SMaRT ON-FARM RESEARCH REPORT

2018

Michigan Soybean Committee, PO Box 287, Frankenmuth, MI 48734

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SMaRT

Soybean Management and Research Technology

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THANK YOU to the farmer 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 a 2019 on-farm research project, contact Mike Staton at (269)673-0370 extension 2562 or staton@msu.edu.

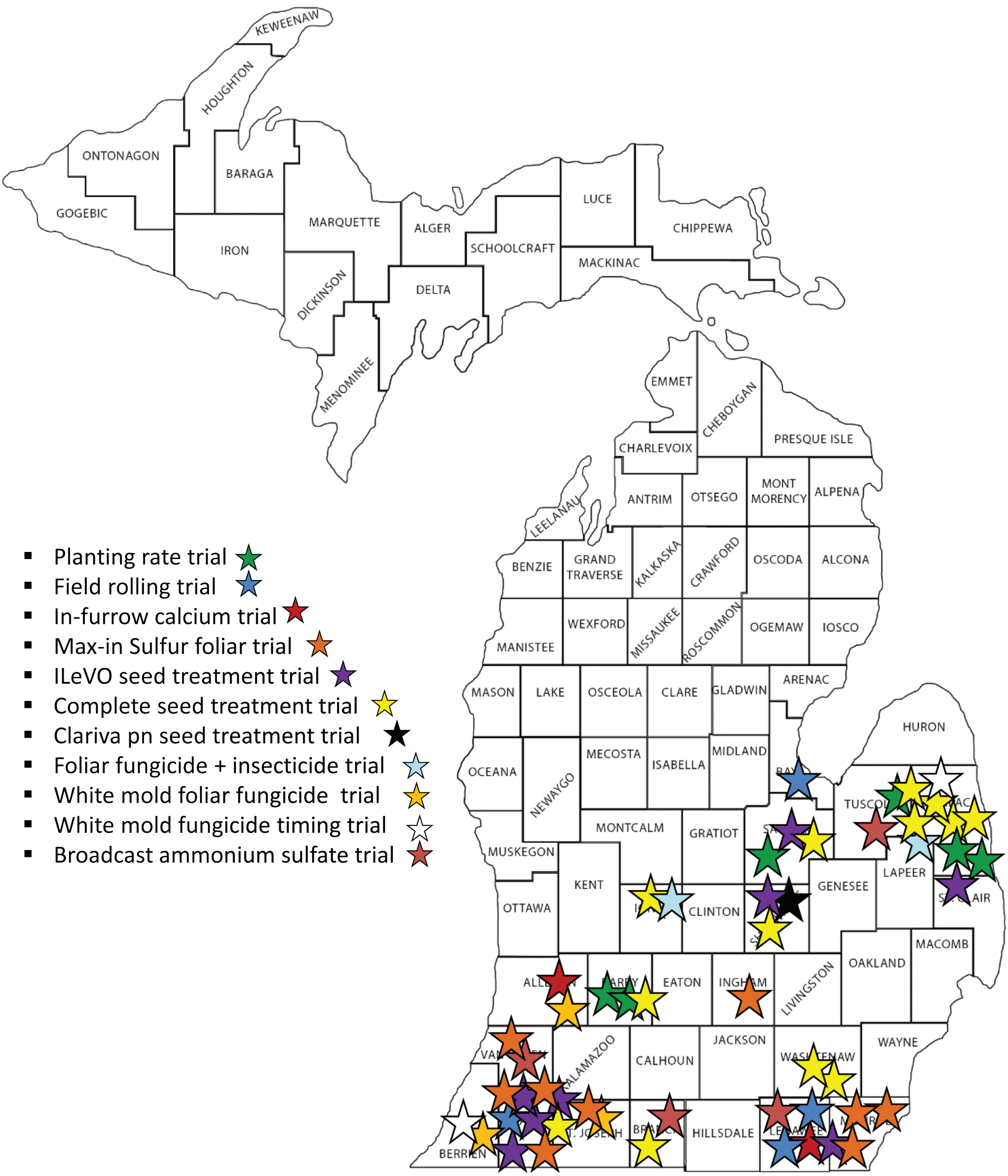
2018 marks the eighth season of the SMaRT on-farm research program, made possible by the checkoff investment of Michigan soybean producers. This year 48 producers around the state conducted on-farm research trials within 11 projects. Contained in this publication you'll find the results from 51 individual trial locations. The research projects were developed with producer input and represent some of the most challenging production issues confronting producers. Most of the projects were conducted at multiple locations and, in some cases across several years, improving the reliability of the results.

Agronomic and economic data is presented for each treatment. Partial budgets and breakeven yields utilized the projected USDA 2018-19 average soybean price of $8.60 per bushel, the manufacturers' suggested retail prices for all product(s) and application costs associated with the treatments.

Conducting these trials would not be possible without strong partnerships. One example is the unique collaboration between Michigan State University Extension (MSUE) and the Michigan Soybean Promotion Committee (MSPC) to jointly fund Mike Staton, MSUE statewide soybean educator and SMaRT project coordinator. This program would also not be possible without the efforts of Ned Birkey in southeast MI and Dan Rajzer in southwest MI with whom MSPC contracts to implement SMaRT trials and who are essential to this project's success. Ty Bodeis, MSPC soybean production specialist, took final plant stand counts, rated ILeVO trials for foliar symptoms of sudden death syndrome and white mold trials for white mold incidence. Ty also collected soil samples for soybean cyst nematode testing and nutrient analysis. We also want to thank the Center for Excellence and MSU Extension educators Martin Nagelkirk and George Silva for their efforts in making this research possible.

Dr. Arnold Saxton, Professor Emeritus, University of Tennessee, provided the SAS statistical procedure used for analyzing the 2018 trial results and provided valuable input regarding experimental design and statistical analysis.

2018 SMaRT Trial Locations



2015 to 2018 Planting Rate Trial

Purpose: The topic of soybean planting rates was the highest ranking area of interest identified by soybean producers for evaluation in the SMaRT trials. The producers were interested in evaluating the effect of reduced planting rates on soybean yields and income. There are two main factors driving the increased interest in reducing soybean planting rates – seed cost and white mold. The purpose of this trial was to evaluate how reducing planting rates would affect soybean yield and income in 2015, 2016, 2017 and 2018.

Procedure: Eleven planting rate trials were conducted each year from 2015 to 2017 and six trials were conducted in 2018. Four target planting rates (80,000, 100,000, 130,000 and 160,000 seeds per acre) were compared at all locations except the Sanilac 3 location in 2015. Stand counts were taken to determine actual final plant stands at each location in all years. Projected market prices and conservative seed costs were used to determine the income (gross income – seed cost) produced by the four planting rates.

Results: The 2015 to 2017 planting rate trials were summarized in detail in the 2017 SMaRT On-Farm Research report available online at www.michigansoybean.org. In 2018, the 160,000 planting rate never produced a higher yield than the 130,000 rate and beat the 100,000 and 80,000 planting rates in only two of the six trials (Table 3). When all of the 2018 locations were combined and analyzed, the four planting rates produced similar yields. Because of this, the lowest two seeding rates were the most profitable and the highest seeding rate was the least profitable.

The Saginaw location was hit with white mold and is an excellent example of how planting rates affect disease pressure, yield and income (Table 4). Figure 1 summarizes the yield and income for all four years of the SMaRT planting rate trials. It is very impressive how consistently well the 130,000 planting rate performed across the 39 trials and four growing seasons. It produced higher yields than the 160,000 rate at four locations and produced a lower yield than the 160,000 rate in only one trial.

Figure 1. Planting rate effects on soybean yield and income in 2015, 2016, 2017 and 2018

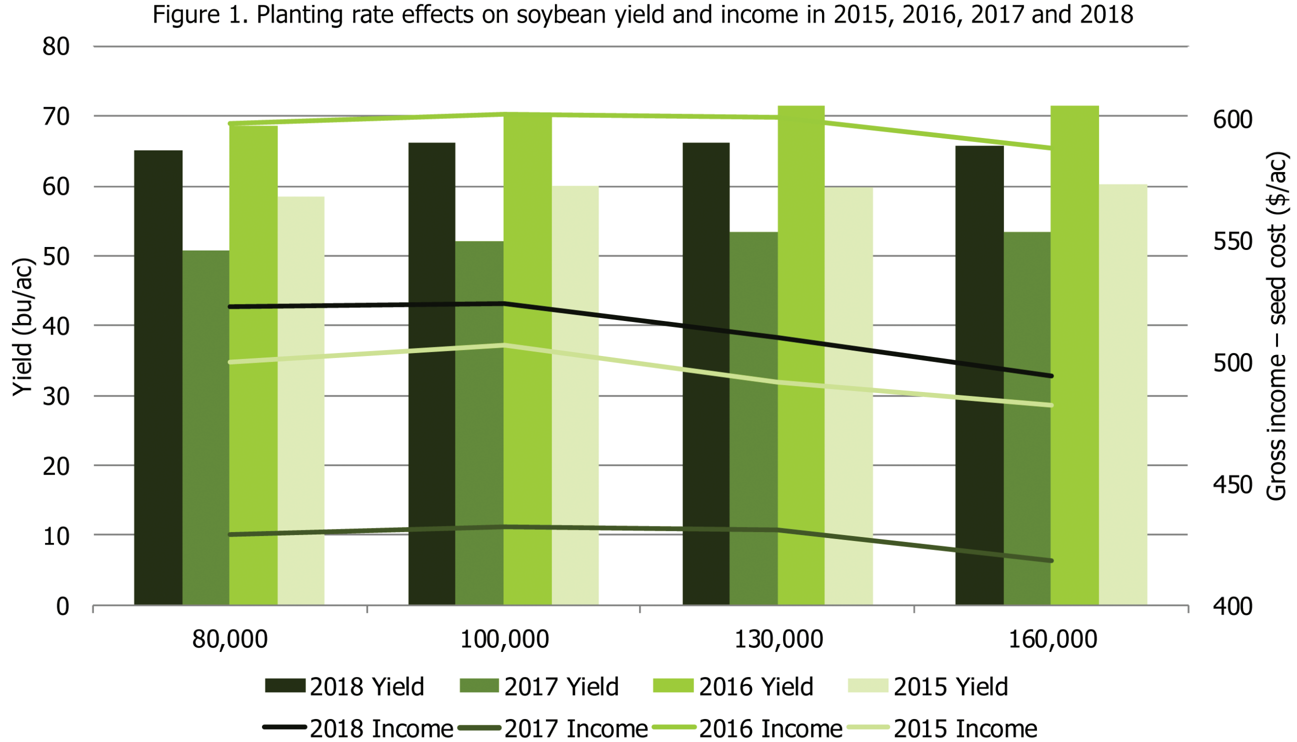


Table 1. Tillage, planting equipment, row spacing, CEC, planting date, planting depth and seed treatment in 2018

Location	Tillage operations (fall/spring)	Planter/drill	Row spacing	CEC	Planting date	Planting depth	Seed treatment
Tuscola	VT/FC	JD 1790	15″	8.2	May 14	1.5″	Pioneer PPST FST/IST
Sanilac 1	NT	Kinze 3500	30″	9.2	May 18	1.0″	Acceleron Basic
Barry 1	NT	JD 1780	30″	6.6	May 8	1.25″	None
Sanilac 2	DR/FC	JD DB44	22″	9.3	May 25	1.0″	Pioneer PPST FST/IST
Barry 2	NT	JD 1780	30″	5.9	May 8	1.25″	None
Saginaw	DR/FC	JD 7200	30″	8.1	June 7	1.5″	Escalate

FC = field cultivator, NT = no-till, VT = vertical tillage and DR = disc ripper

Table 2. Target planting rates and actual plant stands in 2018

	------------------- Target planting rate (seeds/ac) ------------------			
Location	**80,000**	**100,000**	**130,000**	**160,000**
	------------------- Actual plant stands (plants/ac) ------------------			
Tuscola	64,700	71,900	98,900	124,200
Sanilac 1	74,700	87,000	106,000	130,200
Barry 1	62,800	70,700	85,700	97,900
Sanilac 2	54,500	70,000	96,600	121,000
Barry 2	51,500	62,800	74,400	92,300
Saginaw	57,400	72,900	95,100	105,100
Average (all locations)	**60,900**	**72,600**	**92,800**	**111,800**
	----------------------- Average stand loss (%) -----------------------			
	24	27	29	30

Table 3. Effect of four planting rates on soybean yield and income in 2018

	------------------- Target planting rate (seeds/ac) ------------------				
Location	**80,000**	**100,000**	**130,000**	**160,000**	**$LSD_{0.10}$**
	--------------------- Yield (bushels/ac) --------------------				
Tuscola	66.0 b	66.4 b	68.2 a	68.5 a	1.2
Sanilac 1	59.5	64.3	63.0	63.5	3.3
Barry 1	65.3	65.0	63.8	62.5	3.8
Sanilac 2	79.2 bc	77.4 c	83.0 a	81.4 ab	2.5
Barry 2	53.9 b	57.6 a	54.8 ab	57.7 a	3.0
Saginaw	66.2 a	66.5 a	64.3 a	61.2 b	2.4
Average yield	**65.0**	**66.2**	**66.2**	**65.8**	**1.3**
	--------------------- Income ($/ac) --------------------				
Average income	**$523**	**$524**	**$510**	**$494**	

Seed cost = $63 per 140,000 seed unit

Table 4. Soybean planting rate effects on white mold disease incidence, yield and income at the 2018 Saginaw location

Planting rate	Disease incidence (%)	Yield (bu/ac)	Income ($/ac)
80,000	13 c	66.2 a	$533
100,000	26 b	66.5 a	$527
130,000	21 bc	64.3 a	$494
160,000	46 a	61.2 b	$454
$LSD_{0.10}$	11	2.4	

2016-2018 ILeVO® Seed Treatment Trial

Purpose: Soybean producers have identified seed treatments as a high priority for evaluation in SMaRT on-farm research trials. ILeVO was selected because yield losses due to Sudden Death Syndrome (SDS) and Soybean Cyst Nematodes (SCN) are increasing in Michigan. This trial evaluates the effect of ILeVO seed treatment on soybean yields and income in fields having a history of SDS and/or SCN.

Foliar sypmtoms of Sudden Death Syndrome

Procedure: This trial compared two treatments (a seed treatment *without* ILeVO vs. the same seed treatment *with* ILeVO). Seven trials were conducted in 2016, four in 2017 and eight in 2018. The cooperating producers worked closely with their seed dealers to ensure all seed planted in each trial was the same variety and seed lot. The ILeVO was applied at 1.18 oz per 140,000 seeds. Soil samples were collected from the same areas in each treatment after planting and again before harvest to determine the effect ILeVO had on soybean cyst nematode (SCN) population development. The number of SCN eggs and juveniles found in the pre-harvest sample (PF) was divided by those in the post-planting sample (PI) to determine the SCN reproductive index (PF/PI). A lower reproductive index indicates less SCN reproduction.

All of the 2017 and 2018 sites were also scouted for foliar symptoms of SDS in August.

The halo effect caused by ILeVO seed treatments

Results: The occurrence of above-ground symptoms of SDS was minimal at all of the sites in all three years. In 2018, only the St. Clair, Saginaw and St. Joseph sites had any visible SDS symptoms. Despite this, the ILeVO seed treatment increased soybean yields by 5 bushels per acre at two of the seven locations in 2016, by 2.1 bushels per acre at one site in 2017 and by 1.9 bushels per acre at one site in 2018 (Figure 1). When all 19 sites were combined and analyzed, ILeVO increased soybean yields by 1.9 bushels per acre and income by $3.44 per acre.

ILeVO did not significantly reduce SCN population development at any of the trial locations (Table 2).

We want to thank Bayer CropScience for providing and delivering the ILeVO (ILeVO is now a BASF product) and local seed dealers for treating the seed.

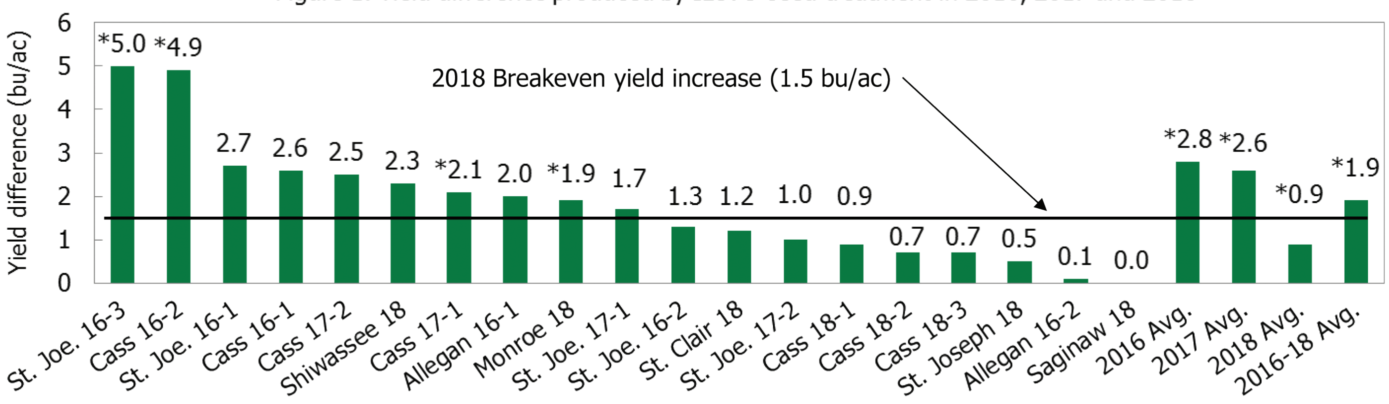
Planting no-till soybeans in Shiawassee County

Table 1. The effect of an ILeVO seed treatment on soybean yield and income in 2018

Location	Untreated control	ILeVO	LSD $_{0.10}$	Yield difference
	------------------- Yield (bu/ac)	------------------		Yield (bu/ac)
Shiawassee 18	36.1	38.4	4.2	2.3
Monroe 18	59.2 b	61.1 a	1.8	1.9
St. Clair 18	58.0	59.2	1.8	1.2
Cass 18-1	53.6	54.5	1.4	0.9
Cass 18-2	40.5	41.2	0.9	0.7
Cass 18-3	42.5	43.2	5.8	0.7
St. Joseph 18	75.9	76.4	0.9	0.5
Saginaw 18	48.5	48.5	3.2	0.0
Average (2018)	**51.8 b**	**52.7 a**	**0.7**	**0.9**
	------------------ Income ($/ac)	----------------		
Average income	**$445**	**$440**		

ILeVO cost = $13 per 140,000 seed unit

Figure 1. Yield difference produced by ILeVO seed treatment in 2016, 2017 and 2018



* The yield difference was statistically significant at these locations

Table 2. ILeVO seed treatment effects on SCN population development in 2018

Location	SCN population after planting (PI)		SCN population before harvest (PF)		SCN reproductive index (PF/PI)	
	Control	ILeVO	Control	ILeVO	Control	ILeVO
	---------------- SCN eggs and juveniles per 100 cm^3 of soil -------------------					
Shiawassee 18	2,085	1,390	10,915	6,810	5	5
Monroe 18	--	--	3,010	4,560	--	--
St. Clair 18	40	1	215	85	5	85
Cass 18-1	1	17	117	344	117	20
Cass 18-2	42	18	2,230	1,601	53	89
Cass 18-3	12	26	17,360	22,210	1,447	854
St. Joseph 18	1	1	60	318	60	318
Saginaw 18	320	1,156	5,496	3,832	17	3

The SCN reproductive index measures SCN reproduction during the growing season (lower numbers = less reproduction).

2014, 2015 and 2018 Clariva® pn Trial

Purpose: Syngenta's Clariva pn (formerly known as Clariva) seed treatment consists of a naturally occurring soil bacteria (*Pasturia nishizawae*) having a unique, direct mode of action on soybean cyst nematodes (SCN). Clariva pn is not a stand-alone seed treatment. Syngenta recommends that Clariva pn be applied with CruiserMaxx®Vibrance® (Clariva® Elite Beans). The purpose of this trial was to evaluate the effect of the *Pasturia nishizawae* contained in Clariva pn on SCN populations and soybean yields in 2014, 2015 and 2018.

SCN cyst on a soybean root

Procedure: Two seed treatments (CruiserMaxx Vibrance *with* Clariva pn and CruiserMaxx Vibrance *without* Clariva pn) were applied to SCN-resistant soybean seed and compared at four locations in 2014, two locations in 2015 and one location in 2018. SCN soil samples were collected from each treatment after planting and again before harvest to determine the effect of the seed treatments on SCN populations. The number of SCN eggs and juveniles found in the pre-harvest sample (PF) was divided by the number of SCN eggs and juveniles in the post-planting sample (PI) to determine the SCN reproductive index (PF/PI) for each seed treatment. A lower reproductive index represents less SCN reproduction.

Seed tender for handling bulk soybean seed

Results: The addition of Clariva pn did not improve soybean yields at any of the seven locations (Table 1). This was not surprising for Sanilac 14 and St. Clair 14 as SCN was not detected at these sites. However, SCN was present at the other five locations. When these were combined and analyzed, the Clariva pn did not affect soybean yields.

The nematode populations are presented in Table 2. The Clariva pn did not significantly suppress SCN population development at any of the four locations having the highest SCN levels.

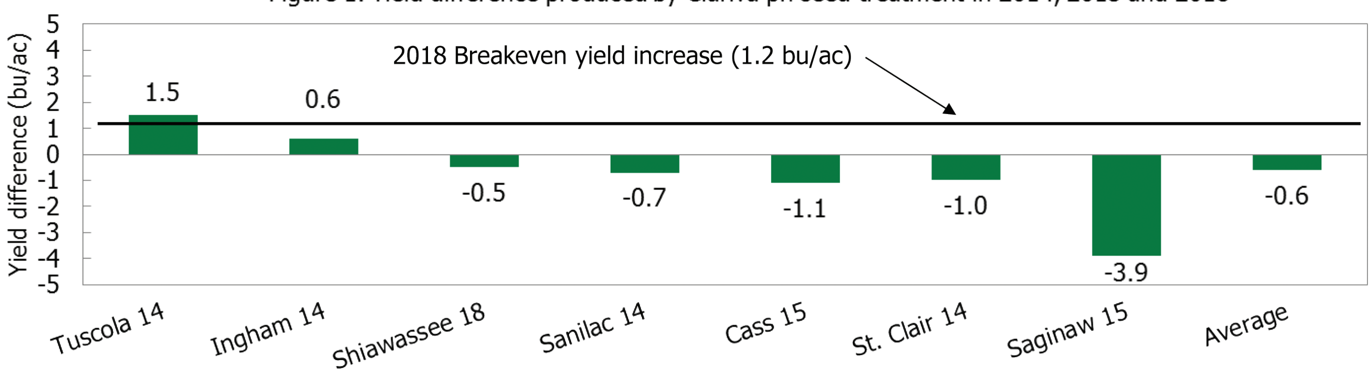
Seed treatments are one of the available tools for managing SCN. However, prevention, crop rotation and resistant varieties are the most effective SCN management practices.

Table 1. The effect of Clariva pn seed treatment on soybean yield and income in 2014, 2015 and 2018

Location	Control	Clariva pn	$LSD_{0.10}$	Yield difference
	------------------- Yield (bu/ac)	-----------------		Yield (bu/ac)
Tuscola 14	51.4	52.9	5.9	1.5
Ingham 14	51.6	52.2	2.1	0.6
Shiawassee 18	33.7	33.2	1.1	-0.5
Sanilac 14	54.8	54.1	2.4	-0.7
Cass 15	36.4	35.4	4.6	-1.1
St. Clair 14	49.5	48.4	5.1	-1.0
Saginaw 15	60.6	56.7	6.5	-3.9
Average **	**46.7**	**46.1**	**1.5**	**-0.6**
	------------------- Income ($/ac)	-----------------		
Average income	**$402**	**$392**		

** Does not include the Sanilac 14 and St. Clair 14 locations as SCN was not detected at these locations
Clariva pn cost = $10 per 140,000 seed unit

Figure 1. Yield difference produced by Clariva pn seed treatment in 2014, 2015 and 2018



The yield difference was not statistically significant at these locations

Table 2. Clariva pn seed treatment effects on SCN population development in 2014, 2015 and 2018

	SCN population after planting (PI)		**SCN population before harvest (PF)**		**SCN reproductive index (PF/PI)**	
	Control	**Clariva pn**	**Control**	**Clariva pn**	**Control**	**Clariva pn**
	---------------- SCN eggs and juveniles per 100 cm^3 of soil -------------------					
Ingham 14	1,310	1,793	4,250	4,880	3.2	2.7
Shiawassee 18	2,085	1,700	10,915	6,810	5.2	4.6
Cass 15	180	224	1,139	1,420	6.3	6.3
Saginaw 15	100	61	1,567	581	15.7	9.5

The SCN reproductive index measures SCN reproduction during the growing season (lower numbers = less reproduction).

2017-2018 Complete Seed Treatment Trial

Purpose: Soybean producers have identified seed treatments as a high priority for evaluation in SMaRT on-farm research trials. The purpose of this trial was to provide an opportunity for cooperators to evaluate the performance of a complete seed treatment (fungicides plus an insecticide) of their choosing on their farms in 2017 and 2018.

Procedure: This trial compared two treatments (a complete seed treatment including multiple fungicides plus an insecticide vs. untreated seed). Eight trials were conducted in 2017 and 13 were conducted in 2018. The cooperating producers worked closely with their seed dealers to ensure all seed planted in each trial was the same variety and came from the same seed lot. We also took final stand counts to determine the effect that seed treatments had on soybean stands.

Results: Complete seed treatments increased soybean yield at two of the eight locations in 2017 and five of the 13 locations in 2018. The yield increases ranged from 1.2 to 2.6 bushels per acre in 2018 (Table 2). When all 21 sites were combined and analyzed, the complete seed treatments increased soybean yields by 1.2 bushels per acre. This is less than the 1.6 bushels per acre required to recoup the cost of a basic fungicide plus insecticide seed treatment costing $14.00 per acre. At three locations a nematicide was added increasing the cost to $25.00 per acre.

The seed treatments led to significantly higher final plant stands at five of the 21 locations (two in 2017 and three in 2018). When all the 2017 and 2018 sites were combined and analyzed, the complete seed treatments increased plant stands by 7,100 plants per acre.

We appreciate the help provided by local seed dealers.

Close up of soybean plants damaged by Phytophthora

Phytophthora root and stem rot damage to soybeans

Table 1. 2018 Seed treatments, varieties, phytophthora genes/tolerance rating, tillage practices and planting dates.

Location	Seed treatment	Variety	Phytophthora gene/tolerance	Tillage fall/spring	Planting date
Sanilac 18-2	Agrishield + Insecticide	Great Lakes GL1675X	1c/8 (9=excellent, 1=poor)	NT	May 23
Cass 18	PPST FST/IST/ILeVO	Pioneer P31T11R	1k/6 (9=excellent, 1=poor)	VT/--	May 7
Saginaw 18	Stine XP-F&I	Stine 20RD20	1c,1k/very good	NT	May 7
Barry 18	PPST FST/IST	Pioneer P25A70R	1k/4 (9=excellent, 1=poor)	NT	May 9
Sanilac 18-3	PPST FST/IST	Pioneer P24A99X	1k/5 (9=excellent, 1=poor)	DR/FC	May 24
Ionia 18	Vibrance Trio	Northrup King S20T6	1c/5 (1=best, 9=worst)	VT/--	May 5
Washtenaw 18-1	PPST FST/IST	Pioneer P28T08R	1k/4 (9=excellent, 1=poor)	VT/--	May 29
Washtenaw 18-2	PPST FST/IST	Pioneer P28T08R	1k/4 (9=excellent, 1=poor)	NT	June 1
Branch 18	PPST FST/IST	Pioneer P32T16R	1k,3a/6 (9=excellent, 1=poor)	NT	April 26
Sanilac 18-5	Equity VIP	DynaGro 24LL98	1k,7 (9=excellent, 1=poor)	--/FC (2x)	May 17
Sanilac 18-4	Dfender	DF Seeds Jackson	1k/1.3 (1= best, 5= worst)	CP/FC	May 25
Shiawassee 18	CruiserMaxx + Vibrance	Golden Harvest 2788X	1c/4 (1=best, 9=worst)	--/CP,SF	June 4
Sanilac 18-1	Dfender	DF 155	1k/1.3 (1= best, 5= worst)	CP/FC	April 30

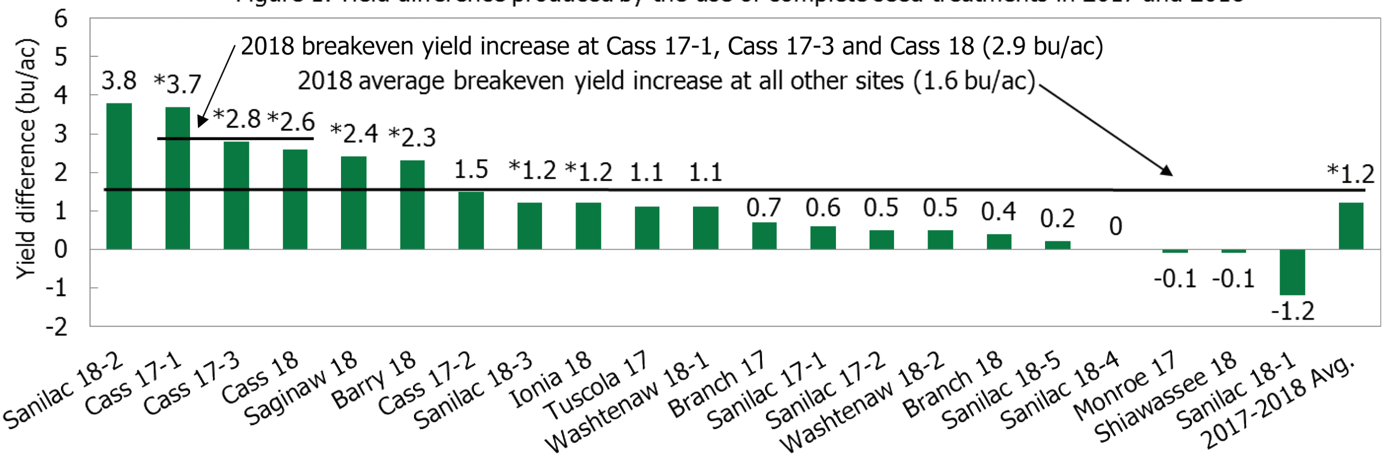
CP = chisel plow, FC = field cultivator, NT = no-till, VT = vertical tillage, SF = soil finisher and DR = disc ripper

Table 2. The effect of complete seed treatments on soybean yield and income in 2018

Location	Untreated control	Treated seed	LSD $_{0.10}$	Yield difference
	------------------- Yield (bu/ac)	------------------		Yield (bu/ac)
Sanilac 18-2	49.8	53.6	4.7	3.8
Cass 18	34.9 b	37.5 a	2.5	2.6
Saginaw 18	69.9 b	72.3 a	2.1	2.4
Barry 18	61.3 b	63.6 a	1.6	2.3
Sanilac 18-3	64.5 b	65.7 a	1.1	1.2
Ionia 18	46.8 b	48.0 a	1.2	1.2
Washtenaw 18-1	58.5	59.6	1.2	1.1
Washtenaw 18-2	51.6	52.1	1.5	0.5
Branch 18	54.2	54.6	3.1	0.4
Sanilac 18-5	51.4	51.6	2.1	0.2
Sanilac 18-4	62.0	62.0	1.7	0.0
Shiawassee 18	36.3	36.2	0.2	-0.1
Sanilac 18-1	59.7	58.5	4.2	-1.2
Average (2018)	**53.9 b**	**55.1 a**	**0.5**	**1.2**
	------------------- Income ($/ac)	-----------------		
***Average income**	**$463**	**$460**		

*Using an average cost for complete seed treatments (fungicide mix + insecticide) of $14.00 per acre

Figure 1. Yield difference produced by the use of complete seed treatments in 2017 and 2018



* The yield difference was statistically significant at these locations

Table 3. The effect of complete seed treatments on final plant stands in 2018

Location	Untreated control	Treated seed	LSD $_{0.10}$	Stand difference
	----------- Plant stand (plants/ac)	-----------		Plant stand (plants/ac)
Sanilac 18-2	118,300	128,000	12,076	9,700
Cass 18	136,900	153,800	24,990	16,800
Saginaw 18	108,800	112,400	5770	3,600
Barry 18	60,600 b	67,700 a	3,004	7,100
Sanilac 18-3	118,900	115,600	3553	-3,600
Ionia 18	--	--	--	--
Washtenaw 18-1	104,700 b	117,700 a	6,210	13,000
Washtenaw 18-2	93,500	101,400	8,019	7,900
Branch 18	91,900	88,700	5,279	-3,200
Sanilac 18-5	90,600 b	100,200 a	4,587	9,600
Sanilac 18-4	114,800	118,500	23,709	3,700
Shiawassee 18	92,400	97,800	14,520	5,400
Sanilac 18-1	95,100	95,100	2528	0
Average (2018)	**102,300 b**	**108,000 a**	**2153**	**5,700**
Average (2017-2018)	**102,400 b**	**109,500 a**	**1,974**	**7,100**

2017 and 2018 In-furrow Calcium Fertilizer Trial

Purpose: Some soybean producers have the capability of applying in-furrow products at planting. These producers are looking for products that will increase soybean yields and income when applied in-furrow. The purpose of this trial was to evaluate how an in-furrow application of LiberateCa™, a liquid calcium fertilizer from AgroLiquid affected soybean yield and income in 2017 and 2018.

Procedure: An in-furrow application of LiberateCa was compared to an untreated control at three locations in 2017 and two locations in 2018. The LiberateCa was applied at a rate of 1 quart per acre.

Results: The in-furrow LiberateCa application did not increase soybean yields in any of the trial locations. The lack of a positive yield response is probably due to the fact that the soil calcium levels were medium to high at all five sites.

Low volume,
low cost
starter fertilizer is
convenient but
significant yield increase
was not found.

The MSU soybean research planter has been equipped to conduct in-furrow fungicide/insecticide/nematicide trials using precision nozzles, thanks to generous support by FMC Corporation.

Table 1. Soil test levels at the 2017 and 2018 in-furrow LiberateCa trial locations

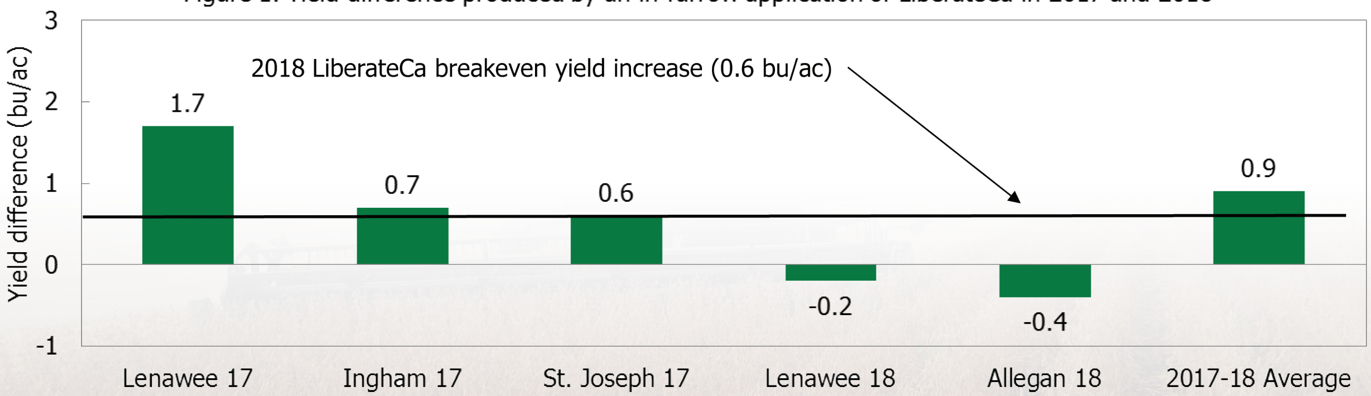
Location	Phosphorus	Potassium	Magnesium	Calcium	Soil pH	Mg base saturation	Ca base saturation
	-------------- Parts per million			---------------	1:1	-------- Percent	--------
Lenawee 17	144	122	149	899	6.2	23	58
Ingham 17	18	93	175	2100	6.7	11	78
St. Joseph 17	65	92	112	780	6.6	16	65
Lenawee 18	22	75	158	1107	6.4	18	65
Allegan 18	15	78	190	1200	6.1	16	59

Table 2. The effect of an in-furrow application of LiberateCa on soybean yield and income in 2017 and 2018

Location	**Untreated control**	**LiberateCa**	**LSD $_{0.10}$**	**Yield difference**
	------------------- Yield (bu/ac)	------------------		Yield (bu/ac)
Lenawee 17	48.1	49.8	3.1	1.7
Ingham 17	39.3	40.0	1.3	0.7
St. Joseph 17	84.4	85.0	1.6	0.6
Lenawee 18	53.1	52.9	1.1	-0.2
Allegan 18	59.9	59.5	0.4	-0.4
Average	**56.6**	**57.5**	**1.0**	**0.9**
	------------------- Income ($/ac)	-----------------		
Average income	**$487**	**$490**		

LiberateCa cost = $5.00 per acre

Figure 1. Yield difference produced by an in-furrow application of LiberateCa in 2017 and 2018



The yield difference was not statistically significant at any of these locations

2016-2018 Field Rolling Trial

Purpose: Field rolling is a common practice on many farms in Michigan. Its appeal is largely due to the fact that rolling reduces stone damage to combines, lowers operator fatigue and enables lower cutting heights during harvest operations. Most producers roll soybeans after planting and prior to emergence. This is a narrow window in some years and producers are wondering if they can safely roll soybeans during the early vegetative stages. There is also growing speculation that rolling soybeans between the V1 and V3 stages may stress the plants and actually increase yield. The purpose of the field roller trials was to determine the effect of field rolling at various growth stages on soybean yields in 2016, 2017 and 2018.

Procedure: Field rolling trials were conducted at six locations in 2016, seven locations in 2017 and four locations in 2018. The cooperating producers selected the rolling treatments they wanted to compare on their farms. Stand counts were taken at most of the locations to determine how rolling affected final stand.

Results: Three rolling timings were compared to an unrolled control at two locations in 2018 (Tables 1 and 2). Field rolling did not affect soybean yield at either location. However, rolling at V3 reduced final plant stands by 23,000 plants per acre at the Bay 18 site.

Table 3 and Figure 1 summarize the results from the 13 sites that compared an unrolled control to rolling at the V1 stage. Rolling at V1 increased soybean yields by 3.9 bushels per acre at the Bay 16 site and by 2.3 bushels per acre at the Bay 18 site. However, rolling at V1 reduced yields by 3.3 bushels per acre at the Lenawee 18-1 site. When all 13 sites were combined and analyzed, rolling at V1 did not increase soybean yields compared to the unrolled control.

Final plant stands were not affected by rolling at nine of the 10 sites for which this information was collected (Table 2). However, rolling at the V1 growth stage decreased stands by 5,200 plants per acre at the St. Joseph 17-1 location.

Example what field rollers do to stones

Rolling soybeans during their early growth stages can damage them causing significant stand reductions. *See Table 3 on page 15.*

Table 1. Effect of field rolling at four different timings on soybean yield and income in 2018

	------------------- Time of rolling ------------------				
Location	**Unrolled**	**Pre**	**Post (V1)**	**Post (V3)**	**$LSD_{0.10}$**
	-------------------- Yield (bushels/ac) --------------------				
Bay 18	78.0	78.7	80.3	79.3	2.5
Lenawee 18-1	69.5	63.9	66.1	67.4	4.9
Average yield	**74.0**	**71.1**	**73.1**	**73.4**	**3.0**
	-------------------- Income ($/ac) --------------------				
Average income	**$636**	**$604**	**$621**	**$624**	

Field Rolling cost = $7.30 per acre

Table 2. Effect of field rolling at four different timings on soybean final plant stands in 2018

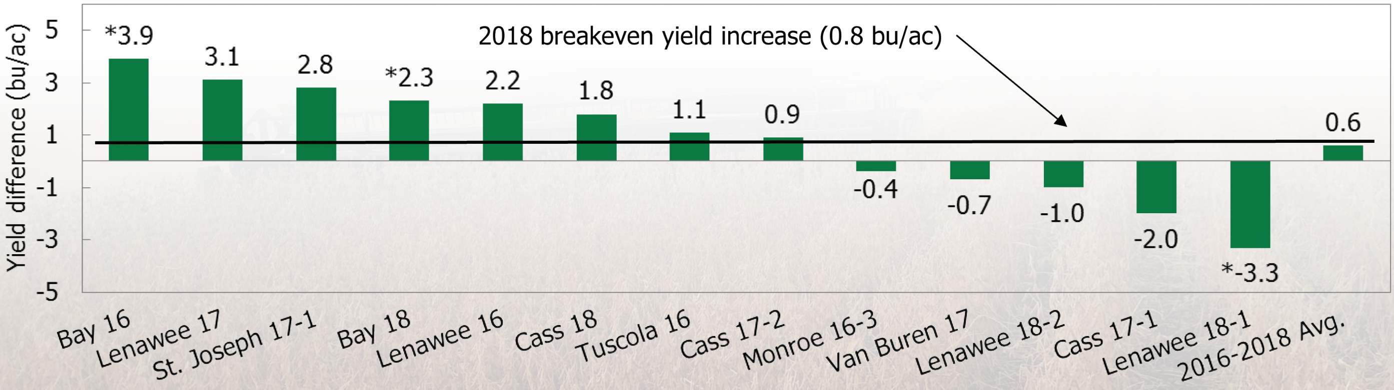
	------------------- Time of rolling ------------------				
Location	**Unrolled**	**Pre**	**Post (V1)**	**Post (V3)**	**$LSD_{0.10}$**
	--------------------- Final stand (plants/ac) --------------------				
Bay 18	136,100 a	132,700 a	131,300 a	113,000 b	5,554
Lenawee 18-1	105,700	99,600	100,800	105,300	7,657
Average stand	**120,500**	**115,600**	**115,600**	**110,400**	**6,826**

Table 3. The effect of field rolling at the V1 growth stage on soybean yield, income and final stand in 2016, 2017 and 2018

Location	**Unrolled control**	**First trifoliate**	**$LSD_{0.10}$**	**Yield difference**	**Unrolled control**	**First trifoliate**	**$LSD_{0.10}$**
	----- Yield (bu/ac) -----			Yield (bu/ac)	-- Final stand (plants/ac) --		
Bay 16	68.0 b	71.9 a	2.4	3.9	127,200	123,900	6,874
Lenawee 17	57.5	60.6	4.6	3.1	116,700	105,900	14,767
St. Joseph 17-1	73.7	76.5	6.7	2.8	157,800 a	152,600 b	2,591
Bay 18	78.0 b	80.3 a	1.9	2.3	136,100	131,300	9,308
Lenawee 16	60.0	62.2	3.1	2.2	98,100	103,000	31,269
Cass 18	46.1	47.9	8.0	1.8	171,500	169,900	13,432
Tuscola 16	78.7	79.8	1.1	1.1	87,900	85,500	7,606
Cass 17-2	51.1	52.0	4.5	0.9	178,300	170,500	14,009
Monroe 16-3	70.2	69.8	3.2	-0.4	--	--	--
Van Buren 17	44.3	43.6	0.9	-0.7	122,800	113,500	13.701
Lenawee 18-2	68.2	67.2	1.4	-1.0	--	--	--
Cass 17-1	88.6	86.6	2.9	-2.0	--	--	--
Lenawee 18-1	69.5 a	66.2 b	3.0	-3.3	105,700	100,800	8,599
2016-2018 Average	**65.8**	**66.4**	**0.8**	**0.6**	**130,300 a**	**125,500 b**	**3,023**
	------- Income ($/ac) -------						
2016-2018 Average	**$566**	**$564**					

Field rolling cost = $7.30 per acre

Figure 1. Yield difference produced by field rolling at the V1 growth stage in 2016, 2017 and 2018



* The yield difference was statistically significant at these locations

2018 Pre-plant, Broadcast Ammonium Sulfate Trial

Purpose: There is growing interest in applying sulfur fertilizers to soybeans. Much of this is due to recent research conducted by Dr. Shawn Casteel at Purdue University. Dr. Casteel has shown some profitable yield increases when ammonium sulfate (AMS) is broadcast prior to planting soybeans. The purpose of this trial was to evaluate how a pre-plant, broadcast application of ammonium sulfate would affect soybean yield and income in Michigan in 2018.

Procedure: A pre-plant, broadcast application of ammonium sulfate (21-0-0-24) was compared to an unfertilized control at four locations in 2018. The ammonium sulfate was applied at 100 pounds per acre. Soil tests were collected from each site to determine the baseline sulfur levels in the soil.

Results: The ammonium sulfate did not increase soybean yields at any of the 2018 trials or when all the locations were combined and analyzed. Due to the lack of a positive yield response and the associated fertilizer and application costs with this treatment, the ammonium sulfate treatment reduced income by $18 per acre in 2018.

2018 trials showed little benefit to AMS

despite growing interest in applying sulfur fertilizers to soybeans.

As-applied map from one of the AMS trial sites. At this site, the AMS was applied in 80 foot wide strips and a calibrated yield map was provided, eliminating the need for weigh wagons or individual yield monitor loads.

Table 1. Soil test levels at the 2018 pre-plant ammonium sulfate trial locations

Location	Organic Matter	Phosphorus	Potassium	Magnesium	Calcium	Sulfur	CEC	Soil pH
	Percent	---------------------------	Parts per million	---------------------------			meq/100g	1:1
Van Buren	1.7	34	115	75	700	**7**	5.6	6.4
Branch	1.5	45	91	100	600	8	4.1	6.9
Tuscola	2.9	**14**	125	145	1250	9	7.8	7.0
Lenawee	3.9	31	154	495	2500	**7**	17	7.0

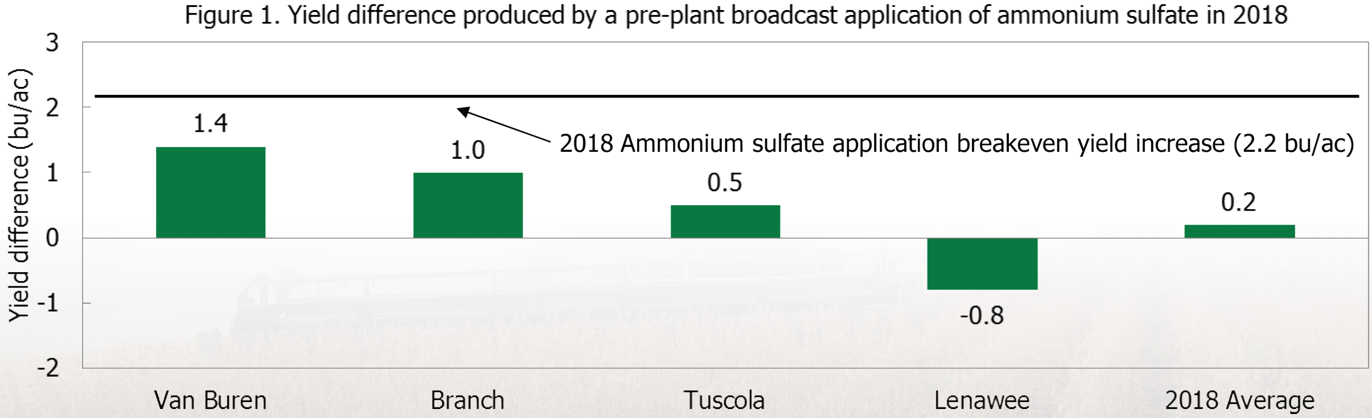
Bold figures indicate low or vey low soil test levels

Table 2. The effect of a pre-plant broadcast application of ammonium sulfate on soybean yield and income in 2018

Location	Untreated control	Ammonium sulfate	LSD $_{0.10}$	Yield difference
	------------------- Yield (bu/ac)	------------------		Yield (bu/ac)
Van Buren	56.6	58.0	1.5	1.4
Branch	51.5	52.5	10.1	1.0
Tuscola	54.6	55.1	3.6	0.5
Lenawee	53.9	53.1	2.6	-0.8
Average	**54.4**	**54.6**	**1.3**	**0.2**
	------------------- Income ($/ac)	-----------------		
Average income	**$468**	**$450**		

Ammonium sulfate cost = $13.45 per acre
Dry fertilizer spreading cost = $5.80 per acre

Figure 1. Yield difference produced by a pre-plant broadcast application of ammonium sulfate in 2018



The yield difference was not statistically significant at any of these locations

2018 MAX-IN® Sulfur Foliar Fertilizer Trial

Purpose: There is growing interest in applying sulfur fertilizers to soybeans. The convenience of adding nutrients in a foliar application is also appealing to many growers. The purpose of this trial was to evaluate how a foliar application of MAX-IN Sulfur, a liquid fertilizer containing potassium and sulfur sold by Winfield United, affected soybean yield and income in 2018.

Procedure: A foliar application of MAX-IN Sulfur (0-0-19-13) plus MasterLock® adjuvant at R1 (one open flower on 50 percent of the plants) was compared to an unfertilized control at nine locations in 2018. The MAX-IN Sulfur was applied at 1 quart per acre and the MasterLock was applied at 6.4 ounces per acre.

Results: The foliar application of MAX-IN Sulfur plus MasterLock did not increase soybean yields in any of the individual trial locations or when all the locations were combined and analyzed. The lack of a positive yield response is probably due to the fact that the soil was able to supply enough potassium and sulfur to meet crop demand.

We want to thank Winfield United for providing the products.

Foliar fertilizer applications to soybeans are rarely profitable.

Foliar fertilizers increased yields in eight of the 117 on-farm foliar fertilizer trials the SMaRT program has conducted in Michigan.

Foliar fertilizer application to soybeans

Table 1. Soil test levels at the 2018 MAX-IN Sulfur trial locations

Location	Organic Matter	Phosphorus	Potassium	Sulfur	CEC	Soil pH
	Percent	-------------------	Parts per million	--------------------	meq/100g	1:1
Cass 3	2.4	17	**86**	**7**	7.5	6.5
Cass 2	1.7	36	98	**4**	3.9	6.9
Monroe 1	2.7	42	**58**	**7**	5.0	6.0
Ingham	1.3	75	123	**7**	4.2	6.6
Monroe 3	2.7	72	113	8	5.4	5.8
St. Joseph	1.3	36	97	**3**	3.6	6.9
Van Buren	1.6	50	109	9	4.4	5.9
Cass 1	1.9	74	106	6	4.9	6.5
Monroe 2	3.5	32	167	9	11.2	6.8

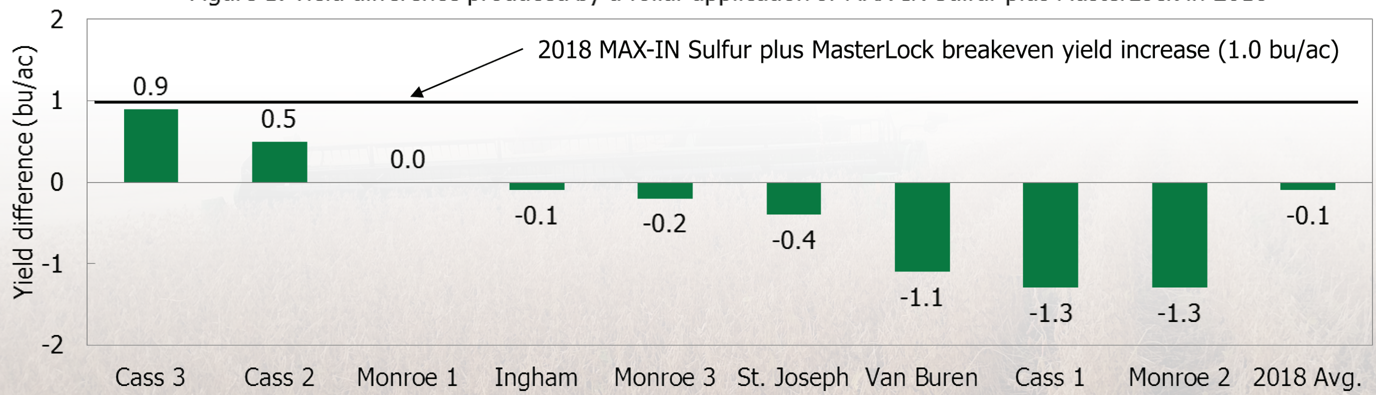
Bold figures indicate low or vey low soil test levels.

Table 2. The effect of a foliar application of MAX-IN Sulfur plus MasterLock on soybean yield and income in 2018

Location	Untreated control	MAX-IN Sulfur plus MasterLock	$LSD_{0.10}$	Yield difference
	------------------ Yield (bu/ac)	-----------------		Yield (bu/ac)
Cass 3	71.0	71.9	2.0	0.9
Cass 2	66.0	66.5	2.8	0.5
Monroe 1	32.5	32.5	2.9	0.0
Ingham	56.0	55.9	2.6	-0.1
Monroe 3	45.9	45.7	4.5	-0.2
St. Joseph	64.7	64.3	0.6	-0.4
Van Buren	55.1	54.0	3.7	-1.1
Cass 1	63.6	62.3	4.1	-1.3
Monroe 2	51.0	49.7	5.9	-1.3
Average	**56.1**	**56.0**	**0.7**	**-0.1**
	------------------ Income ($/ac)	-----------------		
Average income	**$482**	**$473**		

MAX-IN Sulfur cost = $5.50 per acre
MasterLock cost = $3.00 per acre

Figure 1. Yield difference produced by a foliar application of MAX-IN Sulfur plus MasterLock in 2018



The yield difference was not statistically significant at any of these locations

2017 and 2018 Foliar Fungicide and Insecticide Trial

Purpose: Soybean producers are trying to improve soybean yields and many are willing to manage the crop more intensively to achieve this goal. There is interest in applying foliar tank mixtures which include a fungicide and an insecticide. The purpose of this trial was to provide an opportunity for interested producers to evaluate the yield and income performance of the fungicide and insecticide tank mixture of their choosing on their farm in 2017 and 2018.

Procedure: Cooperating producers were given the opportunity to select the foliar fungicides and insecticides they wanted to evaluate on their farms. As a result, a tank mixture of Priaxor™ (fungicide) and Fastac™ (insecticide) was applied at six of the eight locations. Stratego® YLD (fungicide) and Mustang® Maxx (insecticide) was applied at the Ionia location in 2017 and 2018. Priaxor was applied at 4 ounces per acre and Fastac was applied at 3.8 ounces per acre. Stratego YLD was applied at 6 ounces per acre and Mustang Max was applied at 3 ounces per acre. The foliar applications were made at R3 and the sprayers were driven through the untreated control treatments to prevent tire tracks from being a factor.

Results: The foliar fungicide-insecticide application increased soybean yields by 4.4 bushels per acre at one site in 2017 and by 3.0 bushels per acre in another field operated by the same producer in 2018. However, the fungicide-insecticide application did not increase soybean yields at any of the other six locations. When all eight locations were combined and analyzed, the foliar fungicide and insecticide tank mixture produced an average yield increase of 1.6 bushels per acre which is less than the yield increase required to break even.

A foliar fungicide and insecticide application increased yield (1.6 bushels) but not enough to pay for the expense.

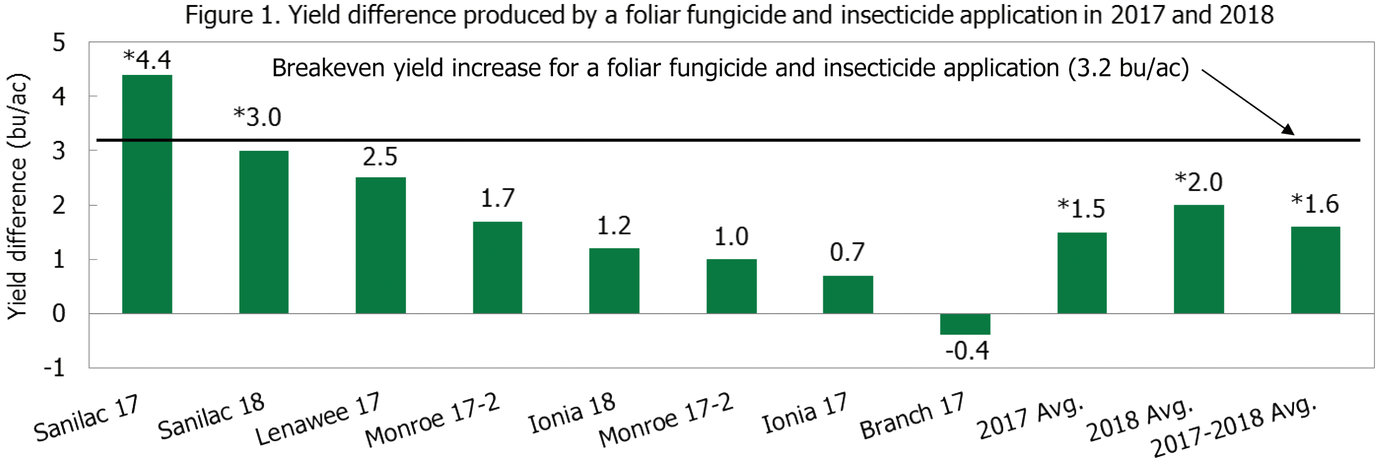
Self-propelled sprayer equipped with a 120 foot boom

Table 1. The effect of a foliar fungicide and insecticide application on soybean yield and income in 2017 and 2018

Location	**Untreated control**	**Foliar fungicide and insecticide**	**LSD $_{0.10}$**	**Yield difference**
	------------------ Yield (bu/ac)	-----------------		Yield (bu/ac)
Sanilac 17	39.3 b	43.7 a	2.6	4.4
Sanilac 18	56.8 b	59.8 a	1.9	3.0
Lenawee 17	59.8	62.3	3.7	2.5
Monroe 17-2	46.1	47.8	5.1	1.7
Ionia 18	59.6	60.8	1.4	1.2
Monroe 17-1	60.3	61.3	2.9	1.0
Ionia 17	46.6	47.3	0.8	0.7
Branch 17	54.5	54.1	7.7	-0.4
Average	**53.0 b**	**54.6 a**	**0.9**	**1.6**
	------------------ Income ($/ac)	-----------------		
***Average income**	**$456**	**$442**		

*Using the cost for a foliar application of Priaxor and Fastac
Priaxor fungicide cost = $15.90 per acre
Fastac insecticide cost = $4.00 per acre
Application cost = $7.50 per acre

Figure 1. Yield difference produced by a foliar fungicide and insecticide application in 2017 and 2018



* The yield difference was statistically significant at these locations

Post emergence herbicide application in soybeans

2017 and 2018 White Mold Foliar Fungicide Comparison Trial

Purpose: *Sclerotinia Stem Rot* or white mold can cause significant yield reductions in soybeans grown in Michigan. This trial evaluated the effect of two commercially available foliar fungicides on soybean yields and income in 2017 and 2018.

Procedure: This trial consisted of three treatments: Omega®, Propulse® and an untreated control and was conducted at four locations in 2017 and three locations in 2018. Both fungicides were applied at the lowest recommended rates for white mold (12 ounces per acre for Omega and 6 ounces per acre for Propulse) about one week after the appearance of the first blossoms. Sprayer tracks were eliminated from being a confounding factor by driving the sprayer through the untreated strips or using a spray boom wide enough that none of the harvested strips contained tire tracks. White mold incidence was assessed at all locations by counting 100 consecutive plants and recording the number of diseased plants.

Results: All seven sites had a history of white mold and environmental conditions favoring disease development occurred in 2017 at the Allegan 17-2, Berrien 17 and Sanilac 17 locations. White mold incidence was very low at the Allegan 17-1 site and all of the 2018 sites. These sites demonstrate how the foliar fungicides affect soybean yield and income in the absence of white mold pressure. Propulse increased soybean yields over the untreated control at all three Allegan locations and at the Berrien location. Omega increased yields at the Allegan 17-2, Berrien 17, Sanilac 17 and Allegan 18 locations. The performance of the two products was similar at all locations except for the Allegan 17-1 site where Propulse increased soybean yield by 2.5 bushels per acre over Omega.
Each fungicide reduced disease incidence relative to the control at three locations. Both fungicides were profitable at the Berrien 17 location. However, only Propulse was profitable when all seven sites were combined and analyzed.

We want to thank Bayer Crop Science for providing the Propulse and Syngenta for providing the Omega.

Apothecia

Sclerotia

Effect of variety selection on white mold

Table 1. Varieties, planting dates, planting rates, row spacing and fungicide application dates at the trial locations

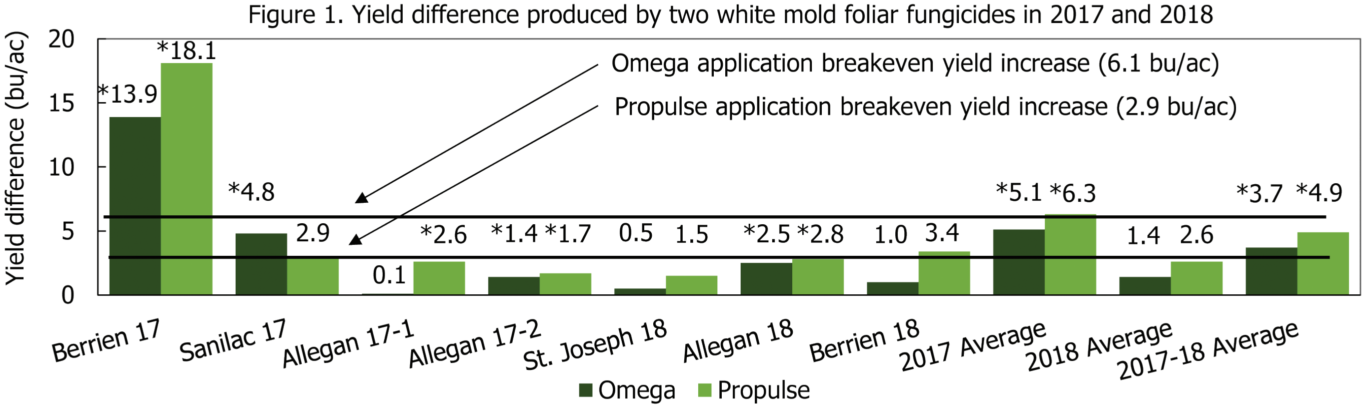
Location	Soybean variety	White mold resistance/tolerance of soybean variety	Planting date	Planting rate	Row spacing	Application date
Berrien 17	NuTech 7240-DA26	6 (1=excellent and 9=poor)	May 18	130,000	30”	July 15
Sanilac 17	DynaGro DG21XT 77	6 (9=excellent and 1=poor)	May 15	130,000	20”	July 10
Allegan 17-1	DF 155	0.8 (1=excellent and 5=poor)	May 15	150,000	Twin 7”	July 18
Allegan 17-2	Great Lakes 2939R2	8 (9=excellent and 1=poor)	May 22	155,000	20”	July 16
St. Joseph 18	Asgrow 3231	5 (1=excellent and 9=poor)	May 2	140,000	20”	July 16
Allegan 18	DF5268 RR2	2 (1=excellent and 5=poor)	May 25	140,000	Twin 7”	July 17
Berrien 18	Pioneer P31T11	4 (9=excellent and 1=poor)	May 29	150,000	15”	July 21

Table 2. White mold foliar fungicide effect on soybean yield and income in 2017 and 2018

	Untreated control	Omega	Propulse	LSD $_{0.10}$
	------------------ Yield (bu/ac) ------------------			
Berrien 17	51.6 b	65.5 a	69.7 a	4.7
Sanilac 17	53.7 b	58.5 a	56.6 ab	2.9
Allegan 17-1	63.2 b	63.3 b	65.8 a	1.7
Allegan 17-2	62.6 b	64.0 a	64.3 a	1.3
St. Joseph 18	70.0	70.6	71.6	4.1
Allegan 18	57.1 b	59.5 a	59.8 a	1.4
Berrien 18	64.7	65.7	68.1	15.9
Average (2017-18)	**60.2 b**	**63.9 a**	**65.1 a**	**2.0**
	------------------ Income ($/ac) ----------------			
Average income	**$518**	**$496**	**$536**	

Omega cost = $45.28 per acre, Propulse cost = $16.40 per acre, application cost = $7.50 per acre

Figure 1. Yield difference produced by two white mold foliar fungicides in 2017 and 2018



*The yield difference between the fungicides and the control was statistically significant at these locations
The yield difference between the two fungicides was statistically different at only the Allegan 17-1 location

Table 3. Foliar fungicide effect on white mold incidence in 2017 and 2018

Location	Untreated Control	Omega	Propulse	LSD $_{0.10}$
	-------------- White mold disease incidence (% infected) --------------			
Berrien 17	47.0 a	26.6 b	12.6 b	17.8
Sanilac 17	56.5 a	31.9 b	49.4 a	8.3
Allegan 17-1	1.4	1.0	1.0	1.3
Allegan 17-2	11.5 a	7.5 ab	3.8 b	4.5
St. Joseph 18	3.2	2.2	1.3	1.6
Allegan 18	1.1	0.8	2.6	3.4
Berrien 18	4.2 a	0.8 b	2.3 b	1.7
Average (2017-18)	**17.5 a**	**9.8 b**	**10.5 b**	**4.2**

2018 White Mold Fungicide Application Timing Trial

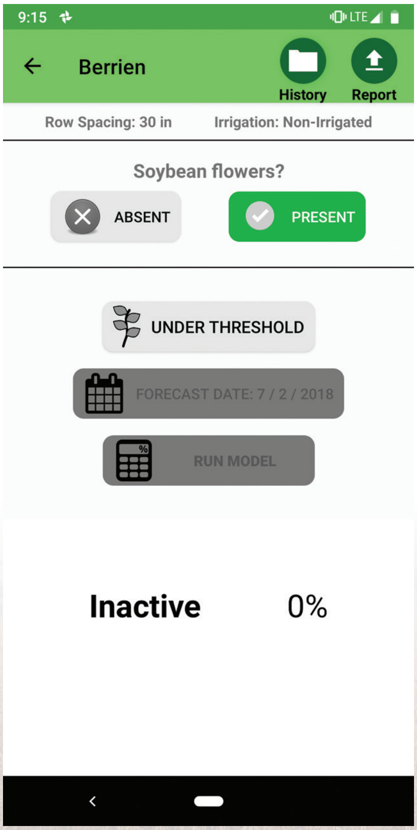
Purpose: Foliar fungicides can be an important tactic for reducing yield loss from white mold, especially when combined with other effective management practices such as resistant/tolerant varieties, wide rows, reduced planting rates, tillage decisions and irrigation water management. Properly timing fungicide applications is essential for success but challenging for producers. The purpose of this trial was to determine the effect that fungicide application timing had on soybean yield and income in 2018. Another goal was to use the yield data from this trial to validate Sporecaster, a new white mold apothecia prediction application for smart phones.

Procedure: The trial compared three fungicide application timings to an untreated control at two locations. The application timings were: one application at R1 (one open flower on 50 percent of the plants), one application at R3 (one pod >3/16” long on any of the upper four nodes on the main stem) and an application at R1 followed by an application at R3. Aproach® fungicide was applied at a rate of 9 ounces per acre for all application timings. We entered the dates for the R1 and R3 applications into the Sporecaster app to determine the apothecia risk level for the dates and locations. White mold incidence was also determined at both locations.

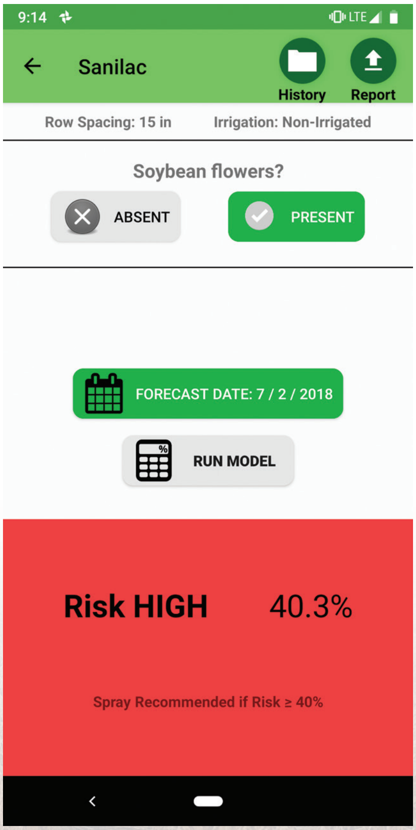
Results: The sequential application of Aproach at R1 followed by R3 (R1+R3) produced a higher yield than the R3 timing, the R1 timing and the untreated control at the Berrien site. The R3 timing also produced a higher yield than the R1 timing and the control at this site. Despite the absence of white mold at the Sanilac site, the sequential application produced a higher yield than the R1 timing and the control. When the product and application costs were subtracted from the gross income for each treatment, the ranking by income for the treatments was R1+R3 > R3 > control > R1.

The Sporecaster app recommended spraying at R1 at Sanilac but not Berrien. However, the hot dry weather occurring in July prevented white mold from developing. At R3, Sporecaster recommended spraying only at the Berrien site which is consistent with the yield data and white mold at this site.

We want to thank Corteva Agriscience for providing the Aproach fungicide and Dr. Martin Chilvers for his input.



Smart phone screenshot of Sporecaster risk assessment for Berrien county on 7/2/2018



Smart phone screenshot of Sporecaster risk assessment for Sanilac county on 7/2/2018

Table 1. Planting dates, planting rates, row spacing and fungicide application dates at the trial locations

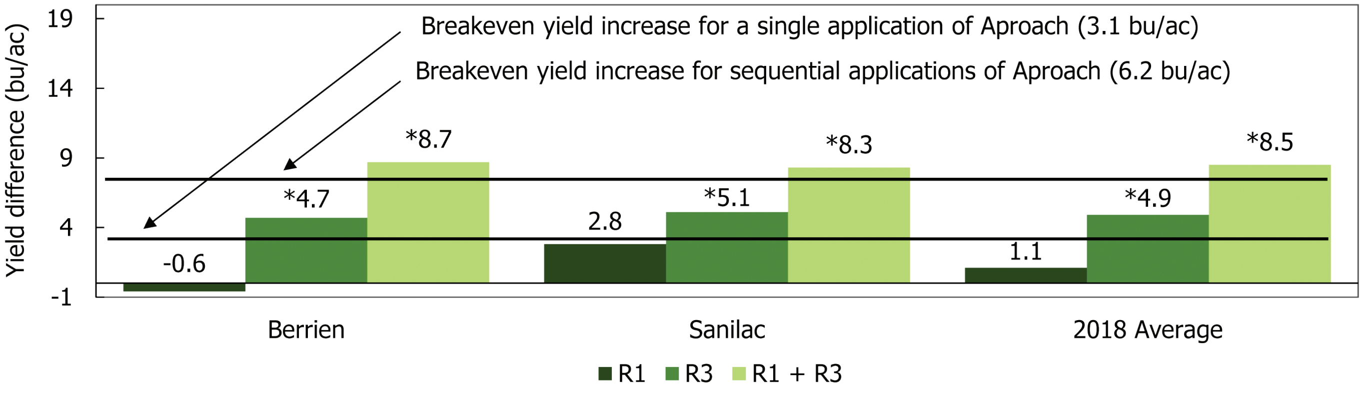
Location	Soybean variety	White mold resistance/tolerance of soybean variety	Planting date	Planting rate (seeds/ac)	Row spacing	Application dates
Berrien	NuTech 7240-DA26	6 (1=excellent and 9=poor)	May 26	130,000	30″	July 2 and August 11
Sanilac	Asgrow AG19X8	4 (1=excellent and 9=poor)	May 13	130,000	20″	July 2 and July 14

Table 2. White mold foliar fungicide application timing effect on soybean yield and income in 2018

Location	Untreated control	R1	R3	R1 + R3	$LSD_{0.10}$
	------------------ Yield (bu/ac) ------------------				
Berrien	74.5 c	73.9 c	79.3 b	83.2 a	3.8
Sanilac	63.9 c	66.8 bc	69.0 ab	72.2 a	4.4
Average	**69.2 c**	**70.3 c**	**74.1 b**	**77.7 a**	**2.7**
	------------------ Income ($/ac) -----------------				
Average income	**$595**	**$578**	**$610**	**$615**	

Aproach fungicide cost for a single application = $19.32 per acre, application cost = $7.50 per acre

Figure 1. Yield difference produced by different fungicide application timings in 2018



*The yield difference between the fungicide application timings and the control were statistically significant at these locations. The yield difference between the R3 and the R1 + R3 application timings was statistically significant at the Berrien County site and when both locations were combined.

Table 3. Foliar fungicide application timing effect on white mold incidence in 2018

Location	Control	R1	R3	R1+R3	$LSD_{0.10}$
	------------- White mold disease incidence (% infected) -------------				
Berrien	0.5	0.3	0	0.3	0.5
Sanilac	0.8	0.1	0.5	0.4	0.7
Average	**0.6**	**0.2**	**0.3**	**0.3**	**0.4**

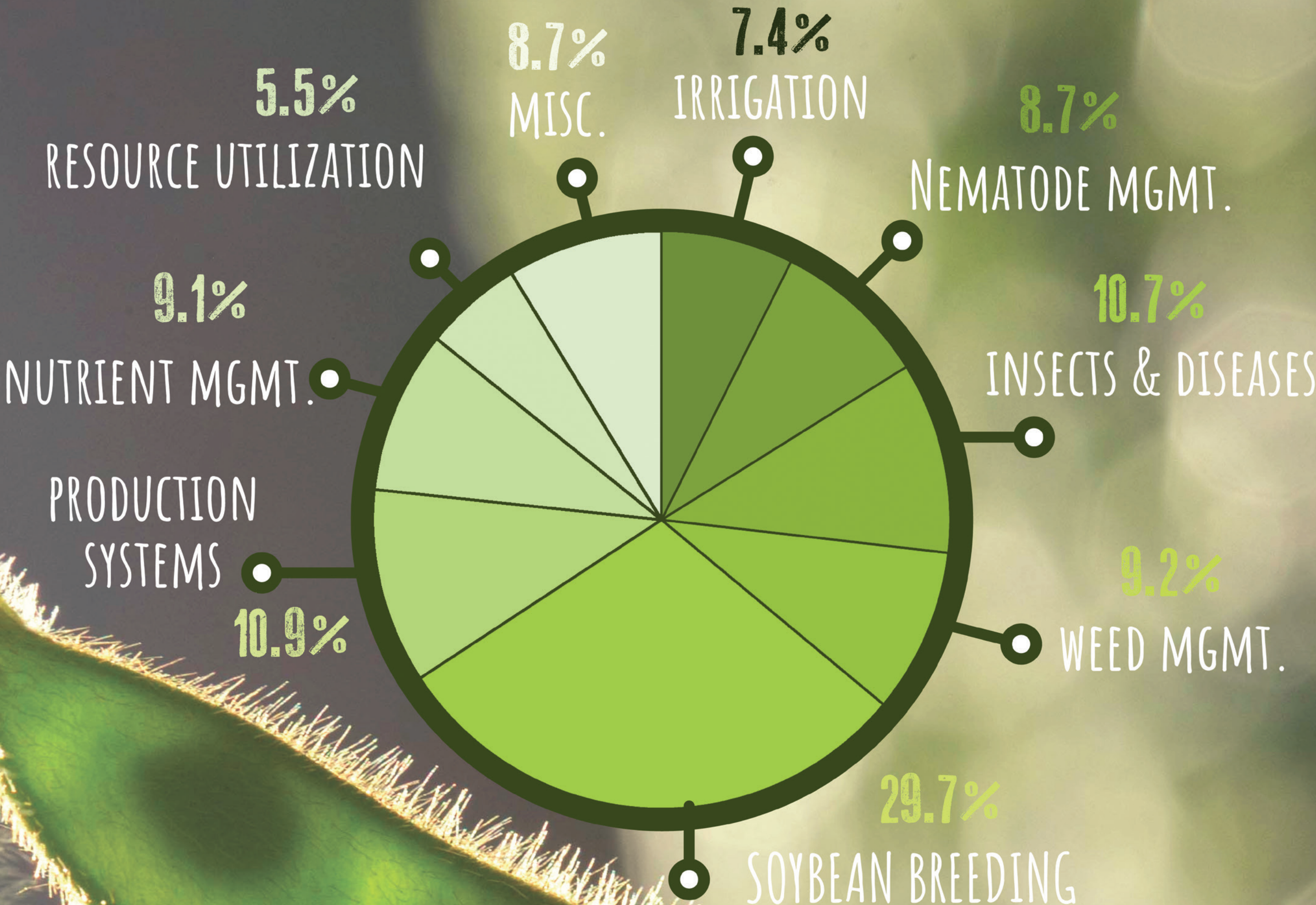
Due to a soil type change, the incidence of white mold increased significantly in the last 200 feet of row at the Berrien site (approximately 25% incidence in the control strips). This is not represented in the incidence levels listed above.

As-planted map from the Saginaw 18 planting rate trial. Precision technology used at this trial makes it easier and faster to collect data.

Planting a 2018 SMaRT trial

Planting rates significantly affected white mold incidence at the Saginaw 18 planting rate trial site, as shown in this drone image.
To see the impact white mold had on income, see Table 4 on page 5.

MSPC FUNDED RESEARCH



MSPC funds nearly $700,000 in soybean production research each year using soybean checkoff dollars. Funding is divided among the categories listed above to provide well-rounded research results for Michigan soybean farmers.

The Value of On-Farm Research: Farmers Weigh In

By: Sonja Lapak, Communication Director

The Michigan Soybean Promotion Committee aims to responsibly spend soybean checkoff dollars on projects that have the potential to benefit all Michigan soybean growers. The Soybean Management and Research Technology (SMaRT) on-farm research program was started in November of 2010 in partnership with MSU Extension to help increase the profitability of raising soybeans in Michigan. The program works with farmer trial cooperators around the state who help to evaluate new products, management practices and equipment on their farms. The program is unique in that it uses grower input to guide what trials are conducted each year. Farmers are invited to share feedback on projects and suggest new trials at the regional SMaRT Meetings held each winter.

I caught up with four long-time cooperators who have hosted a variety of trials on their farms over the years. I asked them questions related to why they choose to continually host trials on their farms, why other farmers should consider hosting trials, what results have impacted their farms directly and why they value the data that comes from the trials. Read their thoughts below.

Kurt Kreger – Snover, MI

I've been a trial cooperator for six years. I attended a SMaRT meeting and some of the trials Mike mentioned caught my attention. I thought it might be beneficial to try the projects on my farm so I agreed to be a cooperator. I participated in the planting population trial for three years in a row and the trial proved that I could lower my planting rates without sacrificing yield. I like that the trials look at things that make sense both agronomically and economically. For people considering being a trial cooperator, I really encourage it. The results and information can be better and more valuable on your own farm. The SMaRT report and meetings are very beneficial; even if you don't host trials it's a good way to gather information and hear from other farmers. Additionally, the data continues to increase in credibility because many of these trials have multiple years of data stacking up.

Rich D'Arcy – Kingston, MI

I've been a cooperator for eight years. It's a good learning experience for farmers, and if you're not willing to do research and testing on your farm, you may not be trying very hard to improve. We also have good staff to work with on the trials and we keep participating because we continue to learn new things each year. I also work with Martin Nagelkirk on wheat research and both programs help us continue to raise the bar on our operation. I could do some of the trials on my own, but having replicated trials increases the validity and helps all farmers learn together. I've been looking at lower planting rates for years, but the SMaRT program pushed me out of my comfort zone and I planted populations lower than I've ever done. The program really helps expand your horizons and encourages farmers to think about things beyond what they've always done. To a potential new cooperator: You will have to invest some time to participate but what you will learn will be worth far more than the original investment of time. You might not expect what you learn. Focusing on a crop to do a trial makes you engage and pay attention; you observe and learn a lot through the process. I also really value the research report and winter meetings – it's unbiased information and MSPC isn't trying to sell you anything. They are trying to provide growers with information that they've gathered and replicated around the state. They are always seeking grower feedback to guide their research focus for upcoming years.

Rob Steenbergh – Melvin, MI

I've been a cooperator since the program began. I like on-farm trials because they allow me to see how things act on my own farm, rather than just reading about trials or products in a paper. I don't think it's too difficult to be a cooperator as long as you plan your work and work the plan – it requires preparation but especially if you can use your yield monitor and combine data, it can be fairly easy to participate.

The planting rate trials have really interested me lately. I also participated in an insecticide/fungicide trial which showed good results. Even when I don't make a change to what I am doing on my farm, the trial data allows me to decide whether or not I want to try something – a practice, a product or a piece of equipment – on my farm. The results let me weed through some of the witch's brew and propaganda that's out there – MSPC has nothing to gain by promoting one product or practice over another. I also encourage farmers to attend the winter meetings. They are interesting and allow us to stay up to date on what research is taking place.

Darin LaBar – Union City, MI

I started hosting trials in 2010. I really like the program because SMaRT offers a lot of information on multiple trials; more data than one farmer could accomplish on their own. I wanted to be a part of increasing the number of locations to help provide more data and better information. If you are considering being a cooperator – do it. There is no better data for you than what comes from your farm. It incorporates your soil, weather, fertility and management and is the best data you will get. You can do tests on your own, but SMaRT adds validity and pushes you to take samples, have sufficient replications and document the results. Many trials don't require much in addition to what you're already doing, just slight modifications – treat or don't treat certain sections, modify planting rates across a field, etc. Additionally, the SMaRT program welcomes farmer input – if you go to the meetings, you get a say. They literally hand out voting clickers and ask for your input. It's a direct say in how some of your checkoff dollars are spent. The on-farm research program is different from company trials which may not be truly independent. One of the biggest benefits to my farm is that I can do a payback analysis on different products and equipment without having to buy and try everything on my own. Looking at the results from different trials helps me decide what is worth trying on my farm and what isn't, which saves me time and money.

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 can 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 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 for cooperators to implement. 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 but six replications is preferred for trials comparing only two treatments.

Another important aspect of a good experimental design is the concept of randomization. Randomly assigning the order of the treatments within each block removes bias from treatment averages or means and reducing experimental error. Figure 1 shows the actual RCBD design that was used in the 2018 planting rate trials and demonstrates the principles outlined above. Note how each planting rate is included and randomized within the replications. All of the 2018 trials comparing three or more treatments utilized the RCBD with four replications of each treatment unless stated otherwise in the procedure section. The treatments in all of the trials comparing two treatments were alternated (not randomized within each block) and replicated at least four times.

Figure 1. The randomized complete block design used in the 2018 SMaRT planting rate trials.

80K	100K	130K	160K	100K	160K	80K	130K	100K	80K	160K	130K	160K	100K	130K	80K
Replication 1				**Replication 2**				**Replication 3**				**Replication 4**			

After the trials were harvested, the GLIMMIX procedure within SAS was used to determine if the differences in measurable variables such as yield were due to the treatments or other outside factors. We set our confidence level at 90% for all statistical analysis as designated by LSD 0.10 (Least Significant Difference). Whenever the difference between two yields or other measurable variables is greater than the LSD 0.10, we can say that the difference is due to the treatment. This is always true for trials comparing only two treatments. However, the LSD 0.10 can sometimes falsely indicate statistical significance whenever more than two treatments are compared. This situation is more likely to occur when the number of treatments compared increases. Three examples of this situation occur in this publication (the Sanilac 1 site in table 3 on page 5, the Lenawee 18-1 site in table 1 on page 14, and the St. Joseph 18 site in table 3 on page 23). In all three cases, the treatments are not statistically different. If the yield of two treatments differs by less than the LSD 0.10 listed, we cannot say with a reliable degree of confidence that it is due to the treatment.

Letters are used in the tables and an asterisk (*) is used in the figures in this publication to identify yields or other measurements that are statistically different. When no letters are listed or the same letter appears next to the yield or other measurable condition, the difference between the treatments is not statistically significant. Only the statistically significant yield increases are mentioned in the text in this report. All other yield differences (no matter how large) are not due to the applied treatment and should be ignored.

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

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, management practices and equipment. Producers across Michigan help identify new products, management practices or equipment of interest to them and conduct field scale 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 cooperating producers are never identified to maintain confidentiality.

Please provide the following information if you are interested in conducting a SMaRT on-farm research project in 2019

Name:____

Address:____

____

Phone:______________________ Cell phone:______________________

Email:____

Please use the space below to list the soybean topic(s) that you would like to see evaluated in on-farm trials and return this form by U.S. mail, email or fax before February 1, 2019. Please complete this section even if you do not plan to conduct a trial on your farm in 2019. We will use your input when we identify the 2019 on-farm research projects.

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