.5
4	200	Urea	Split	**72.3**	17.8	60.5	42.0	48.1
5	100	ESN	Planting					
6	100	ESN	Flowering	54.9	**33.8**	55.8	43.8	47.0
7	0	Gypsum	Planting	-	-	-	-	-
8	0	TSP	Planting	-	-	-	-	-
9	0	KCL	Planting	-	-	-	-	-
10	100	Gyp, TSP,KCL	Planting	44.0	24.0	60.8	37.5	41.6
Means				52.3	24	56	39	
	Treatments (Trt)		Prob. > F	0.19	0.06	0.92	0.03	Loc 0.04
								Trt 0.15
								Trt x Loc 0.51
			CV (%)	34	29	31	11	50
			LSD 0.05	28	11	29	6	NA

Integrated Evaluation of Common Inputs
To Increase Soybean Yield in Nebraska (2015)

Authors: Josh Miller (UNL Graduate Research Assistant and Doctor of Plant Health student)
Nicholas Arneson (Nebraska Extension Technologist-Plant Pathology)
Loren J. Giesler (Nebraska Extension Plant Pathologist)
Charles Shapiro (UNL Extension Soil Scientist – Crop Nutrition)

Research Team: Steve Spicka (UNL Agricultural Tech III), Kent Eskridge (UNL Statistics Professor), Keith Glewen (Nebraska Extension Educator),
Kyle Broderick (Nebraska Extension Technologist-Plant Pathology)

TAKE HOME POINTS:

- There were no interactions observed between the early season treatments and the pod set treatments
- Early season treatments consistently increased populations across locations but did not consistently increase yields
- Pod set treatments did not consistently increase yields
- Disease and insect pressure were low for all sites through the R3 treatment
- Pod set treatments that included insecticide resulted in significant yield increases when soybean aphids were present

METHODS

A factorial designed experiment was conducted at all four locations of the Soybean Management Field Days. These locations were near Alda, Greenwood, Holdrege and Wakefield, Nebraska. Soybeans planted at all four sites were irrigated and maintained with adequate moisture to ensure high yield production. The soybean variety used was Mycogen 5N286R2, and planted at 140 K seeds/ac. The actual design was complicated and is called an alpha lattice design with incomplete blocks. The alpha lattice design is used to reduce the effect of soil property changes over the large experimental area. This is important when there are a lot of treatments. In this case there were 35 treatments (five early season treatments x seven pod set treatments). There were four replications at each site. The treatments were randomized within the each replicate in specific groups of seven. Each treatment unit was 10 ft wide and 30 ft long.

Table 8. Specific treatments tested in the 2015 SMFD factorial experiment that were "Early Season Inputs" and "Pod Set Inputs". All seed treatments were applied to the seed prior to planting and all foliar applications were applied at 15 gal. /ac.

Early Season Inputs	Pod Set (Stage R3) Inputs
No Treatment	No Treatment
Fungicide Seed Treatment (ST) (Apron XL 7.5 g/100 kg seed + Maxim 4FS 2.5 g/100 kg seed + Vibrance 2.5 g/100 kg seed)	Fungicide (Stratego YLD 4.0 fl oz/ac)
Fungicide ST + Insecticide ST (Apron XL 7.5 g/100 kg seed + Maxim 4FS 2.5 g/100 kg seed + Vibrance 2.5 g/100 kg seed + Thiamethoxam 50 g/100 kg seed)	Fertility [UAN (28-0-0) 25 lb N/ac +N-Rage (23-4-2, slow release N plus Mn) 1 gal/ac + Soy Grow (0.04 Fe EDTA, 0.05 Mg EDTA, 0.27 Mn EDTA, 0.16 Zn EDTA) 1 pt/ac]
Fungicide ST + Insecticide ST +Biological (Apron XL 7.5 g/100 kg seed + Maxim 4FS 2.5 g/100 kg seed + Vibrance 2.5 g/100 kg seed + Thiamethoxam 50 g/100 kg seed) + QuickRoots [*Bacillus amyloliquefaciens* and *Trichoderma virens, 0.14 fl oz/140,000 seeds*])	Fungicide + Fertility (Stratego YLD 4.0 fl oz/ac) +[UAN (28-0-0) 25 lb N/ac +N-Rage (23-4-2, slow release N plus Mn) 1 gal/ac + Soy Grow (0.04 Fe EDTA, 0.05 Mg EDTA, 0.27 Mn EDTA, 0.16 Zn EDTA) 1 pt/ac]
Biological (QuickRoots [*Bacillus amyloliquefaciens* and *Trichoderma virens, 0.14 fl oz/140,000 seeds*])	Fungicide + Insecticide (Stratego YLD 4.0 fl oz/ac + Leverage 360 2.8 fl oz/ac)
	Fungicide + Insecticide + Fertility (Stratego YLD 4.0 fl oz/ac + Leverage 360 2.8 fl oz/ac) +[UAN (28-0-0) 25 lb N/ac +N-Rage (23-4-2, slow release N plus Mn) 1 gal/ac + Soy Grow (0.04 Fe EDTA, 0.05 Mg EDTA, 0.27 Mn EDTA, 0.16 Zn EDTA) 1 pt/ac]
	Integrated Pest Management (IPM) (Plots were routinely scouted and fungicide and insecticide applications were made based on economic thresholds)

Prior to planting, one composite soil sample was collected for each SMFD location at a depth of 0 – 8 in. The results are given in Table 9.

Table 9. Soil analysis results from spring soil samples (0-8 in.) collected over the whole Soybean Management Field Day site in April prior to planting in 2015. Information in ppm unless indicated.

(0-8" sample)				
	Alda	Greenwood	Holdrege	Wakefield
Soil Series	Silt Loam	Silty Clay Loam	Silt Loam	Silty Clay Loam
CEC (me/100g)	15.2	15.1	20.5	20.6
pH	6.0	6.9	7.5	6.2
Buffer pH	6.8	-	-	6.7
OM (%)	3.1	3.6	2.4	4.2
Nitrates (lbs/8 in)	41	22	56	41
P (Mehlich 3)	26	40	94	72
K	480	424	581	423
Sulfate	12	10	37	13
Zn	1.9	2.0	3.8	4.0
Fe	68.7	77.8	21.6	81.5
Mn	24.4	13.6	2.6	22
Boron	2.3	1.7	1.8	2.0
Mg	252	281	376	434
Cu	1.0	0.8	1.1	1.4

EVALUATED INPUTS

Early season inputs included fungicide, insecticide, and biological seed treatments and a combination of the individual products. Inputs at pod set included fungicide, insecticide, fertility and a combination of the individual products. Pod set inputs also included an Integrated Pest Management (IPM) treatment, in which plots were routinely scouted and decisions to use fungicides and insecticides were made based on economic thresholds. A complete list of the treatment details for each product and input is in Table 8. The selection of the chemistry tested in this study is not an indication that this is the best product; it is intended to be representative of a product group. For example, we have selected Stratego YLD as a fungicide input at R3. This product could be comparable to other fungicides which have a strobilurin included in their composition.

Soil Fertility Inputs. Early season nitrogen (growth stage, V2-V5) was knifed in a 50 lbs N/ac as UAN (28-0-0) after soybean emergence. This application was blanketed across the entire trial area to remove the variable of early season fertility. For the added fertility at growth stage R3, 25 lbs N/ac was applied with Nachurs N-Rage™ which contains nitrogen, phosphorus, potash, and manganese and Nachurs Soy Grow™ which is a combination of several micronutrients (details in Table 8.).

Data Collection. Plant populations were assessed by counting the total number of plants in two 10 ft. sections of row in each plot. During the season, plots were evaluated for foliar diseases and insect defoliation on a linear percentage scale of 0-100 with 0=no disease or insect feeding present. Assessment was a total percentage of canopy damage or injury. This was part of the IPM plot that will be discussed at length later in this report. Additional scouting was also performed at the Wakefield location due to high levels of soybean aphids. Plots were also evaluated for "green stem" in which plants were rated based on the percentage of the stem that remained green at maturity (R8). Yield was determined with a small plot combine and all yields were adjusted to 13% grain moisture. The two middle rows were harvested for yield.

Statistical analysis. The experimental data was analyzed by individual sites and as a combined experiment using an alpha lattice design. All treatments were considered across all locations. Significant differences were determined based on a probability of 0.90.

No interactions were observed between the early season treatments and pod set treatments, so all results in this report will focus on the effects of each class of treatments separately. 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 four locations. Tables 10-12, and 14 show the means for each variable for each site, the overall means for the treatments across all locations, and the appropriate statistics. Table 13 does not include the overall means for the treatments across all locations because disease severity varied significantly between sites.

RESULTS

Since the end of season soil analysis for the SFMD combined trial data is incomplete, we have to rely on the early season site data to assess soil fertility (Table 9). All sites were within normal ranges for all of the soil properties related to soybean growth. See the soil fertility report in this document for more detail on soybean response to applied nutrients.

Early Season Inputs. Soybean populations recorded shortly after emergence indicated there was a significant effect due to early season treatments at three of the locations, Greenwood, Holdrege and Wakefield (Table 10). There was no significant difference on early season population from any of the early season treatments at Alda. At two of the four sites, early season populations were taken at both 17 and 32 days after planting (DAP). The average 17 DAP was 62% of the planted population and at 32 DAP it was 80%. Three of the treatments, Fungicide + Insecticide, Fungicide + Insecticide + Biological, and Biological resulted in significantly greater early season populations than the "no treatment." The average populations for these treatments was 115% of the control at 17 DAP and 104% of the control at the 32 DAP. At harvest these treatments still averaged 109% of the control. Stand counts at harvest indicated there were no significant effects from any treatment at Wakefield, but the Fungicide + Insecticide + Biological treatment still had the highest average across all locations (Table 11).

Table 10. Soybean populations for the early season inputs at each 2015 SMFD location and overall average populations.

Early Season Input	Location and Population (plants/ac)									
	Alda		Greenwood		Holdrege		Wakefield		Average	
	17 DAP[z]	31 DAP	19 DAP	33 DAP	19 DAP	34 DAP	14 DAP	28 DAP	17 DAP	32 DAP
No Treatment	.	121,159	90,294	87,307	62,166	.	86,124	119,168	79,528	109,211
Fungicide Seed Treatment (ST)	.	118,172	90,418	92,472	59,895	.	87,898	113,816	79,404	108,153
Fungicide ST + Insecticide ST	.	124,955	**97,419**[x]	**96,392**	**93,063**	.	**90,418**	118,608	**93,633**	113,318
Fungicide ST + Insecticide ST + Biological	.	121,159	**101,775**	**102,957**	**90,636**	.	**96,983**	**123,710**	**96,465**	**115,942**
Biological	.	121,408	**96,952**	**93,872**	61,855	.	**92,721**	122,777	**83,843**	112,686
Site average	.	121,371	95,372	94,600	73,523	.	90,829	119,616	86,575	111,862
Prob >F	NA[y]	0.4902	0.0006	0.0006	<.0001	NA[y]	0.0002	0.0009	<0.0001	0.0296
CV (%)	NA[y]	11.3	12.1	14.0	15.6	NA[y]	10.0	7.8	18.1	15.8
LSD (α=0.10)	NA[y]	6083	5116	5853	5092	NA[y]	4024	4121	3980	4488

[z] DAP = number of days after planting

[y] NA – Stand count information not available for Alda (17 DAP) and Holdrege (34 DAP).

[x] **BOLD** = values in bold represent significant increases over the “no treatment” (p<0.1)

Table 11. Harvest soybean populations for the early season inputs at each 2015 SMFD location and overall average populations.

Early Season Input	Location and Population (plants/ac)				
	Alda	Greenwood	Holdrege	Wakefield	Average
No Treatment	107,655	80,679	81,457	97,823	91,904
Fungicide Seed Treatment (ST)	111,638	81,395	80,990	96,765	92,697
Fungicide ST + Insecticide ST	**115,496**^{z}	85,281	**102,242**	98,570	**100,533**
Fungicide ST + Insecticide ST + Biological	**114,065**	**91,134**	**108,464**	99,503	**103,292**
Biological	**118,421**	83,075	79,466	101,090	95,513
Prob >F	0.0178	0.0017	<0.0001	0.4860	<0.0001
CV (%)	10.8	12.3	13.7	9.5	17.8
LSD (α=0.10)	5,406	4,621	5,503	4,150	4,529

^{z} **BOLD** = values in bold represent significant increases over the “no treatment” ($p<0.1$)

While populations were affected by early season treatments, these treatments did not significantly increase yields. Average yields varied by location, and there were only two significant treatment effects at the four locations (Table 12). Only the Fungicide treatment at Greenwood and the full treatment (Fungicide + Insecticide + Biological) at Holdrege resulted in a significant increase over the “no treatment”. A few other treatments were significantly different from each other, but none compared to the “no treatment.”

Table 12. Yield results for the early season inputs at each 2015 SMFD location and overall average yields.

Early Season Input	Location and Yield (bu/ac)				
	Alda	Greenwood	Holdrege	Wakefield	Average
No Treatment	54.7	64.3	79.9	70.3	67.3
Fungicide Seed Treatment (ST)	56.7	**66.3**	79.3	69.2	67.9
Fungicide ST + Insecticide ST	55.8	65.7	81.2	71.8	68.6
Fungicide ST + Insecticide ST + Biological	56.6	64.7	**82.0**[z]	69.2	68.1
Biological	56.2	63.8	80.5	69.3	67.4
Prob >F	0.6712	0.0694	0.0747	0.1407	0.8930
CV (%)	9.7	5.6	4.7	6.2	15.4
LSD (α=0.10)	2.4	1.6	1.7	1.9	2.3

[z] **BOLD** = values in bold represent significant increases over the "no treatment" ($p<0.1$)

Pod Set Inputs. The only disease observed in these studies was brown spot (*Septoria glycines*) and only very low levels were observed at all locations (Table 13). Severity was less than 10% for all locations except for Alda, which had severity ratings up to 14% for the "no treatment." At this location, plots that received a fungicide all had significantly lower disease severity than those plots that did not receive fungicide.

There was a low response overall to pod set treatments this year, and only three individual treatments yielded significantly more than the "no treatment" (Table 14). These were the Fungicide + Insecticide treatment at Holdrege and the Fungicide + Insecticide and Fungicide + Insecticide + Fertility treatment at Wakefield. Because of the low disease pressure at all locations, the fungicide was not needed to provide yield protection from disease which may account for the low response to fungicide. It should be noted that there was significant pressure from soybean aphids at the Wakefield location which would account for the yield response to treatments with insecticide as a component.

Table 13. Brown Spot (S. glycines) Severity ratings for the pod set inputs at each 2015 SMFD location.

Pod Set (Stage R3) Inputs	**Location and Brown Spot Evaluations[z] (%)**			
	Alda	**Greenwood**	**Holdrege**	**Wakefield**
	31 DAA[y]	**28 DAA**	**33 DAA**	**35 DAA**
No Treatment	14	6	1.8	0.02
Fungicide	**9.5[x]**	6.3	1.4	**0**
Fertility	12.5	7	3.1	0.02
Fungicide + Fertility	**10**	5.8	1.4	0.01
Fungicide + Insecticide	**7.5**	5.8	1.1	0.02
Fungicide + Insecticide + Fertility	**8**	5.8	1.6	0.02
Integrated Pest Management (IPM)	12.5	7.5	2.9	0.01
Prob >F	<0.0001	0.0633	0.0271	0.3594
CV (%)	31.7	34.7	36.0	26.0
LSD (α=0.10)	1.8	1.1	1.2	0.02

[z] Estimated across the entire plant canopy of the two center rows of each plot on a percentage scale (0-100)

[y] DAA: Number of days after pod set treatment application

[x] **BOLD** = values in bold represent significant decreases from the "no treatment" (p<0.1)

Table 14. Yield results for the pod set inputs at each 2015 SMFD location and overall average yields.

Pod Set (Stage R3) Inputs	Location and Yield (bu/ac)				
	Alda	Greenwood	Holdrege	Wakefield	Average
No Treatment	57.0	64.4	79.8	68.6	67.4
Fungicide	55.4	64.2	80.8	70.0	67.7
Fertility	55.0	65.0	81.0	68.1	67.3
Fungicide + Fertility	54.5	64.3	**82.0**[z]	70.2	67.8
Fungicide + Insecticide	59.1	66.0	80.1	**71.0**	69.1
Fungicide + Insecticide + Fertility	55.6	66.0	79.7	**71.6**	68.2
Integrated Pest Management (IPM)	55.4	64.7	80.6	70.1	67.7
Prob >F	0.1395	0.5302	0.5321	0.1887	0.9560
CV (%)	9.7	5.6	4.7	6.2	15.4
LSD (α=0.10)	2.8	1.9	2.0	2.3	2.7

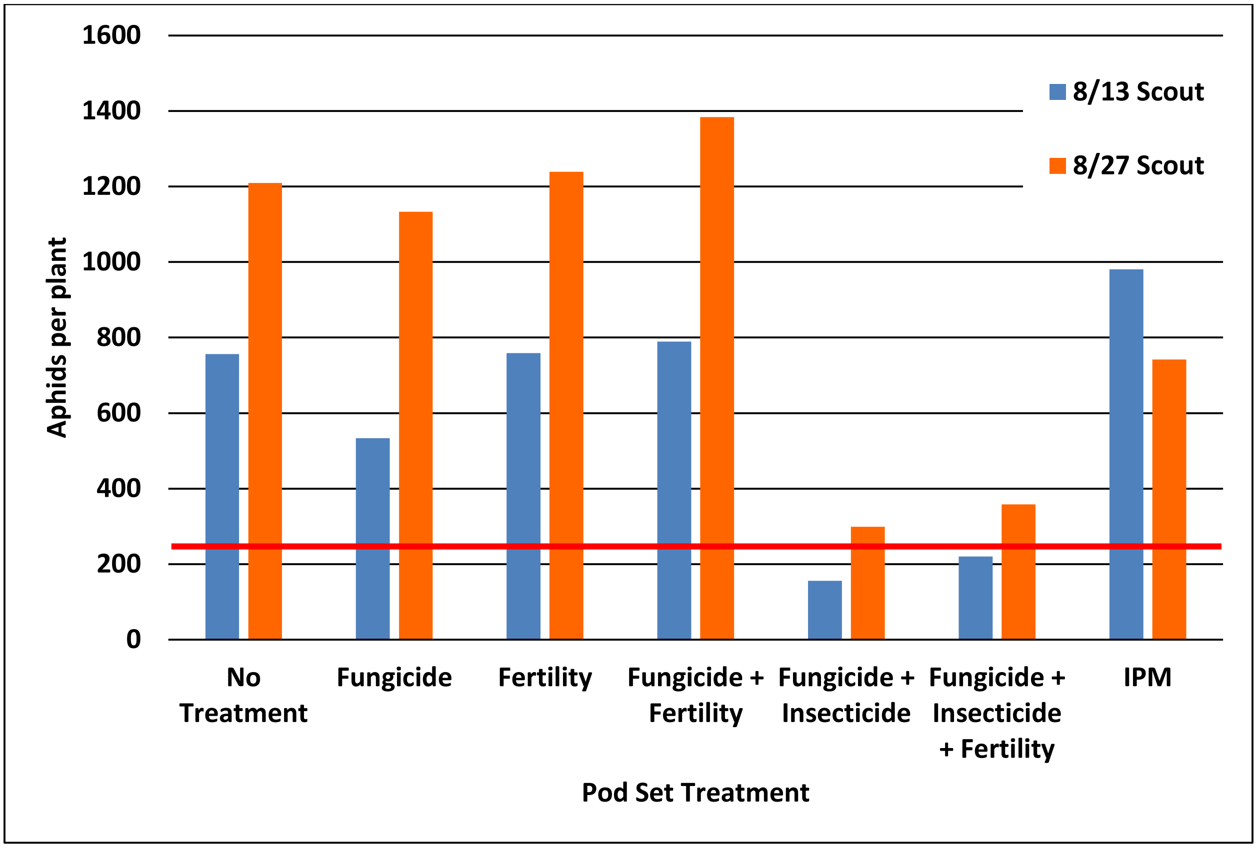
[z] **BOLD** = values in bold represent significant increases over the “no treatment” (p<0.1)

Integrated Pest Management (IPM) Plots. An IPM plot was added to the treatment list this year to determine if using fungicides and insecticides based on observed economic thresholds rather than calendar date would result in profitable returns. Based on routine scouting, disease incidence and severity never reached levels that required management. There was early feeding from bean leaf beetle at the Greenwood location, but the damage did not reach a level that a spray was needed.

The only site that had significant insect pressure was at Wakefield. The scouting of these fields for aphids began on August 13 (R5), which turned out to be too late since the aphid populations were already greater than the IPM economic threshold of 250 aphids/plant. An application of Warrior was made 7 days later on August 20. A second round of counts were performed one week after application. Figure 1 illustrates the average number of aphids counted for each treatment at R5, and two weeks later after the insecticide was sprayed on the IPM plot.

The two pod set treatments that contained insecticides never reached the economic injury levels, but the other treatments reached very high populations of aphids. The IPM plot had the highest numbers of aphids recorded at the R5 growth stage and was the only treatment to see reduced numbers two weeks later. However, because the criteria for this being an IPM plot were not met, we cannot draw any conclusions on the effectiveness of this treatment compared to the scheduled R3 application of insecticide. It can be said that the two treatments that contained an insecticide component, Fungicide + Insecticide and Fungicide + Insecticide + Fertility, did yield significantly better than the "no treatment" by 2.4 and 3 bu/ac, respectively.

Figure 1. Soybean aphid levels at Wakefield from scouting one week prior and one week after Warrior treatment on designated IPM plots. Red line indicates the 250 aphid/plant threshold.

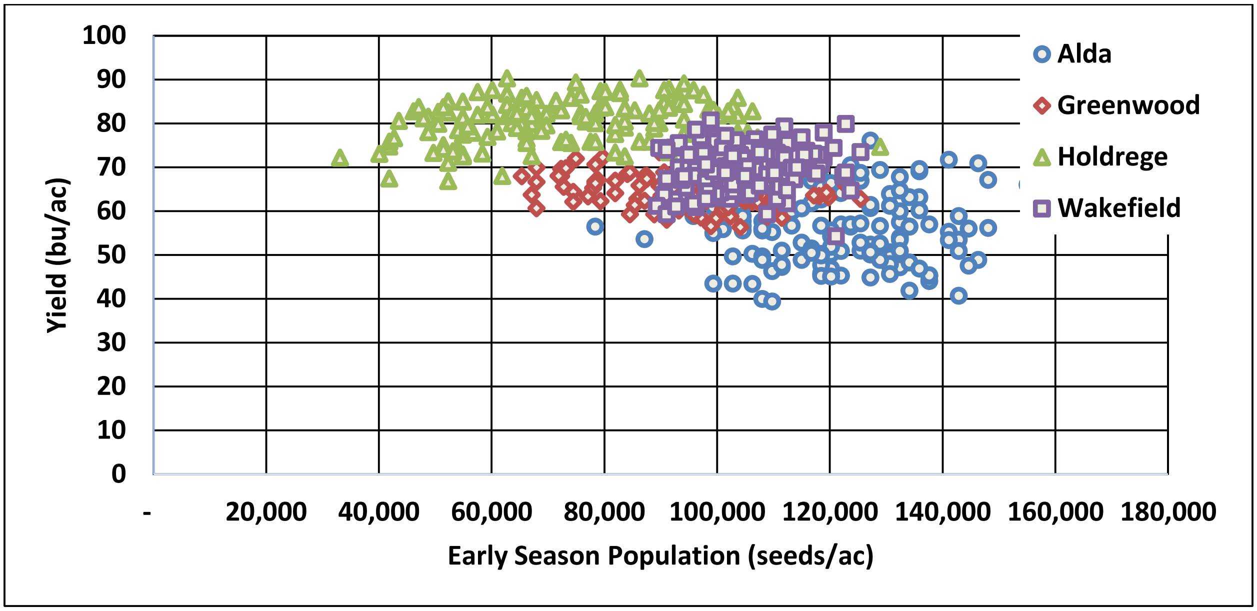


DISCUSSION

In 2014, we noted that narrower row spacing (15 in) yielded significantly more than wide row spacing (30 in) by an average of 5 bu/ac. There were no interactions between row spacing and either early season or pod set treatments, however, indicating that the response to any of the treatments we are evaluating would perform similarly on either row spacing. For that reason, all plots in 2015 were planted at 30 in spacing for the ease of data collection and to reduce the space requirements and workload. Narrow row spacing is still an option that typically yields higher than 30 in soybeans.

Early season seed treatments that included an insecticide component consistently increased soybean stand, but this did not consistently increase yield. This phenomenon is due to the ability of soybean plants to compensate for lower plant density by increasing individual plant biomass. This is illustrated in Figure 2 where the early season population of each experimental unit is plotted against the yield. Within each location, indicated by different colors, there is no response to yield based on differing populations. Many studies will show no yield differences between 75,000 and 100,000 plants for an ending population.

Figure 2. Relationship of early season soybean population to yield by location.



It should be noted that fields with a history of stand problems will typically benefit by getting a higher percentage of seed to establish, however, this will not consistently result in higher yield. It should also be noted that maximum yield will not be achieved without having a strong and well established root system which seed treatments are known to facilitate under stressful environmental conditions. Fungicide seed treatments did not result in increased stands this year, but the addition of the insecticide seed treatments did increase soybean populations. This would indicate that there may have been some level of soil feeding taking place, although this would be counterintuitive considering the responses were greatest in fields that were tilled. The environmental conditions throughout the summer were very favorable for soybean yield which may have contributed to an overall lack of significant yield impacts from the early season treatments.

Pod set inputs did not result in significant yield increases across locations. Only the fungicide + fertility treatment was significantly greater at Holdrege, which we will investigate further from plant tissue samples that were collected this year. Pod set treatments that included an insecticide were also significantly higher than the "no treatment" at Wakefield due to the high levels of soybean aphids that were observed. These treatments did not result in significant yield increases, however, at the other locations where soybean aphids were not a problem. Current IPM practices would suggest that the addition of insecticides to planned fungicide treatments at R3 are not recommended and can result in increased populations of soybean aphids later in the season. Rather, insecticides should only be administered after economic thresholds have been met. The results from the 2015 study do not clearly differentiate between the planned R3 treatment and IPM based management because at Wakefield, the aphids were already nearing the economic threshold when the R3 application was made. Warrior was applied to the IPM plot when the aphids were detected and this did decrease the levels of aphids while the numbers of aphids increased for all of the other treatments. However, the criteria for this to be considered a true IPM plot were not met because detection of aphids occurred after the populations had already greatly exceeded the economic threshold. A more timely insecticide application when the populations first reached the 250 aphid/plant threshold may have resulted in yield increases for the IPM plots.

Overall, there were no clear relationships with any of the treatment strategies which resulted in maximum soybean yield in 2015. While there were effects with the early season inputs, there were none that consistently increased yield. Similarly, late season inputs did not consistently increase yields and there was no association of an early season treatment being related to any late season treatment for maximum yields. Based on this study and the studies conducted in 2013 and 2014, it appears that soybean farmers should continue to use sound agronomic practices to manage their crop based on field history and it is critical to determine the economic impact of investing in all the treatments we tested to achieve maximum yields. Location and soil continue to be one of main effects on overall yields as is represented by the overall range in yields at the four locations.

Soybean Management Field Day Irrigation Management Trial

Authors/Researchers: Chuck Burr (Nebraska Extension Educator),
Gary Zoubek (Nebraska Extension Educator),
Troy Ingram (Nebraska Extension Educator),
William Kranz (Nebraska Extension Irrigation Specialist)
Daran Rudnick (Nebraska Extension Irrigation Specialist)

TAKE HOME POINTS:

- Irrigation before the R3 growth stage can result in taller soybean plants that are prone to lodging
- Starting irrigation at the R3 growth stage is recommended for deep medium or fine textured soils with a full soil water profile at planting
- Irrigation may be required during vegetative growth stages on sandy and sandy loam soils
- Highest Irrigation Water Use Efficiency was achieved by irrigating at 50% pre and full irrigation following the R5 growth stage

INTRODUCTION

Soybean acreage in Nebraska has increased from 43,000 acres of irrigated production in 1972 to 1.95 million acres of irrigated production in 2013. With rising fuel costs and declining crop prices soybean growers are looking for ways to reduce operating costs. Following two years of severe drought over much of Nebraska, several Natural Resources Districts implemented irrigation water pumping restrictions. Currently, over 1.5 million irrigated acres are under some form of irrigation water allocation.

Proper irrigation management is critical to optimize both grain yields and irrigation water use efficiency. Recent UNL research has shown that the optimal time to begin irrigating soybeans is at the R3 growth stage (Irrigating Soybean, NebGuide G1367). Watering before the R3 stage can lead to taller plants which may lodge before harvest. Lodging may impede grain harvesting equipment thus leading to yield reductions. Research has also shown that irrigation during the vegetative growth stage has little impact on soybean yields; whereas, irrigation during the reproductive growth stage has the greatest yield response for a limited water supply.

METHODS

The variety planted at all four Soybean Management Field Day (SMFD) locations was Mycogen 5N286R2. Four irrigation treatments were investigated at each of the SMFD locations with four replications per treatment. The treatment plots were four rows wide and twenty feet long with a 30-inch row spacing. A non-irrigated buffer row separated each plot to reduce the possibility of soybean plants pulling soil water from an adjacent irrigation treatment. Irrigation treatments were watered with drip tape laid on the soil surface next to the soybean row. Plumbing with a main line and valves controlled the water application to the four rows in each treatment plot. The center two rows of each plot were harvested for yield comparisons. Two replications of Watermark soil water sensors (Irrometer Co., Inc., Riverside, CA) were installed at each foot depth down to three feet to monitor changes in soil water storage. The Wakefield and Greenwood sites were located on a silty clay loam soil and the Alda and Holdrege sites were located on a silt loam soil. Watermark sensor readings of 21 and 150 cb corresponds to field capacity and 50% of plant available water for a silty clay loam soil and 34 and 158 cb for a silt loam soil (UNL CropWater App).

The four irrigation treatments were as follows:

Full Irrigation - Irrigations were scheduled by monitoring soil water to maintain soil water levels above 50% depletion.

75% Irrigation – Irrigation amounts were 75% of the full irrigation treatment for the entire season.

50% Early - Full Late – Irrigation amounts were 50% of the full irrigation treatment until the R5 growth stage then full irrigation from then on.

Rainfed – No irrigation water was applied to this treatment.

Due to scheduling conflicts in addition to significant rainfall it was not possible to maintain the target irrigation depth of the limited irrigation treatments at all locations.

Irrigation Water Use Efficiency (IWUE, bu/in) was calculated for each treatment (Equation 1). Irrigation Water Use Efficiency is a measure of how many bushels of grain were produced for an irrigation treatment yield (Y_i, bu) minus the rainfed yield (Y_r, bu) divided by the irrigation water applied (Irr) to that treatment.

Equation 1: $$IWUE = \frac{Y_i - Y_r}{Irr}$$

RESULTS

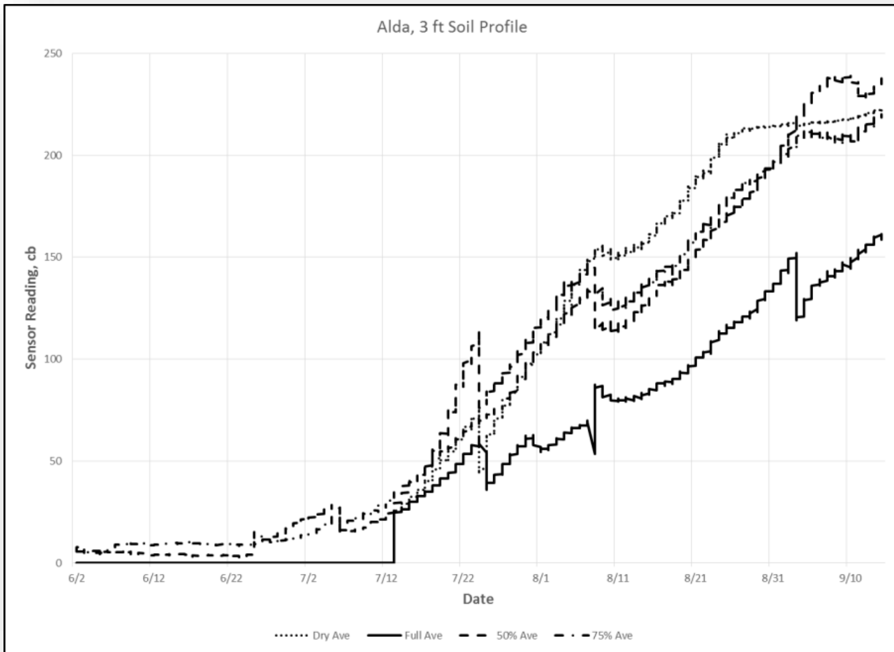
Alda Site

The irrigation study was located on a dryland pivot corner on a silt loam soil. Yield results for the four treatments ranged from 76.8 to 78.7 bu/ac. The 75% irrigation had the greatest mean yield, but none of the treatments were significantly different. All irrigation treatments received 1.5 to 5.0 inches of water. The highest Irrigation Water Use Efficiency was from the 75% irrigation treatment.

Table 15. Soybean grain yields (bu/ac), applied irrigation water (in), and irrigation water use efficiency (IWUE, bu/in) for the four irrigation treatments at the Alda site.

Treatment	Soybean Yield- bu/ac	Irrigation- inches	Irrigation Water Use Efficiency- bu/inch
Full Irrigation	78.0 a	5.0	0.2
75% Irrigation	78.7 a	3.0	0.6
50% Early – Full Late	77.4 a	1.5	0.4
Rainfed	76.8 a	-	-
Average	77.7		
Rainfall May 15 – September 30 = 19.6 inches			

Following is a graph of the soil water for each of the irrigation treatments.



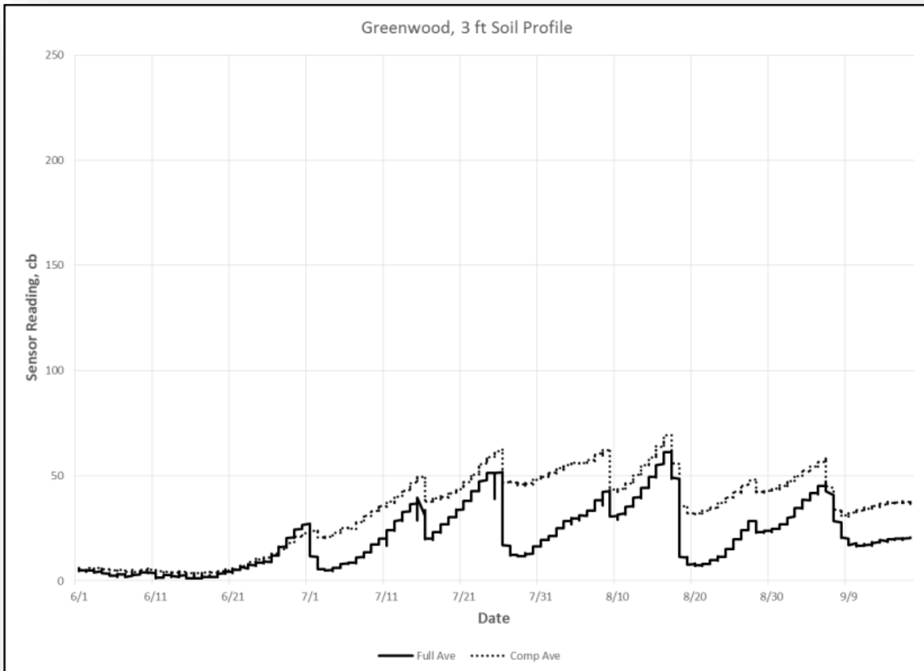
Greenwood Site

The irrigation study was located on a dryland pivot corner on a silty clay loam soil. As a result of high in-season rainfall, the limited irrigation treatments did not require irrigation, and therefore, only the full irrigation and rainfed treatments were investigated. The yield results were 64.7 and 64.1 bu/ac for the full irrigation and rainfed treatments, respectively. The full irrigation treatment received 1.0 inch of irrigation water. No statistical difference existed between the rainfed and full irrigation treatment, and actually the full irrigation treatment experienced lower grain yield than the rainfed treatment due to lodging. Consequently, a negative IWUE value was observed, which indicated that irrigation did not have a positive impact on grain yield under the observed soil and climatic conditions. As a result, both water and energy could have been conserved by withholding irrigation in 2015.

Table 16. Soybean grain yields (bu/ac), applied irrigation water (in), and irrigation water use efficiency (IWUE, bu/in) for the full irrigation and rainfed treatments at the Greenwood site.

Treatment	Soybean Yield- bu/ac	Irrigation- inches	Irrigation Water Use Efficiency- bu/inch
Full Irrigation	64.1 a	1.0	-0.5
Rainfed	64.7a	-	-
Average	64.5		
Rainfall May 15- September 30 = 18.0 inches			

Following is a graph of the soil water for each of the irrigation treatments.



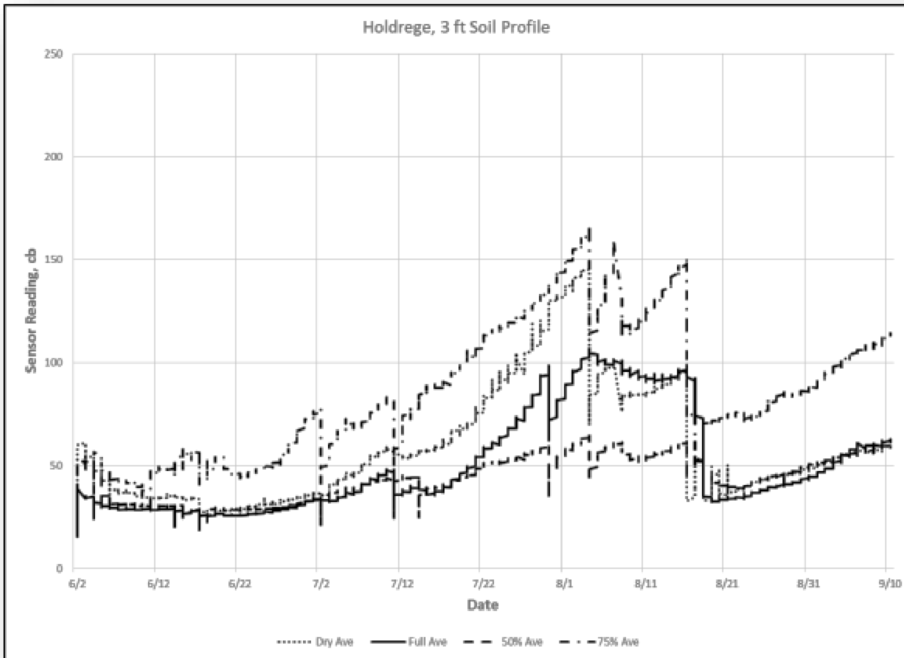
Holdrege Site

The irrigation study was located on a dryland pivot corner on a silt loam soil. Yield results for the four treatments ranged from 92.7 to 100.6 bu/ac with no significant differences among irrigation treatments. Also note that the rainfed treatment yielded 99.5 bushels which lead to small and even negative Irrigation Water Use Efficiencies. Again, very little need for irrigation at this site in 2015, and therefore, both water and energy could have been conserved by withholding irrigation.

Table 17. Soybean grain yields (bu/ac), applied irrigation water (in), and irrigation water use efficiency (IWUE, bu/in) for the four irrigation treatments at the Holdrege site.

Treatment	Soybean Yield- bu/ac	Irrigation- inches	Irrigation Water Use Efficiency- bu/inch
Full Irrigation	95.1 a	2.0	-2.2
75% Irrigation	92.7 a	1.5	-4.5
50% Early - Full Late	100.6 a	1.0	1.1
Rainfed	99.5 a	-	-
Average	97.0		
Rainfall May 15- September 30 = 17.3 inches			

Following is a graph of the soil water for each of the irrigation treatments.



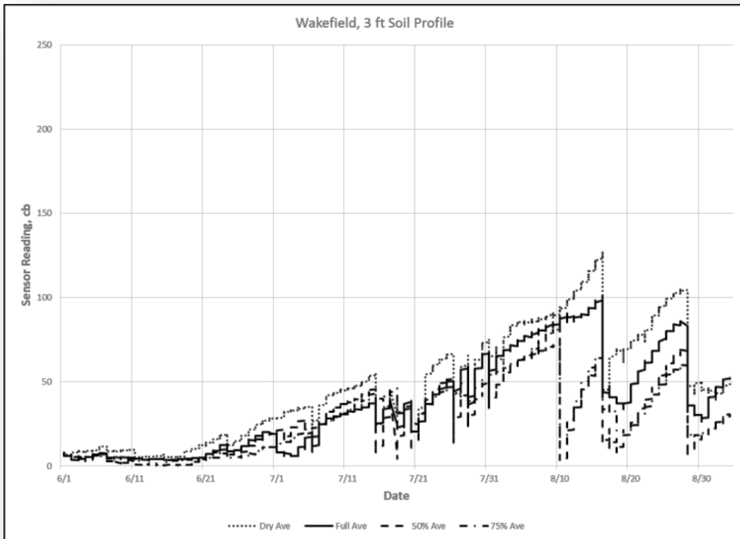
Wakefield Site

The irrigation study was located on a dryland pivot corner on a silty clay loam soil. Yield results for the four treatments ranged from 67.7 to 72.8 with no statistical difference among treatments. Irrigation treatments ranged from 1.3 to 2.0 inches of applied water. Similar to the Holdrege site, the highest Irrigation Water Use Efficiency was from the treatment that stressed the soybeans during the vegetative growth stage and supplied full water after the R5 growth stage.

Table 18. Soybean grain yields (bu/ac), applied irrigation water (in), and irrigation water use efficiency (IWUE, bu/in) for the four irrigation treatments at the Wakefield site.

Treatment	Soybean Yield- bu/ac	Irrigation- inches	Irrigation Water Use Efficiency- bu/inch
Full Irrigation	71.9 a	2.0	2.1
75% Irrigation	69.3 a	1.3	1.2
50% Early - Full Late	72.8 a	1.3	3.9
Rainfed	67.7 a	-	-
Average	70.4		
Rainfall May 15- September 30 = 14.5 inches			

Following is a graph of the soil water for each of the irrigation treatments.



DISCUSSION

There were no significant soybean yield differences across irrigation treatments when averaged at Alda, Holdrege and Wakefield study locations, due to adequate in-season rainfall. August is a great time for soybeans to have ample water. With the rainfall we received in August this year even the rainfed yields were similar to the irrigated yields. On average, the delayed irrigation strategy of applying 50% of full irrigation prior to the R5 growth stage and thereafter full irrigation gave the greatest Irrigation Water Use Efficiency of 1.8 bushels per inch of applied water. The results indicate that both water and energy can be conserved without impacting grain yields by practicing limited irrigation of applying 50% of full irrigation prior to the R5 growth stage and thereafter full irrigation as compared to full irrigation throughout the entire growing season.

Table 19. Average Soybean Yield and Irrigation Water Use Efficiency for three sites (Alda, Holdrege and Wakefield) in 2015.

Treatment	Soybean Yield-bu/ac	Irrigation-inches	Irrigation Water Use Efficiency-bu/inch
Full Irrigation	81.7 a	3.0	0.1
75% Irrigation	80.2 a	1.9	-0.6
50% Early- Full Late	83.6 a	1.3	1.8
Rainfed	81.3 a	0.0	-
Average Rainfall	17.1 inches		

Thanks to Nebraska Extension Educators Troy Ingram, Keith Jarvi, Chuck Burr and Don Treptow, Research Technician and Wil Lage, Summer Intern for taking weekly readings and managing the irrigation systems.

Soybean Management Field Days

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

TONY ADESMOYE
Nebraska Extension Plant Pathologist
West Central Research
and Extension Center
402 West State Farm Road
North Platte, 69101-7751
Phone: (308)696-6708
E-mail: tony.adesemoye@unl.edu

NICHOLAS ARNESON
Pathology Research Technologist
University of Nebraska–Lincoln Dept. of Plant
Phone: (402) 472-6771
E-mail: nicholas.arneson@unl.edu

TINA BARRETT
Executive Director
Nebraska Farm Business, Inc.
3815 Touzalin Ave, Ste. 105
Lincoln, NE 68507
Phone: (402) 464-6324
E-mail: tbarrett2@unl.edu

* **ASHLEY BENES**
Nebraska Extension Educator
8400 144th St.
Weeping Water NE 68463-1932
Phone: (402)267-2205
E-mail: ashley.benes@unl.edu

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

RJ CAMPBELL
Field Services Manager
Nebraska Soybean Board
3815 Touzalin Ave., Suite 101
Lincoln, NE 68507
Phone: (800) 852-2326
E-mail: rj@nebraskasoybeans.org

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

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

KEITH GLEWEN
Project Coordinator and
Nebraska Extension Educator
1071 County Road G
Ithaca, NE 68033
Phone: (800) 529-8030
or (402) 624-8000
E-mail: kglewen1@unl.edu

CLINT HOFFMAN
Risk Management Consultant
The ARC Group, LLC
8555 Executive Woods Drive, Suite 400
Lincoln, Nebraska 68512
Phone: (866)574-2724
E-mail: CHoffman@agrisk.net

THOMAS HUNT
Nebraska Extension Entomologist
Haskell Ag Lab
57905 866 Rd
Concord, NE 57905
Phone: (402)584-3863
E-mail: thunt2@unl.edu

TROY INGRAM
Nebraska Extension Educator
1510 18th St.
Central City, NE 68826-0027
Phone: (308) 946-3843
E-mail: troy.ingram@unl.edu

* **KEITH JARVI**
Nebraska Extension Educator
57905 866 Rd.
Concord, NE 68728-2828
Phone: (402)584-3819
E-mail: keith.jarvi@unl.edu

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

GREG KRUGER
Nebraska Extension Weed Science and
Application Technology Specialist
West Central Research
and Extension Center
402 West State Farm Road
North Platte, 69101-7751
Phone: (308) 696-6715
E-mail: gkruger2@unl.edu

JOSH MILLER
Doctoral Student, UNL DPH & Pathology
University of Nebraska–Lincoln
E-mail: joshua.miller@huskers.unl.edu

JULIE PETERSEN
Nebraska Extension Entomology Specialist
West Central Research
and Extension Center
402 West State Farm Road
North Platte, 69101-7751
Phone: (308)696-6704
E-mail: julie.peterson@unl.edu

DELORIS PITTMAN
Marketing and Promotions Manager
University of Nebraska Agricultural
Research and Development Center
122 Mussehl Hall
Lincoln, NE 68583-0718
Phone: (402)472-3293
E-mail: dpittman1@unl.edu

RON SEYMOUR
Nebraska Extension Educator – Entomologist
300 N Joseph Ave Rm 103
Hastings, NE 68901-7597
Phone: (402)461-7209
E-mail: ron.seymour@unl.edu

CHARLES SHAPIRO
University of Nebraska–Lincoln
Soil Scientist - Crop Nutrition
Haskell Agricultural
Laboratory
57905 866 Rd
Concord, NE 68728-2828
Phone: (402) 584-3803
E-mail: cshapiro1@unl.edu

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

LAURA THOMPSON
Nebraska Extension Educator
1071 County Road G
Ithaca, NE 68033
Phone: (402) 624-8033
E-mail: laura.thompson@unl.edu

FRED WHITFORD
Coordinator
Purdue University Pesticide Programs
915 West State Street
West Lafayette, IN 47907-2054
Phone: (765) 494-1284
E-mail: fwhitford@purdue.edu

GARY ZOUBEK
Nebraska Extension Educator
2345 Nebraska Ave
York, NE 68467-1104
Phone: (402)362-5508
E-mail: gary.zoubek@unl.edu

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

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

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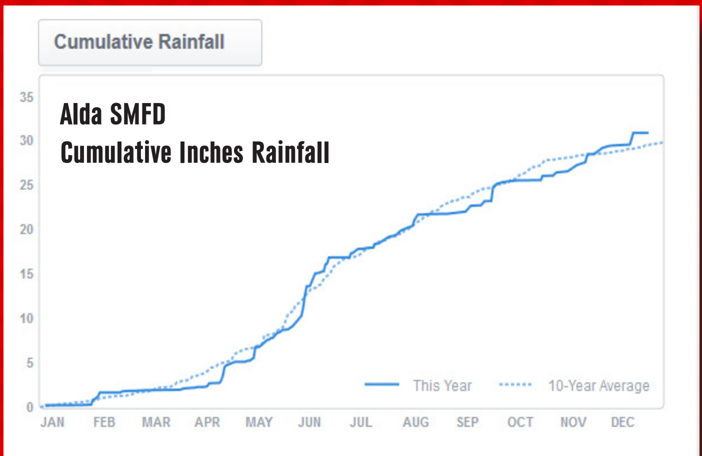
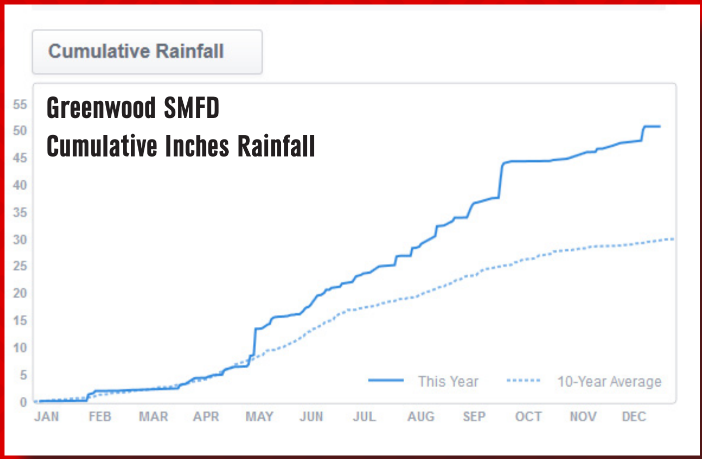
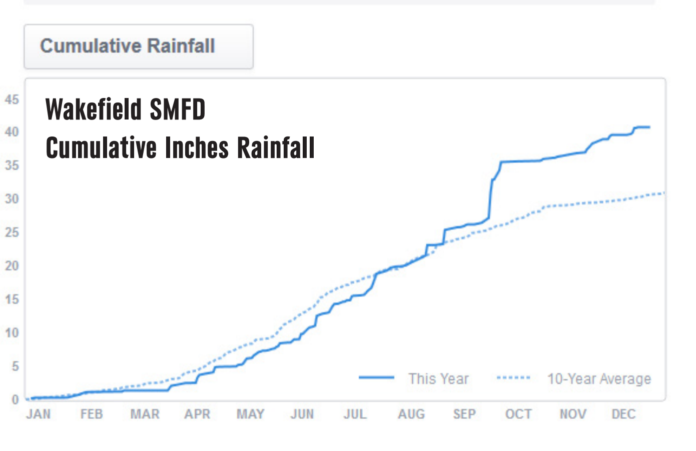
Soybean Management Field Days

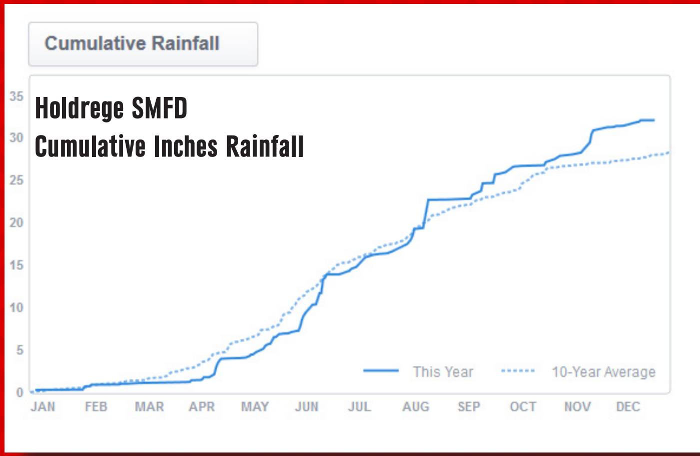
RESEARCH UPDATE

Cumulative Rainfall Totals









A look at planting and harvesting at the Soybean Management Field Days research sites.

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