Soybean Management and Research Technologies 2013 Report

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2013 marks the third season of the SMaRT research program, made possible by the checkoff investment of Michigan soybean producers. This year, more than 48 producers around the state conducted on-farm research trials within 14 projects. Contained in this publication you'll find the results from 63 individual trial locations. Each specific research project was developed with grower input and as a whole, represents some of the most pertinent challenges producers face. Evaluating results on both a local and state-wide basis, you the producer can see how specific practices may fit into your operation, as well as how they may be expected to perform in years to come.

Along with agronomic data, average income is presented for each treatment. These prices are based on the USDA 2013-14 average soybean price, typical equipment operation costs, and suggested retail prices. These figures are intended as a guide for comparing management practices and inputs to maximizing profitability.

Conducting these trials would not be possible without strong partnerships. Mike Staton serves as the SMaRT project coordinator though a unique partnership between MSU Extension and the Michigan Soybean Promotion Committee (MSPC). As state soybean educator based in Allegan County, half of his salary, benefits and operating budget is supplied by the Michigan Soybean checkoff. Ned Birkey, in southeast MI, and Dan Rajzer, in southwest MI, are contracted employees of MSPC who implement SMaRT trials and are essential to this project's success. We also want to thank Martin Nagelkirk, Dan Rossman, George Silva, James Dedecker, and Phil Kaatz of MSU Extension for their efforts in making this research possible.

THANK YOU to the plot cooperators for contributing their land, equipment, and time during the busy planting and harvest seasons to help improve Michigan soybean production.

For more information on participating in the 2014 SMaRT project, contact Mike Staton at (269) 673-0370 extension 27 or staton@msu.edu.

Vertical Tillage

Purpose: Vertical tillage tools have gained interest as an option to manage corn residue in soybean rotations. Manufacturer recommendations range from fall only, fall and spring, and spring only operation, but optimal performance will vary considerably with individual producer systems. The purpose of this trial was to compare the effects of one and two vertical tillage operations on soybean yields in 2013.

Procedure: A one-pass fall vertical tillage treatment was compared to a two-pass treatment consisting of a fall tillage operation followed by a spring tillage operation. Each treatment was replicated four times in a randomized complete block experimental design and conducted at three locations in 2013. The Sunflower 6630 was used at the Sanilac and Monroe County locations and the Case 330 Turbo Disk was used at the Montcalm location. Harvest stand counts were taken to determine if the number of vertical tillage passes affected final plant stands.

Table 1. The effect of one and two passes of vertical tillage implements on soybean yield and income in 2013

Treatment	Monroe	Sanilac	Montcalm	Average	Average Income
	---------- Yield (bu/ac) ----------				($/ac)
Fall	57.8 a	41.0 a	46.1 b	48.3 b	$576
Fall + Spring	62.0 a	42.7 a	47.0 a	50.5 a	$592
$LSD_{0.10}$	6.8	1.8	0.8	1.7	

Soybean price = $12.15 per bushel
Vertical tillage costs = $11.00 per acre per pass

Results: There was a trend for the two-pass vertical tillage treatment to produce higher yields than the one-pass treatment at all three locations. However, the difference was statistically significant at only one location (Montcalm). When all three locations were combined and analyzed, the two-pass tillage system produced a significantly higher yield (2.2 bu/ac) than the one-pass treatment, increasing income by $16.00 per acre. Harvest populations tended to be higher in the one-pass treatment. However, the difference was not statistically significant.

We want to thank, Ned Birkey, Dan Rossman and Martin Nagelkirk for coordinating these trials.

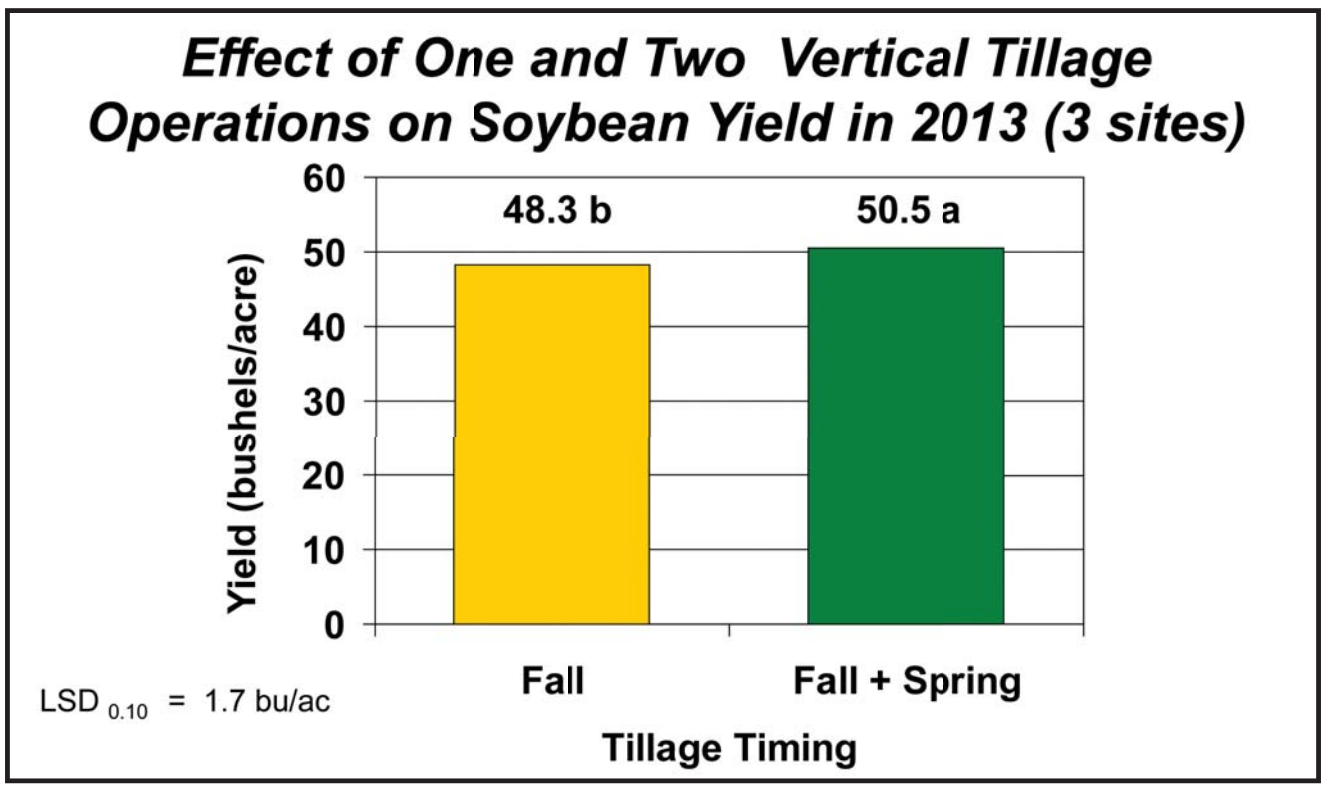
2013 Vertical Tillage Trial Locations

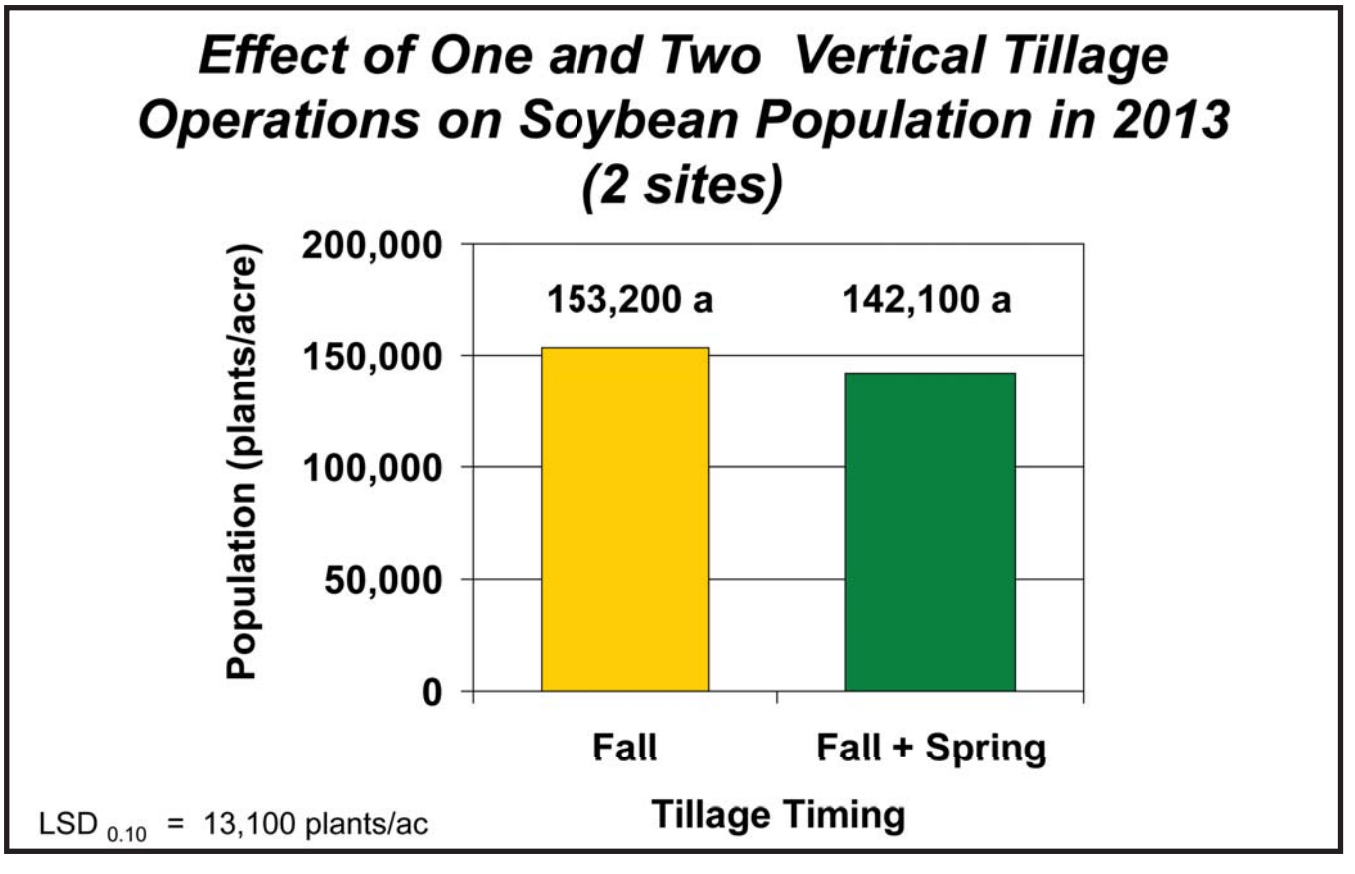
Vertical Tillage

Table 2. The effect of one and two passes of vertical tillage implements on soybean population in 2013

Treatment	Sanilac	Montcalm	*Average (2 sites)
	---------- Harvest Population (plants/acre) ----------		
Fall	126,100 a	179,000 a	153,200 a
Fall + Spring	125,500 a	159,700 a	142,100 a
$LSD_{0.10}$	19,000	21,500	13,100

* Harvest populations from the Monroe location were not included due to extreme variability.





2012 and 2013 Soil Finisher Trial

Purpose: Corn residue management presents a challenge in seedbed preparation for many producers. While new tillage tools offer alternative management options, the unconventional use of older tools may hold promise as well. This study evaluates the effect of a single pass of a soil finisher on soybean yields in 2012 and 2013.

Procedure: A single pass of a John Deere 724 soil finishing implement was compared to an untilled control in one location in 2012 and 2013. Each treatment was replicated four times in a randomized complete block design. The soil finisher was operated in standing corn stalks in the spring prior to planting. The soil finisher was modified by removing one row of spring tines to improve residue flow.

Table 1. The effect of a single pass of a John Deere 724 soil finisher on soybean yield and income in 2012 and 2013

Treatment	Clinton (2012)	Clinton (2013)	Average	Average Income
	Yield (bu/ac)			($/ac)
Untilled Control	51.8 a	53.7 a	52.7 b	$640
Soil Finisher	52.7 a	55.5 a	54.1 a	$648
$LSD_{0.10}$	1.2	3.2	1.3	

Soybean price = $12.15 per bushel
Soil finisher cost = $9.00 per acre

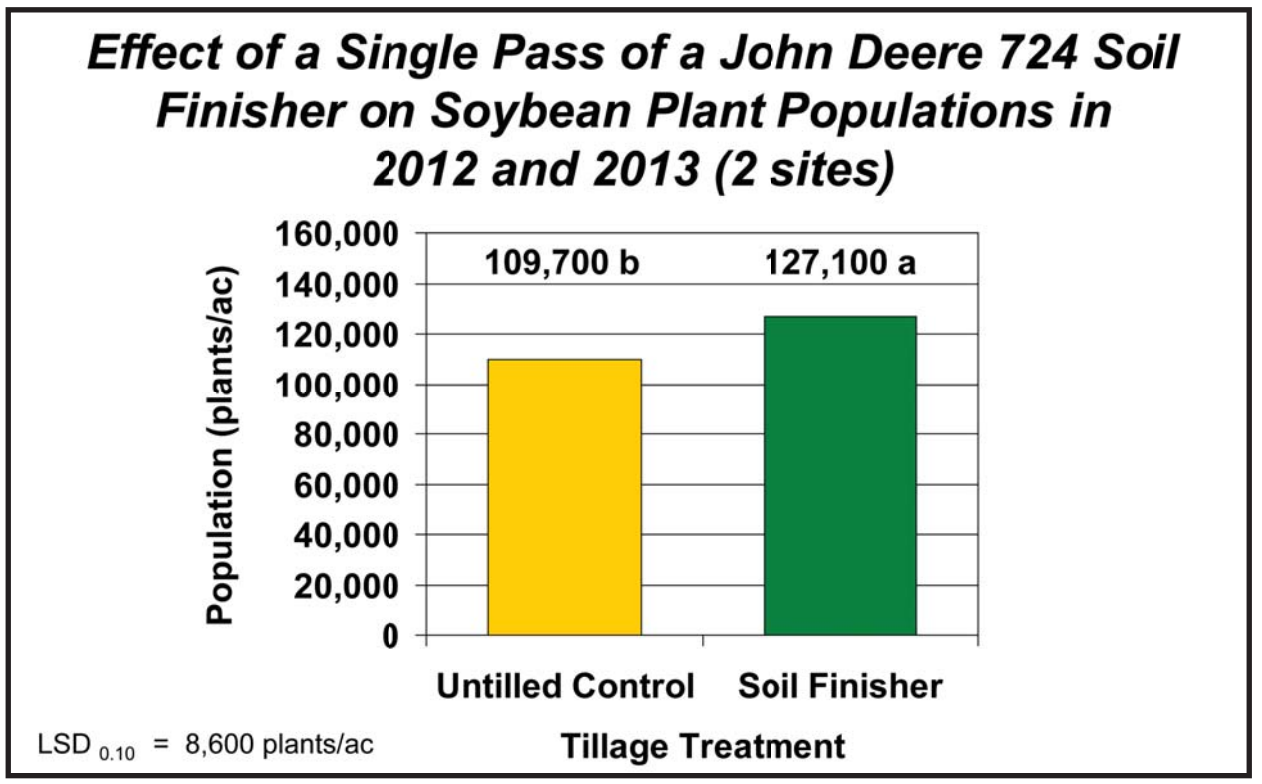
Results: Soil finisher operation failed to increase soybean yields when individual years were analyzed separately, though when years were combined, yields were greater following a single pass of the soil finisher compared to the untilled control. Harvest populations were significantly higher in the soil finisher treatment in 2013 and when both years were combined and analyzed.

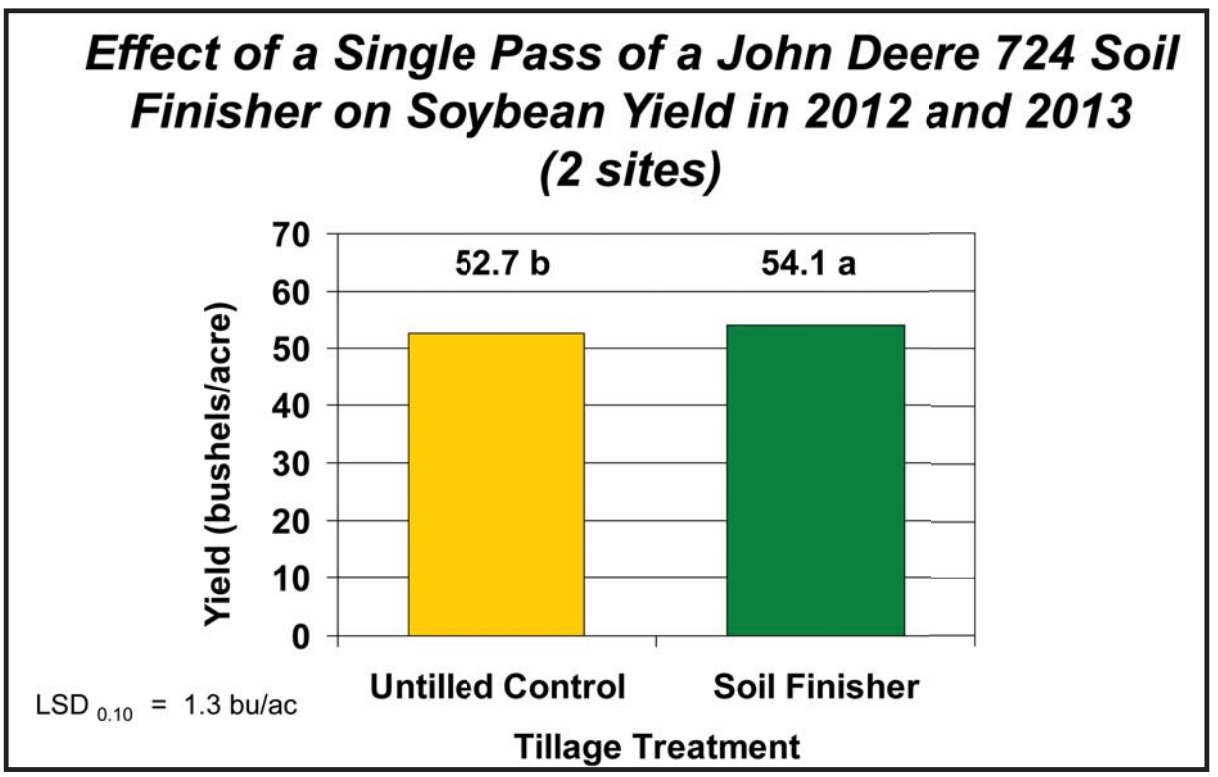
2012 and 2013 Soil Finisher Trial Locations

2012 and 2013 Soil Finisher Trial

Table 2. The effect of a single pass of a John Deere 724 soil finisher on soybean plant populations in 2012 and 2013

Treatment	Planting Population (2012)	Harvest Population (2012)	Planting Population (2013)	Harvest Population (2013)	Average Harvest Population (2012 & 2013)
	---------- (plants/ac) ----------				
Untilled Control	140,000	95,400 a	150,000	123,900 b	109,700 b
Soil Finisher	140,000	113,000 a	150,000	141,600 a	127,100 a
$LSD_{0.10}$		21,400		13,000	8,600





Starter Fertilizer Trial

Purpose: Starter fertilizers (in-furrow and 2x2) have produced mixed results in previous SMaRT trials. The purpose of these trials was to evaluate the effect of starter fertilizer on soybean yields in 2013.

Procedure: Three starter fertilizer trials were conducted in 2013. A different fertilizer was applied at each location (table 2). The fertilizer was applied in-furrow at the Calhoun County location and in a 2x2 band at the Sanilac and Kent County locations. The starter fertilizer was compared to an unfertilized control at all locations using a randomized complete block design. Each treatment was replicated four times.

Table 1. Starter fertilizer effect on soybean yield and income in 2013

Treatment	Sanilac *		Calhoun **		Kent *	
	Yield (bu/ac)	Income ($/ac)	Yield (bu/ac)	Income ($/ac)	Yield (bu/ac)	Income ($/ac)
Control	45.0 a	$547	55.1 a	$669	55.6 b	$676
Starter fertilizer	47.6 a	$522	53.8 b	$636	61.7 a	$691
$LSD_{0.10}$	4.7		1.1		3.9	

Soybean price = $12.15 per bushel
Sanilac County starter fertilizer cost = $56.00 per acre
Calhoun County starter fertilizer cost = $18.00 per acre
Kent County starter fertilizer cost = $ 59.00 per acre

*2x2 fertilizer placement

** In-furrow fertilizer placement

Results: The starter fertilizers produced mixed results again in 2013. At the Sanilac location, the yield increase was not statistically different than the unfertilized control and did not cover the cost of the fertilizer. At the Kent County site, the starter fertilizer increased soybean yields by 6.1 bushels per acre compared to the unfertilized control. The yield increase was statistically significant and increased income by $15.00 per acre. The Calhoun County site produced the opposite result. The in-furrow fertilizer treatment yielded 1.3 bushels per acre lower than the unfertilized control. The difference was statistically significant and resulted in a loss of income of $33.00 per acre.

In general, starter fertilizer has a greater probability of increasing soybean yields when phosphorus and potassium soil test levels are low and when planting into cool soil conditions. Factors such as planting date, tillage and soil texture can impact soil temperature and affect the chances of a yield increase.

We want to thank Crop Production Services for providing the starter fertilizer for the Sanilac site and Dan Rajzer, Ned Birkey and Martin Nagelkirk for coordinating these trials.

2013 Starter Fertilizer Trial Location

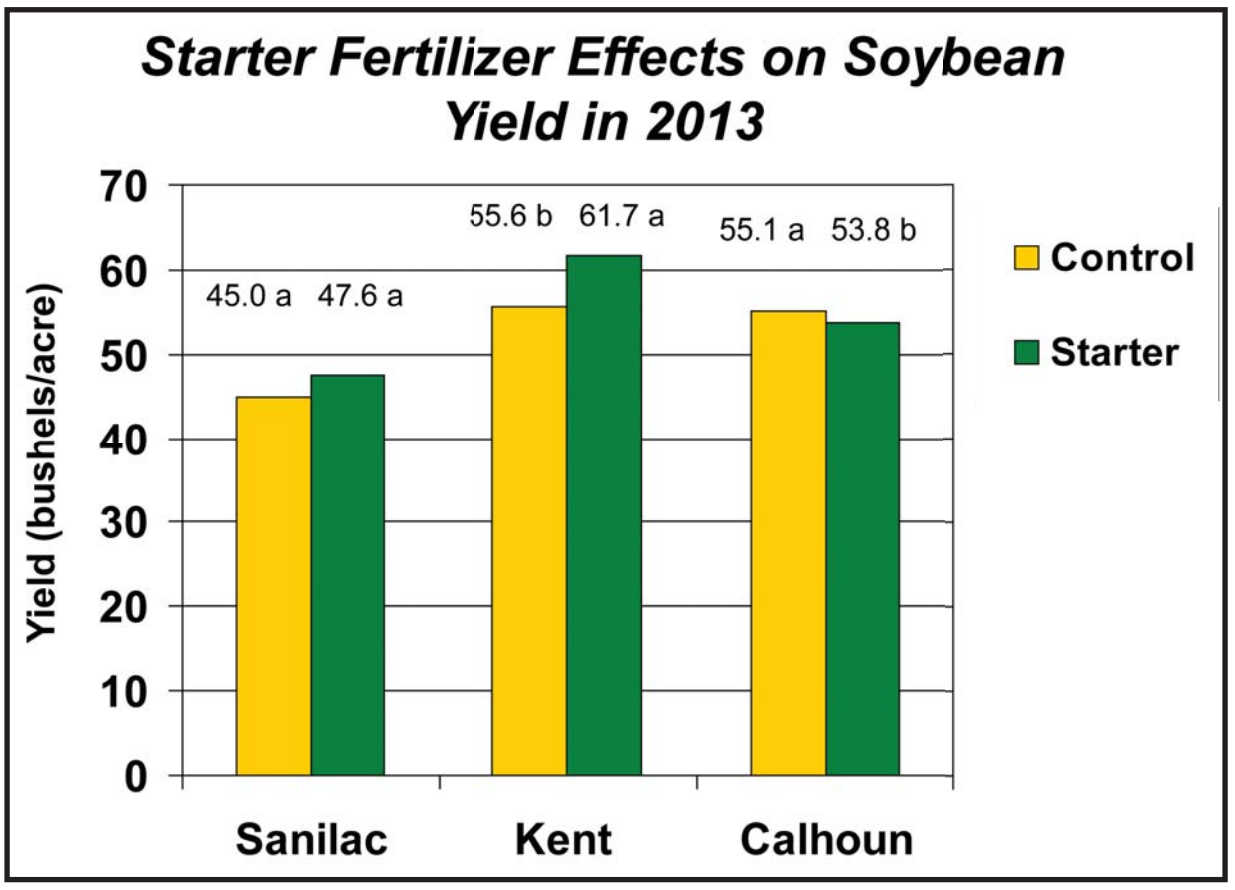
Starter Fertilizer Trial

Table 2. Starter fertilizer analysis, application rate, placement and cost per acre.

Location	Fertilizer Analysis	Application Rate	Fertilizer Placement	Fertilizer Cost ($/ac)
Sanilac	4.1-4.9-11.4-6.8 S-0.19 Zn	5 gallons per acre	2x2	$56.00
Jackson	6-18-6-1 S-0.46 Zn	3 gallons per acre	In-furrow	$18.00
Kent	6.3-18.6-26.8-3.8 S-1.8 Zn	188 lbs. per acre	2x2	$59.00

Table 3. Planting dates, tillage, and soil test information for the 2013 starter fertilizer trials

Location	Planting Date	Tillage	Soil pH	Soil Test Phosphorus (ppm)	Soil Test Potassium (ppm)	Cation Exchange Capacity (CEC) (meq/100 g)
Sanilac	5/9/2013	Chisel plow (fall) Field cultivator (spring)	6.7	29	104	12.5
Jackson	5/1/2013	No-till	6.2	75	140	9.5
Kent	5/15/2013	Disk and culti-packer	6.4	100	113	3.4



2011 and 2013 Potassium Fertilizer Application Rate Trial

Purpose: The role of potassium in soybean production continues to be a question for many producers. This trial was designed to evaluate the effect of three potassium fertilizer application rates on soybean yield and income in 2011 and 2013.

Procedure: Two application rates (100 lbs./ac and 200 lbs./ac) of potassium chloride fertilizer (0-0-60) were compared to an unfertilized control at one location in 2011 and one location in 2013.

The fertilizer was applied with spinner spreaders in the spring prior to planting. The treatments were replicated four times in a randomized complete block design at each location. The potassium soil test level was 100 ppm at the St. Joseph location and 140 ppm at the Lenawee County location. The soil at the St. Joseph site was coarse-textured with a cation exchange capacity (CEC) of only 4.3 meq/100 g. The soil at the Lenawee site was fine-textured with a CEC of 17.2 meq/100 g.

Table 1. The effect of three potassium fertilizer (0-0-60) application rates on soybean yield and income in 2011 and 2013

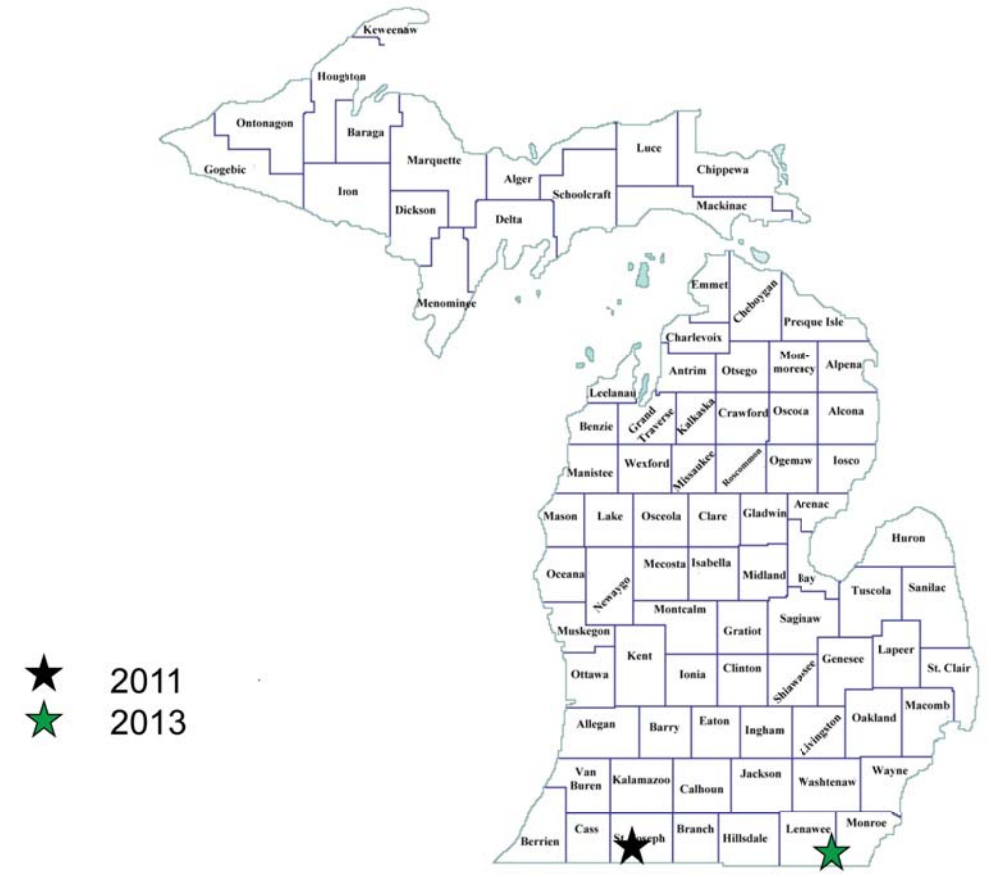
Treatment	St. Joseph (2011)	Monroe (2013)	Average	Average Income
	---------- Yield (bu/ac) ----------			($/ac)
Unfertilized	53.1 a	57.2 a	55.2 a	$671
100 lbs./ac of 0-0-60	54.5 a	54.8 a	54.6 a	$629
200 lbs./ac of 0-0-60	54.0 a	54.9 a	54.4 a	$599
$LSD_{0.10}$	4.7	4.2	2.8	

Soybean price = $12.15 per bushel
Potassium chloride (0-0-60) cost = $557 per ton
Broadcast fertilizer application cost = $6.38 per acre

Results: The applied potassium fertilizer did not affect soybean yields in 2011 or in 2013, or when both years were combined and analyzed. The results are not surprising as the potassium soil test levels at both locations were above their respective critical levels [75+(2.5 x CEC)]. The critical soil test levels for potassium are 86 ppm at the St. Joseph site and 118 ppm at the Lenawee site. Very small yield increases (3 to 5%) are expected when additional fertilizer is applied to soils that are above the critical level for a given nutrient. However, if maintenance levels of potassium fertilizer are not applied, soil test levels for potassium can fall below the critical level. The maintenance level for both sites is 140 lbs. per acre of 0-0-60.

We want to thank Ned Birkey for coordinating the Monroe County trial in 2013.

2011 and 2013 Potassium Rate Trial Locations

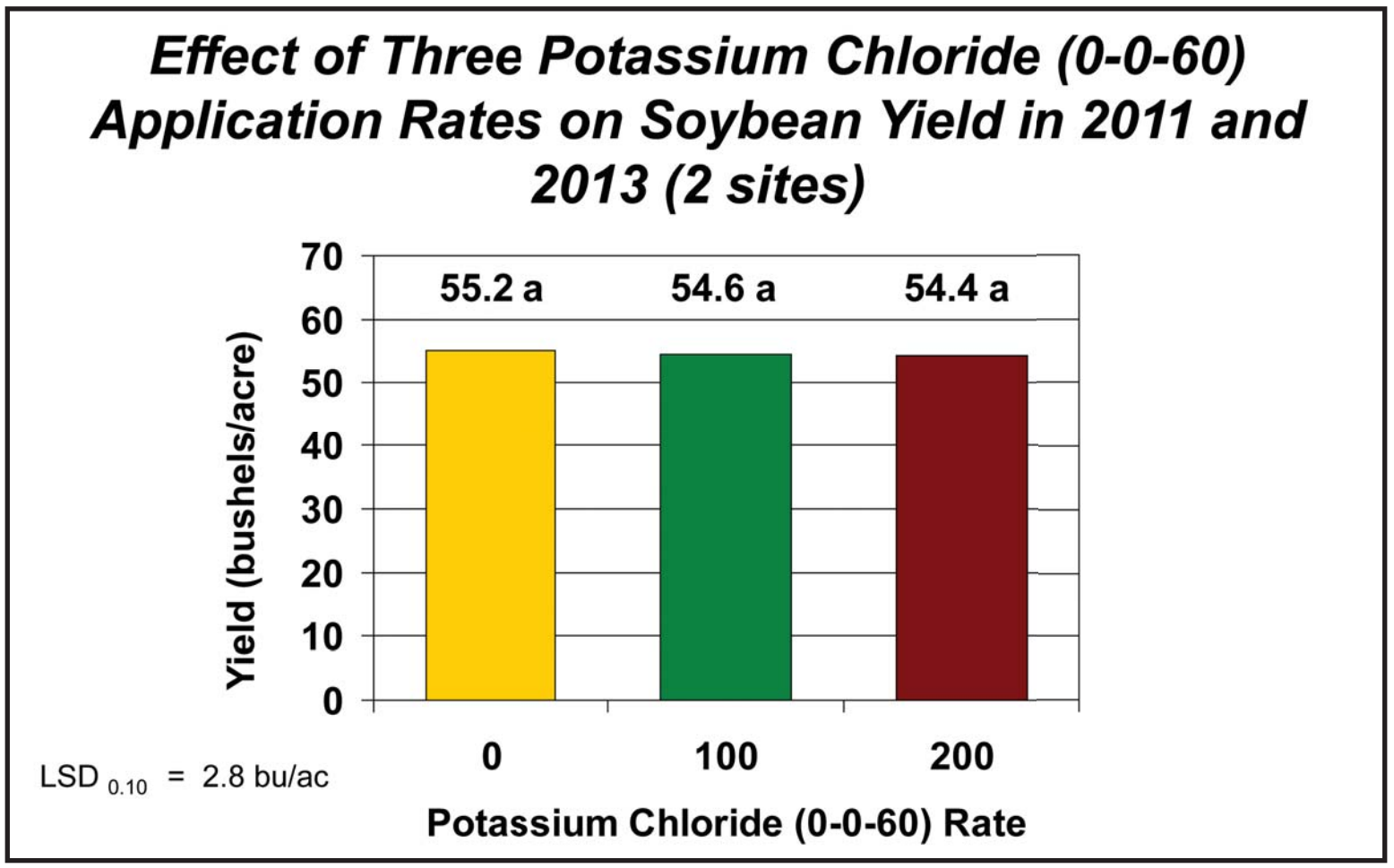


2011 and 2013 Potassium Fertilizer Application Rate Trial

Table 2. Soil test information for the 2011 and 2013 potassium fertilizer (0-0-60) application rate trial locations

Location	Potassium (ppm)	Phosphorus (ppm)	Soil pH	Cation Exchange Capacity (meq/100 g)
St. Joseph (2011)	100	35	6.3	4.3
Lenawee (2013)	140	33	7.3	17.2

Potassium deficiency in soybeans



2013 Residual vs Direct Application of Potassium Fertilizer Trial

Purpose: Fertilizer rate studies have consistently shown few and inconsistent yield increases when potassium (K) is applied on soils with a medium or higher soil test K level. Because of this, fertilizer recommendations state that in a corn-soybean rotation, a biannual fertilization strategy where K fertilizer is applied before the corn crop to meet the nutrient requirements of both corn and soybean crops is a viable approach. However, on coarse-textured, low CEC soils, K is vulnerable to leaching. On soils with less than 6 meq/100 g, K fertilizers are recommended annually rather than biannually. This trial was conducted to compare the effects of residual K applied before the corn crop or applied directly every year on a coarse textured soil.

Procedure: Three potassium fertilizer treatments were compared in a randomized complete block experimental design at one location in Cass County. The site is has a sandy loam soil with a CEC of 4.3 meq/100 g (table 2). Based on the 118 ppm K soil level, the Michigan State University nutrient recommendations are in the drawdown category (less than crop removal). The K fertilizer recommendations for this site are 60 lbs. per acre of 0-0-60 for 150 bushels per acre corn and 105 lbs. per acre of 0-0-60 for 50 bushels per acre soybean, for a two year need of 165 lbs. This recommendation is significantly lower than the K fertilizer applied at the site.

The three treatments are described below:

1. 250 lbs. per acre of 0-0-60 applied prior to planting corn in 2012 plus 150 lbs. per acre of 0-0-60 applied prior to planting soybeans in 2013.
2. 400 lbs. per acre of 0-0-60 broadcast prior to planting corn in 2012.
3. 250 lbs. per acre of 0-0-60 per acre broadcast prior to planting corn in 2012.

Table 1. The effect of residual and direct applied potassium fertilizer on soybean yield and income in 2013

Treatment	Cass County Yield (bu/ac)	Average Income ($/ac)
2012 (250 lbs./ac) + 2013 (150 lbs./ac)	39.9 a	$360
2012 (400 lbs./acre)	40.6 a	$375
2012 (250 lbs./ac)	39.4 a	$402
$LSD_{0.10}$	3.9	

Soybean price = $12.15 per bushel
Potassium fertilizer = $557 per ton
Broadcast fertilizer application cost = $6.38 per acre

Results: All three potassium fertilizer treatments produced essentially the same soybean yield in 2013. This lack of response was most likely a result of the high K fertilizer application rates in all treatments compared to the recommended rate.

We want to thank Dan Rajzer for coordinating this trial.

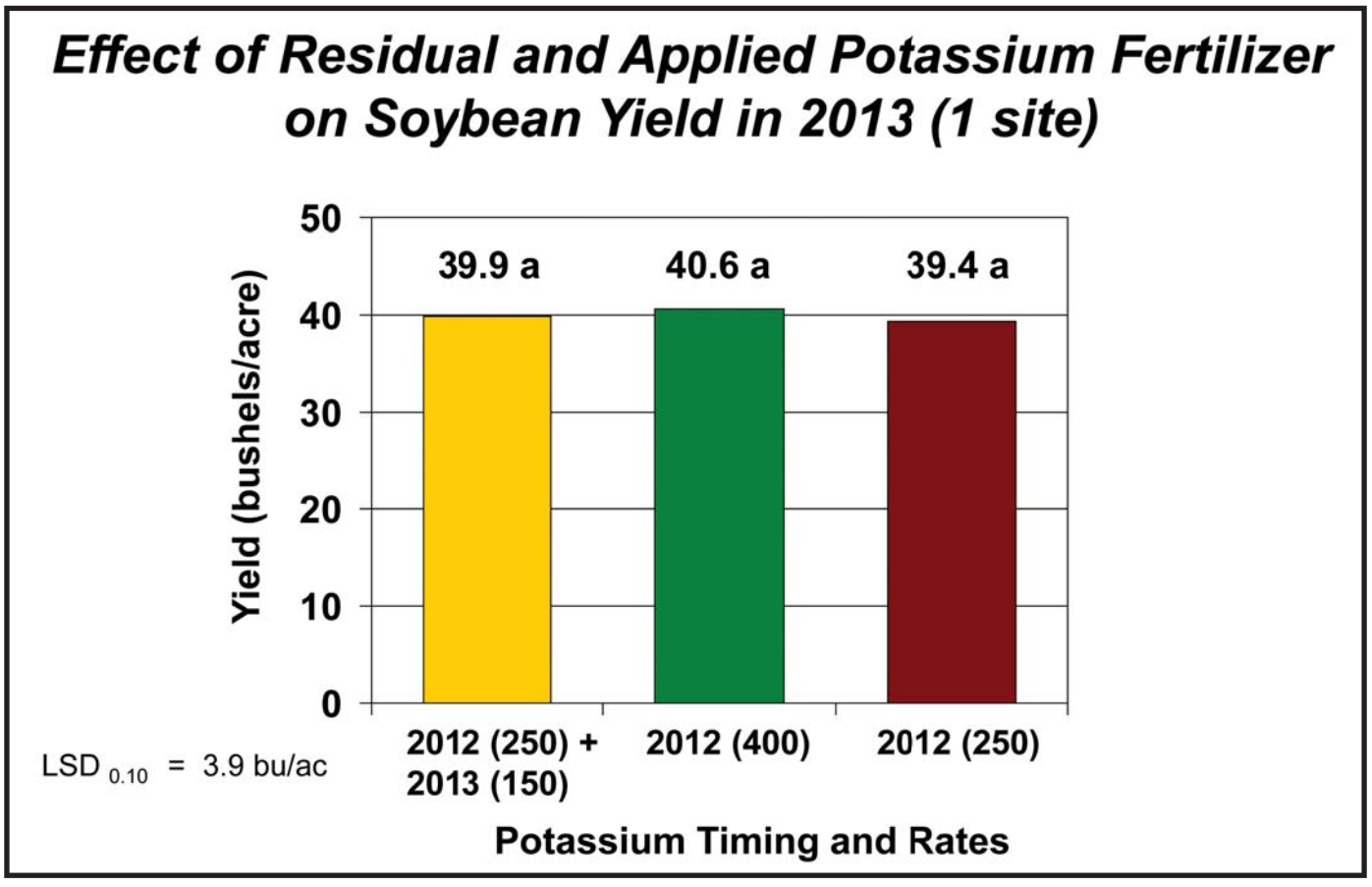
Residual Potassium Trial Location

2013 Residual vs Direct Application of Potassium Fertilizer Trial

Table 2. 2012 soil test information

Potassium (ppm)	Phosphorus (ppm)	Soil pH	Cation Exchange Capacity (CEC) (meq/100 g)
118	52	6.5	4.3

Potassium deficiency in soybean



Managanese Fertilizer Sources Compared

Purpose: Foliar applications of manganese (Mn) have been shown to effectively correct Mn deficiency in soybeans grown on soils high in organic matter such as mucks or black sands. The purpose of this trial was to compare the yield and income effects of three manganese fertilizers at a site with a history of severe manganese deficiency symptoms.

Procedure: Three manganese fertilizers, manganese sulfate monohydrate, Eezy™Man and Manni-Plex® Mn, were compared at one location in 2013. The soil at the site is a true muck soil having 44% organic matter. The site has a history of exhibiting severe manganese deficiency symptoms. Each treatment was replicated four times in a randomized complete block design. All treatments were applied at the V2 growth stage and again at the R1 growth stage. The manganese sulfate monohydrate was applied at 3.2 lbs. per acre and the EezyMan and the Manni-Plex Mn were applied at 2 qts. per acre.

Table 1. The effect of three manganese fertilizers on soybean yield and income in 2013

Treatment	Yield (bu/ac)	Average Income ($/ac)
EezyMan	28.0 b	$321*
Manni-Plex Mn	30.6 a	$344
Manganese Sulfate Monohydrate	30.3 a	$349
$LSD_{0.10}$	2.1	

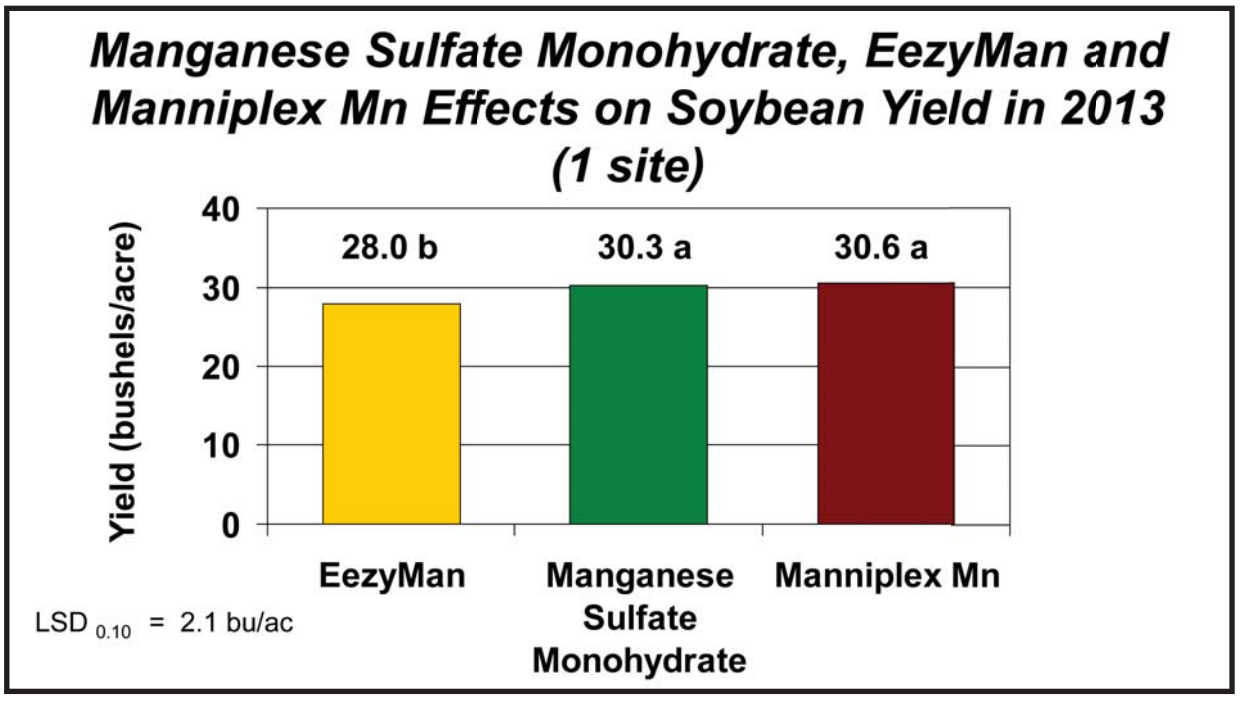
Soybean price = $12.15 per bushel
Manganese Sulfate Monohydrate cost = $2.10 per acre per application
EezyMan cost = $5.75 per acre per application
Manni-Plex Mn cost = $6.12 per acre per application
Application cost = $7.50 per acre

*The first application cost was not applied to the EezyMan treatment as this product can be applied with glyphosate.

Results: The Manni-Plex Mn and the manganese sulfate monohydrate treatments produced higher soybean yields than the EezyMan treatment. The difference was statistically significant. However, the Manni-Plex Mn and the manganese sulfate monohydrate treatments were not statistically different from each other. These products should not be tank-mixed with glyphosate.

We want to thank Pestell Minerals and Ingredients for providing the manganese sulfate monohydrate fertilizer.

2013 Manganese Foliar Fertilizer Comparison Trial Location



Managanese Fertilizer Sources Compared

Purpose: Foliar applications of manganese (Mn) have been shown to effectively correct Mn deficiency in soybeans grown on soils high in organic matter such as mucks or black sands. The purpose of this trial was to compare the yield and income effects of three manganese fertilizers at a site with a history of manganese deficiency symptoms.

Procedure: Three manganese foliar fertilizers (manganese sulfate monohydrate, Tecmagnam® manganese sulfate and Smart Trio®) were compared at one location in 2013. The three treatments were replicated four times in a randomized complete block experimental design. The manganese sulfate monohydrate and the Tecmangam manganese sulfate contain 32% Mn and 19% S and were applied at 3.2 lbs. per acre. The Smart Trio contains 4.0% N, 3.0% S, 0.25% B, 3.0% Mn, 3.0% Zn and was applied at 1 qt. per acre. Each product was applied in a single application at the R1 growth stage. The soil at the site was comprised of Brookston loam, Parkhill loam and Palms muck. All treatments ran across all three soil types. Soil test levels for the loam and muck soils are provided in table 2.

Manganese Sulfate Monohydrate vs. Tecmangam vs. Smart Trio Foliar Fertilizer Trial Location

Table 1. The effect of manganese sulfate monohydrate, Techmangam and Smart Trio foliar fertilizers on soybean yield and income in 2013

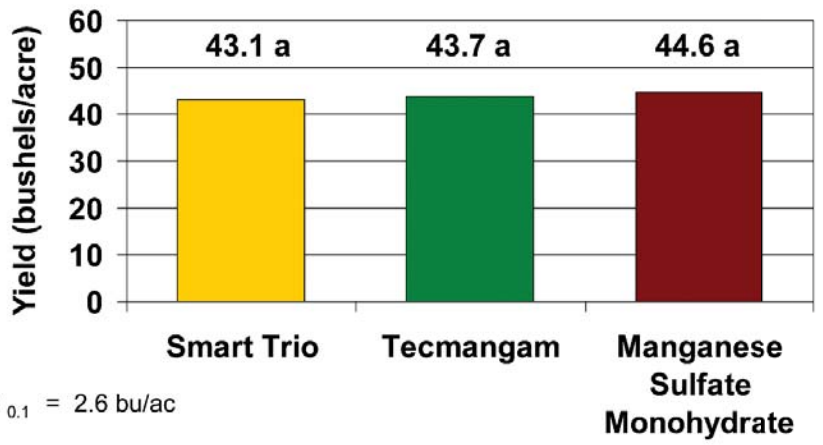
Treatment	Yield (bu/ac)	Income ($/ac)
Smart Trio	43.1 a	$512
Tecmangam	43.7 a	$521
Manganese Sulfate Monohydrate	44.6 a	$532
$LSD_{0.1}$	2.6	

Soybean price = $12.15 per bushel
Manganese Sulfate Monohydrate cost = $2.10 per acre
Tecmangam cost = $2.62 per acre
Smart Trio cost = $ 4.12 per acre
Application cost = $7.50 per acre

Table 2. Soil test information from the two soils at the Lapeer County trial

Soil Type	pH	Phosphorus	Potassium	Manganese	Organic matter	Cation Exchange Capacity
		---------- (ppm) ----------			(%)	(meq/100 g)
Loam soil	7.3	76	136	31	4.7	15.4
Muck soil	6.7	38	133	13.8	51.1	35.3

Manganese Sulfate Monohydrate, Tecmangam and Smart Trio Foliar Fertilizer Effect on Soybean Yield in 2013



Results: The soybean yields produced by the three foliar fertilizers were not statistically different at this site in 2013.

We want to express our appreciation to Pestell Minerals and Ingredients for providing the manganese sulfate monohydrate.

2013 Manganese Foliar Fertilizer Application Timing Trial

Purpose: Manganese deficiency is known to be an issue in high pH, lake bed soil conditions. Generally, no yield loss is expected without visible Mn deficiency symptoms, but the low product costs of some Mn products can mean even small yield increases will result in a positive economic return. The purpose of this trial was to determine how the timing of foliar manganese fertilizer applications affects soybean yields.

Procedure: Three manganese foliar fertilizer application timing treatments were compared to an untreated control treatment at one location in 2013. The three manganese fertilizer application timing treatments are described below:

1. Manganese applied when the plants reached six inches tall
2. Manganese applied when the plants reached 12 inches tall
3. Manganese applied when the plants were six and 12 inches tall

An effective and economical manganese fertilizer (manganese sulfate monohydrate) was applied at 3.2 lbs. per acre per application. The soil at the site was a lake bed soil having a soil pH of 7.4.

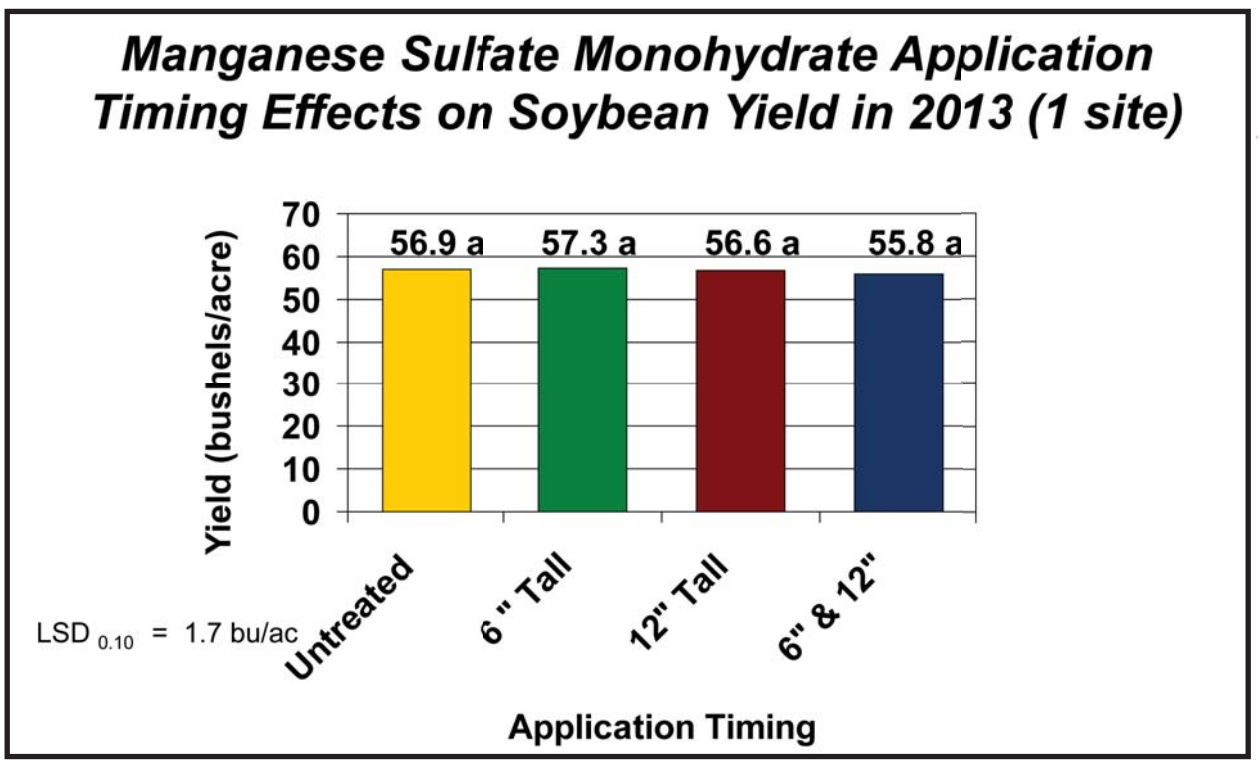
Table 1. The effect of manganese foliar fertilizer application timing on soybean yield and income in 2013

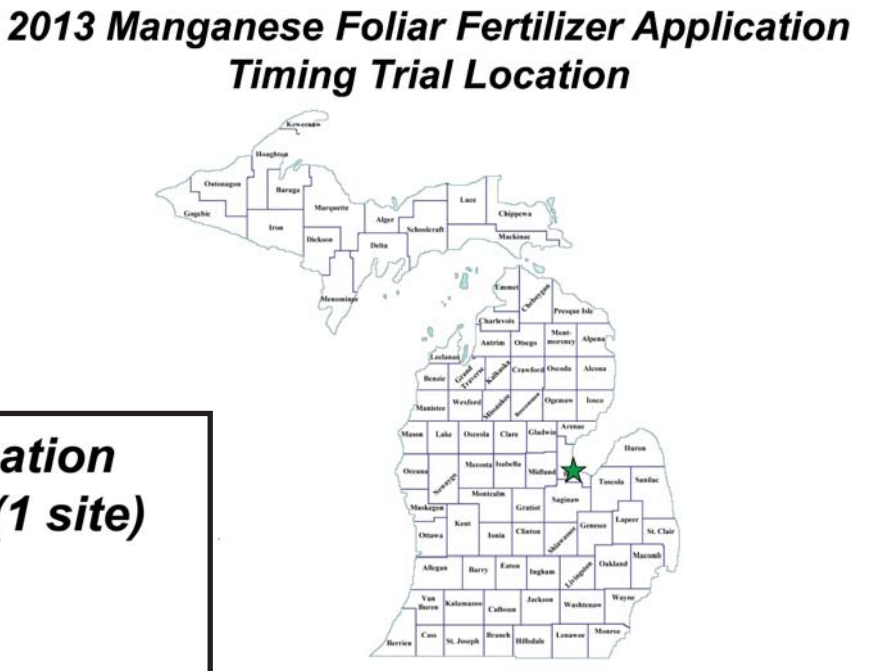
Treatment	Yield (bu/ac)	Average Income ($/ac)
Unfertilized Control	56.9 a	$691
6″ Tall	57.3 a	$686
12″ Tall	56.6 a	$678
6″ Tall + 12″ Tall	55.8 a	$659
$LSD_{0.10}$	1.7	

Soybean price = $12.15 per bushel
Manganese Sulfate Monohydrate cost = $2.10 per acre per application
Application cost = $7.50 per acre

Results: Manganese fertilizer application did not increase yields at any of the application timings. Yields across all four treatments were equal. These results confirm the current Michigan State University recommendation to apply a manganese foliar fertilizer when the plants reach six inches tall and begin to exhibit deficiency symptoms. If deficiency symptoms persist after 10 days, make a second application.

We want to thank Pestell Minerals and Ingredients for providing the manganese sulfate monohydrate fertilizer.





Manganese Sulfate Monohydrate vs. an Untreated Control

Purpose: Soybean manganese deficiencies have been commonly reported on lake bed or out-wash soils having pH levels above 6.5 and soils high in organic matter such as mucks or black sands. The purpose of this trial was to determine if foliar manganese applications improve soybean yields on potentially responsive sites that have not historically shown deficiency symptoms.

Procedure: An effective and economical manganese foliar fertilizer (manganese sulfate monohydrate) was compared to an unfertilized control at two locations in 2013. The lake bed soils at both sites (Bay County 1 and Bay County 2) had high pH levels with no history of manganese deficiency symptoms. A single manganese application was applied when the plants were approximately six inches tall. The two treatments were replicated four times in a randomized complete block design at each location. The manganese sulfate monohydrate was applied at a rate of 3.2 lbs. per acre.

Table 1. Manganese sulfate monohydrate effect on soybean yield and income on high pH, lakebed soils in 2013

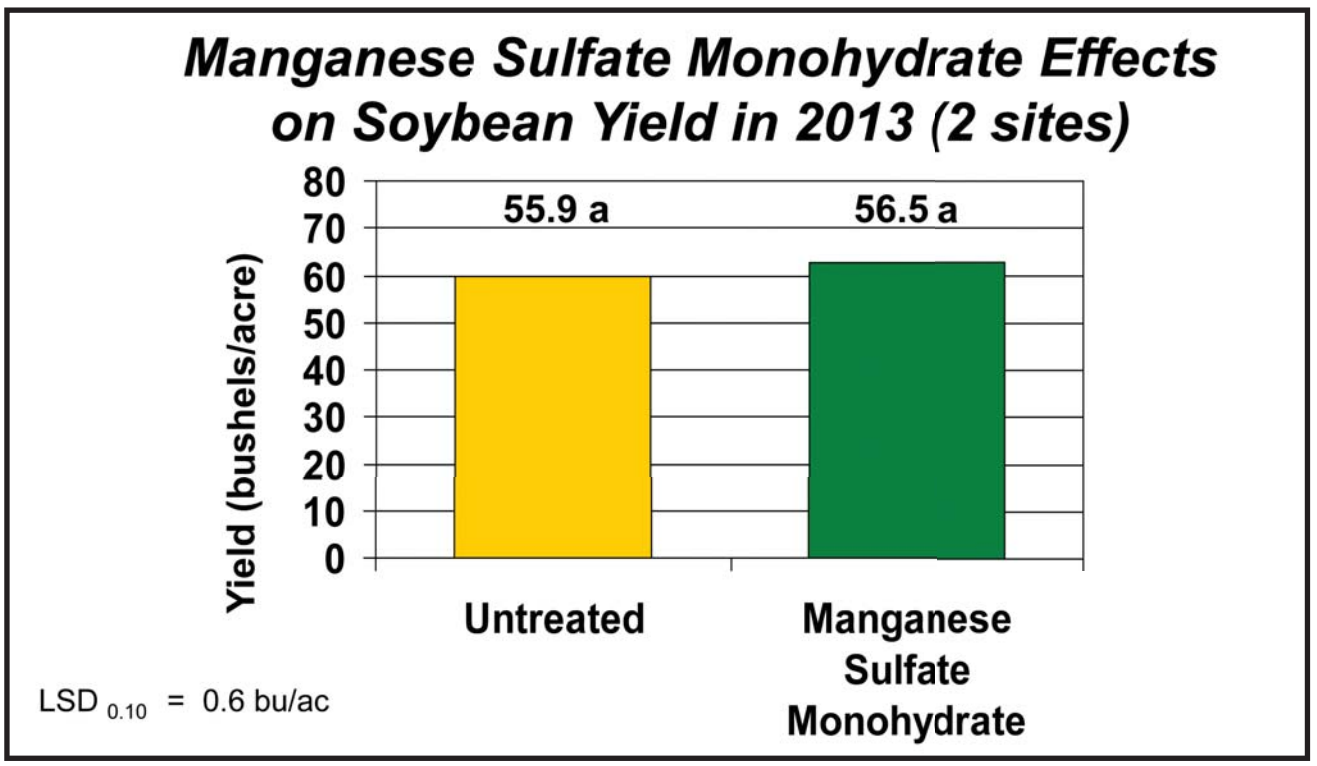
Treatment	Bay County 1	Bay County 2	Average	Average Income
	---------- Yield (bu/ac) ----------			($/ac)
Unfertilized Control	54.9 a	56.9 a	55.9 a	$679
Manganese Sulfate Monohydrate	55.6 a	57.3 a	56.5 a	$677
$LSD_{0.10}$	1.1	1.3	0.6	

Soybean price = $12.15 per bushel
Manganese Sulfate Monohydrate cost = $2.10 per acre
Application cost = $7.50 per acre

2013 Manganese Sulfate Monohydrate vs an Unfertilized Control Trial Locations

Results: No differences were observed between the manganese sulfate monohydrate fertilizer treatment and the untreated control. These results confirm the current recommendations of only applying Mn fertilizers in response to visual Mn deficiency symptoms.

We want to thank Pestell Minerals and Ingredients for providing the manganese sulfate monohydrate fertilizer.



Managanese Sulfate Monohydrate vs. EDTA Chelate Foliar Fertilizer Trials

Purpose: Manganese sulfate is one of the most economical and effective manganese fertilizers available. However, it has been shown to reduce weed control when tank-mixed with glyphosate and some producers have experienced mixing problems with the product. Because of these two issues, most producers have switched to manganese EDTA Chelate as their preferred fertilizer source of manganese. Producers that have experienced severe manganese deficiency symptoms are willing to separate their glyphosate and manganese applications to improve manganese nutrition and yields. A new more soluble form of manganese sulfate (manganese sulfate monohydrate) is now available which is marketed as reducing mixing problems. The purpose of this trial was to compare the effects of manganese sulfate monohydrate and manganese EDTA Chelate on soybean yields and income in 2013.

Procedure: Two manganese foliar fertilizers (manganese sulfate monohydrate and manganese EDTA Chelate) were compared at two locations in 2013. Due to severe Mn deficiency history, an untreated control was not included. The two treatments were replicated four times in a randomized complete block design at each location. The manganese sulfate monohydrate was applied at a rate of 3.2 lbs. per acre and the EDTA Chelate was applied at 2 qts. per acre. The trials at both locations were conducted on uniform muck soils. Two applications of each fertilizer were required at these locations.

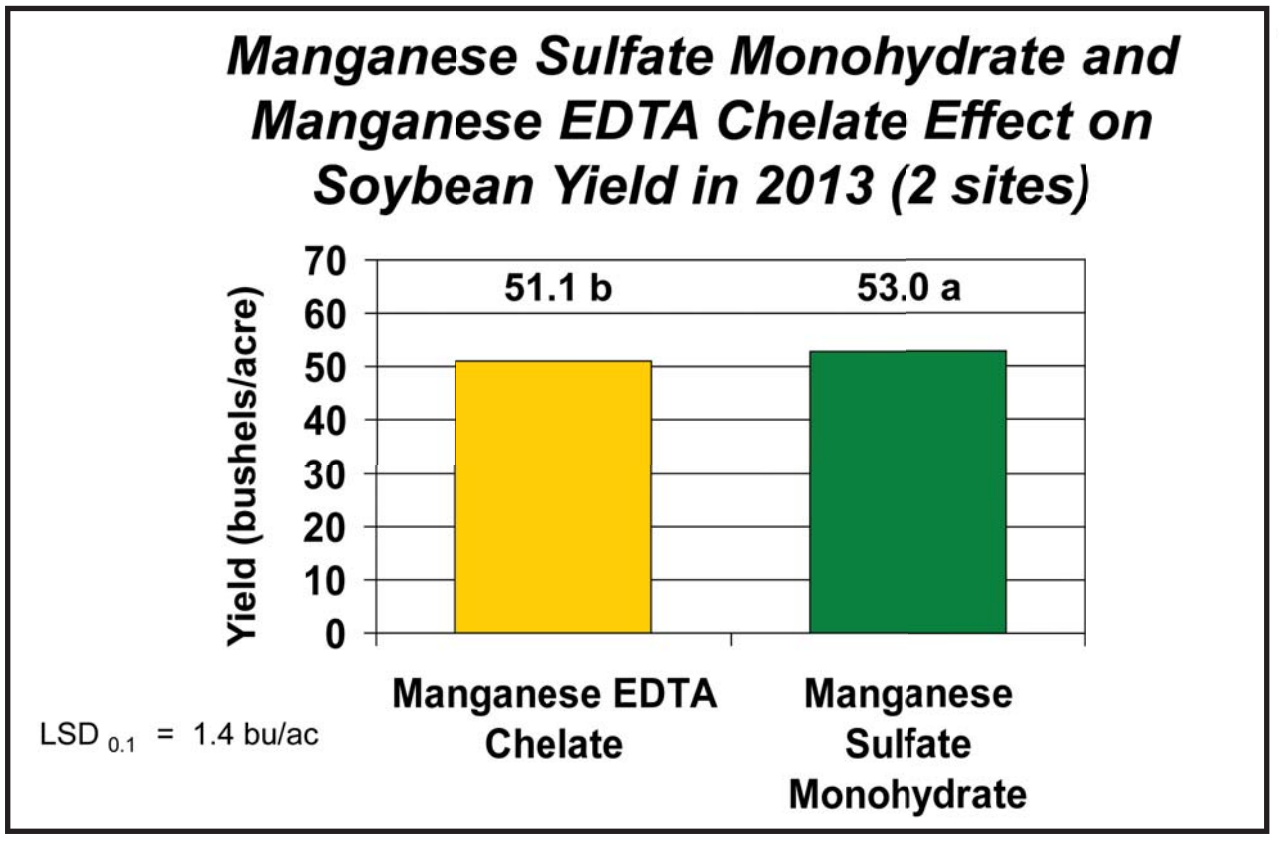
Table 1. The effect of manganese sulfate monohydrate and manganese EDTA chelate on soybean yield and income in 2013

Treatment	Berrien	Ingham	Average	Average Income
	---------- Yield (bu/ac) ----------			($/ac)
Manganese EDTA Chelate	74.3 a	28.0 b	51.1 b	$602*
Manganese Sulfate Monohydrate	75.6 a	30.3 a	53.0 a	$625
$LSD_{0.1}$	3.2	1.7	1.4	

Soybean price = $12.15 per bushel
Manganese Sulfate Monohydrate cost = $2.10 per acre per application
Manganese EDTA Chelate cost = $5.75 per acre per application
Application cost = $7.50 per acre

*The first application cost was not applied to the Manganese EDTA chelate treatment as this product can be applied with glyphosate.

Manganese Sulfate Monohydrate Vs Manganese EDTA Chelate Trial Locations



Results: There was a trend for the manganese sulfate monohydrate to produce higher yields than the EDTA Chelate at both locations. However, the difference was statistically significant at only one location (Ingham). When both locations were combined and analyzed, the manganese sulfate monohydrate increased soybean yields by 1.9 bushels per acre and increased income by $23.00 per acre in 2013.

We want to thank Pestell Minerals and Ingredients for providing the manganese sulfate monohydrate fertilizer and Dan Rajzer for coordinating the Berrien County trial.

Manganese Deficiency

Soybean Mn deficiency on new growth

Typical variable Mn deficiency across the field

2012 and 2013 Boron Fertilizer Trials

Purpose: Soybean yield responses to applied boron fertilizer have been variable in previous research trials. This is not surprising given that soybeans are classified as having a low probability of responding to boron fertilizer even at low soil test boron levels. Boron is more likely to be deficient in coarse-textured and organic soils due to leaching losses. Boron availability also declines in lake bed soils as soil pH increases from 6.5 to 8.0. Yield responses to applied boron are more likely to occur under these conditions. The purpose of these trials was to evaluate the effect of foliar and broadcast boron fertilizer applications on soybean yields at potentially responsive sites.

Procedure: Broadcast boron fertilizer effects on soybean yields were compared at three locations in 2013 using the following treatments: 1) 150 lbs. per acre of 0-0-60 plus seven lbs. per acre of Granubor® 2 broadcast prior to planting and 2) 150 lbs. per acre of 0-0-60 without Granubor 2 broadcast prior to planting.

A single foliar application of Solubor® was compared to an unfertilized control treatment at two locations in 2013. The Solubor was applied at 1.2 lbs. (0.25 lbs. of actual boron) per acre at the R1 growth stage. The sprayers were equipped and operated to optimize leaf coverage and driven through the untreated control treatments to eliminate tire tracks from being a factor.

Table 1. Broadcast boron fertilizer (Granubor 2) effect on soybean yield and income in 2013

Treatment	Cass	Monroe	Van Buren	Average	Average Income
	Yield (bu/ac)				($/ac)
Control	39.4 a	56.3 a	27.3 a	41.0 a	$498
Granubor 2	40.2 a	56.3 a	27.2 a	41.2 a	$494
$LSD_{0.10}$	3.3	4.0	2.1	1.4	

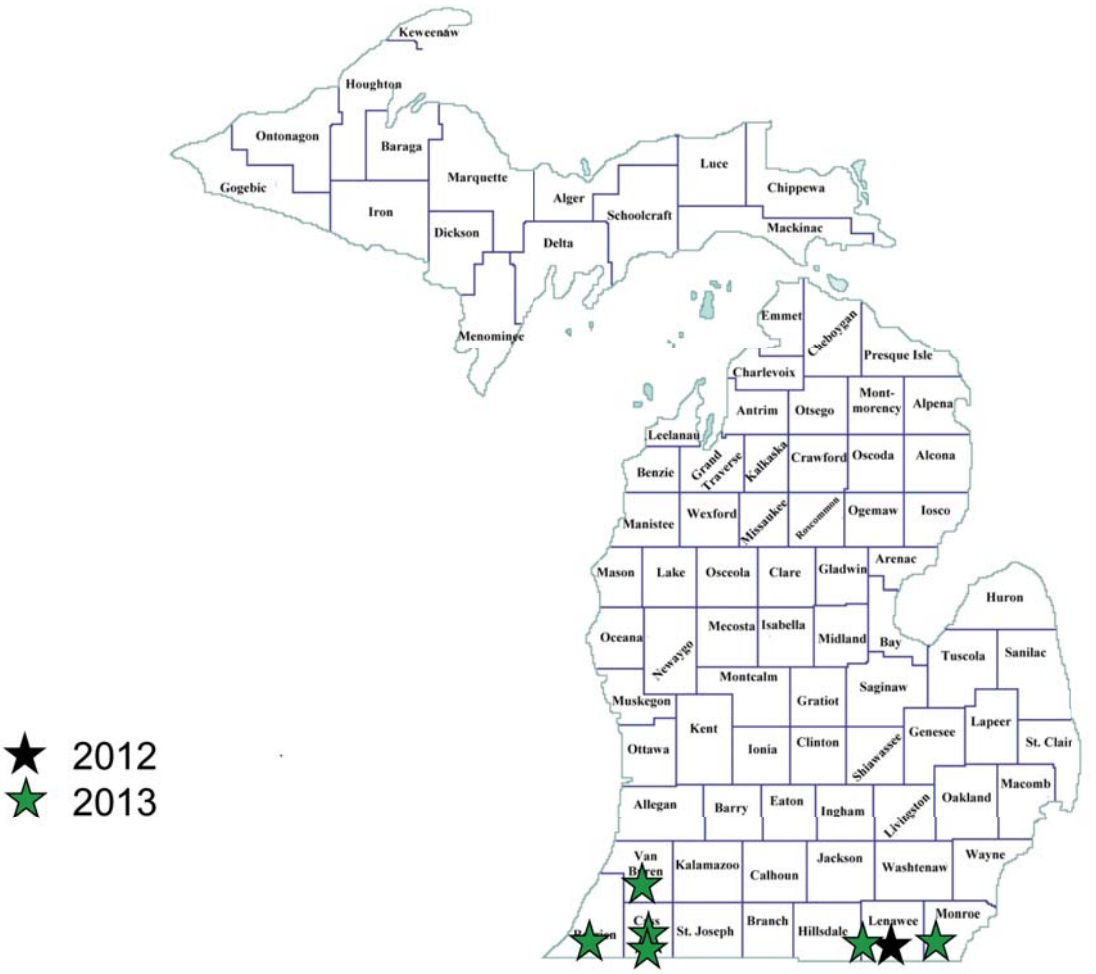
Soybean price = $12.15 per bushel
Granubor 2 price = $7.00 per acre

Results: The addition of Granubor 2 to broadcast fertilizer did not increase soybean yields at any of the locations in 2013. This was also the case when the 2012 and 2013 sites were combined and analyzed.

Foliar applications of Solubor and the untreated control resulted in essentially equal yields at both locations in 2013. This is consistent with on-farm research trials conducted in Michigan in 2005, 2011 and 2012. A foliar application of 0.25 pound per acre of actual boron applied at R1 was compared to an untreated control at one site in 2005, four sites in 2011 and one site in 2012. The boron foliar fertilizer did not affect soybean yields in any of these trials.

We want to express our appreciation to US Borax for providing the Solubor and the Granubor 2 and Dan Rajzer and Ned Birkey for coordinating the trials.

2012 and 2013 Boron Trial Locations

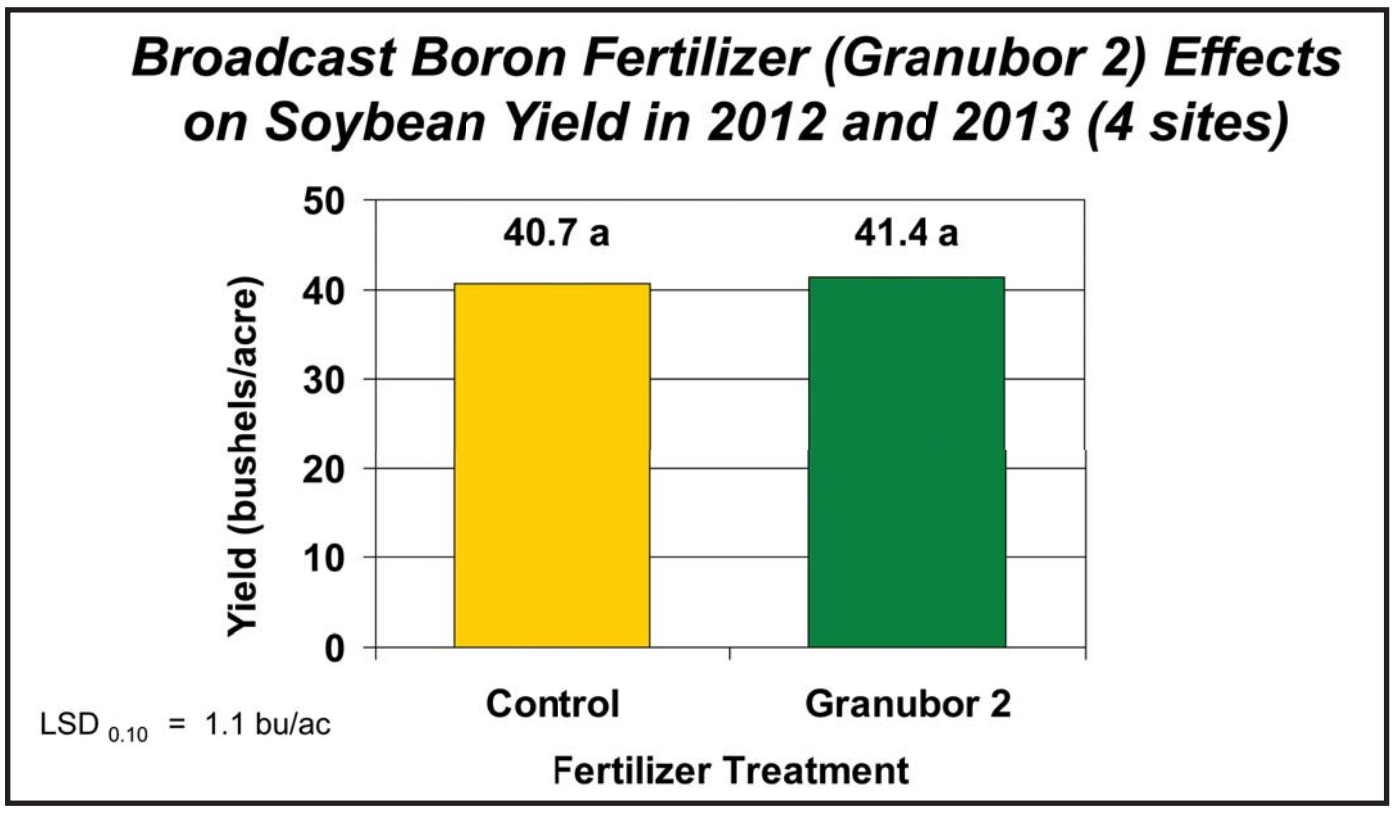


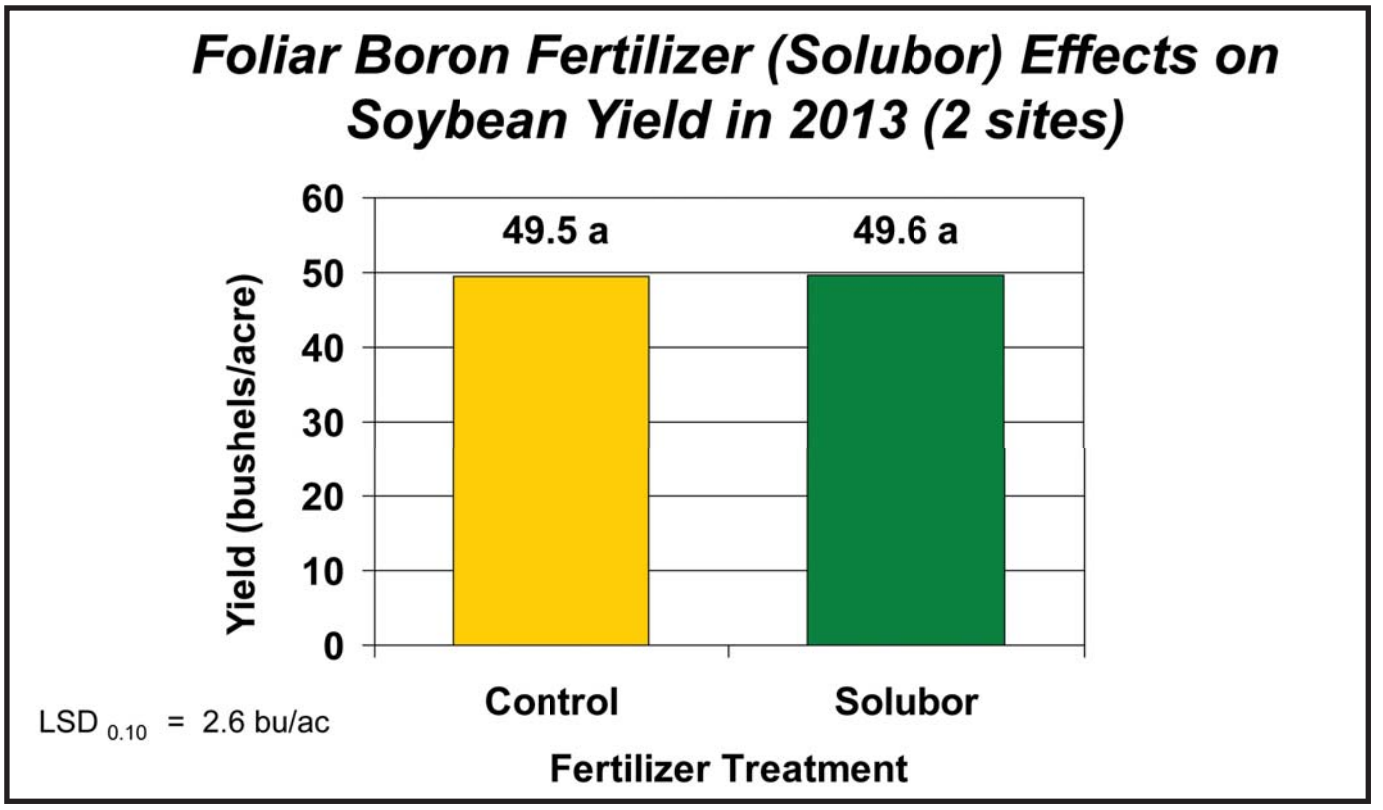
2012 and 2013 Boron Fertilizer Trials

Table 2. Foliar boron fertilizer (Solubor) effect on soybean yield and income in 2013

Treatment	Berrien	Cass	Average	Average Income
	Yield (bushels/acre)			($/ac)
Control	63.9 a	35.1 a	49.5 a	$601
Solubor	63.4 a	35.8 a	49.6 a	$593
$LSD_{0.10}$	5.6	2.1	2.6	

Soybean price = $12.15 per bushel
Solubor price = $2.40 per acre
Application cost = $7.50 per acre





2013 Soybean Seed Inoculation Trial

Purpose: University trials have shown yield increases ranging from one to two bushels per acre from using seed applied inoculants in fields that had previously grown soybeans. In Michigan, Dr. Kurt Thelen showed that inoculation increased soybean yields by 1.3 bushels per acre. This trial was designed to evaluate the effect of two of the best inoculants offered by two leading companies on soybean yields.

Procedure: Two seed inoculants (TagTeam® LCO and Vault® HP) were compared to an untreated control at five locations in Lenawee County in 2013. All three treatments were replicated in a randomized complete block design at all locations. The same soybean variety and seed lot was used for all treatments and trial locations. Both seed treatments were applied at a professional seed treatment facility.

Table 1. Seed inoculant effect on soybean yield and income in 2013

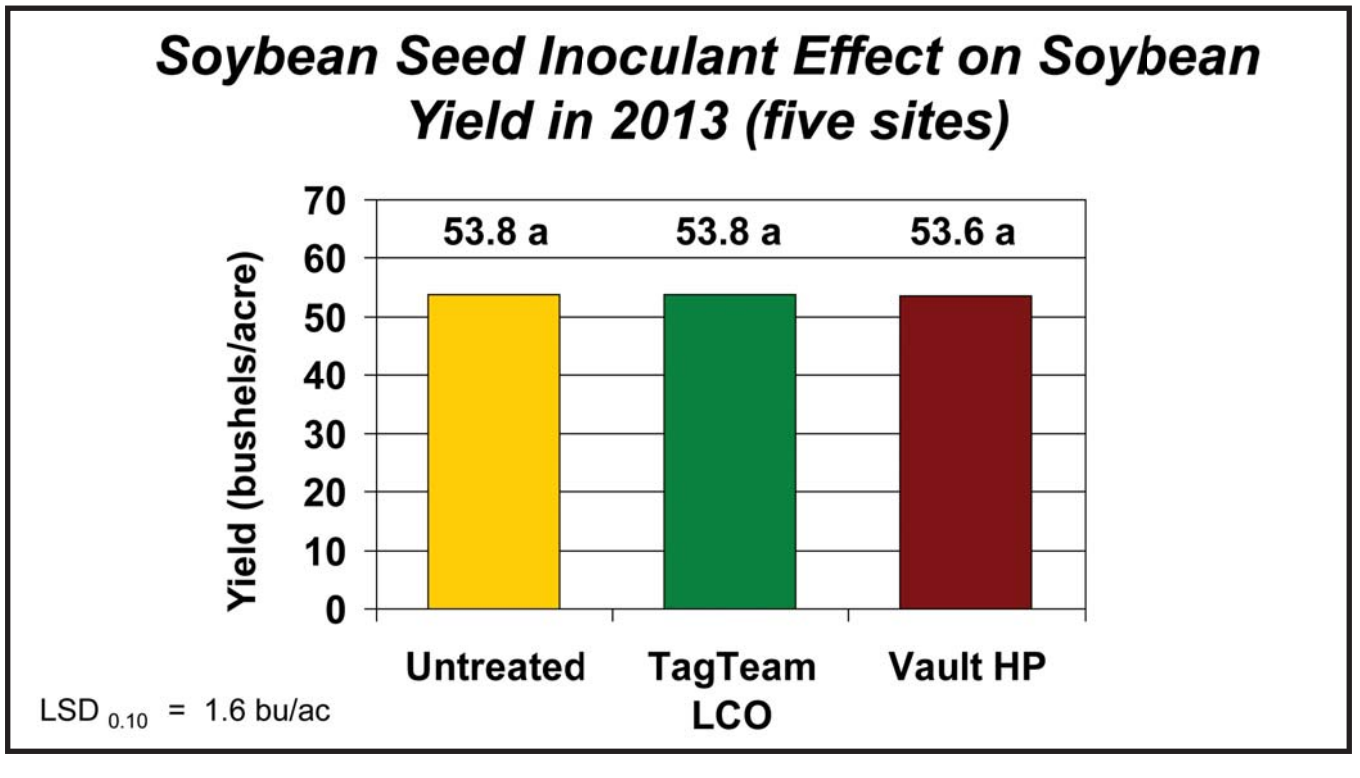
Treatment	Lenawee 1	Lenawee 2	Lenawee 3	Lenawee 4	Lenawee 5	Average	Average Income
	---------- Yield (bushels per acre) ----------						($/ac)
Untreated Control	58.4 a	53.5 a	39.1 a	60.6 a	58.0 a	53.8 a	$654
TagTeam LCO	60.1 a	53.8 a	38.6 a	58.6 b	57.9 a	53.8 a	$649
Vault HP	60.3 a	55.9 a	38.4 a	56.0 c	57.2 a	53.6 a	$647
$LSD_{0.10}$	3.6	3.7	6.8	0.9	5.2	1.6	

Soybean price = $12.15 per bushel
TagTeam LCO price = $4.84 per acre
Vault HP price = $ 4.10 per acre

Results: The three treatments were not statistically different at four of the five locations. At one location, both inoculant products reduced yield compared to the untreated control. The reason for this negative response is not clear. Across all five locations, no yield differences were observed. The contrary results of this study compared to previous studies suggest more research is needed on the topic.

We want to thank Novozymes BioAg Inc. and BASF for providing product and Tom Van Wagner for coordinating the trials.

2013 Seed Inoculant Trial Locations



N-Hibit® plus Vault® HP Seed Treatment Trial

Purpose: There are many seed treatments available to soybean producers. The purpose of the trial was to evaluate the effect of two seed treatments N-Hibit (harpin protein) and Vault HP (Rhizobium inoculant) on soybean yields.

Procedure: Seed from the same seed lot was treated with two different seed treatment packages (Acceleron® vs. Acceleron plus N-Hibit and Vault HP) for the trial. The two treatments were replicated four times and compared in a randomized complete block experimental design.

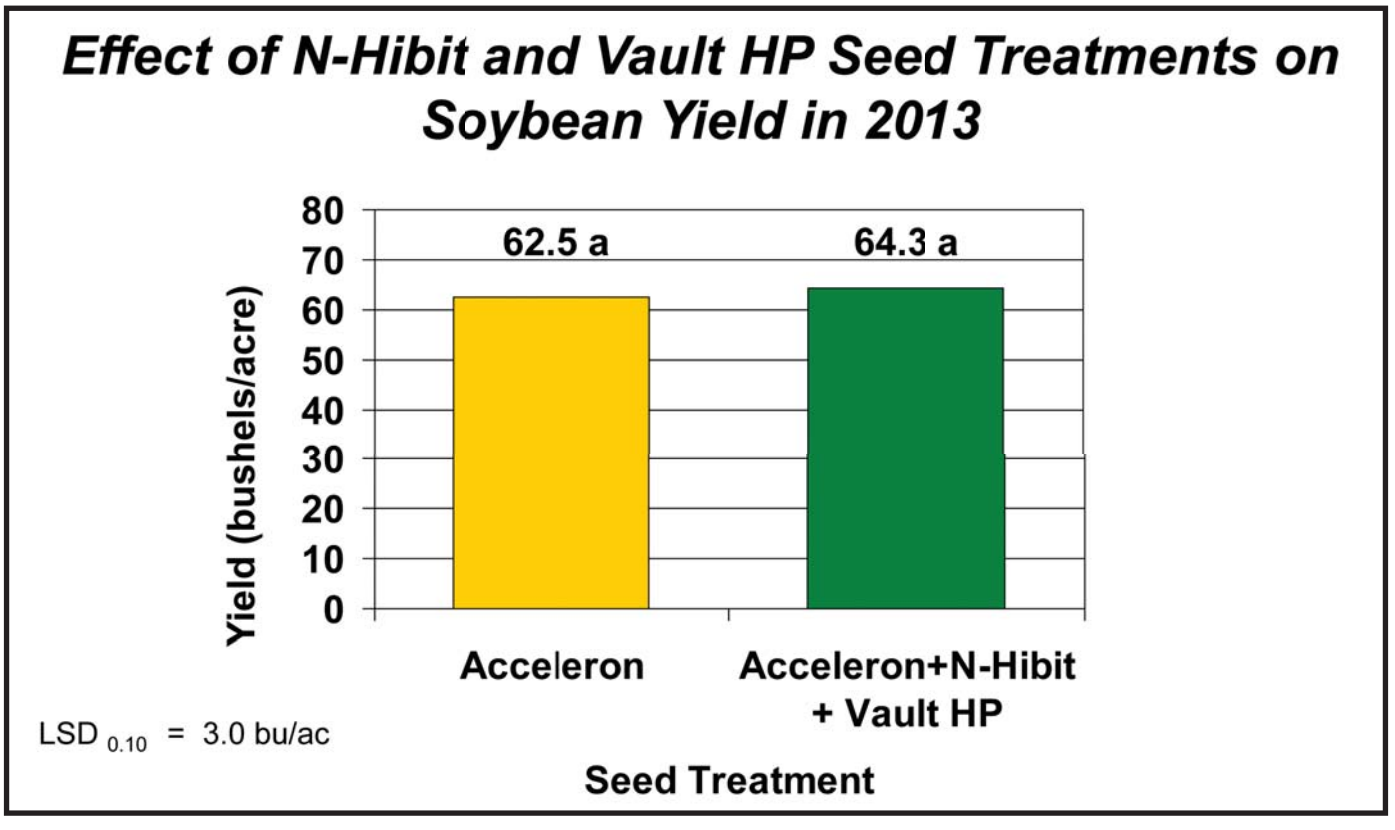
Table 1. The effect of N-Hibit plus Vault HP seed treatments on soybean yield and income in 2013

Treatment	Yield (bu/ac)	Income ($/ac)
Acceleron	62.5 a	$760
Acceleron + N-Hibit + Vault Hp	64.3 a	$773
$LSD_{0.10}$	3.0	

Soybean price = $12.15 per bushel
N-Hibit cost = $3.78 per acre
Vault HP cost = $4.10 per acre

N-Hibit Plus Vault HP Trial Location

Results: While the N-Hibit plus Vault HP seed treatment produced a numerically greater soybean yield at this site in 2013, the yield increase was not statistically significant.



2013 CruiserMaxx® vs. CruiserMaxx® Plus Vibrance™ Trial

Purpose: There is a concern that planting sugar beets after soybeans increases the potential for yield reductions due to the soil-borne plant pathogen Rhizoctonia. The purpose of the trial was to evaluate the performance of a seed treatment, CruiserMaxx plus Vibrance on soybean yields in 2013. CruiserMaxx plus Vibrance contains an active ingredient effective on Rhizoctonia (sedaxane).

Procedure: Seed from the same seed lot was treated with two different seed treatments (CruiserMaxx and CruiserMaxx plus Vibrance) for the trial. The two treatments were replicated four times and compared in a randomized complete block experimental design.

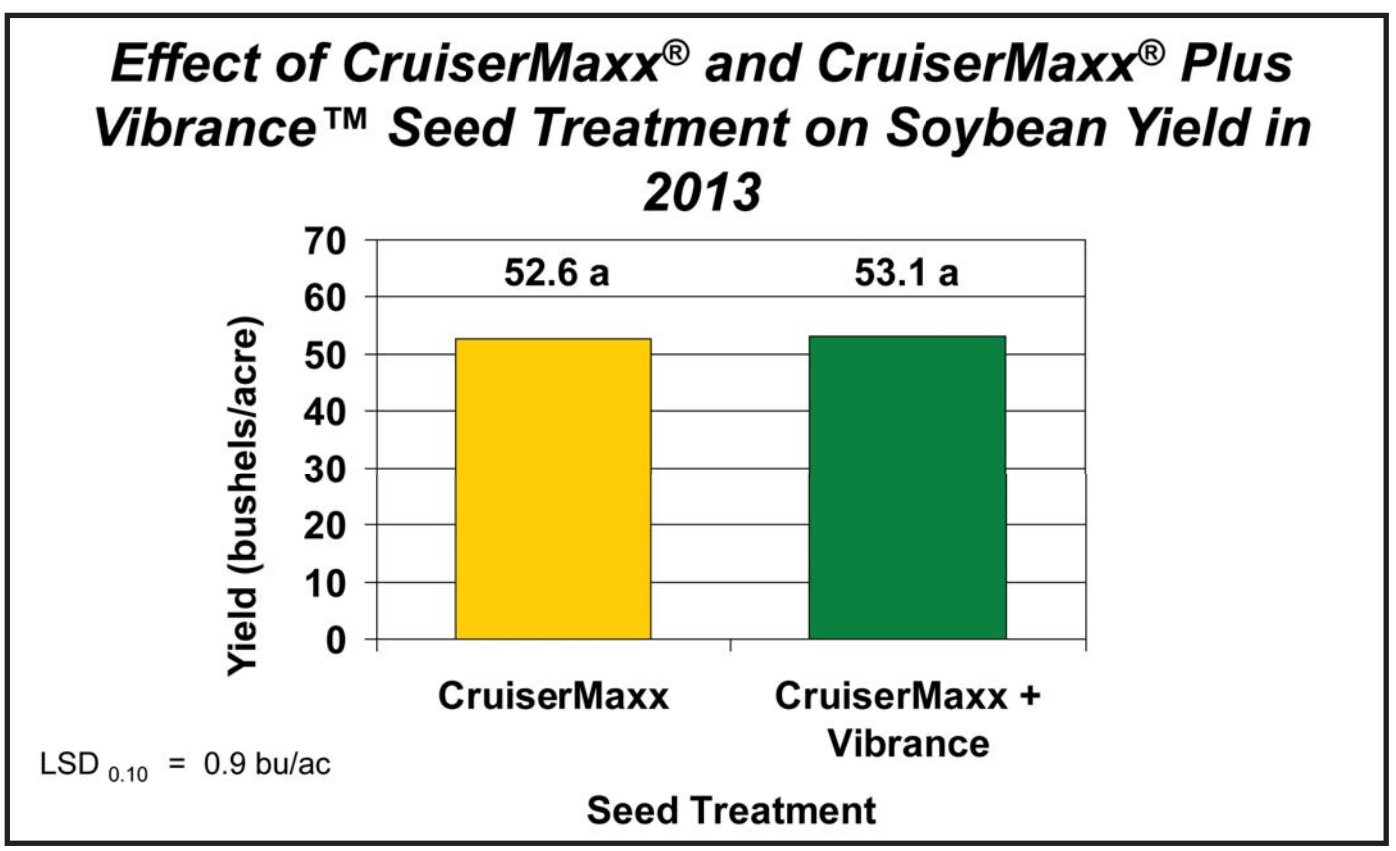
CruiserMaxx® vs. CruiserMaxx® Plus Vibrance™ Trial Location

Table 1. The effect of CruiserMaxx® plus Vibrance™ Advanced and CruiserMaxx® on soybean plant population, yield and income in 2013

Treatment	Plant Population (plants/ac)	Yield (bu/ac)	Income ($/ac)
CruiserMaxx®	128,200 a	52.6 a	$628
CruiserMaxx® plus Vibrance™	120,500 a	53.1 a	$633
$LSD_{0.10}$	9,100	0.9	

Soybean price = $12.15 per bushel
CruiserMaxx® cost= $11.50 per acre
CruiserMaxx® plus Vibrance™ price = $12.50 per acre

Results: The CruiserMaxx plus Vibrance seed treatment did not produce statistically higher yields than the CruiserMaxx seed treatment at one location in 2013. Further research is needed to determine if the use of CruiserMaxx plus Vibrance will increase soybean yields and reduce Rhizoctonia pressure in sugar beets following soybeans. The CruiserMaxx plus Vibrance did not improve the plant stands at harvest when compared to the CruiserMaxx.



2013 Planting System Trials

Purpose: Soybean producers want to identify the optimum planting system for maximizing yields and profitability. The purpose of these trials was to evaluate the effect of different planting systems (planters, drills and row spacing) on soybean yields in 2013.

Procedure: Five trials comparing different planting systems were conducted in 2013. The planting systems compared at each location are listed below:

Hillsdale	John Deere 1690 air drill (15 inch rows) vs. John Deere 1770 planter (30 inch rows). The target population was 150,000 seeds per acre for both systems.
Gratiot	John Deere 750 drill (15 inch rows) planted at 150,000 seeds per acre vs. John Deere 1770 planter (30 inch rows) planted at 135,000 seeds per acre.
Washtenaw	John Deere 1590 drill (15 inch rows) vs. John Deere 1780 planter (15 inch rows). The target population was 160,000 seeds per acre for both systems.
Allegan	A John Deere 750 drill at three different row spacing configurations (7.5 inch twin rows vs. 7.5 inch single rows vs. 15 inch rows).
St. Joseph	John Deere 1720 planter (30 inch rows vs. 7 inch twin rows). The target population (132,000 seeds per acre) was the same for both systems. To achieve the 7 inch twin rows, the planting population was cut in half and the planter was driven through the field a second time 7 inches to the side of the first planter pass.

Results: When two locations in Hillsdale County were combined and analyzed, the 1770 planter on 30 inch rows produced a statistically higher yield than the 1690 air drill on 15 inch rows in 2013 (table 1). A similar comparison conducted in 2012 with the same equipment showed that the two planting systems produced the same yield. In the Gratiot County trial, the John Deere 750 drill on 15 inch rows produced five bushels per acre more than the John Deere 1770 planter on 30 inch rows and increased farm income by $56 per acre (table 2). At the Washtenaw County trial, the two planting systems (John Deere 1590 drill on 15 inch rows and the John Deere 1780 planter on 15 inch rows) produced similar yields (table 3). At the Allegan County trial, the 7.5 inch rows produced three bushels per acre more than the twin rows or the 15 inch rows and generated $40 more income per acre (table 4). At the St. Joseph County trial, the twin rows and the 30 inch rows were not statistically different (table 5). The income generated by the twin rows was reduced by the added expense of making a second pass with the planter.

We want to thank Dan Rossman, Dan Rajzer and Ned Birkey for coordinating these trials.

2013 Planting System Trial Locations

2013 Planting System Trials

Table 1. Planting system (JD 1690 air drill vs JD 1770 planter) effect on soybean population, yield and income Hillsdale County in 2013

Treatment	Planting Population	Harvest Population	Hillsdale 1	Hillsdale 2	Average	Income
	--------- (plants/ac) --------		---------- Yield (bu/ac) ----------			($/ac)
John Deere 1690 air drill (15 inch rows)	150,000	114,400 a	48.7 b	42.8 a	45.7 b	$555
John Deere 1770 Planter (30 inch rows)	150,000	106,100 b	51.2 a	43.1 a	47.2 a	$573
$LSD_{0.10}$		7,800	1.7	3.4	1.4	

Soybean price = $12.15 per bushel

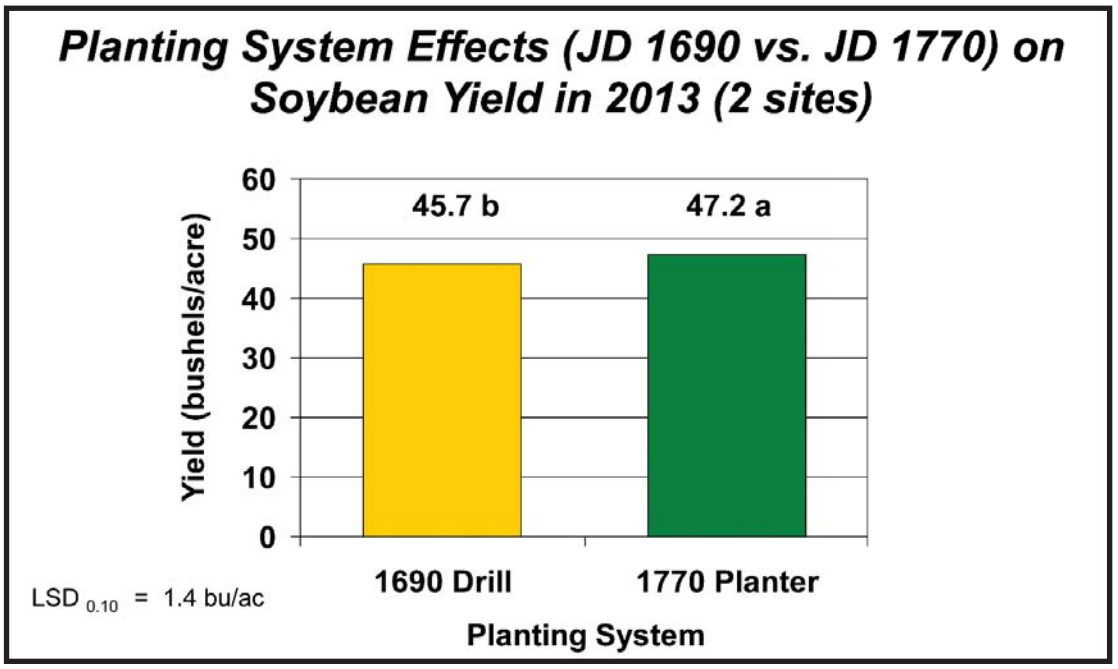
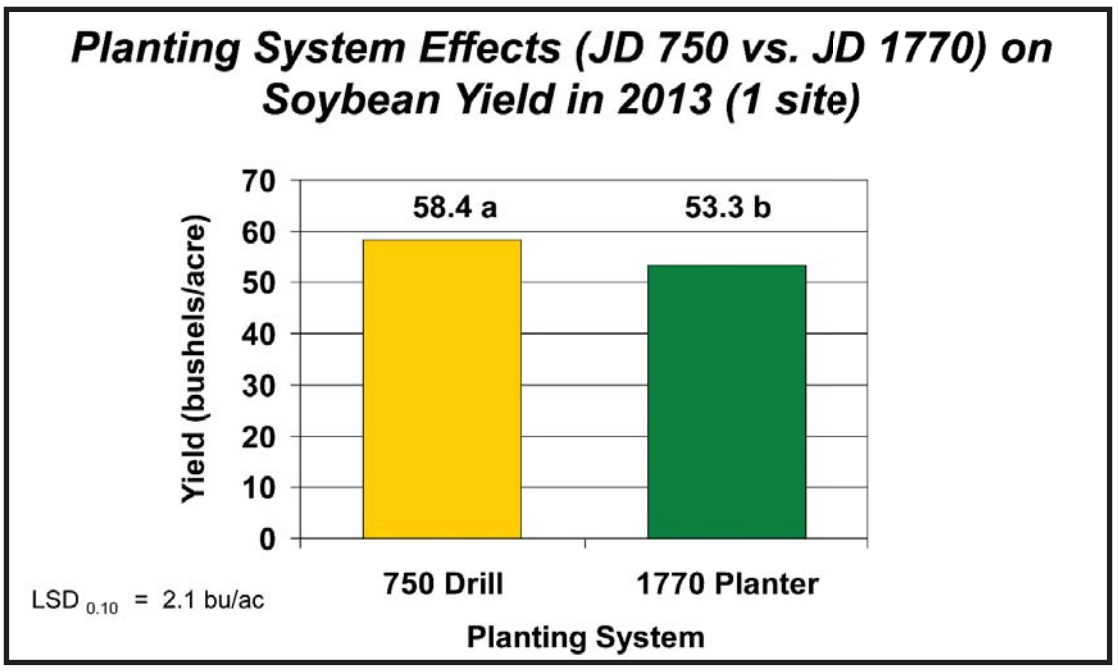


Table 2. Planting system (JD 750 Drill vs JD 1770 planter) effect on soybean yield and income in Gratiot County in 2013

Treatment	Planting Population (plants/ac)	Yield (bu/ac)	Income ($/ac)
John Deere 750 (15 inch rows)	150,000	58.4 a	$650
John Deere 1770 Planter (30 inch rows)	135,000	53.3 b	$594
$LSD_{0.10}$		2.1	

Soybean price = $12.15 per bushel
Soybean seed price = $55 per 140,000 seeds



2013 Planting System Trials

Table 3. Planting system (John Deere 1590 drill vs John Deere 1780 planter) effect on soybean population, yield and income in Washtenaw County in 2013

Treatment	Target Population	Final Population	Yield	Income
	---------- (plants/ac) ----------		(bu/ac)	($/ac)
John Deere 1590 drill (15" rows)	160,000	102,900 b	67.7 a	$823
John Deere 1780 planter (15" rows)	160,000	142,700 a	68.5 a	$832
$LSD_{0.10}$		35,600	3.4	

Soybean price = $12.15 per bushel

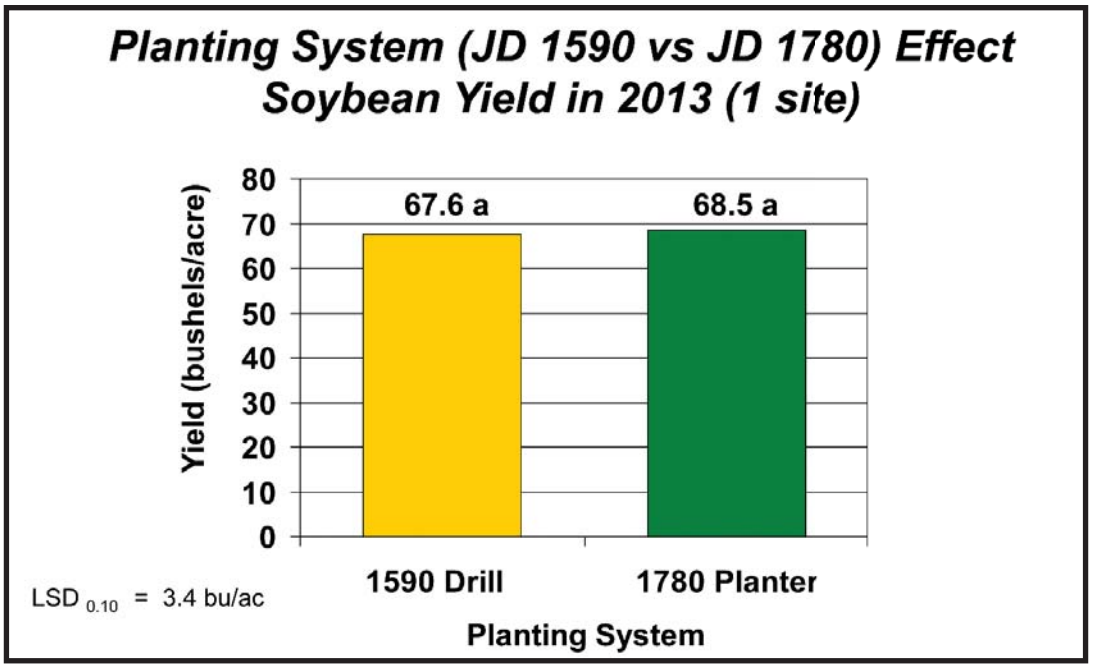
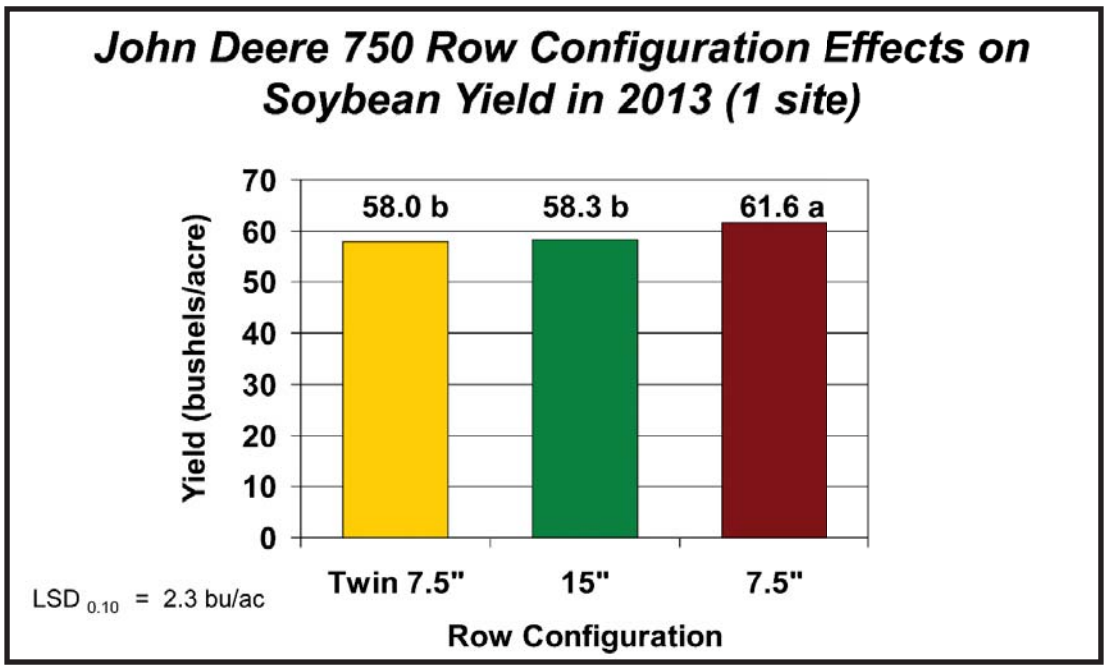


Table 4. The effect of John Deere 750 row configuration on soybean yield and income in Allegan County in 2013

Treatment	Planting Population	Harvest Population	Yield	Income
	---------- (plants/ac) ----------		(bu/ac)	($/ac)
John Deere 750 (twin 7.5 inch rows)	160,000	122,300	58.0 b	$705
John Deere 750 (15 inch rows)	160,000	135,000	58.3 b	$708
John Deere 750 (7.5 inch rows)	160,000	132,400	61.6 a	$748
$LSD_{0.10}$			2.3	

Soybean price = $12.15 per bushel
Soybean seed price = $55 per 140,000 seeds

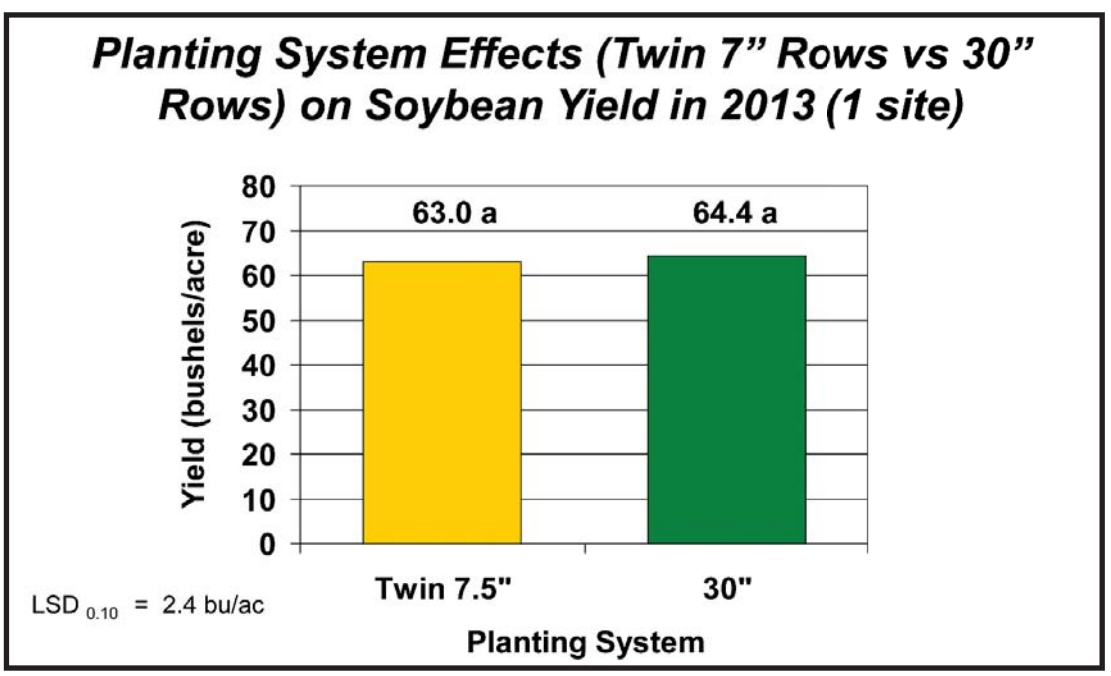


2013 Planting System Trials

Table 5. The effect of twin 7 inch rows and 30 inch rows on soybean yield and income in St. Joseph County in 2013

Treatment	Planting Population (plants/ac)	Yield (bu/ac)	Income ($/ac)
John Deere 1720 planter (twin 7 inch rows)	132,000	63.0 a	$749
John Deere 1720 Planter (30 inch rows)	132,000	64.4 a	$782
$LSD_{0.10}$		2.4	

Soybean price = $12.15 per bushel
Soybean seed price = $55 per 140,000 seeds
Planting cost = $16.22 per acre



2013 ProAct™ (Harpin protein) Trial

Purpose: ProAct, a commercially available foliar product containing the Harpin protein, has been advertised as increasing soybean resistance to stress and soybean cyst nematodes. ProAct was applied with Stratego YLD in two SMaRT trials in 2012 and did not increase soybean yields at either site. The purpose of this trial was to evaluate the effect of a single foliar application of ProAct on soybean yields in 2013.

Procedure: A single foliar application of ProAct was compared to an untreated control at six locations in 2013. The ProAct was applied at one ounce per acre prior to the R1 growth stage. Three of the locations (Berrien 1, Monroe and Van Buren) were infested with soybean cyst nematodes. All of the sprayers were setup and operated to optimize leaf coverage. The sprayers were also driven through the untreated control treatments to eliminate tire tracks from being a confounding factor.

2013 ProAct Harpin Protein Trial Locations

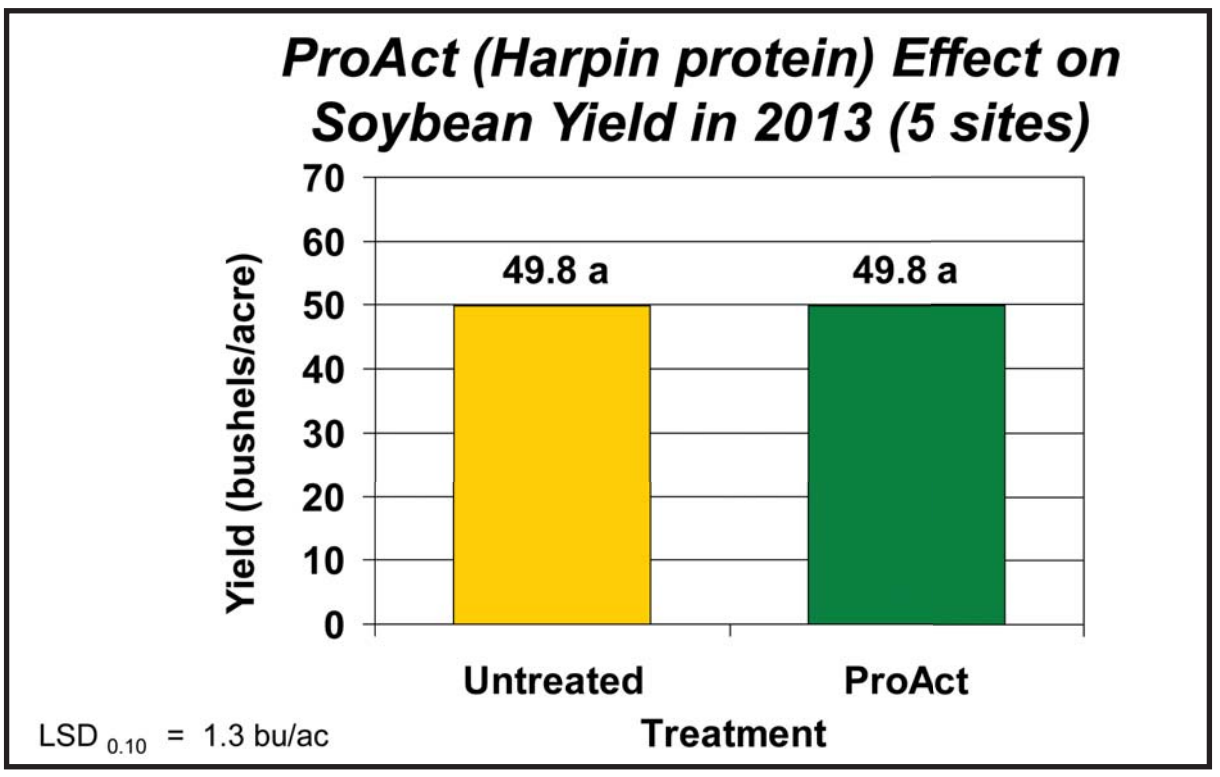
Table 1. The effect of a single application of ProAct (Harpin protein) on soybean yield and income in 2013

Treatment	Berrien 1	Allegan	Monroe	Van Buren	Berrien 2	Average	Average
	Yield (bu/ac)						Income ($/ac)
Control	75.2 a	57.4 a	46.9 a	23.4 a	48.5 a	49.8 a	$605
ProAct	75.2 a	57.0 a	48.1 a	22.4 a	48.9 a	49.8 a	$585
$LSD_{0.10}$	3.2	2.9	5.1	1.6	5.4	1.3	

Soybean price = $12.15 per bushel
ProAct cost = $12.56 per acre
Application cost = $7.50 per acre

Results: A single foliar application of ProAct did not increase soybean yields when compared to an untreated control at any of the five locations in 2013 or when all five locations were combined and analyzed. Because the yields of the untreated control and the ProAct treatments were essentially equal, net income for the ProAct treatment was reduced by about $20.00 per acre (product and application costs).

We want to thank Mitch Ray and Direct Enterprises for providing some of the ProAct and Dan Rajzer, and Ned Birkey for coordinating these trials.



2012 and 2013 Ratchet™ Foliar Growth Promoter Trial

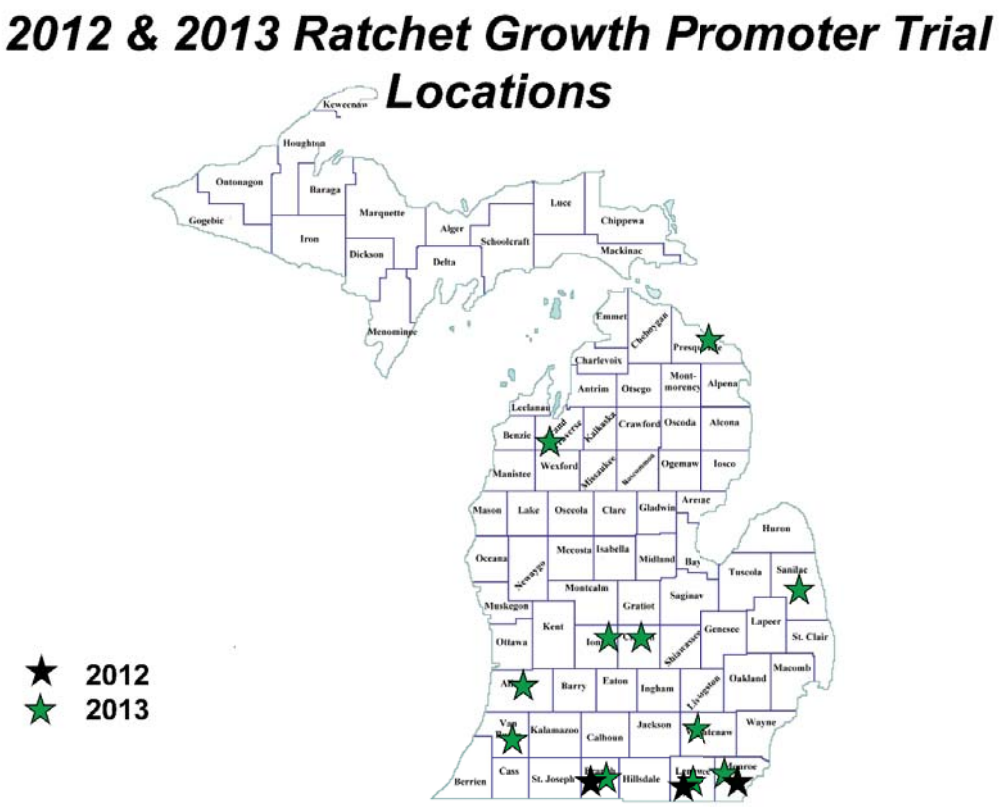
Purpose: Ratchet, a commercially available foliar growth promoter marketed by Novozymes BioAg Inc., has been advertised as enhancing soybean growth and yield. Ratchet produced mixed results in the 2012 SMaRT trials. The purpose of this trial was to evaluate the effect of a single application of Ratchet on soybean yield in 2013.

Procedure: A single application of Ratchet was compared to an untreated control at three locations in 2012 and 11 locations in 2013. The treatments were replicated four times in a randomized complete block experimental design at each location. The Ratchet was applied at 4 ozs. per acre between the V4 and R1 growth stages. The sprayers were driven through the untreated control treatments to ensure that tire tracks were not a confounding factor.

Table 1. The effect of a single foliar application of Ratchet on soybean yield and income in 2013

Location	Untreated Control	Ratchet	LSD $_{0.10}$
	---------- Yield (bu/ac) ----------		
Grand Traverse	46.3 a	44.8 a	3.0
Ionia	46.8 a	46.7 a	0.8
Allegan	57.4 a	56.4 a	1.5
Clinton	53.4 a	53.2 a	1.4
Branch	67.9 a	63.7 a	5.9
Lenawee	54.9 a	55.4 a	7.0
Van Buren	57.9 a	58.0 a	2.6
Monroe	65.2 a	64.7 a	2.2
Presque Isle	34.6 a	35.6 a	2.9
Sanilac	51.7 a	51.3 a	3.4
Washtenaw	50.1 a	53.0 a	5.9
Average	**53.5 a**	**53.2 a**	**0.8**
	---------- Income ($/ac) ----------		
Average Income	**$650**	**$635**	

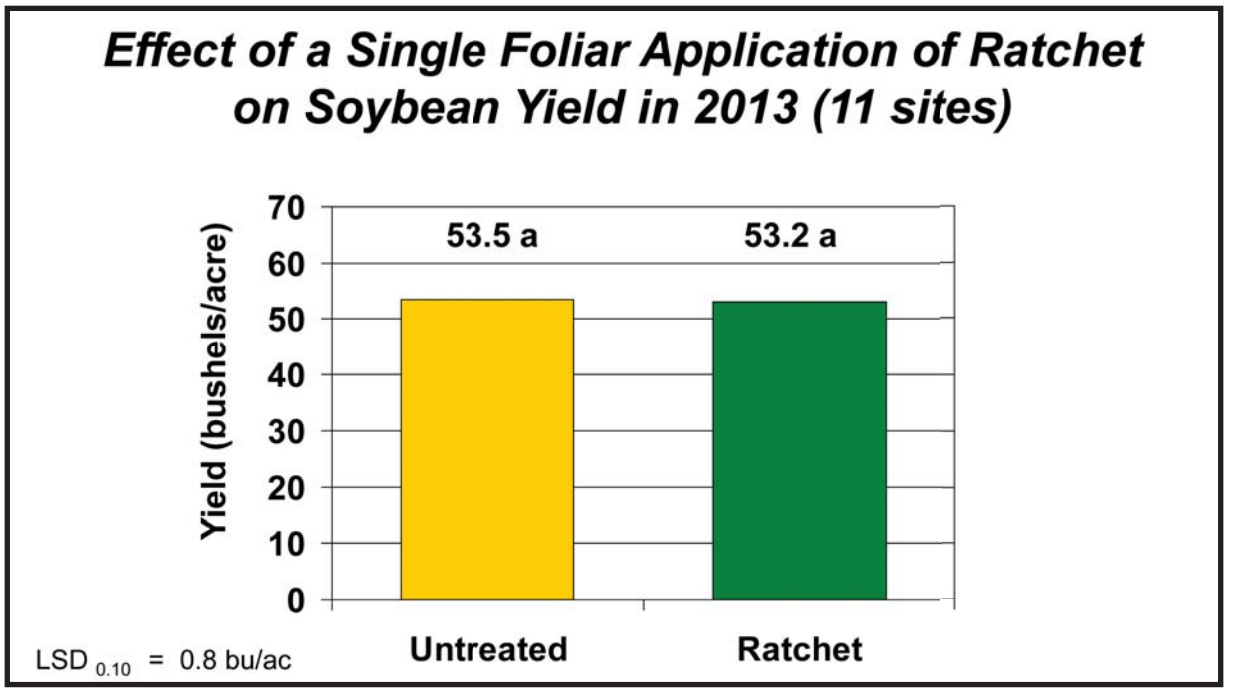
Soybean price = $12.15 per bushel
Ratchet cost = $4.10 per acre
Application cost = $7.50 per acre

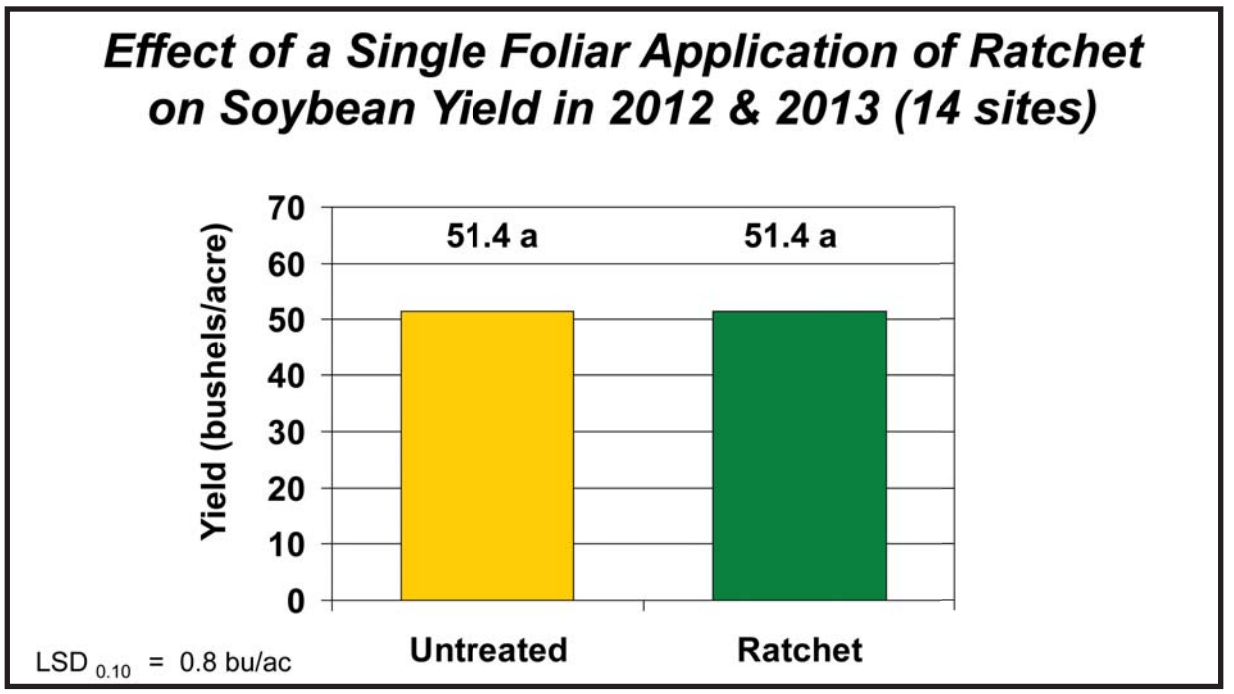


Results: The Ratchet foliar growth promoter treatment did not produce higher soybean yields than the untreated control at any of the individual locations in 2013. When all 11 of the 2013 locations were combined and analyzed, the yields produced by the Ratchet and the untreated control were essentially equal. This was also true when all 14 trials conducted in 2012 and 2013 were combined and analyzed. Because the yields of the Ratchet and the untreated treatments were essentially equal, net income for the Ratchet treatment was reduced by about $12.00 per acre (product and application costs) at these locations in 2013.

We want to thank Lanny Youngson and Novozymes BioAg Inc. for providing the product and Dan Rajzer and Ned Birkey for coordinating these trials.

2012 and 2013 Ratchet™ Foliar Growth Promoter Trial





2013 Bio-Forge® Trial

Purpose: Bio-Forge is advertised as a stress-reducing and yield-promoting product that can be applied in-furrow, on the seed, side dress or as a foliar application. The foliar application increased soybean yields by 1.8 bushels per acre when compared to the seed treatment in two SMaRT trials conducted in 2012. The purpose of this trial was to evaluate the effect of a single foliar application of Bio-Forge on soybean yield in 2013.

Procedure: StollerUSA recommends two applications of Bio-Forge to soybeans. The first application can be either applied to the seed or applied in-furrow. The second is a foliar application applied before R1. Because our 2012 SMaRT trial results showed that the foliar treatment produced higher yields than the seed treatment, a single foliar application of Bio-Forge was compared to an untreated control in 2013. Both treatments were replicated four times in a randomized complete block experimental design at seven locations in 2013. The Bio-Forge was applied at 16 ozs. per acre at or before the R1 growth stage at all locations. Sprayers were equipped and operated to maximize droplet deposition and leaf coverage. All sprayers were driven through the untreated control treatment to eliminate tire tracks from being a factor.

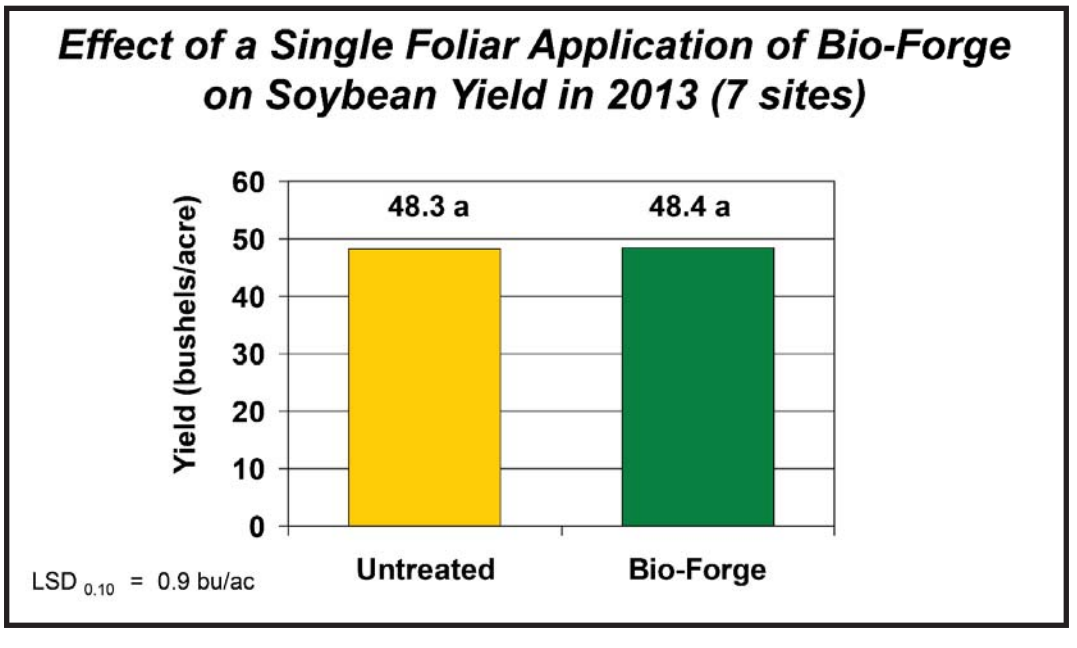
Table 1. BioForge effect on soybean yield and income in 2013

Treatment	Van Buren	Cass	Calhoun	Monroe 1	Berrien	Monroe 2	Presque Isle	Average	Average Income
	Yield (bushels per acre)								($/ac)
Control	50.4 a	24.8 a	52.4 a	61.8 a	48.5 a	65.2 a	34.6 a	48.3 a	$587
BioForge	50.2 a	26.6 a	51.4 a	64.4 a	46.9 a	65.7 a	34.9 a	48.4 a	$567
$LSD_{0.10}$	1.5	3.0	1.9	8.8	6.8	1.6	1.3	0.9	

Soybean price = $12.15 per bushel
BioForge cost = $13.75 per acre
Application cost = $7.50 per acre

Results: Soybean yields between the Bio-Forge and untreated control treatments were not significantly different at any of the seven locations. When all seven locations were combined and analyzed, the yields produced by the two treatments were essentially the same. Because of this, the Bio-Forge treatment reduced income by about $20.00 acre (product plus application costs) at these locations in 2013.

We want to express our appreciation to StollerUSA for providing Bio-Forge and to Dan Rajzer and Ned Birkey for coordinating the trials.



SumaGroulx with SumaGrow Inside™ Trial

Purpose: SumaGroulx with SumaGrow Inside is a biological product containing naturally occurring soil microbes and humic acid. The product is advertised as significantly increasing soybean yields and improving soil quality. The purpose of the trial was to evaluate the effect of the product on soybean yields and income in 2013.

Procedure: SumaGroulx with SumaGrow Inside was compared to an untreated control at two locations in 2013. The treatments were replicated four times in a randomized complete block experimental design at each location. The SumaGroulx with SomaGrow Inside treatment was applied preemergence at the Cass County location. The product was applied at the R1 growth stage at the Eaton County location. One gallon of SumaGroulx with SumaGrow Inside was applied per acre at both locations. The product was applied with boom sprayers at both locations.

2013 SumaGroulx Trial Locations

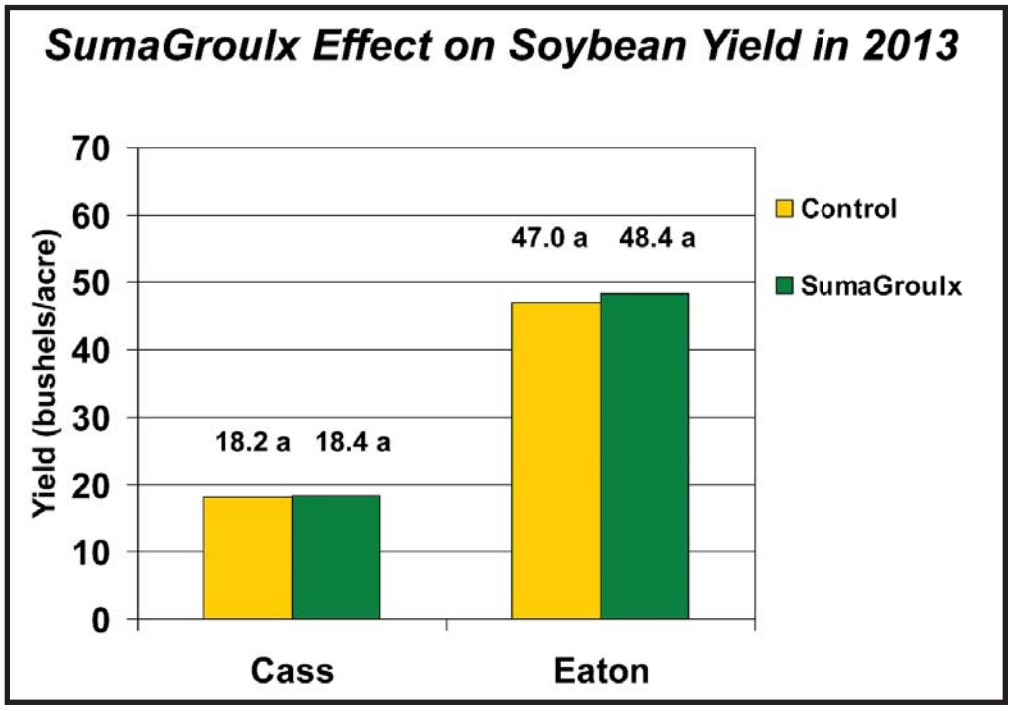
Table 1. The effect of SumaGroulx with SumaGrow Inside™ on soybean yield and income in 2013

Treatment	Cass		Eaton	
	Yield (bu/ac)	Income ($/ac)	Yield (bu/ac)	Income ($/ac)
Untreated Control	18.2 a	$221	47.0 a	$571
SumaGroulx	18.4 a	$171	48.4 a	$536
$LSD_{0.10}$	1.3		5.2	

Soybean price = $12.15 per bushel
SumaGroulx with SumaGrow Inside™ price = $45 per acre
Application cost = $7.50 per acre

Results: Soybean yields produced by the SumaGroulx with SumaGrow Inside treatment and the untreated control treatment were not statistically different at either location. Because of this, the untreated control treatment was more profitable producing $35 to $50 per acre more income than the SumaGroulx with SumaGrow Inside treatment at these sites in 2013.

We would like to Dan Rajzer and George Silva for coordinating these trials.



2013 White Mold Foliar Fungicide Program Trial

Purpose: Sclerotina Stem Rot or white mold can cause significant yield reductions in soybeans grown in Michigan. However, the incidence and severity of the disease vary tremendously by year and location. Three factors determine the incidence and severity of white mold: 1) presence and quantity of disease inoculum; 2) environmental conditions favorable to disease development and 3) a susceptible host. The purpose of this trial was to determine the effect that two white mold fungicide programs would have on soybean yields when the disease was likely to occur.

Procedure: Two white mold fungicide programs were compared to an untreated control at seven locations in 2013. The program recommended by Bayer CropScience consisted of Proline 480 SC applied at R1 followed by Stratego YLD applied at R3. The white mold program recommended by Dupont was Aproach applied at R1 followed by a second application of Aproach at R3. Proline 480Sc was applied at 3 oz. per acre, Stratego YLD was applied at 4 ozs. per acre and Aproach was applied at 9 ozs. per acre per application. The treatments were replicated four times in a randomized complete block experimental design at each location. All sprayers were equipped and operated to optimize spray droplet deposition in the canopy. Sprayers were driven in the control treatments to eliminate tire tracks from being a factor. White mold incidence was determined at all locations by counting 100 consecutive plants and recording the number of diseased plants. All counts were taken from approximately the same location in each treatment. To determine the amount of foreign material (sclerotia) in the harvested beans, representative samples were collected from each treatment and replication at the Sanilac 1 site and taken to a local elevator.

Table 1. White mold fungicide effect on soybean yield and income in 2013

Treatment	Sanilac 1	Allegan	Sanilac 2	Presque Isle	Berrien	Monroe	Average	Average Income
	Yield (bu/acre)							($/ac)
Untreated Control	40.3 c	68.9 b	54.1 b	29.8 a	64.3 a	70.7 a	54.7 c	$665
Proline + Stratego YLD	60.8 a	79.3 a	54.0 b	32.6 a	68.4 a	68.0 a	60.5 a	$690
Aproach + Aproach	51.4 b	77.6 a	55.3 a	32.8 a	63.5 a	65.5 a	57.8 b	$645
$LSD_{0.10}$	5.3	3.4	0.8	4.1	6.4	6.1	2.5	

Soybean price = $12.15 per bushel
Proline followed by Stratego YLD cost = $29.70 per acre
Aproach followed by Aproach cost = $42.00 per acre
Application cost = $7.50 per acre

Eaton County yield data was not available.

Results: All sites had a history of white mold and with favorable environmental conditions, some degree of white mold incidence was found in all trials (table 2). Fungicide applications reduced white mold incidence at three of the seven sites. Soybean yields were increased with fungicide application at three of the six locations having yield data. Yield data from the Eaton County location was not available. When all locations were combined, both fungicide programs reduced disease incidence and increased yield compared to the untreated control. Comparing the two programs, the Proline followed by Stratego YLD program produced a statistically significant yield increase over the sequential Aproach applications.

The Proline followed by Stratego YLD program also had significantly less foreign material (fewer sclerotia) in grain samples collected from the Sanilac 1 location than the Aproach followed by Aproach program and the untreated control.

We want to thank Bayer CropScience and Dupont for providing the foliar fungicides and Dan Rajzer, Ned Birkey, Martin Nagelkirk and James DeDecker for coordinating these trials.

2013 White Mold Foliar Fungicide Trial Locations

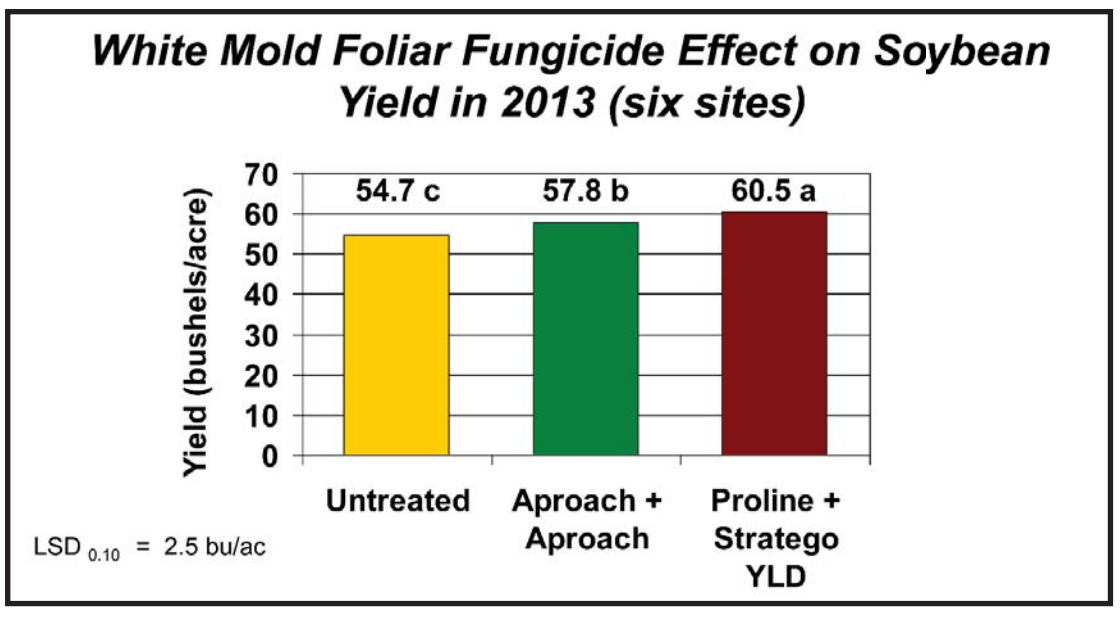
2013 White Mold Foliar Fungicide Program Trial

Table 2. Foliar fungicide effect on white mold incidence in 2013

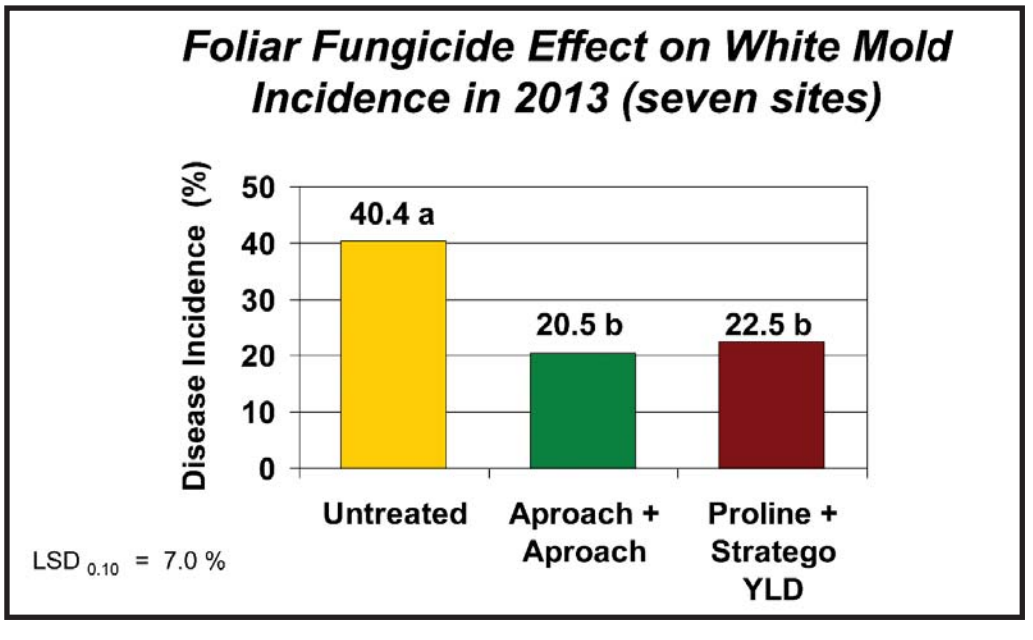
Treatment	Sanilac 1	Allegan	Sanilac 2	Presque Isle	Berrien	Eaton	Monroe	Average
	White Mold Disease Incidence (% affected)							
Untreated Control	79.0 a	66.7 a	2.5 a	4.3 a	40.5 a	39.0 a	50.5 a	40.4 a
Proline + Stratego YLD	26.5 c	39.0 b	6.5 a	0.5 a	21.5 a	34.5 a	29.0 a	22.5 b
Aproach + Aproach	44.5 b	33.0 b	0.7 a	1.8 a	29.5 a	11.5 b	22.5 a	20.5 b
$LSD_{0.1}$	13.8	15.5	7.1	4.0	20.0	14.0	28.3	7.0

Table 3. Foliar fungicide effect on foreign material (sclerotia) in grain samples collected from a trial in Sanilac County in 2013

Treatment	Sanilac 1
	Foreign Material (%)
Untreated Control	4.6 a
Proline + Stratego YLD	2.5 b
Aproach + Aproach	4.5 a
$LSD_{0.1}$	1.0



White mold in soybeans



2012 and 2013 Stratego® YLD Foliar Fungicide Trials

Purpose: Foliar fungicides have been advertized as having plant health benefits and the potential to increase soybean yields in the absence of disease pressure. The purpose of this trial was to evaluate the effect of a single application of Stratego YLD fungicide on soybean yield.

Procedure: A single foliar application of Stratego YLD fungicide was compared to an untreated control at five locations in 2013 and four locations in 2012. The Stratego YLD was applied at a rate of 4 ozs. per acre at the R3 growth stage. All field sprayers were set up and operated to provide optimal leaf coverage. The sprayers were operated in the untreated control treatment to eliminate tire tracks from being a factor.

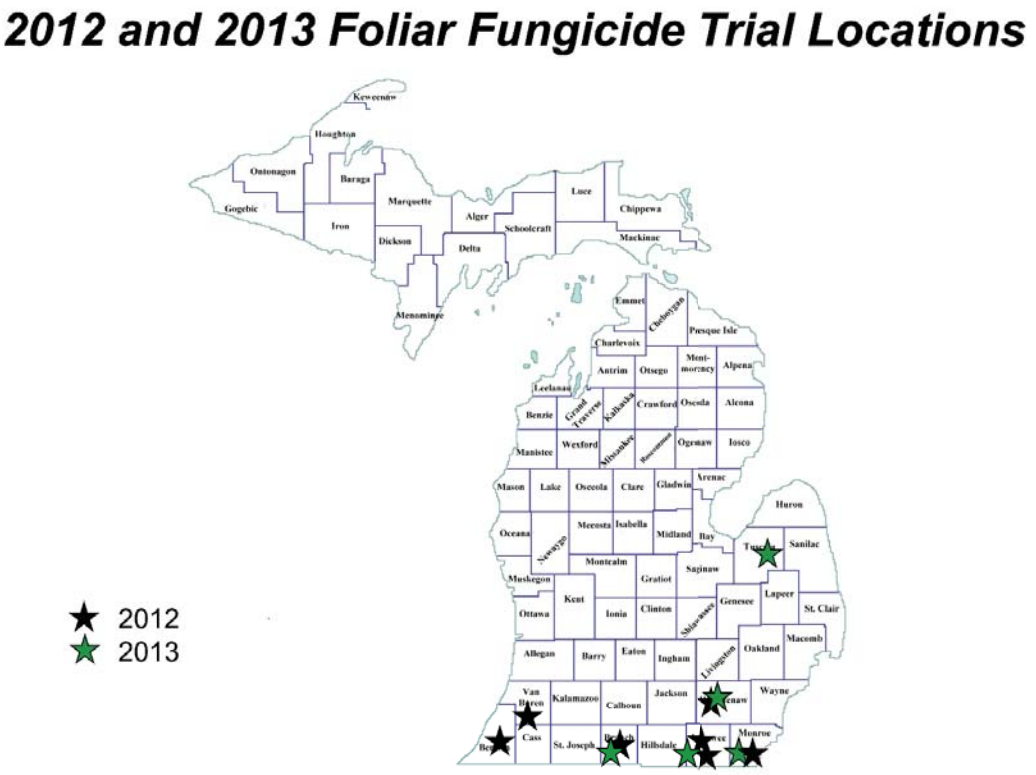


Table 1. Foliar fungicide (Stratego YLD) effect on soybean yield and income in 2013

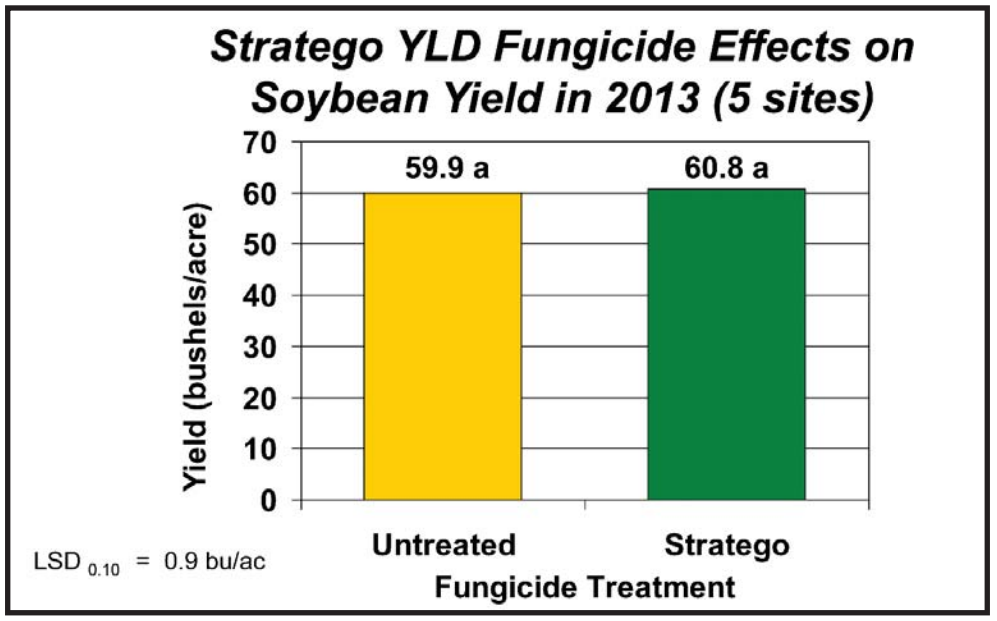
Treatment	Branch	Lenawee	Monroe	Tuscola	Washtenaw	Average	Average Income
	Yield (bu/acre)						($/ac)
Control	66.2 a	68.7 b	59.7 a	50.0 b	55.0 a	59.9 a	$728
Stratego YLD	67.0 a	69.5 a	61.5 a	51.6 a	54.5 a	60.8 a	$716
$LSD_{0.10}$	3.3	0.6	2.3	1.2	4.2	0.9	

Soybean price = $12.15 per bushel
Stratego YLD fungicide cost = $15.62 per acre
Application cost = $7.50 per acre

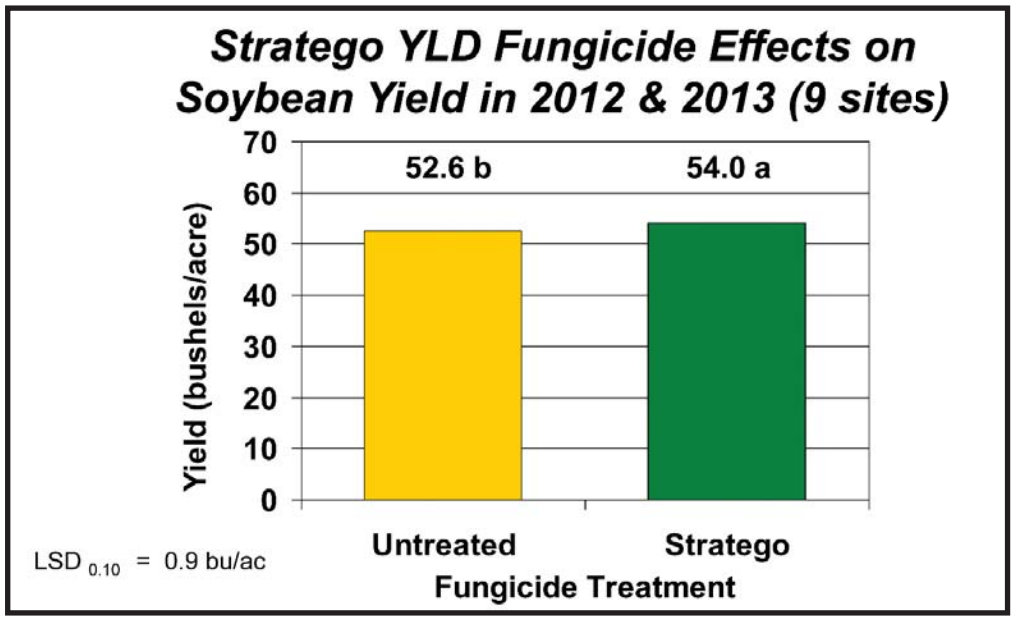
Results: A single application of Stratego YLD fungicide treatment significantly increased soybean yields at two of the five sites when compared to the untreated control in 2013. However, when all of the 2013 sites were combined and analyzed, the Stratego YLD treatment did not produce a significantly different yield than the untreated control. When all nine locations (2012 and 2013) were combined and analyzed, the Stratego YLD treatment produced a statistically significant yield increase of 1.5 bushels per acre. At 1.5 bushels per acre, a single application of Stratego YLD is about a break even proposition. There is also a concern that foliar fungicides can reduce populations of beneficial fungi known to control soybean aphids and two spotted spider mites.

We want to thank Bayer CropScience for providing the fungicides and Dan Rajzer and Ned Birkey for coordinating these trials.

2012 and 2013 Stratego® YLD Foliar Fungicide Trials



Foliar fungicide application



Stratego® YLD Plus Ratchet™ Trial

Purpose: Soybean producers want to identify foliar products that increase soybean yields and prfitability. The purpose of this trial was to evaluate the effect of a single foliar application of Stratego YLD and Ratchet on soybean yield.

Procedure: A single foliar application of a fungicide (Stratego YLD) combined with an LCO growth promoter (Ratchet) was compared to an untreated control at one location in 2013. Each treatment was replicated four times in a randomized complete block experimental design. The Stratego YLD and the Ratchet were applied at 4 ozs. per acre at the R1 growth stage. The sprayer applied 30 gallons of water per acre with a nozzle pressure of 40 psi and the sprayer was driven through the untreated control treatment to eliminate tire tracks from being a factor.

Table 1. The effect of Ratchet plus Stratego YLD on soybean yield and income in 2013

Treatment	Yield (bu/ac)	Income ($/ac)
Untreated Control	65.8 a	$800
Ratchet + Stratego YLD	70.3 a	$826
$LSD_{0.10}$	4.8	

Soybean price = $12.15 per bushel
Ratchet cost = $4.10 per acre
Stratego YLD cost = $15.62 per acre
Application cost = $7.50 per acre

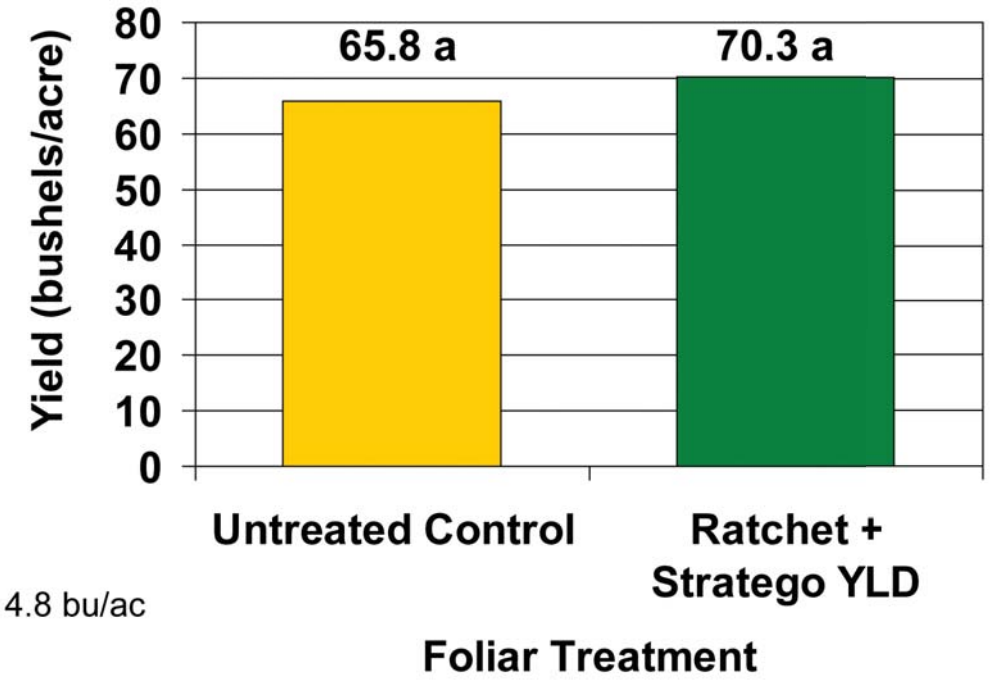
Results: While the Stratego YLD plus Ratchet treatment produced a numerically greater yield than the untreated control, the yield increase was not statistically significant.

We want to thank Bayer CropScience and Novozymes BioAg Inc. for contributing the products and Ned Birkey for coordinating the trial.

Stratego YLD Plus Ratchet Trial Location

Stratego® YLD Plus Ratchet Trial

Effect of a Single Foliar Application of Ratchet Plus Stratego YLD on Soybean Yield in 2013 (1 site)



$LSD_{0.10}$ = 4.8 bu/ac

2013 Combine Speed Trial

Purpose: Maintaining combine groundspeeds around three miles per hour (mph) is recommended for reducing harvest losses. However, some producers will harvest soybeans at five mph. The purpose of this trial was to determine the effect of combine groundspeed on soybean yield.

Procedure: Two combine groundspeeds were compared in this trial (three mph and five mph). The yield monitor on a Case IH 8010 combine equipped with a 40 foot Draper head was calibrated at three mph and at five mph. The optimum threshing and cleaning settings at the two speeds were also identified. The combine operator recorded the yield from the yield monitor for a complete round of the combine at each speed. This procedure was repeated four times to obtain four yields with each groundspeed.

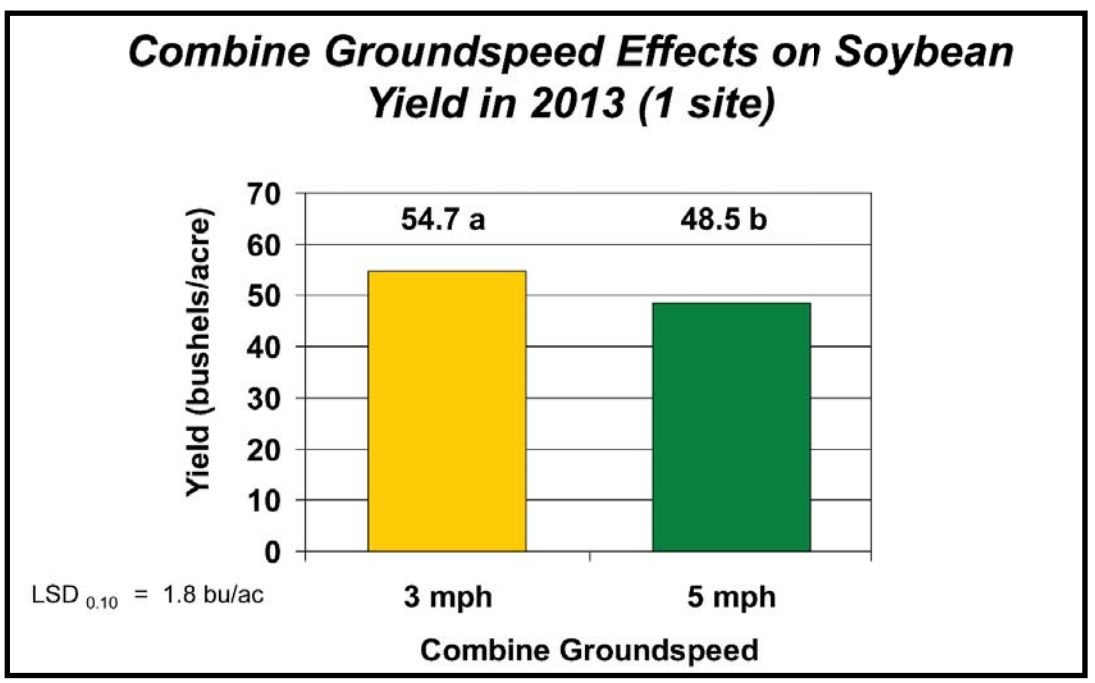
2013 Combine Speed Trial Location

Table 1. The effect of combine groundspeed on soybean yield and income in 2013

Treatment	Yield (bu/ac)	Income ($/ac)
3 Miles Per Hour	54.7 a	$664
5 Miles Per Hour	48.5 a	$589
$LSD_{0.10}$	1.8	

Soybean price = $12.15 per bushel

Results: Combine groundspeed had a statistically significant effect on soybean yield at one location in 2013. The three mph harvest speed increased soybean yields by more than six bushels per acre compared to the five mph harvest speed. Harvest conditions were very good with the moisture content of the beans running around 12 percent. However, the operator noticed that many more beans were flailed out of the pods and hitting the windshield at five mph than at three mph. Selecting the proper groundspeed is essential to maximizing soybean yields.



SMaRT - Soybean Management and Research Technology

The SMaRT program (Soybean Management and Research Technology) provides Michigan soybean producers with a statistically sound method for evaluating the yield and income benefits of new products, equipment and management practices. Producers across Michigan conduct on-farm research trials using a common protocol. The data is collected, subjected to statistical scrutiny, summarized across locations and years and shared with soybean producers. The SMaRT program will adhere to the following guidelines:

- Use an independent third party evaluator (MSU Extension)
- Be producer focused/driven/friendly
- Use similar protocol across the state and all trials
- Perform statistical analysis and interpret the data
- Share group data while keeping individual data confidential

If you are interested in conducting a SMaRT on-farm research project in 2014, please email or mail the following information to Mike Staton (information below)

Name: _____

Address: _____

_____

Phone: _____ Cell phone: _____

Email: _____

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Introduction to Experimental Design, Statistical Analysis and Interpretation

Producers will often evaluate new products or practices by comparing them side by side in two strips or by splitting a field in half. This practice may introduce a tremendous amount of experimental error and may not produce reliable information regarding the performance of the product or practice. The information generated is heavily influenced by factors other than the practice or product being evaluated. Good experimental design followed by careful statistical analysis can eliminate much of the experimental error and help producers determine the actual performance of the new practice, equipment, or product.

Developing and implementing a sound experimental design is the first step to generating meaningful and reliable results from on-farm research trials. One of the most common and effective designs is called the randomized complete block design (RCBD). The RCBD is also one of the easiest to lay out in the field. The RCBD reduces the experimental error by grouping or blocking all of the treatments to be compared within replications. This design improves the likelihood that all the treatments are compared under similar conditions. Blocking the treatments together and replicating the blocks across the field is a simple and effective way to account for variability in the field. Increasing the number of replications generally increases the sensitivity of the statistical analysis by reducing the experimental error. The SMaRT program encourages cooperators to use at least four replications.

Another important aspect of a good experimental design is the concept of randomization. Randomly assigning the order of the treatments within each block is critical to removing bias from treatment averages or means and reducing experimental error. Figure 1 shows the actual RCBD design that was used for the 2011 planting population trials. It demonstrates the principles outlined above. Note how each planting population is included and randomized within the replications.

Figure 1. The randomized complete block design used for all of the 2011 planting population trials.

120	160	180	140	180	120	140	160	120	160	140	180	140	120	180	160
Replication 1				Replication 2				Replication 3				Replication 4			

After the trial is harvested, proven statistical methods are used to determine if the differences in yields are due to the treatments or a result of other outside factors. It is important to look at the Least Significant Difference (LSD 0.10) when you interpret the information contained in the tables and graphs in this publication.

The LSD 0.10 is a calculated figure that producers can use to determine with a confidence level of 90% that the difference between two or more treatments is due to the treatments and not other factors. We are again using an LSD 0.10 for 2013. If the yield of two treatments differs by less than the LSD listed, the difference cannot be statistically attributed to a difference in the treatments.

Letters are used in the tables and graphs in this publication to identify yields or other measurements that are, or are not statistically different. When the same letter appears next to the yield or other measurable condition of two or more treatments, the difference between them is not statistically significant.

The SMaRT program designs and analyzes field research trials enabling Michigan soybean producers to reliably evaluate the performance of new products, equipment and practices on their farms. In many cases, a given trial like the Stratego YLD foliar fungicide trial will be conducted at multiple locations and over multiple years. This greatly improves the reliability of the information produced.

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