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SOYBEAN
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Research-based Management Recommendations for Irrigated Soybeans

Mike Staton

MSU Extension Soybean Educator

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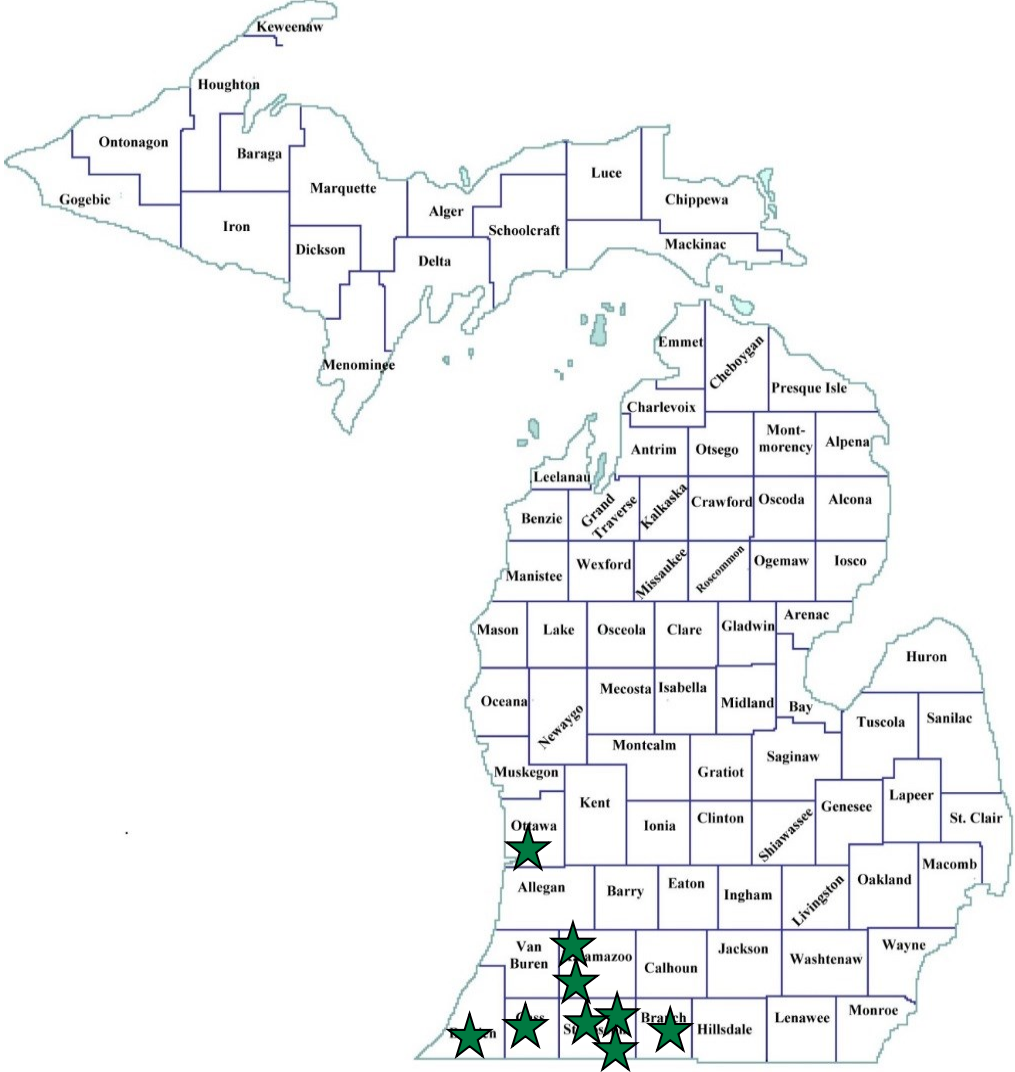
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Reduce Planting Rates



2015 to 2021 Irrigated Planting Rate Trial Locations



Planting rate trial

- Producers across Michigan asked us to evaluate the effect of low planting rates on soybean yield and income.
- Four planting rates were compared at 67 locations from 2015 to 2021.
 - 80,000 seeds per acre
 - 100,000 seeds per acre
 - 130,000 seeds per acre
 - 160,000 seeds per acre
- **9 of the 67 trials were conducted in irrigated fields**

Michigan Soybean On-farm Research

Tillage, planting equipment, row spacing, CEC, planting date, planting depth and seed treatment for irrigated trials

Location	Tillage (fall/spring)	Planter/drill	Row spacing	Planting date	Planting depth	Seed treatment
St. Joseph 15	ST	MonsemNG4	Twin 8"	April 29	1.5	Pioneer FST/IST
Cass 15	DR/FC	JD 1790	15"	May 14	1.0	Pioneer FST/IST
Kalamazoo 19	CP/FC	JD 1795	15"	May 16	1.5	Pioneer FST/IST
St. Joseph 19	D/NT	JD 2290	20"	June 7	1.0	Accelaron
Ottawa 19	VT/VT	JD 7000	30"	May 4	1.5	Escalate
Berrien 21	DR/FC	JD 1790	15"	June 6	1.5	None
St. Joseph 21	CP/D	JD 1770 NT	30"	May 8	1.5	LumiGEN Technologies
Kalamazoo 21	NT	JD 1770 NT	30"	June 6	1.5	None
Branch 21	CP/D	JD 1770 NT	30"	May 1	1.5	None

CP = chisel plow, FC = field cultivator, D = disc, VT = vertical tillage, HSD = high speed disk, ST = strip till and DR = disk ripper

Michigan Soybean On-farm Research

Target planting rates and actual plant stands in irrigated trials

	----- Target planting rate (seeds/ac) -----			
Location	80,000	100,000	130,000	160,000
	----- Actual plant stands (plants/ac) -----			
St. Joseph 15	69,800	82,600	110,100	138,100
Cass 15	78,300	91,200	123,000	150,000
Kalamazoo 19	62,200	77,300	98,300	118,200
St. Joseph 19	66,000	84,500	101,500	121,000
Ottawa 19	50,100	65,500	69,700	87,300
Berrien 21	80,800	97,500	126,500	152,200
St. Joseph 21	71,900	91,000	115,400	138,100
Kalamazoo 21	72,000	87,400	109,400	137,100
Branch 21	45,200	58,800	74,700	99,600
Average	66,300	81,800	103,200	126,800
	----- Average stand loss (%) -----			
	17	18	21	21

Michigan Soybean On-farm Research

Effect of four planting rates on irrigated soybean yield and income

	----- Target planting rate (seeds/ac) -----				
Location	80,000	100,000	130,000	160,000	LSD_{0.10}
	----- Yield (bushels/ac) -----				
St. Joseph 15	63.8	63.9	64.0	64.7	1.1
Cass 15	72.0	73.1	71.6	72.4	1.6
Kalamazoo 19	64.9 b	65.0 b	67.4 a	66.1 ab	1.6
St. Joseph 19	71.0	71.6	72.8	72.3	1.5
Ottawa 19	59.4 c	63.4 a	61.8 b	63.6 a	1.6
Berrien 21	77.0	79.7	79.2	81.4	4.5
St. Joseph 21	75.7	76.4	74.0	75.8	3.3
Kalamazoo 21	66.5	67.8	68.5	66.8	2.7
Branch 21	51.1	53.4	53.4	58.0	6.0
Average	66.7 c	68.3 ab	68.0 b	69.0 a	1.0
	----- Income (\$/ac) -----				
Average income	\$833	\$845	\$828	\$829	

Michigan Soybean On-farm Research

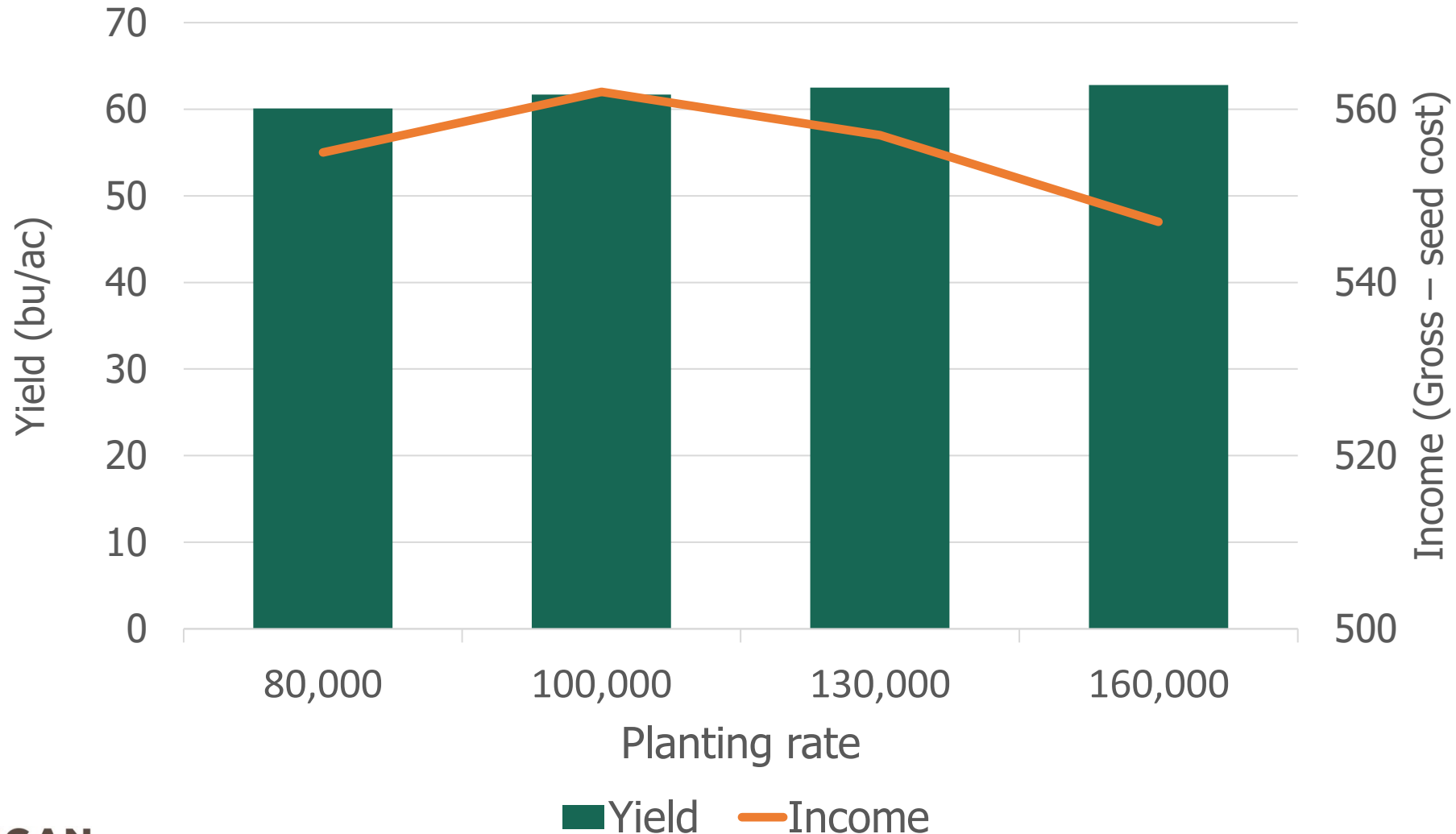
Soybean Planting Rate Effects on White Mold

Planting rate	----- Yield (bu/ac) -----		----- Income (\$/ac) -----	
	2015 Sanilac	2018 Saginaw	*2015 Sanilac	*2018 Saginaw
80,000	63.2 a	66.2 a	\$788	\$827
100,000	61.1 b	66.5 a	\$751	\$822
130,000	61.5 b	64.3 a	\$744	\$780
160,000	57.9 c	61.2 b	\$685	\$728
LSD _{0.10}	1.7	2.4		

* Soybean market price of \$13.00 per bushel and a seed cost of \$60/140,000 seeds

Michigan Soybean On-farm Research

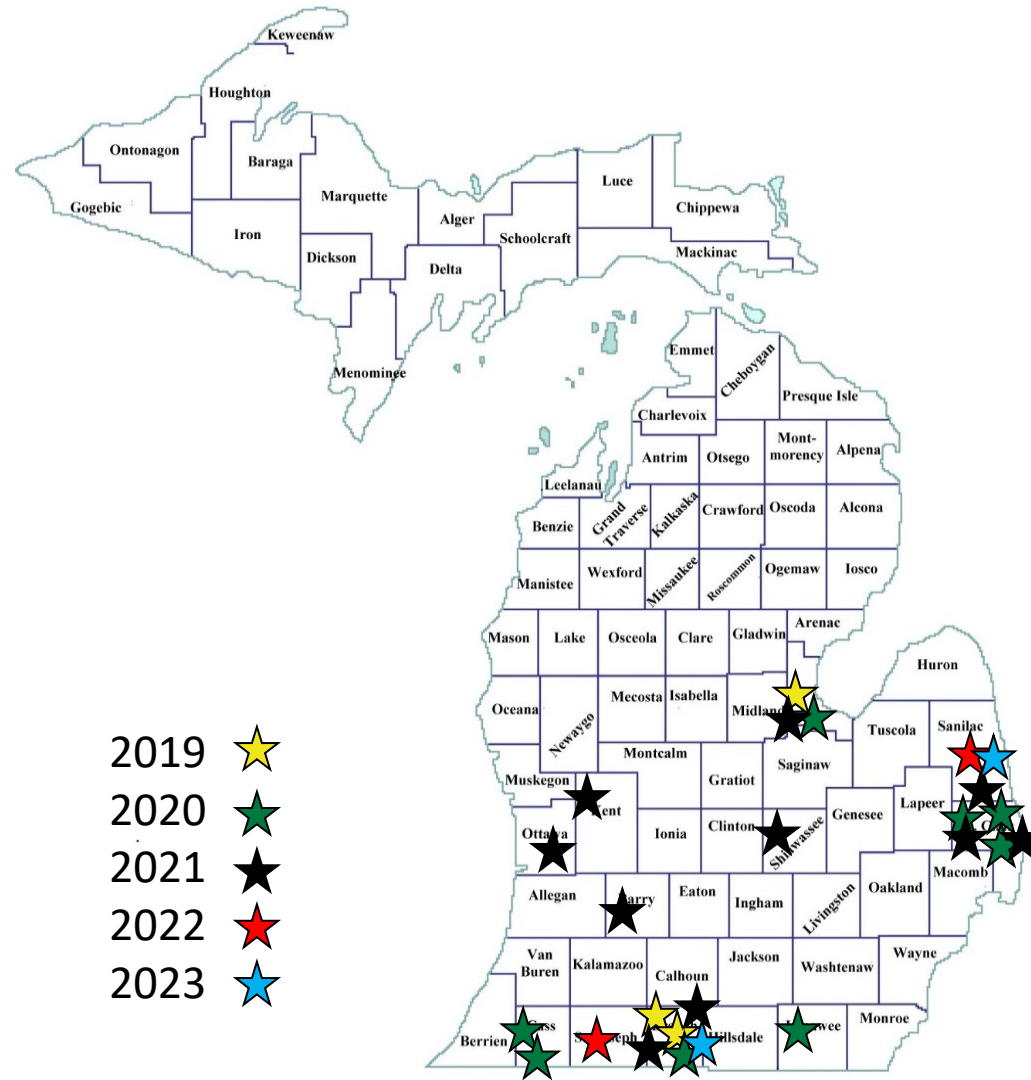
Planting rate effects on soybean yield and income (2015 to 2021)



Plant Early

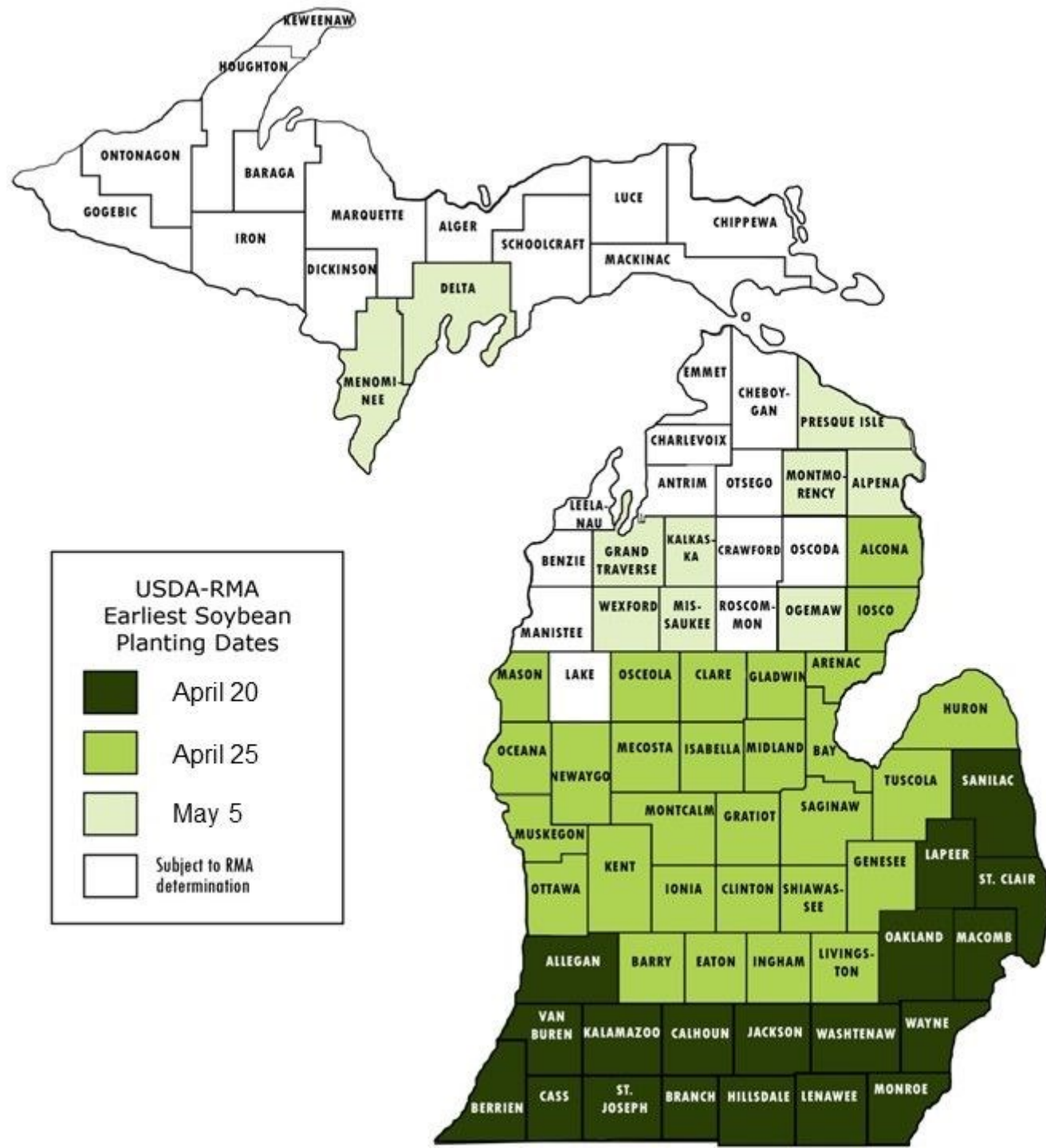


2019-2023 Planting Date Trial Locations



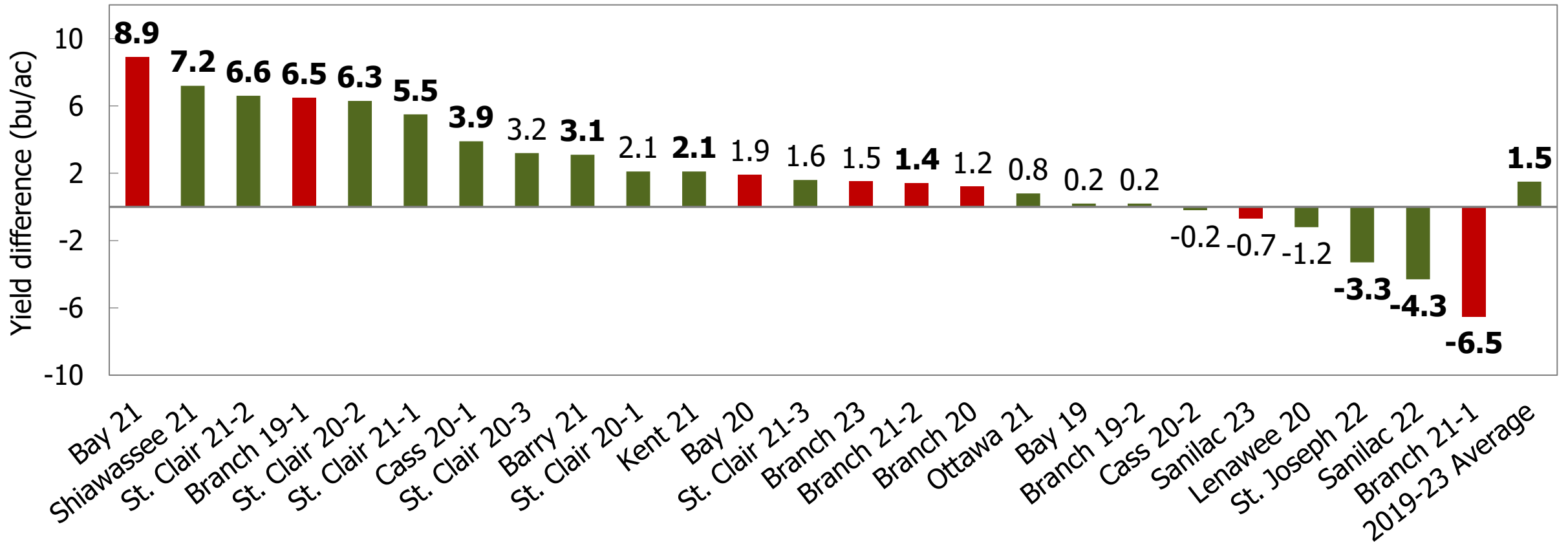






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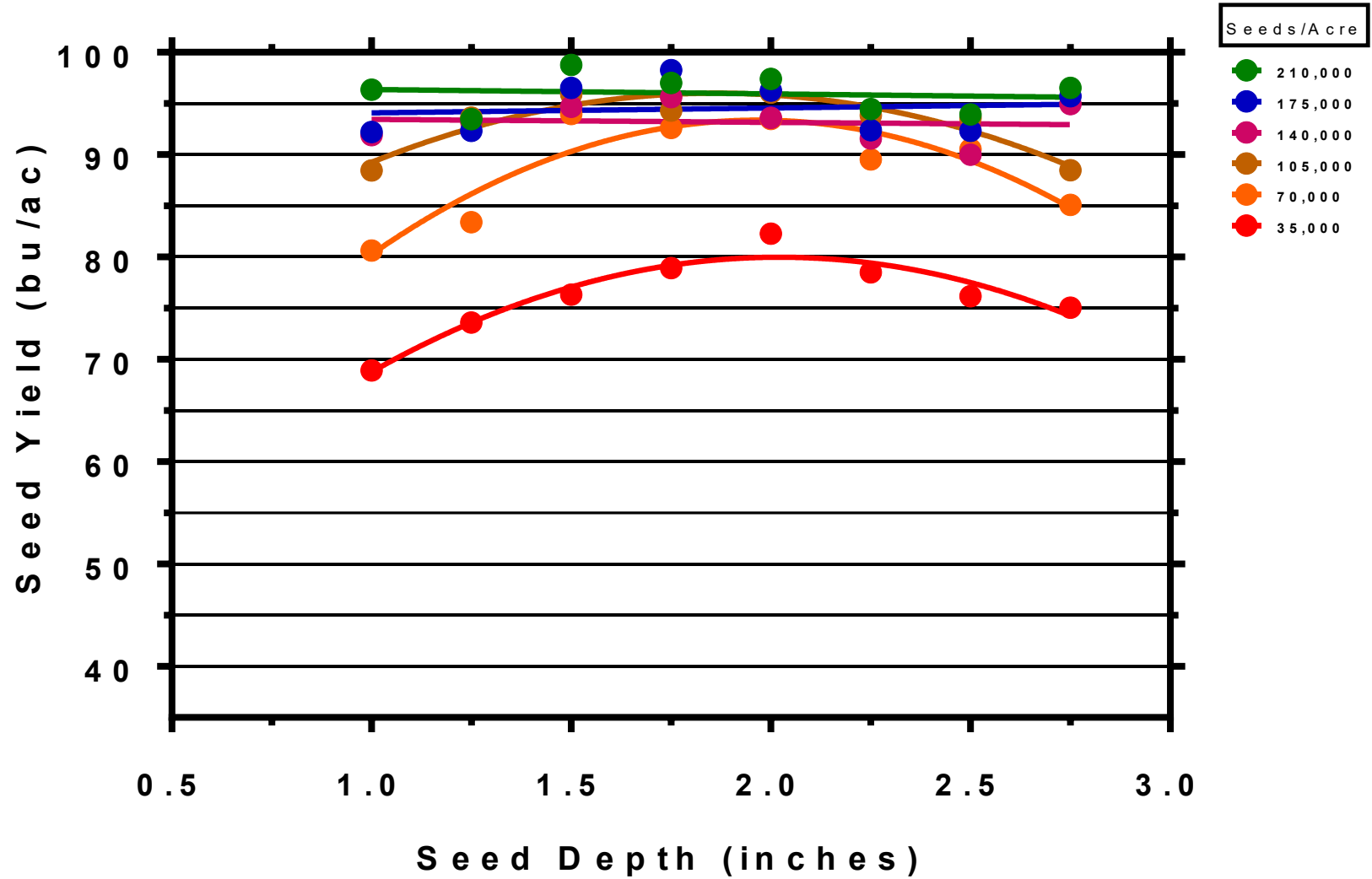
Yield difference produced by early planting from 2019 to 2023



Bold numbers indicate that the yield difference was statistically significant at these locations. Red bars show the trials that were planted prior to April 20th.

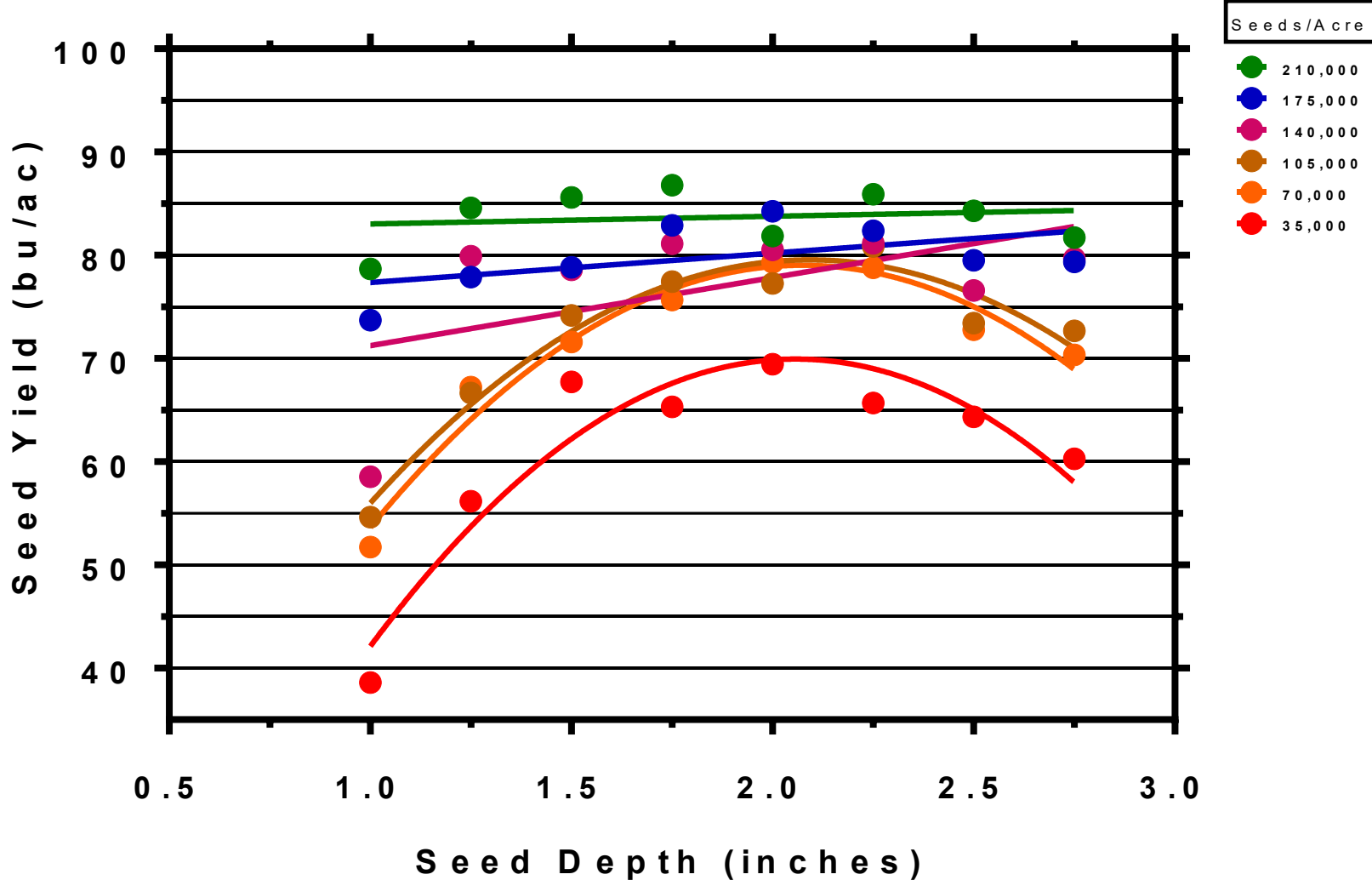
Consider Planting Deeper

2013 04-29 P 93 M 11 Irr S-Till 30" Mead



Note: Center-Pivot Irrigation Scheduled with Soy Water; Prior Crop was Corn; Strip-Tilled in the Spring; Ray & Kevin Kucera, Jr.

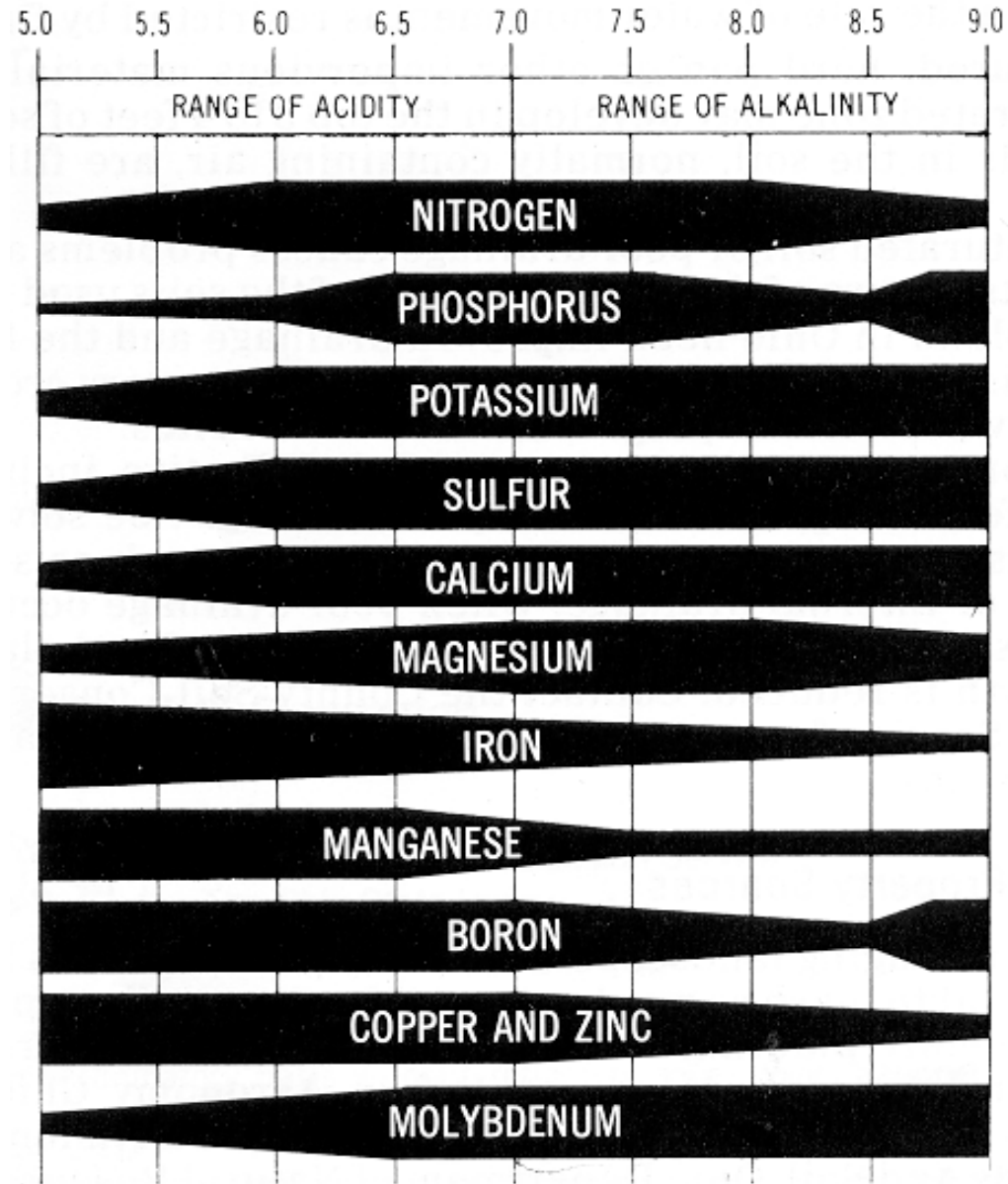
2013 04-29 P 93 M 11 Irr N -Till 30" M ead



Note: Center-Pivot Irrigation Scheduled with Soy Water; Prior Crop was Corn; No Tillage; Ray & Kevin Kucera, Jr.

Manage Soil pH

Soil pH and Nutrient Availability





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Relationship Between Soil pH and Final Soybean Cyst Nematode Population Density at Harvest

	Soil pH Range		
	5.8-6.4	6.5-7.0	7.1-8.0
Year	Soybean Cyst Nematode Eggs/100 cc of Soil		
1997	3950	6950	9750
1998	500	1500	2550
1999	2000	6800	7500
2000	786	766	1574

Source: C. Grau, N. Kurtweil and G. Tylka, "Soil pH Influences Soybean Disease Potential Summary".

Maintain Critical Soil Test Levels for Phosphorus and Potassium

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New tri-state critical soil test levels for phosphorus and potassium

Nutrient	CEC (meq/100g)	Critical level (ppm)	Maintenance limit (ppm)
Phosphorus	All	20	40
Potassium	≤ 5	100	130
Potassium	> 5	120	170

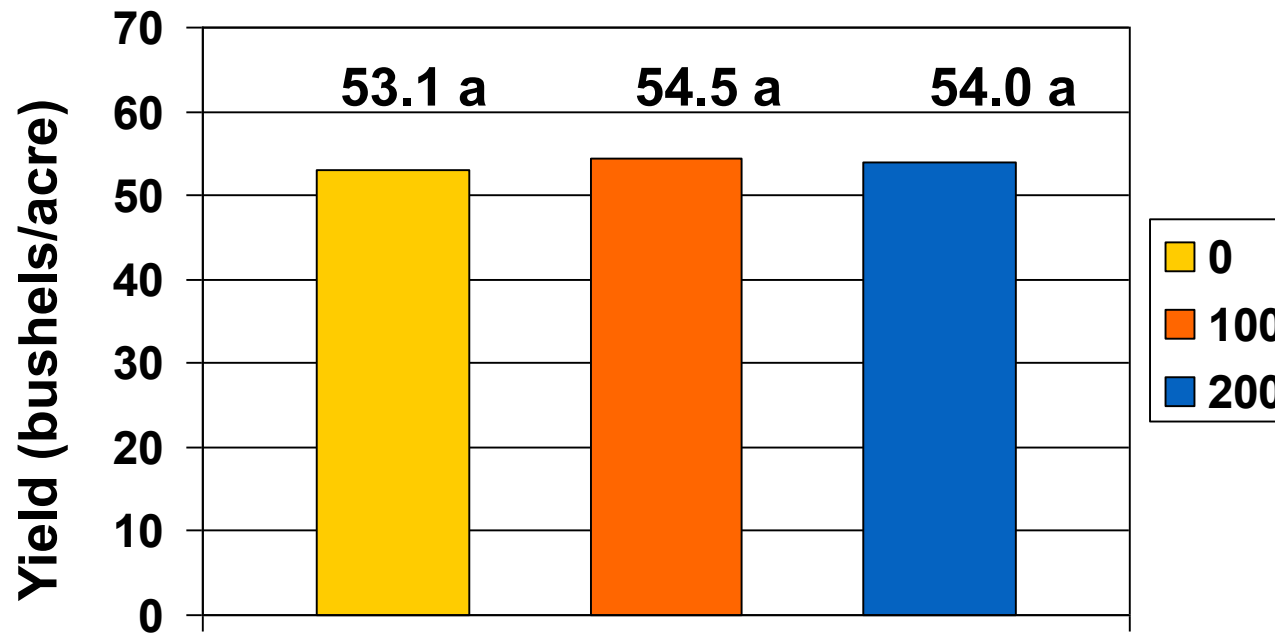
Recommendations are based soil test levels determined using the Mehlich III extraction method and reported as Mehlich III.

Multiply K levels reported as ammonium acetate by 1.14 to convert to Mehlich III.



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Broadcast Potassium Fertilizer Effects on Soybean Yield



0-0-60 Application Rate

C.V. = 6.3%

LSD_{0.05} = 5.9 bu/ac

Soil Test Information From The 2011 Potassium Fertilizer (0-0-60) Application Rate Trial

Location	Potassium (ppm)	Phosphorus (ppm)	Soil pH	Cation Exchange Capacity (meq/100 g)
St. Joseph	100	35	6.3	4.3

Potassium fertilizer management on coarse-textured irrigated soils

- Due to low cation exchange capacity (≤ 5 meq/100 g), leaching losses of K^+ are likely to occur.
- Maintain potassium soil test levels just above the critical level.
- Biannual potash applications are not recommended.
- Fall applications pose greater risk of loss than spring applications.
- Broadcast potash in the spring at least two weeks prior to planting.
- Consider selecting soybean varieties tolerant to chloride (Excluder).

Don't Apply Nitrogen Fertilizer

Michigan Soybean On-farm Research

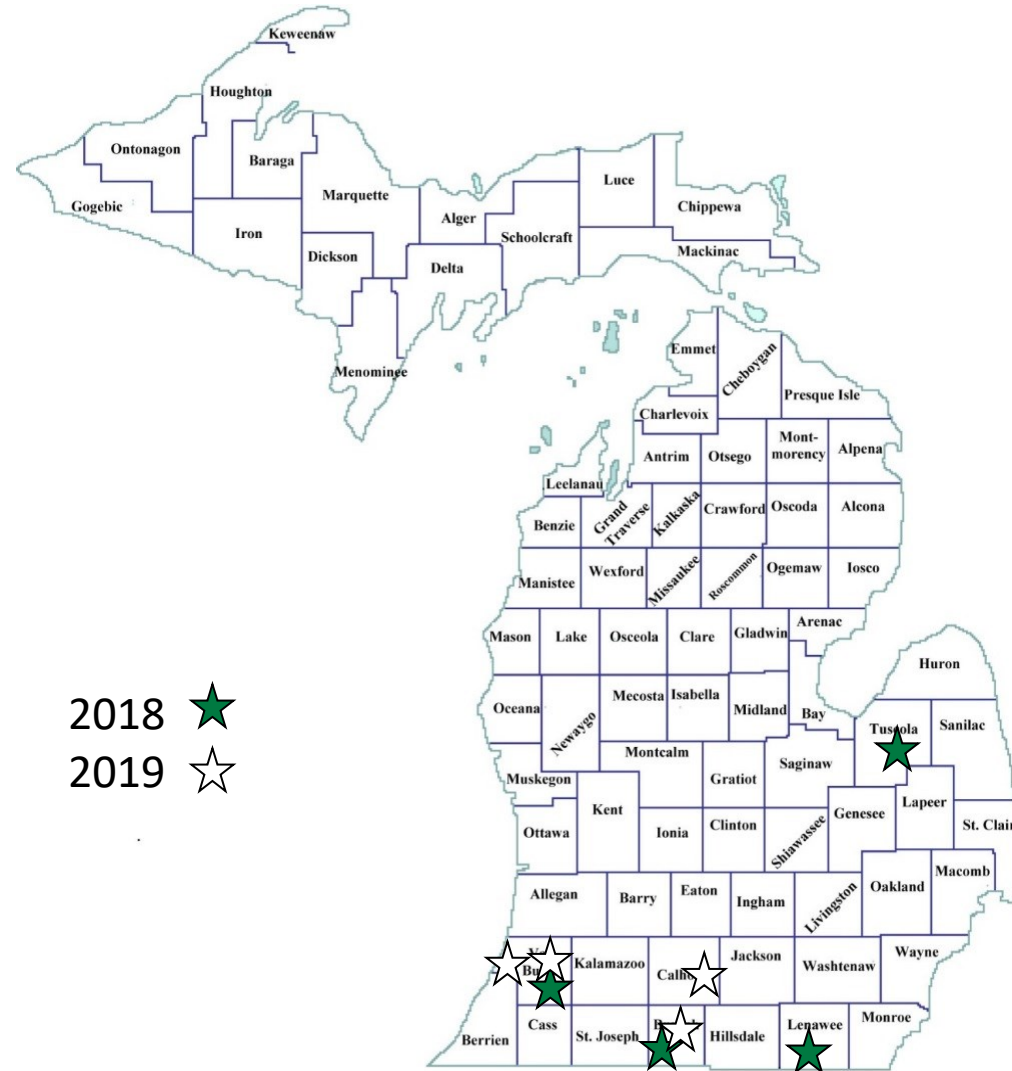
Supplemental Nitrogen Fertilizer Effect on Soybean Yield in Michigan On-farm Trials (2011 and 2012)

N rate (lbs/ac)	*St. Joe 11-1	**St. Joe 11-2	*St. Joe 12
	----- Yield (bu/ac) -----		
0	83.6	67.4	57.5
21	83.8	67.9	59.0
LSD _{0.10}	7.1	2.6	6.6

* Ammonium sulfate

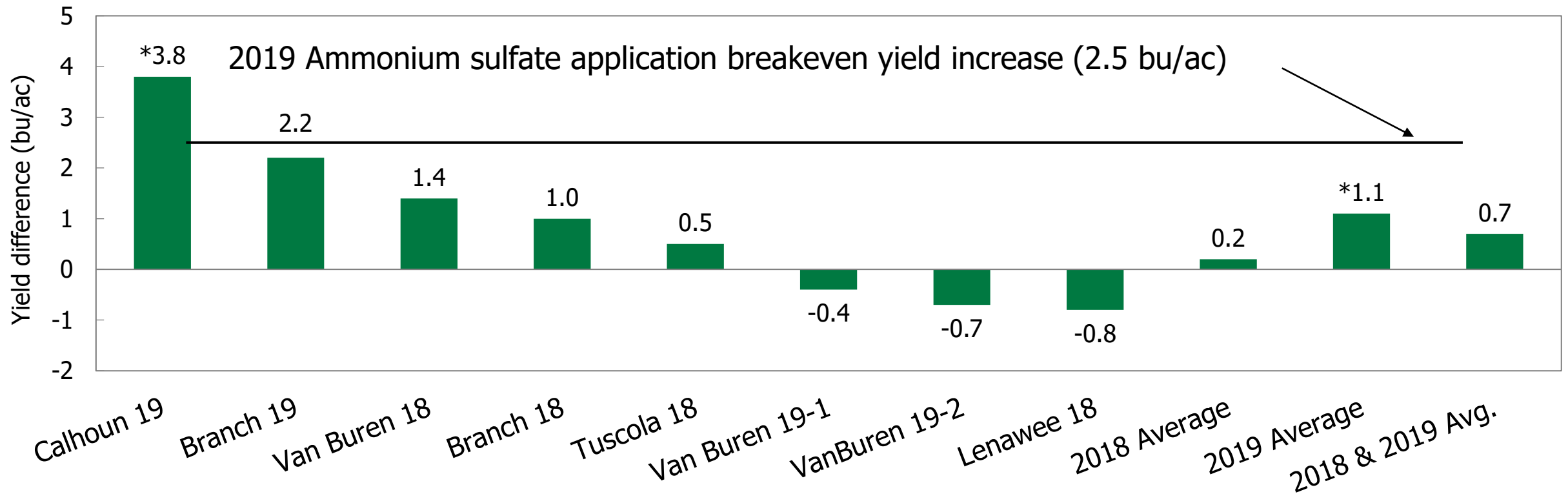
** 28% UAN

Pre-plant broadcast AMS trial locations



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Yield difference produced by a pre-plant application of AMS



*The yield difference was statistically significant at these locations

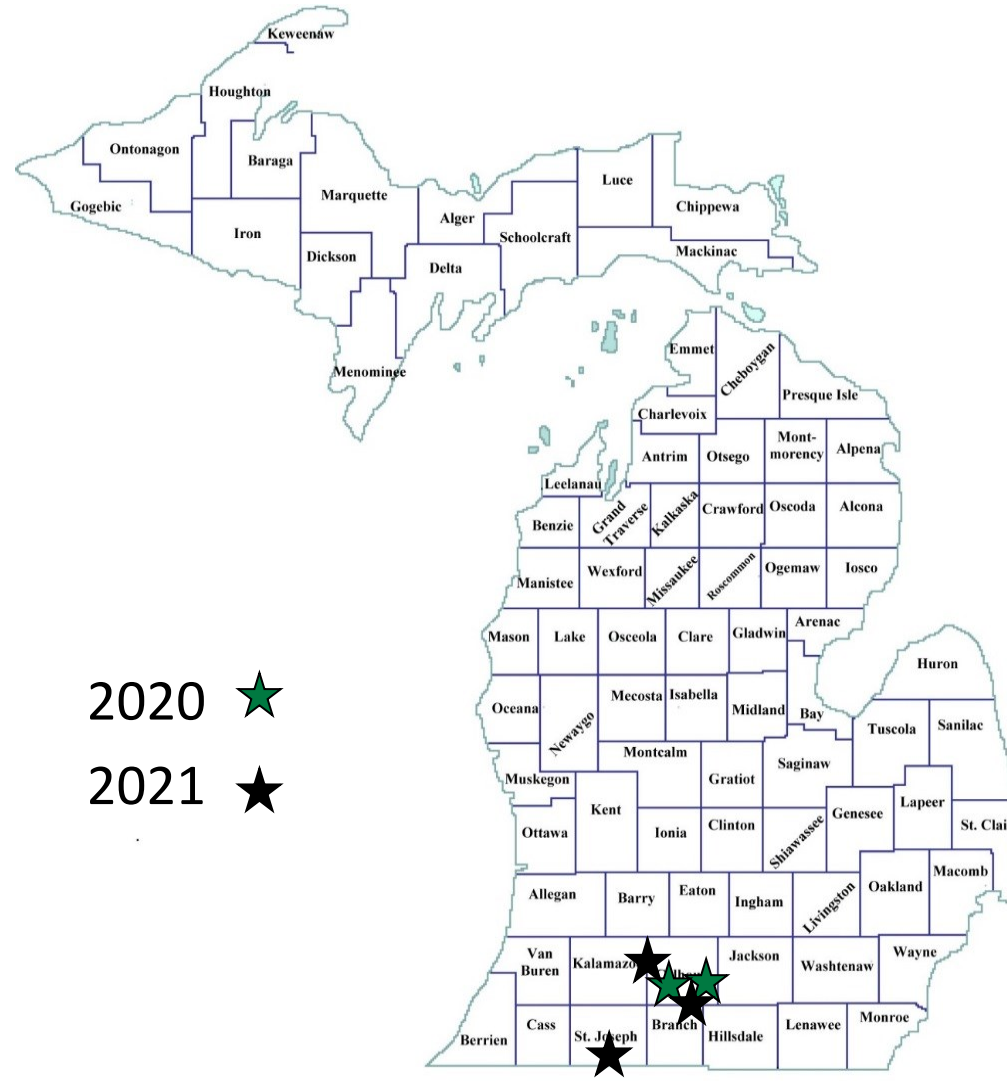
Consider Eliminating Foliar Fertilizer Applications

- Foliar fertilizer applications to soybeans are rarely profitable
 - The foliar fertilizer treatment was more profitable than the untreated control in only 15 of the 172 replicated on-farm trials conducted in Michigan since 2009.
 - Six common foliar fertilizers and an untreated control were compared in a coordinated research project covering 14 states in 2019 and 2020. Three of the foliar fertilizers were profitable at one of the 46 locations.

Manage for Sudden Death Syndrome



2020-2021 Saltro® seed treatment trial

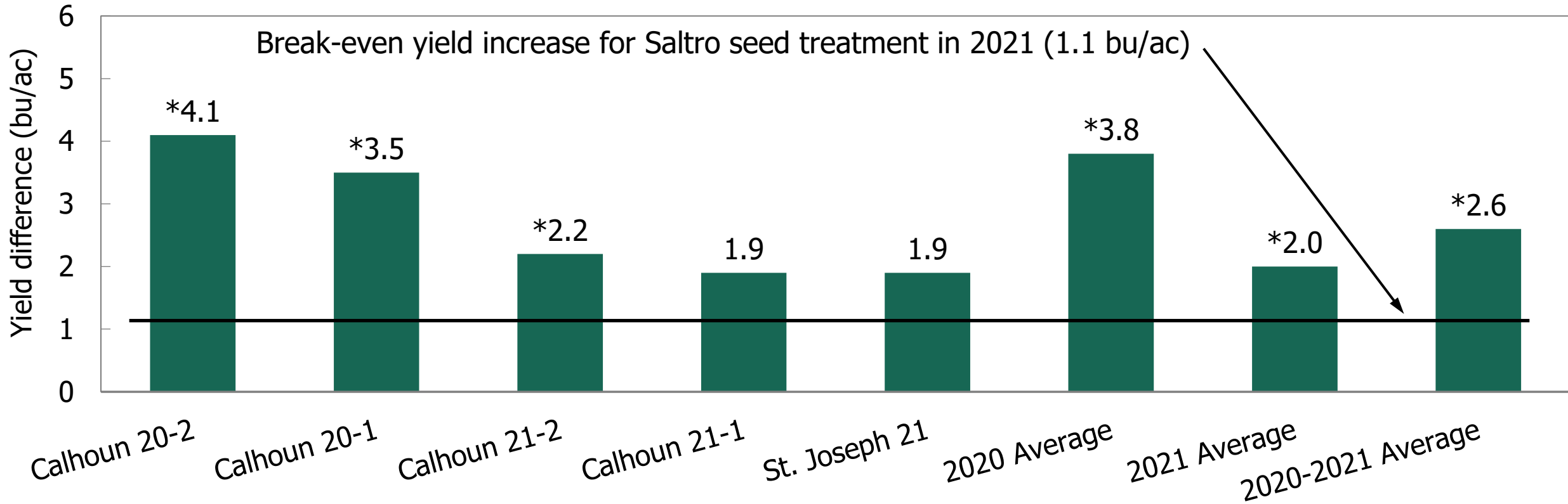


Saltro trial conducted in Calhoun County



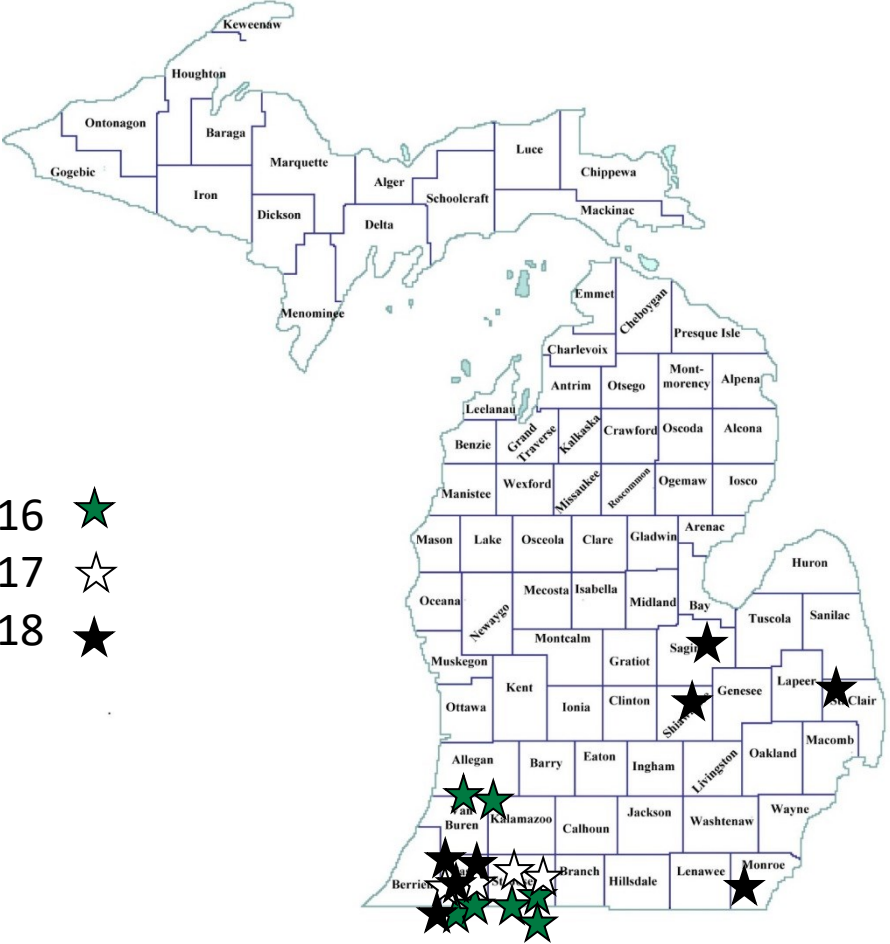
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Yield difference produced by Saltro Seed treatment in 2020 and 2021



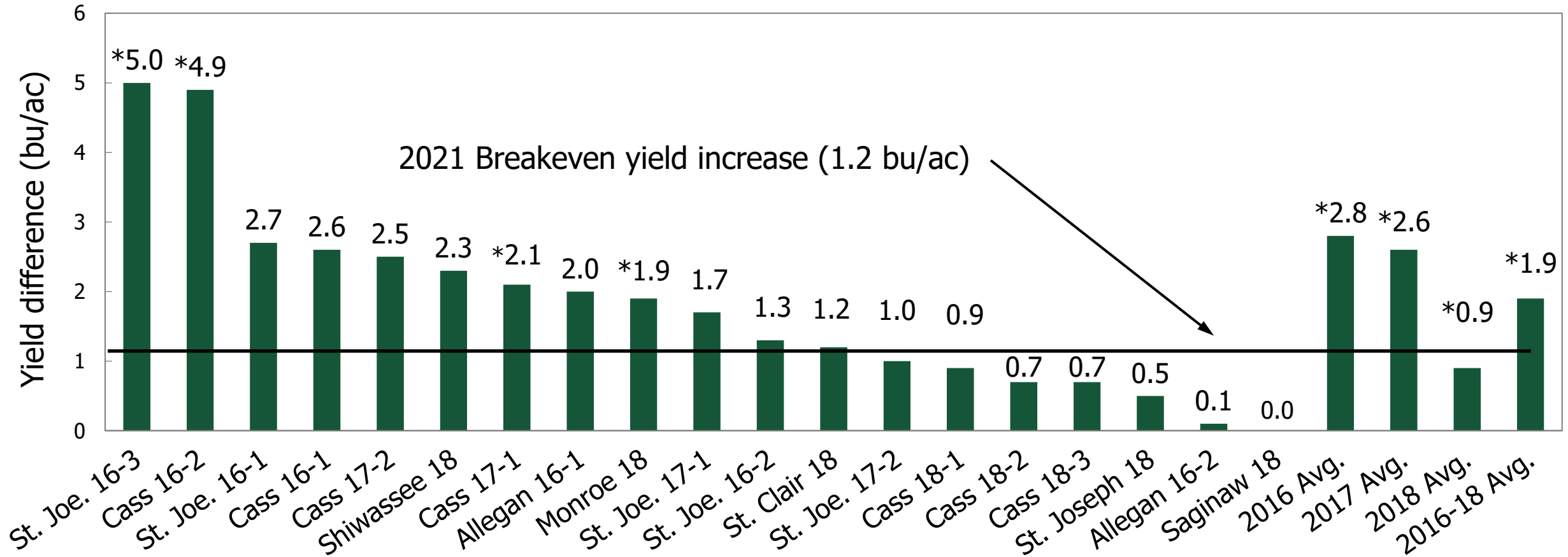
*The yield difference was statistically significant at these locations.

2016, 2017 and 2018 ILeVO trial locations



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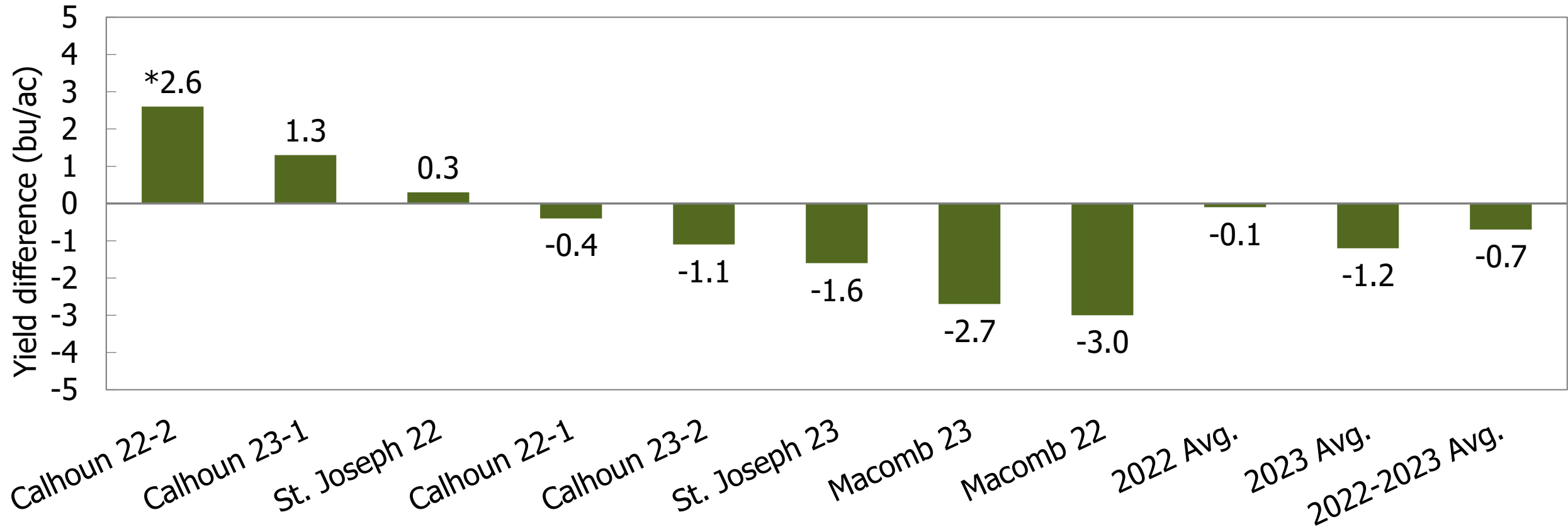
Yield difference produced by ILeVO seed treatment in 2016, 2017 and 2018



* The yield difference was statistically significant at these locations

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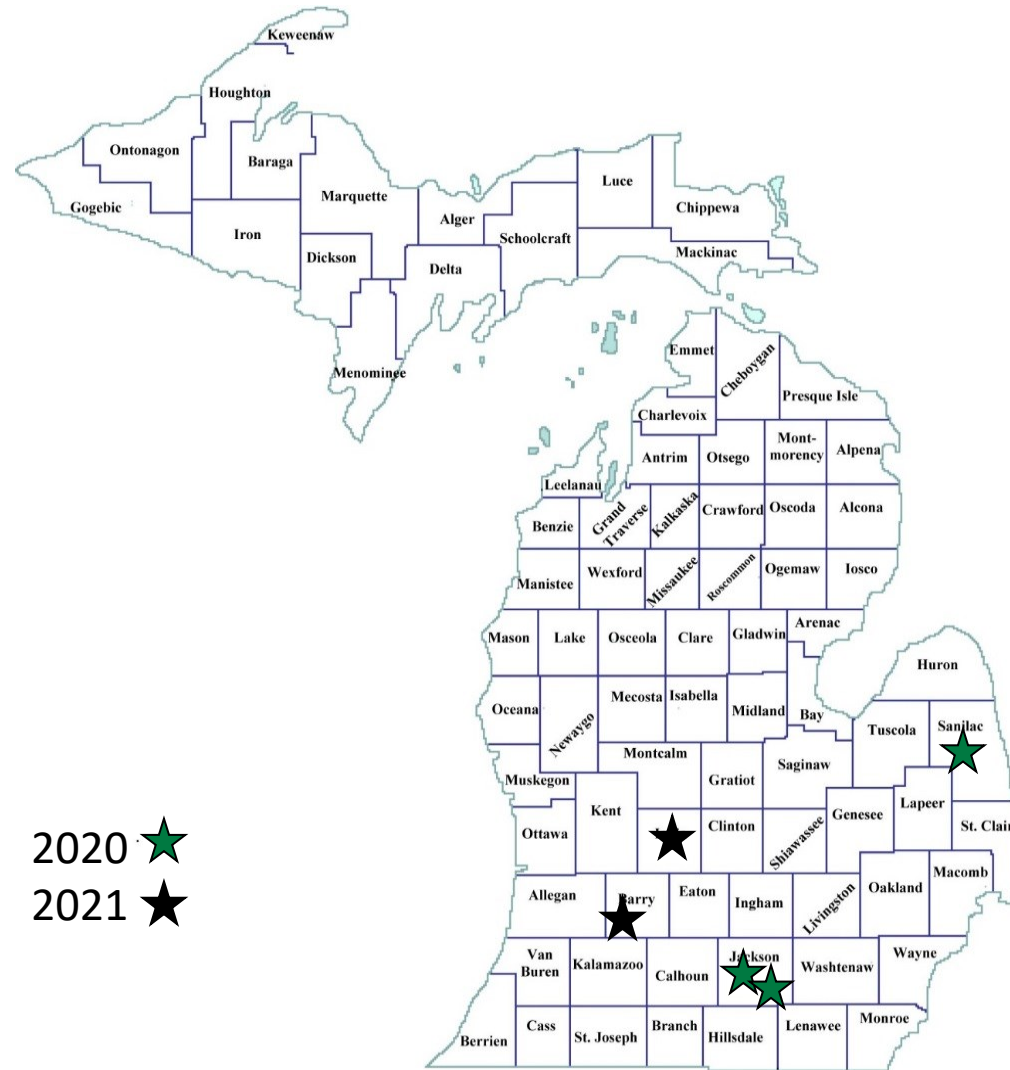
Yield difference produced by ILeVO compared to Saltro



*The yield difference was statistically significant at this location.

ILeVO cost was \$13.00 per acre and the Saltro cost was \$14.85 per acre

2020-2021 Rye Termination Timing Trial Locations



2020-2021 Rye cover crop termination timing trial

- Two rye termination timings were compared at three locations in 2020 and two locations in 2021.
 - Terminating rye prior to planting
 - Terminating rye after planting
- Final stand counts were taken at all locations



Photo by Dean Baas, MSUE



Photo by Dean Baas, MSUE

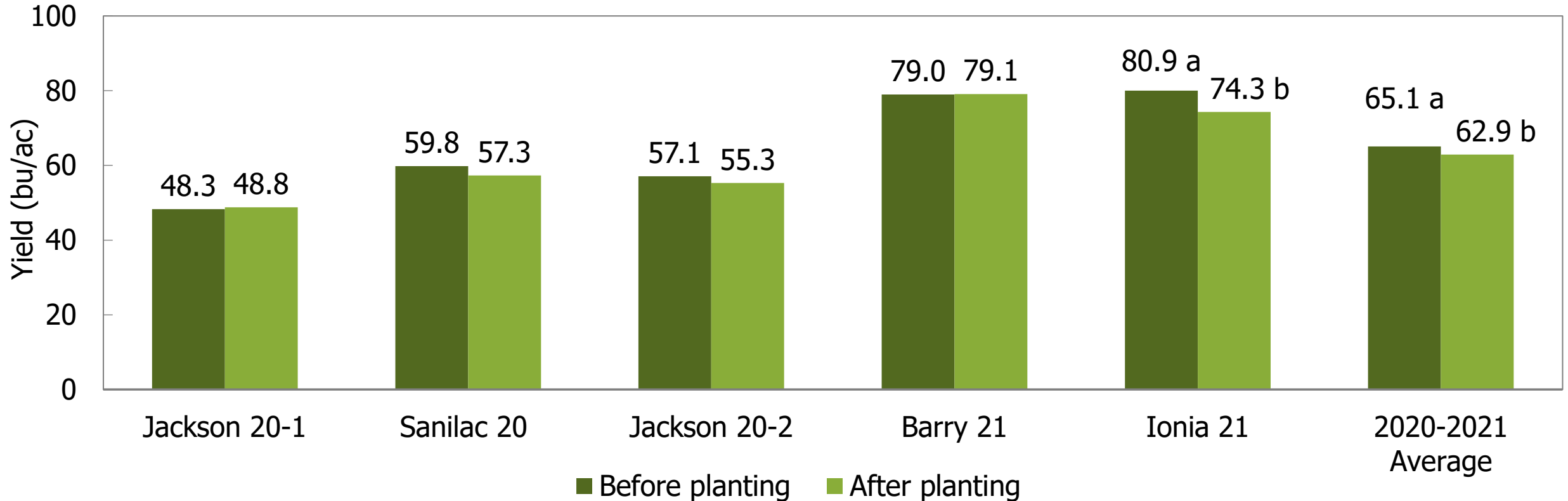
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Planting dates, planting rates, planter/drill, rye termination dates and burndown herbicides

Location	Planting date	Planting rate	Planter/ drill	Early rye termination date	Late rye termination date	Burndown herbicide
Jackson 1	May 21	140,000	White 9936	May 4	May 22	Glyphosate
Sanilac	May 31	155,000	Kinze 3500	May 26	June 1	Roundup, Antaris, Metribuzin
Jackson 2	May 21	140,000	White 9936	May 4	May 22	Glyphosate, Zidua Pro
Barry 21	May 18	120,000	JD 1780	May 4	May 18	Glyphosate
Ionia 21	May 2	180,000	JD 1990	April 24	May 16	Glyphosate + 2,4-D LV6

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Effect of rye termination timing on soybean yield in 2020 and 2021

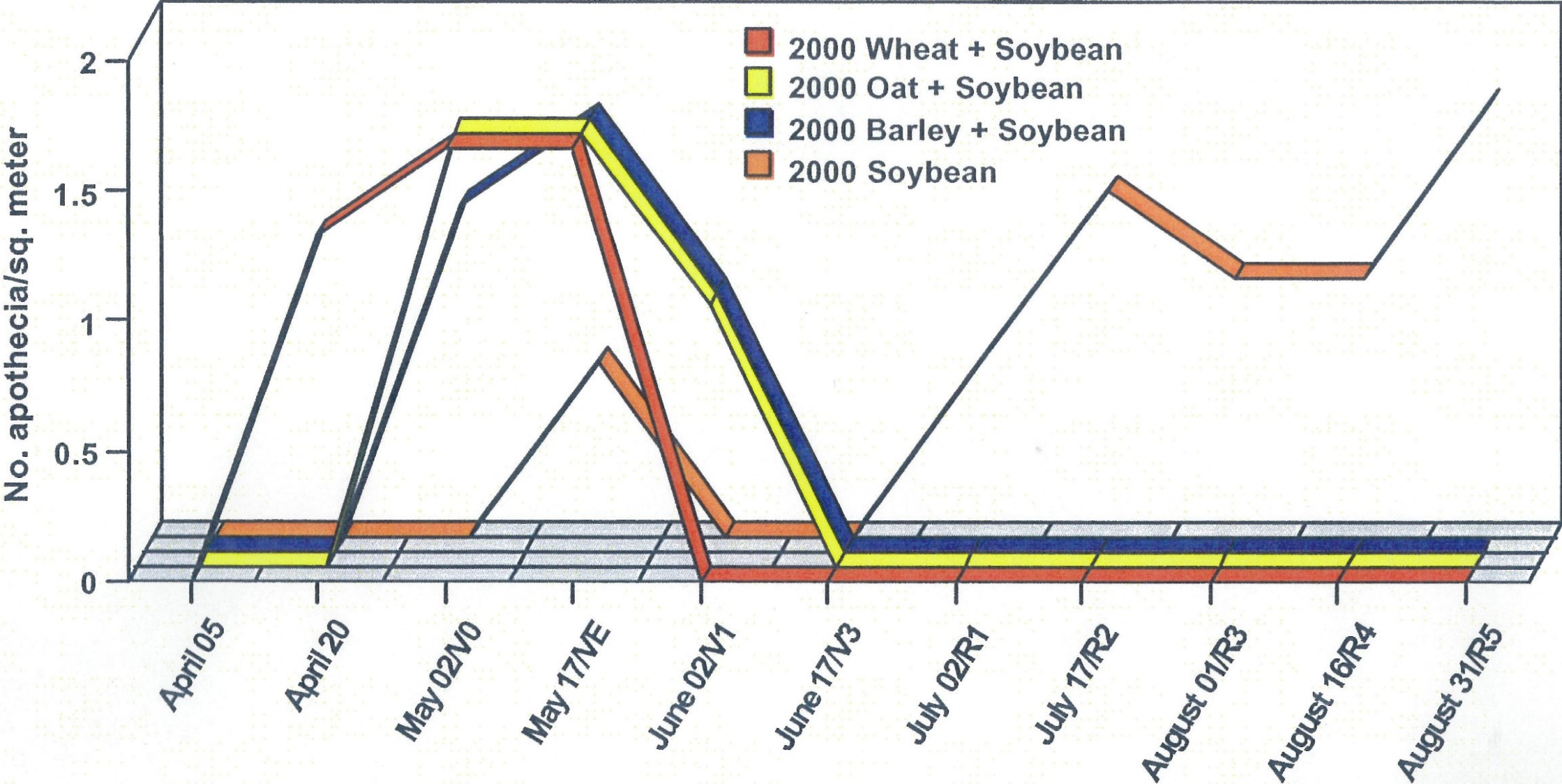


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The effect of rye cover crop termination timing on final plant stands in 2020 and 2021

Location	Controlled prior to planting	Controlled after planting	LSD _{0.10}	Stand difference
	----- Plant stand (plants/ac) -----			Plant stand (plants/ac)
Jackson 1	78,200	77,400	4,272	-800
Sanilac	118,900	121,500	9,159	2,600
Jackson 2	73,100	76,300	6,651	3,200
Barry 21	108,600	109,700	3,763	1,100
Ionia 21	144,700 a	122,700 b	10,021	-22,000
Average	89,900	91,900	3,533	3,000

Small Grain Cover Crop Effect on White Mold Apothecia Production (UW)



Source: T.S. Maloney and C.R. Grau, Unconventional Approaches to Combat Soybean Diseases

Consider Eliminating Foliar Fungicide Applications Unless Field and Weather Conditions are Favorable for White Mold

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Summary of the Michigan On-farm Foliar Fungicide Trials

Fungicide	Stratego [®] YLD	Priaxor [™]	Miravis [®] Neo	Delaro [®] Complete
# of trials	9	22	22	10
# of trials with yield increases	5	8	9	8
Average yield increase (bu/ac)	1.5	2.1	2.2	3.0

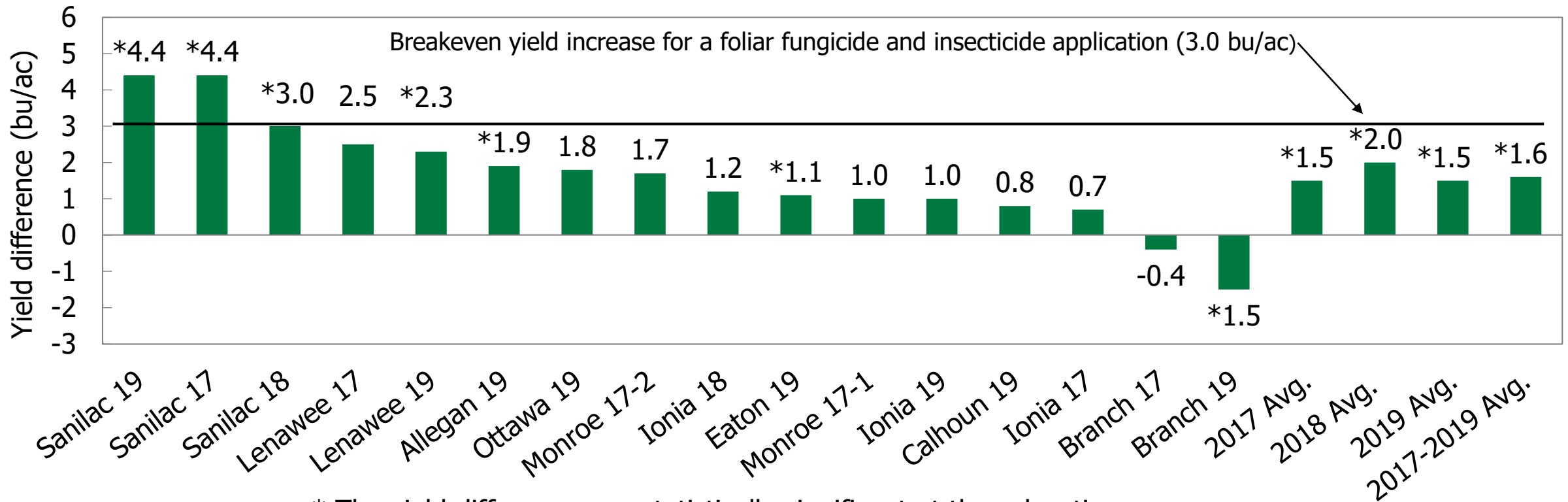
The average yield increases produced by Priaxor and Delaro Complete were profitable at today's prices.

What happens when insecticides are tank-mixed with plant health/high yield foliar fungicide applications?



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Yield difference produced by foliar fungicide plus insecticide applications (2017-2019)



* The yield difference was statistically significant at these locations

*Use a Variety of Tactics to
Manage White Mold*



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Tactics for Managing White Mold

- Tolerant varieties
- Wide row widths (≥ 20 inches)
- Reduced planting rates
- Tillage and rotation decisions
- Irrigation water timing and rates
- Foliar fungicides
 - Select effective fungicides
 - Properly time your application (Sporecaster phone app)
 - Equip and operate your sprayer to maximize canopy penetration and coverage.
- Contans (naturally occurring fungus that attack sclerotia)

Apply white mold fungicides at the optimum time

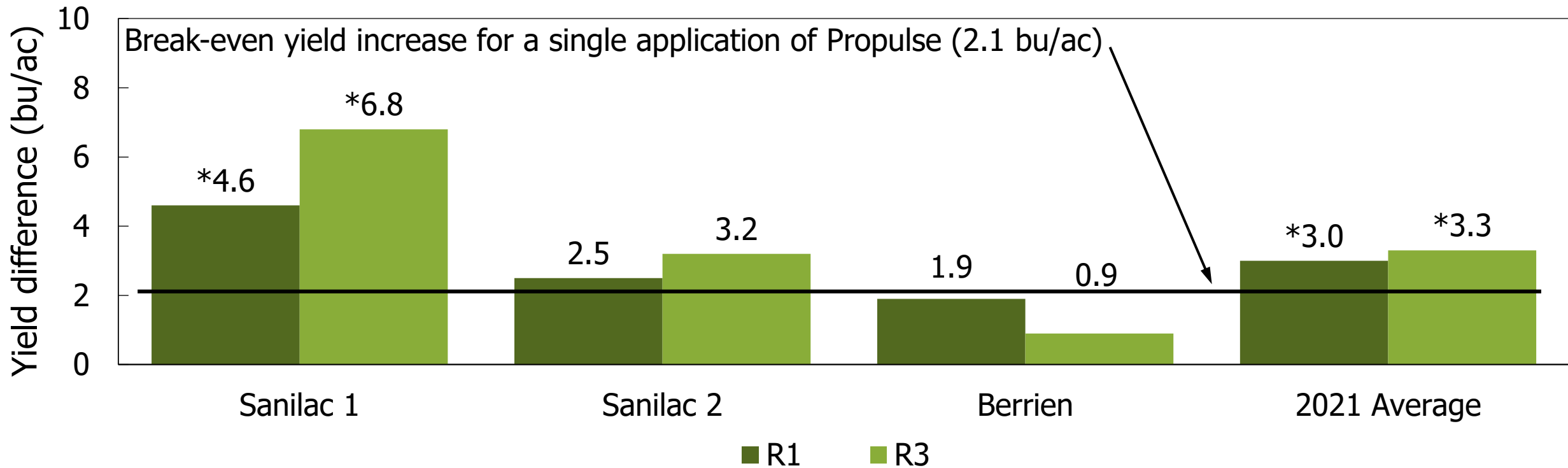


2021 & 2023 White mold foliar fungicide application timing trials

- The trial compared three treatments at three locations in 2021
 - Propulse fungicide applied at R1
 - Propulse fungicide applied at R3
 - Untreated control
- Four treatments were compared in 2023
 - Propulse at R1
 - Propulse 7 days after R1
 - Propulse 14 days after R1
 - Untreated control
- Propulse was applied at 6 ounces per acre

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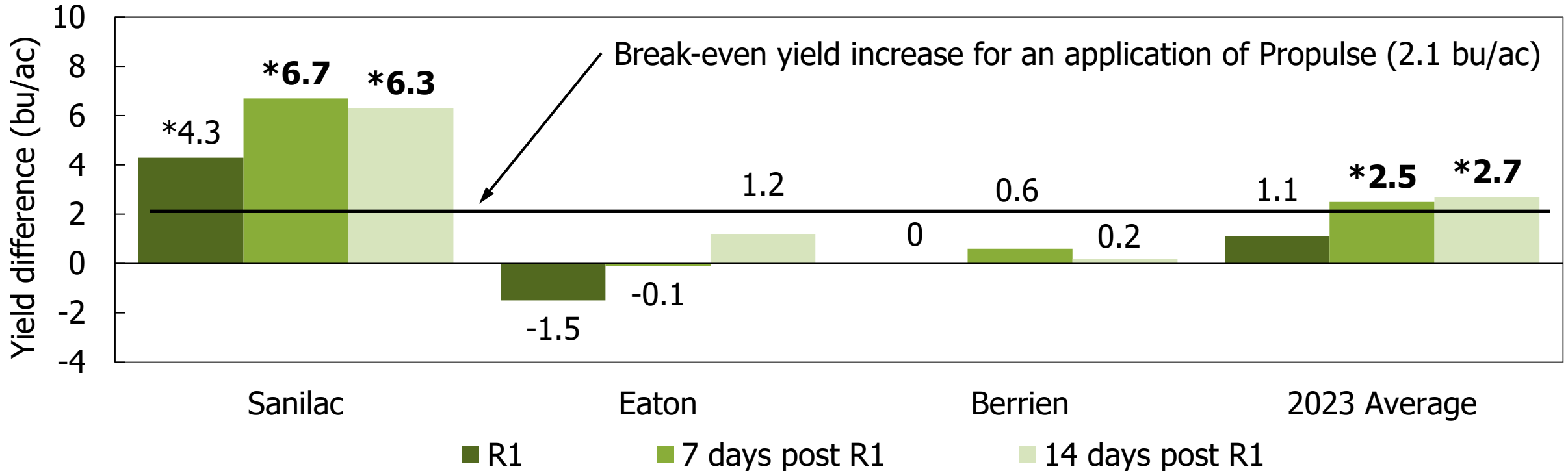
Yield difference produced by a single fungicide application at two different timings compared to an untreated control in 2021



*The yield difference between the fungicide application timings and the control were statistically significant at these locations.

Michigan Soybean On-Farm Research

Yield difference produced by a single fungicide application at three different timings when compared to the control



*The yield difference between the fungicide application timings and the control were statistically significant at these locations.

Bold type indicates that the yield differences between the later application dates and the R1 application date were statistically significant at these locations.

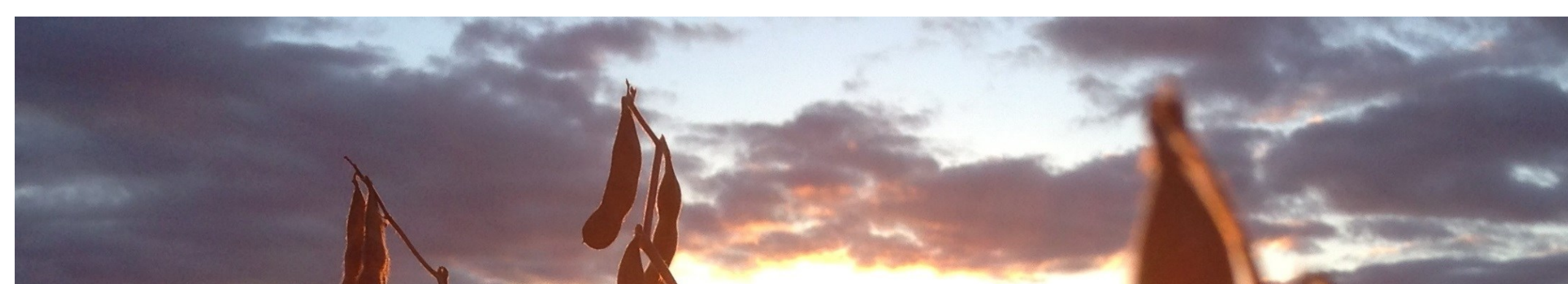


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www.michigansoybean.org

All the soybean articles I've written are available by searching:

Mike Staton, MSUE



Questions?

