

ROI and Soybean Production

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Cropping Systems Agronomy
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NCSRP NORTH CENTRAL SOYBEAN
RESEARCH PROGRAM

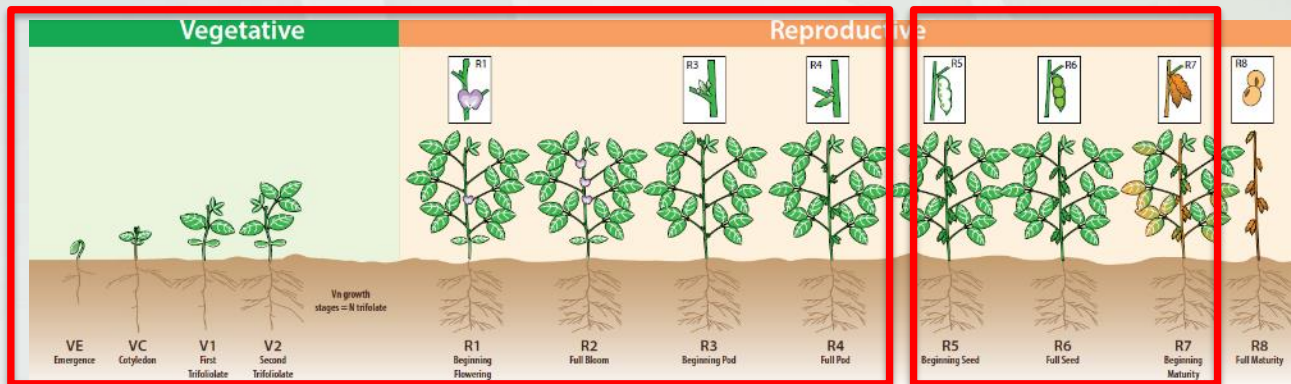
Project
GREEN

USDA
NIFA

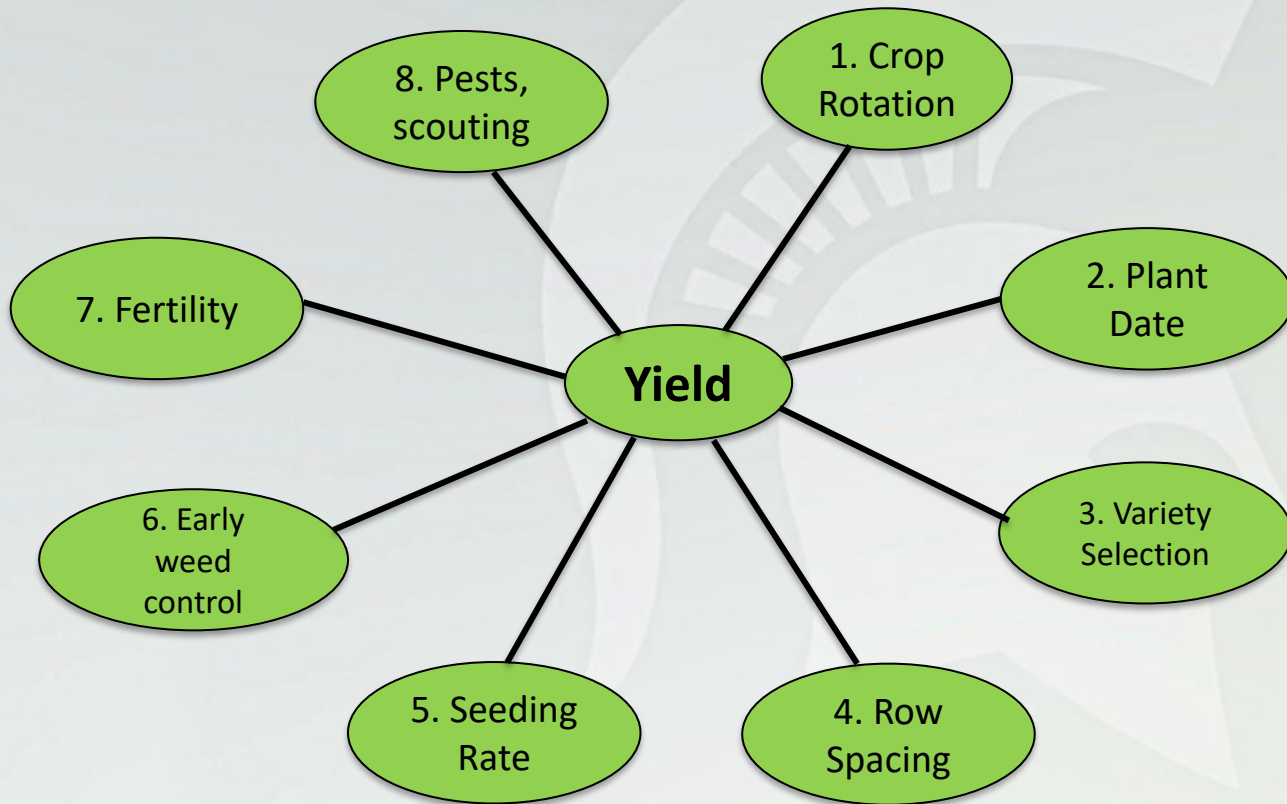
Soybean Yield Components

- Establish uniform plant stand (plants/acre)
 - Set and retain more pods (pods/plant)
 - Increase number of seeds/pod
 - Maximize seed weight (seeds/lb)
- } Pods per acre
 } Seeds per acre
 } Seed weight

What can be done to **POSITIVELY** influence these yield components and **minimize Yield Limiting Factors at field-scale**



Managing Soybean for higher Yield and Profit

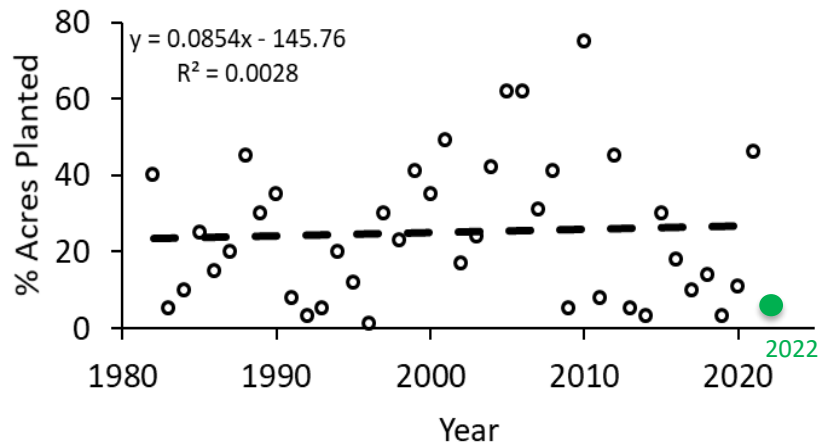


Topics for today:

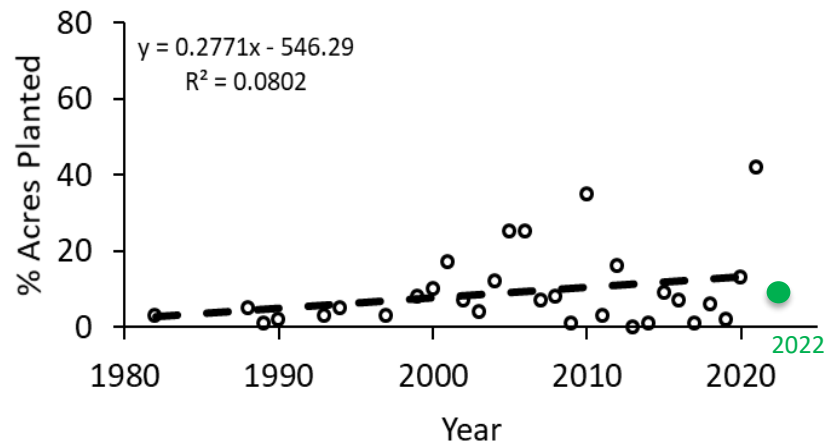
1. Recent data trends
2. Plant date
3. PD x other strategies
 - Variety maturity
 - Seed rate
 - Row spacing
 - Planting method
 - Seed priming
4. Biological seed treatments

Planting Progress- Variability over years

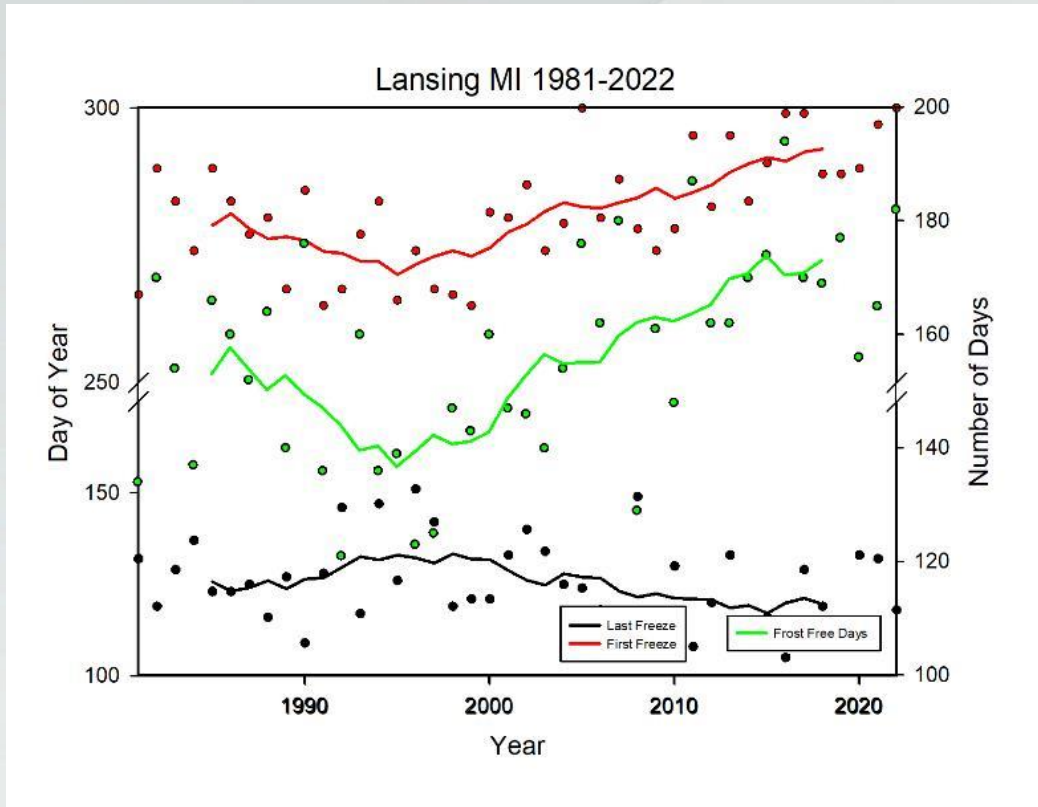
% Corn Planted by 1st week of May



% Soybean Planted by 1st week of May

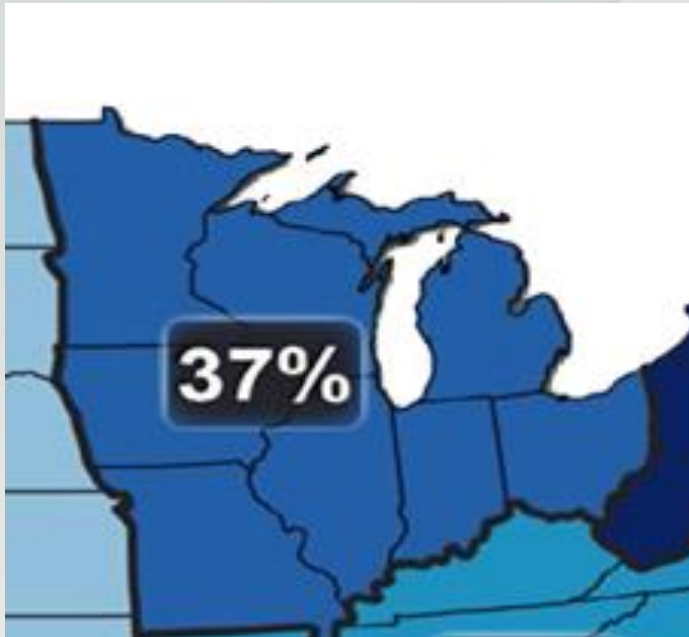


Weather Trends: Longer frost-free season



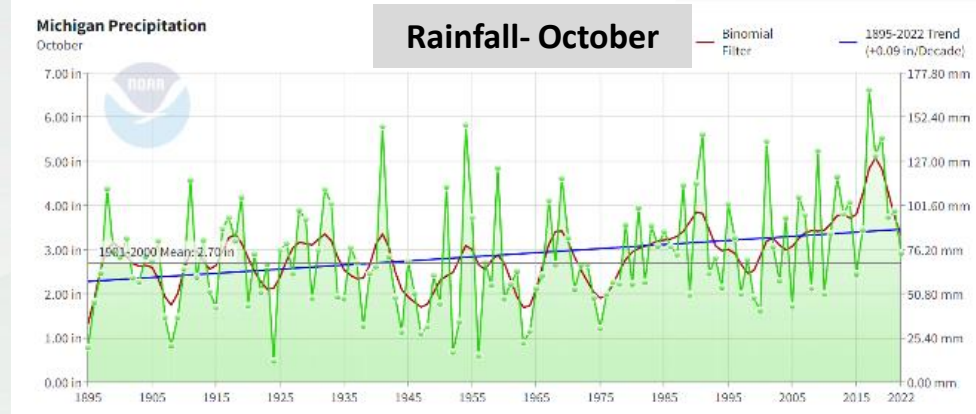
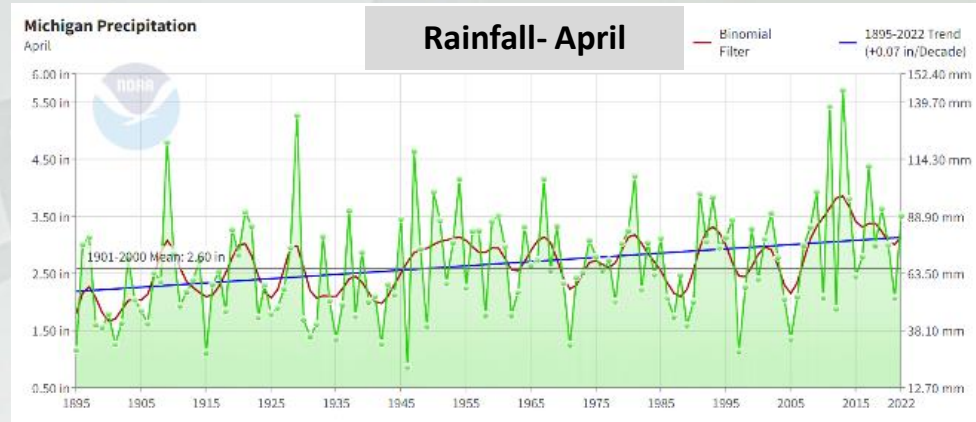
GLISA, 2019

Weather Trends: Wetter in spring/fall



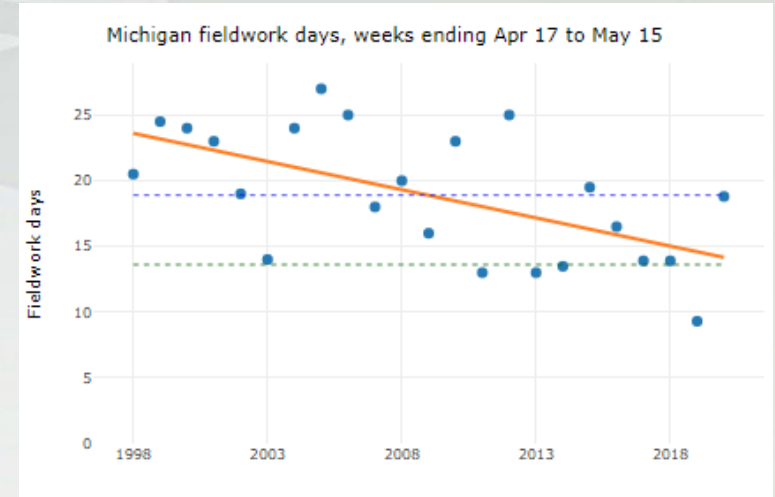
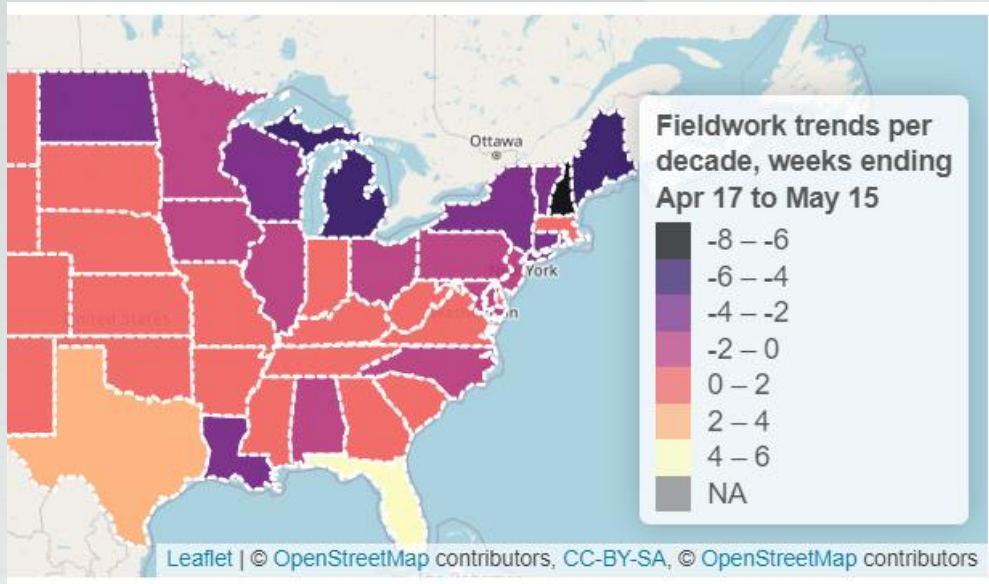
Increase in extreme precipitation
(during top 1% of severe storms)

GLISA, 2019



Jeff Andresen, MSU

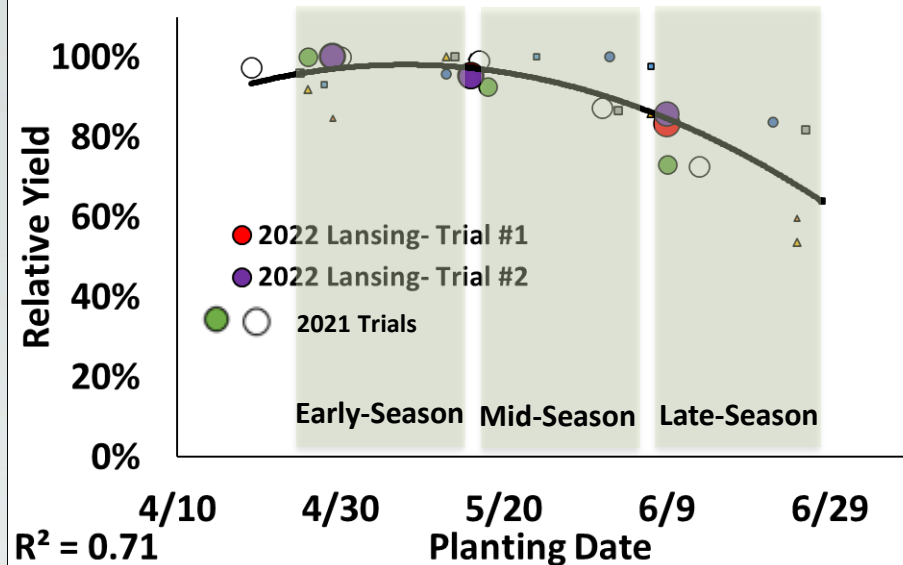
Weather Trends: Less #days for field work in Spring



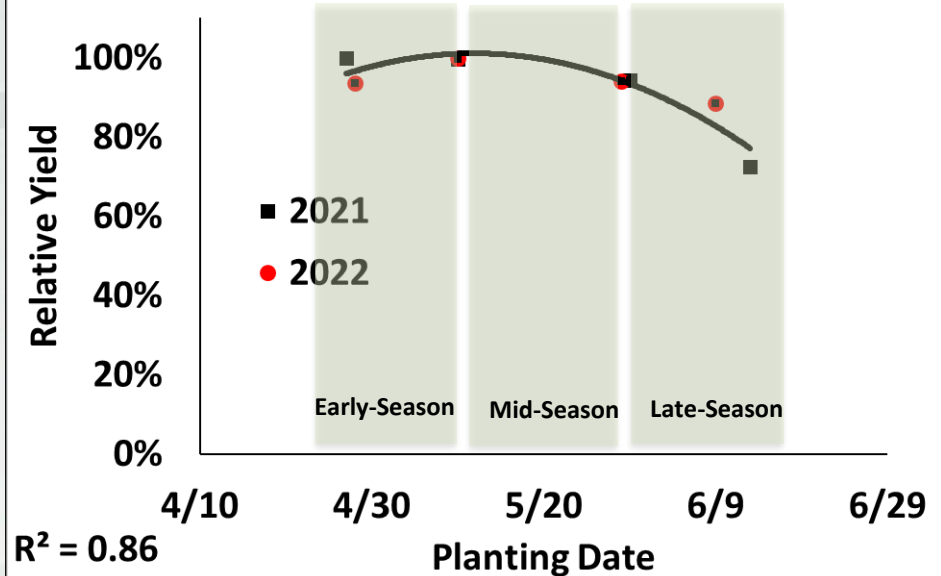
- Michigan: 4 less days per decade for fieldwork (between mid-April to mid-May)

Planting Time Impacts Yield in Michigan

Optimal Soybean Planting Date



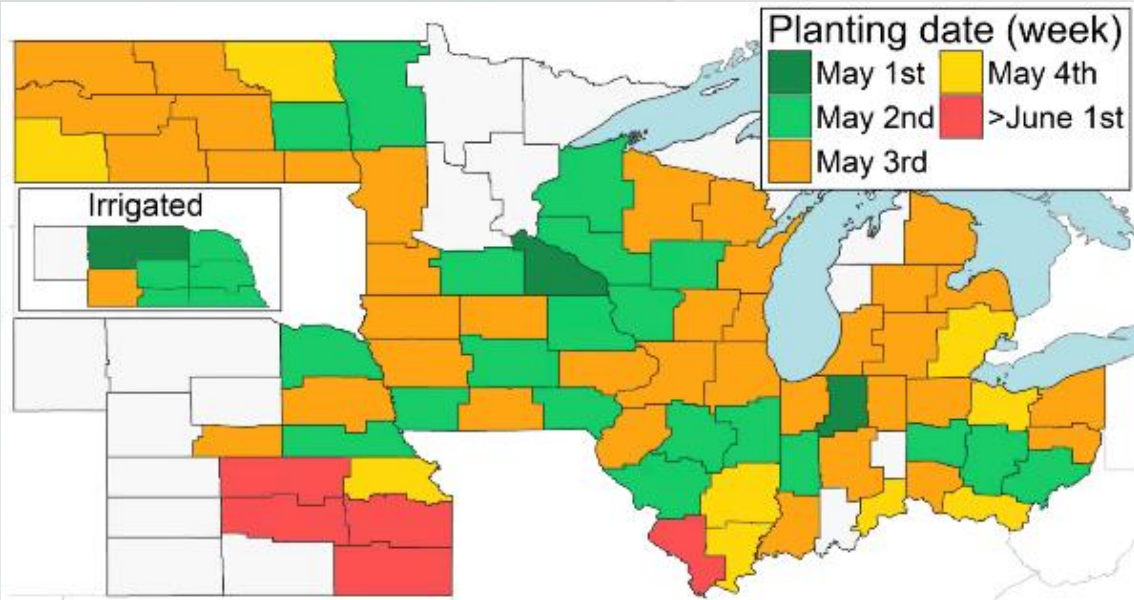
Optimal Corn Planting Date



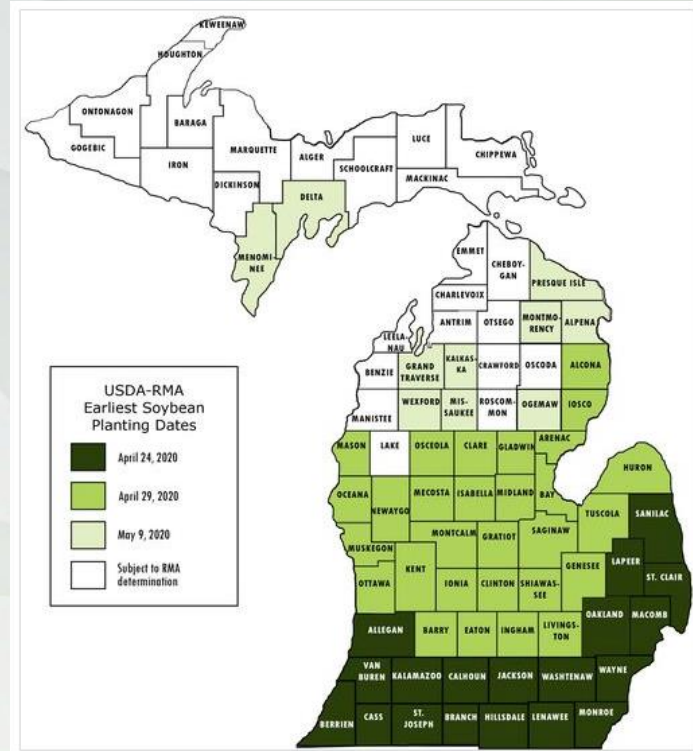
Data from 2018-2022 across multiple trials

Data from 2021-22 Trials

Soybean Planting Date



Grassini, P., & Conley, S. (2019). Benchmarking Soybean Production Systems in the North-Central USA. **2014-2017 data**

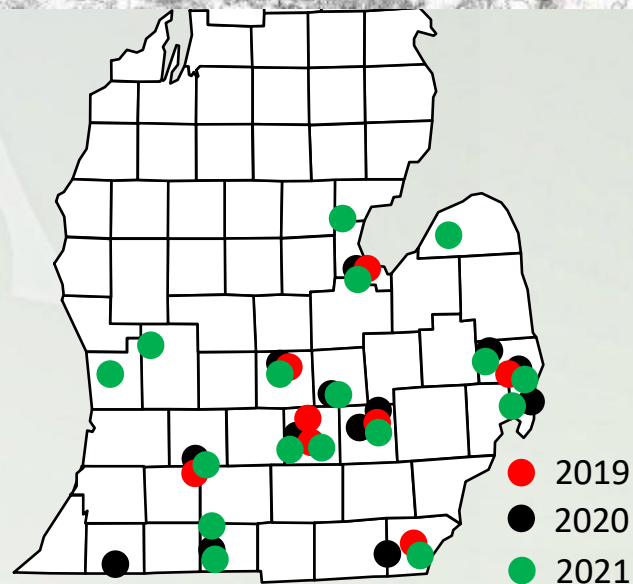
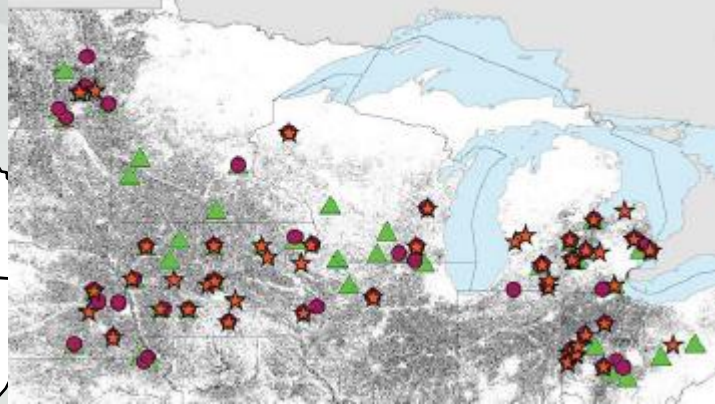


Risk Management Agency's (RMA) earliest planting dates for soybeans in Michigan

On-farm Soybean Trials

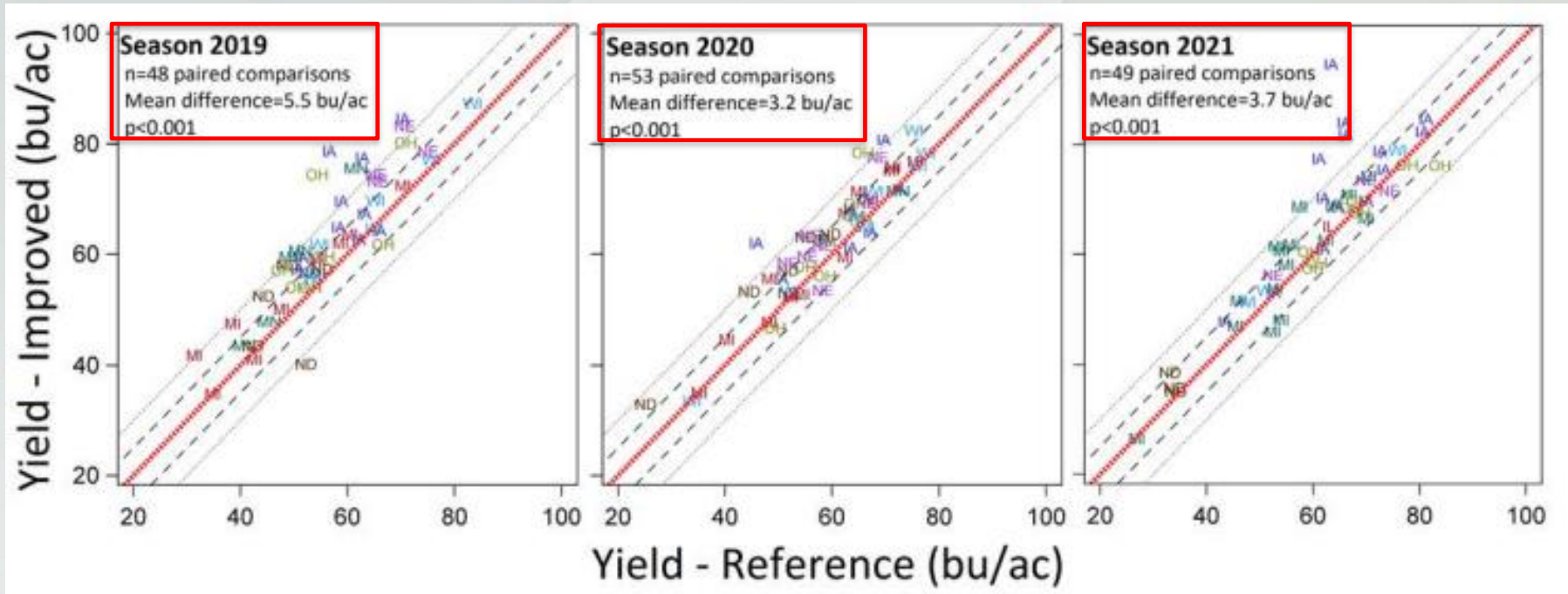
- Conducted 2019 - 2021
- 2 plant dates (**early, typical**),
~3 weeks apart, in strips
 - Fungicide/insecticide at R3 in few fields in 2019
in early planting
- Yield from each strip
- Seed quality samples

2019 2020 2021



Soybean Yield: Data across states

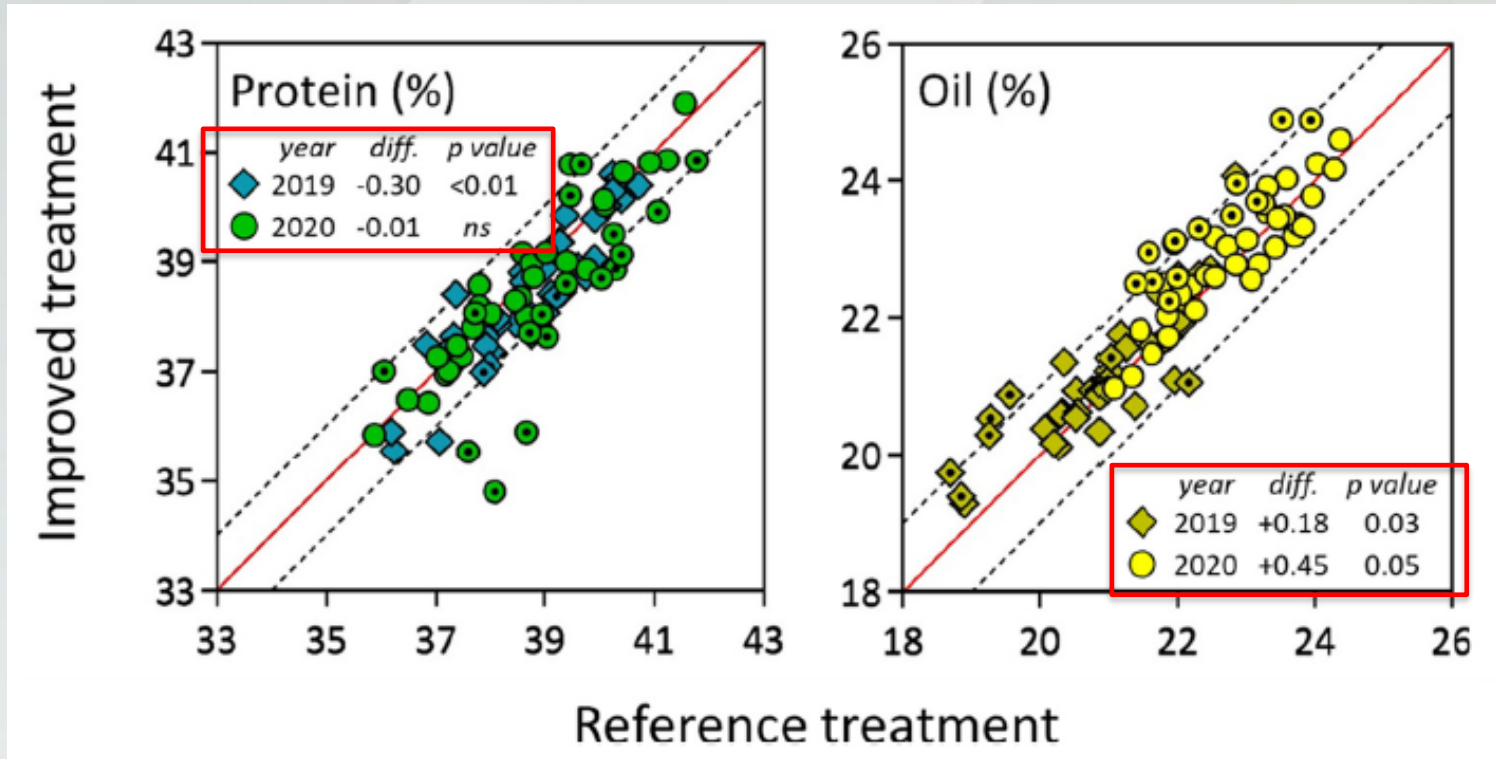
Profit increase in Improved trt:
\$51 (2019), \$31 (202), \$53 (2021)



Reference is Typical planting

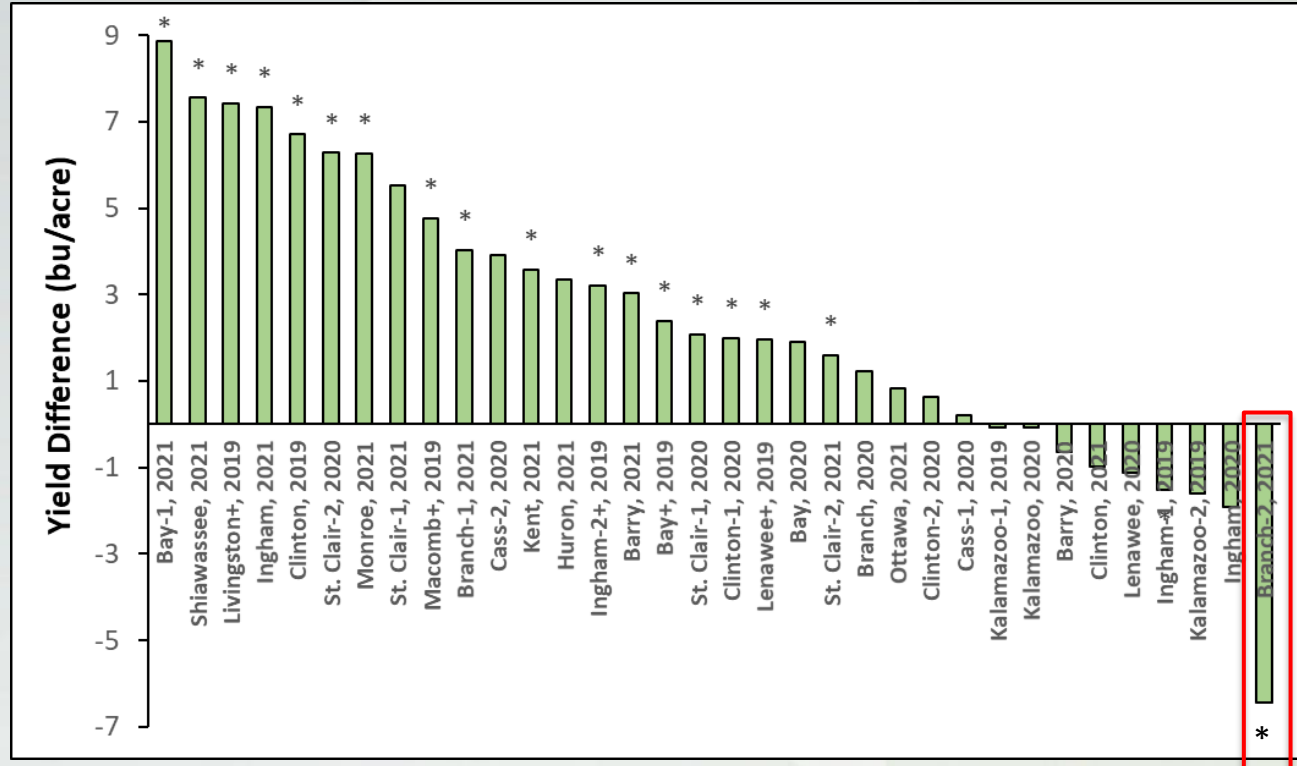
Improved is Early Planting + other management (e.g., fung./insect. spray, late-MG, lower seed rate)

Seed Quality



Soybean Yield: Michigan Data

Yield diff. =
Early planting -
Typical planting



* Denotes significant differences at P < 0.10

+ denotes fung./insect. spray at R3 in early planting in 2019

Risk vs Reward of Early Soybean Planting

➤ Rewards:

- Extended planting window
- Increase in yield

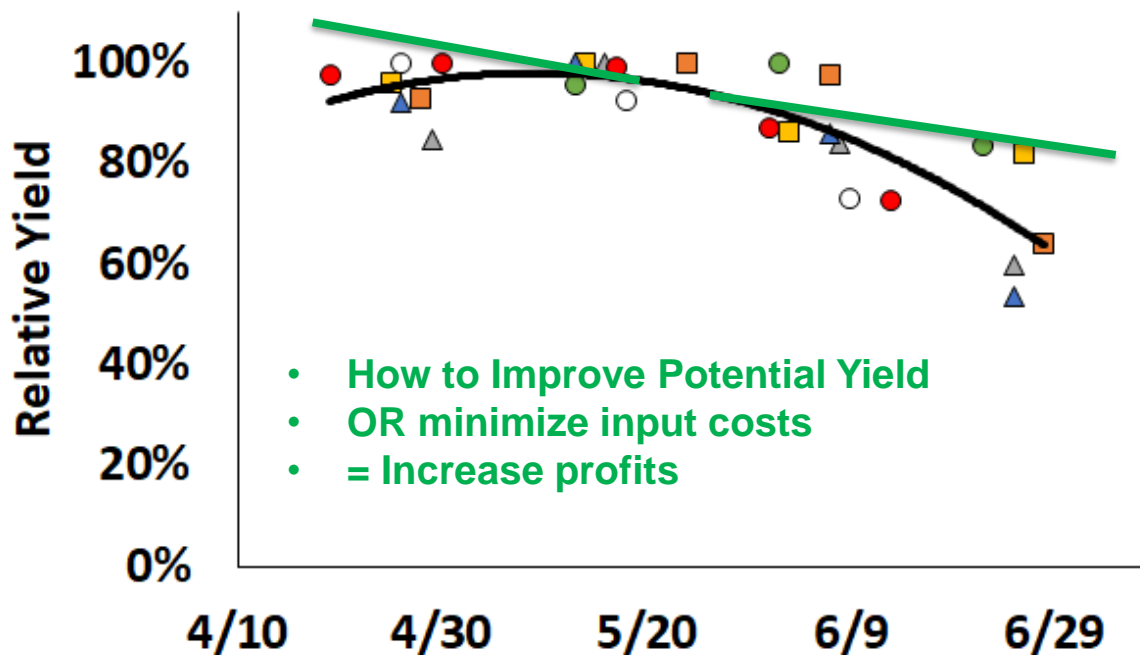
➤ Risks:

- Poor germination/emergence, plant stand
 - Imbibitional injury, insect/disease, crusting
- Freeze damage to emerged plants
- Crop insurance coverage
- Optimal time: typically starts end-April
 - Do NOT plant if forecast of cold rain in 24 hrs
 - Target fields suitable for early planting



Mike Staton

Planting Time: change other management?



Things to consider:

- Variety Selection:
 - Maturity
 - Traits
- Seed treatment
- Seed rate
- Row spacing
- Planting method
- Seed Priming
- Fertility
- Weed control
- Pesticide use

Planting Season

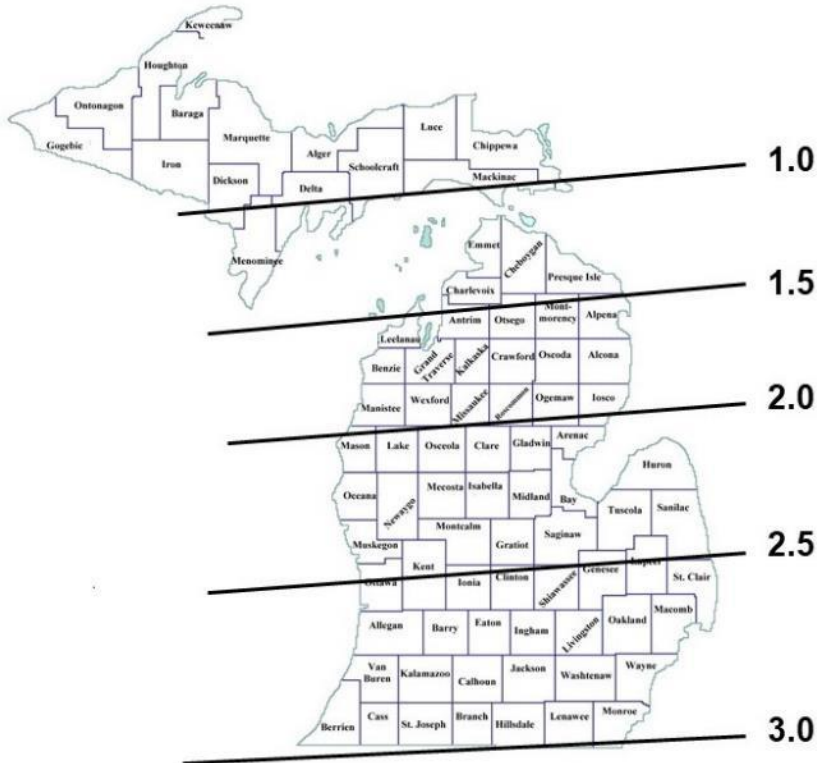
Early

Mid

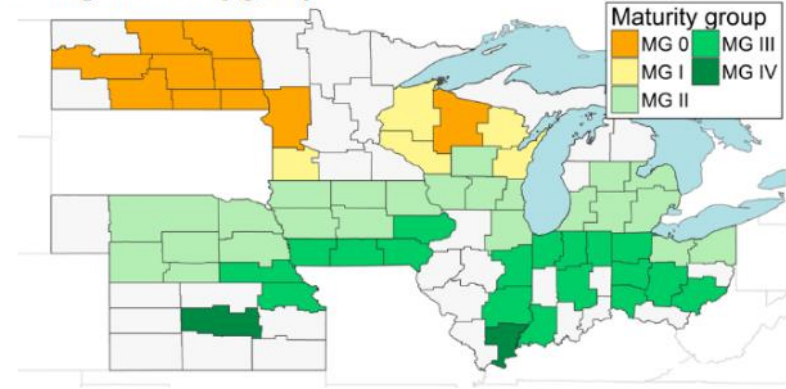
Late

Optimal Maturity Selection: Role of planting date?

Soybean Maturity Zones in Michigan



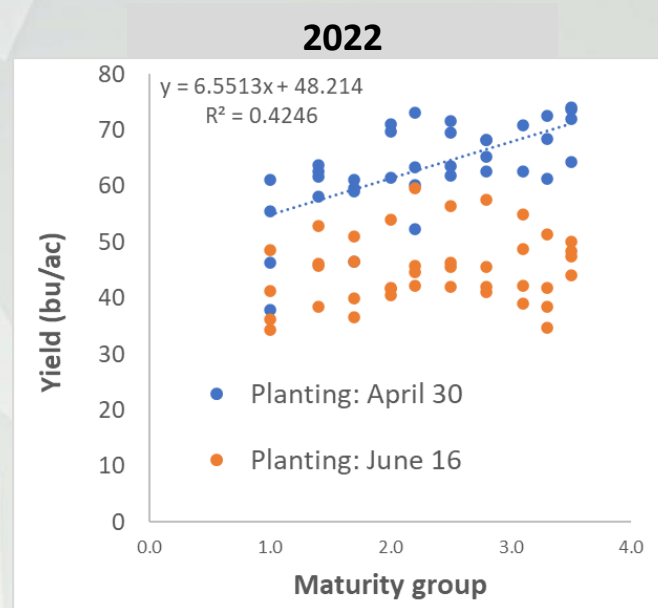
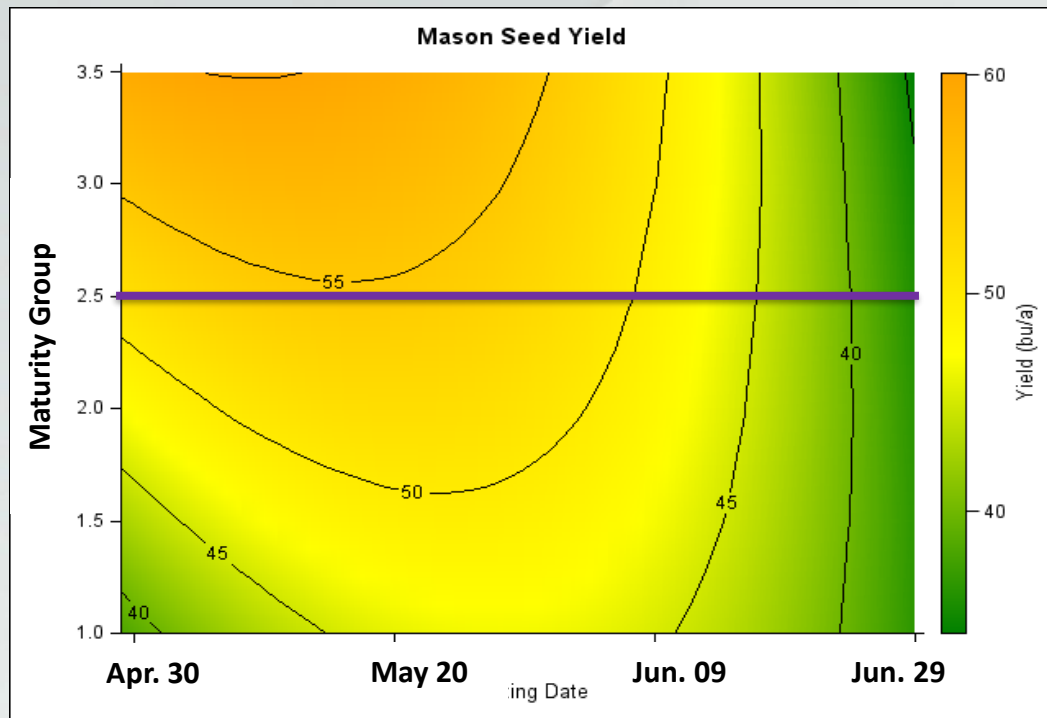
Average maturity group



2014-17 survey data

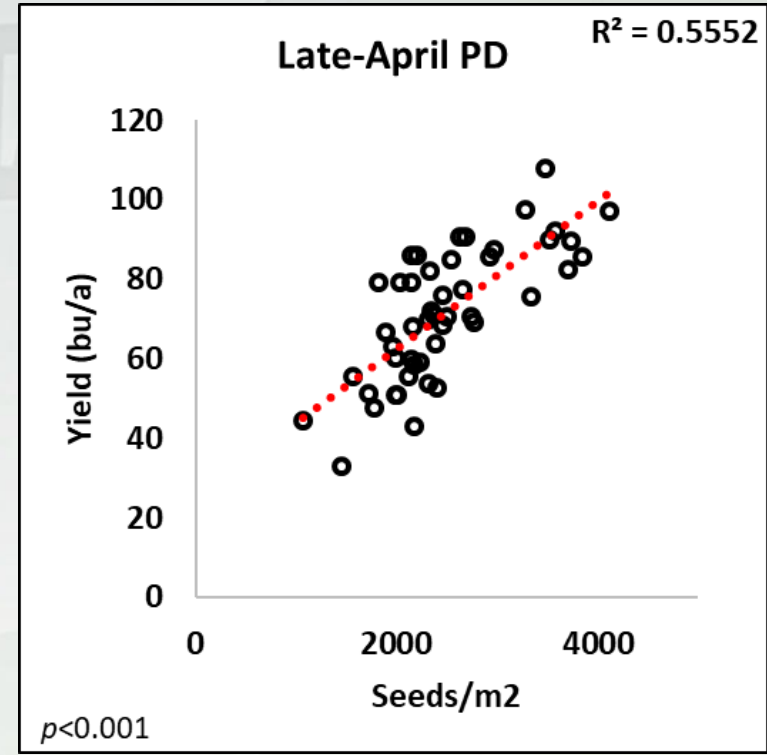
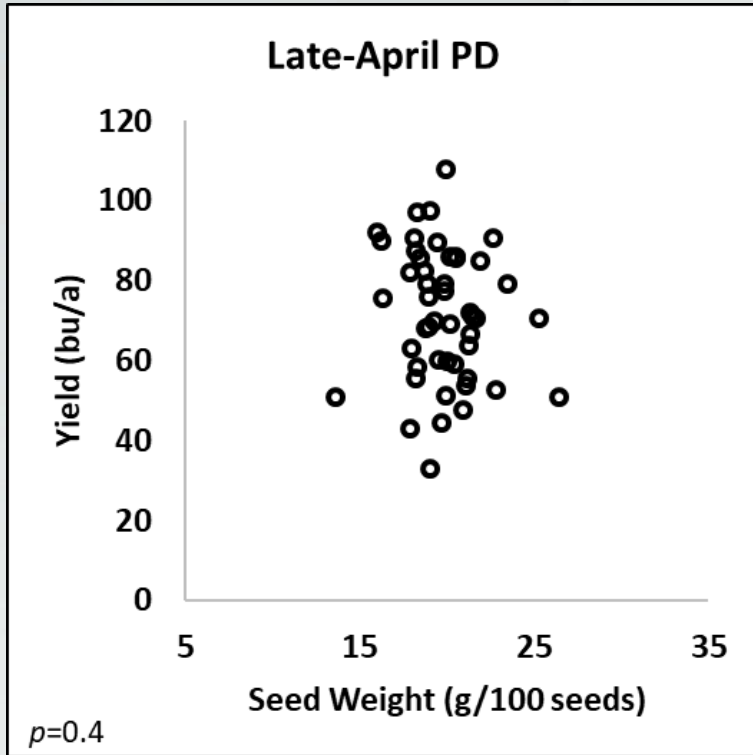
- Based on one planting date (mid-season)
- Does NOT account for early/late planting

Optimal Maturity Selection: by planting date

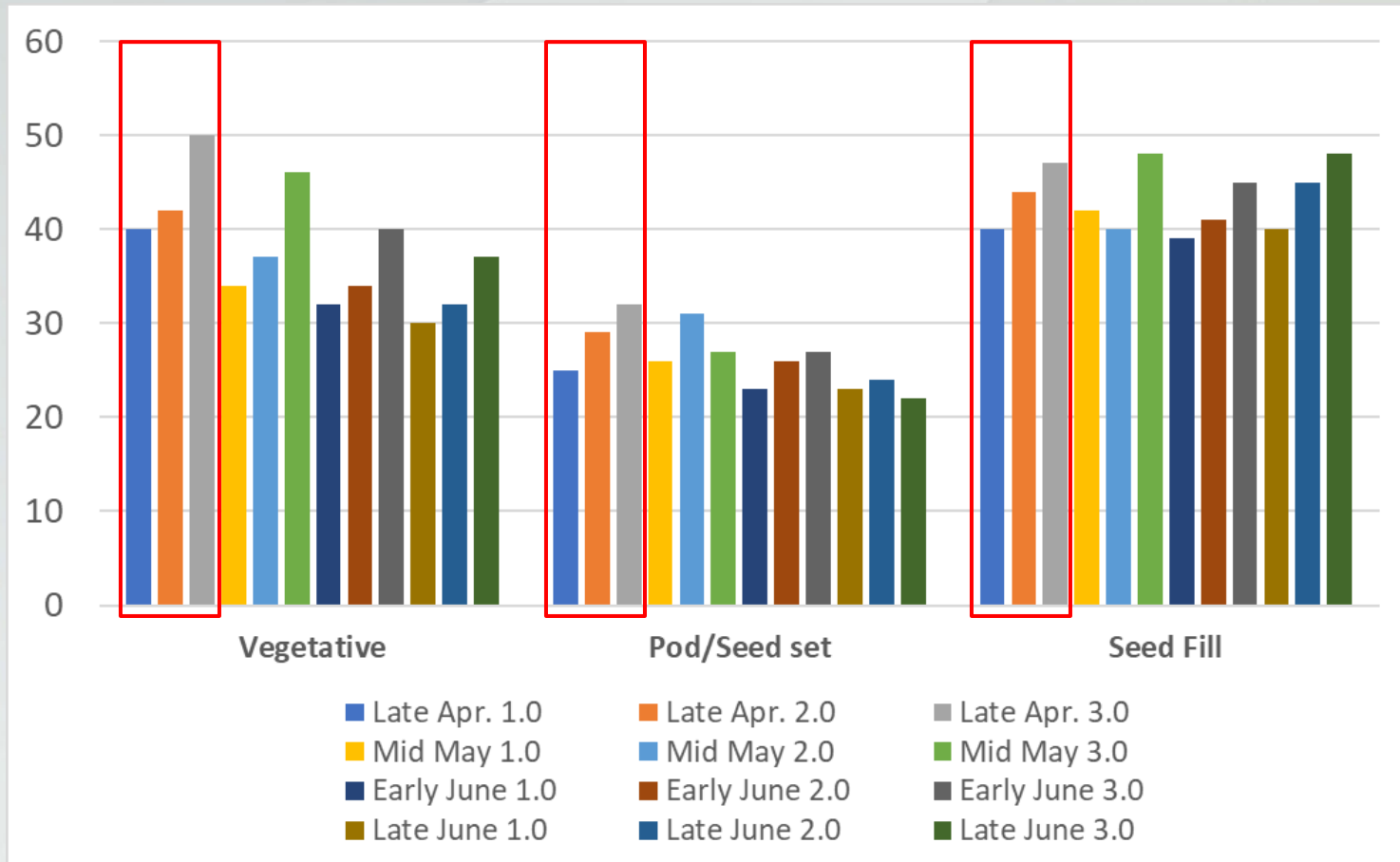


- Late maturity variety for early-season planting (till 1st week of May)
- Switch to early maturity with delay in planting (starting early June)

Yield Components: Seed weight vs Seed Number



Phenology- Days in V vs R stages



Physiology of Yield Increase

- Adjust planting date and soybean maturity in order to:
 - Harvest more light prior to the onset of reproductive development
 - Maximize number of nodes/pods/seed per acre, longer reproductive phase
 - Minimize the impact of periods of extreme heat and/or moisture stress during flowering and pod set



Late-April

mid-May

early-June

Late-June

Maturity/Quality concerns: Late planted soybean



2020- Frost on Oct. 16



2021- Frost on Nov. 3



2022- Frost on Oct 8

Summary: Plant date & Variety maturity

- Combine early planting with other management for higher yields/profits
- For mid-season planting, mid- and early- maturity varieties have competitive yield, and low moisture
- Benefits of early-season planting can be expanded upon with the use of late-maturity varieties
- Select early-maturity variety to minimize yield loss and other (e.g. high moisture) issues in delayed/replant situations (or double crop soybeans)
- **Portfolio approach** in maturity selection (also provide genetic diversity)
 - Plant late-maturity variety first (30-40% acres)
 - Plant mid- and early-maturity varieties in sequence to “stack” soy flowering/pod set
 - Plant ~20-30% acres to each of mid- and early-maturity variety

Soybean Seeding Rate



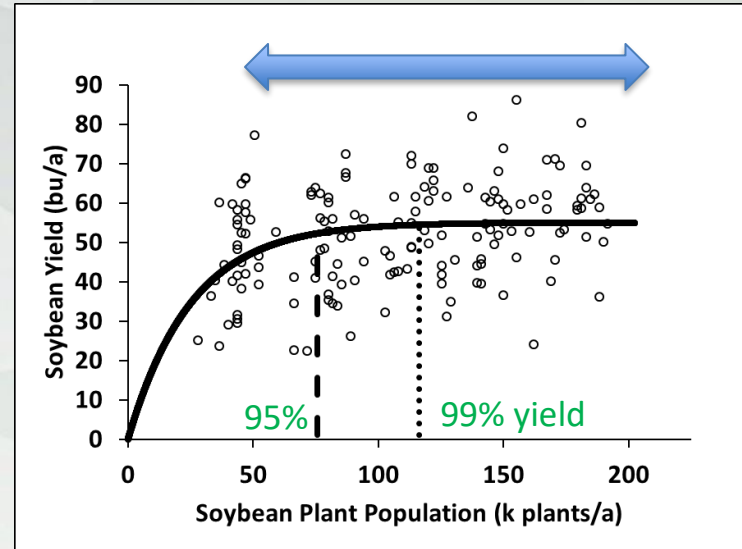
**50,000
Seeds/A**

**90,000
Seeds/A**

**130,000
Seeds/A**

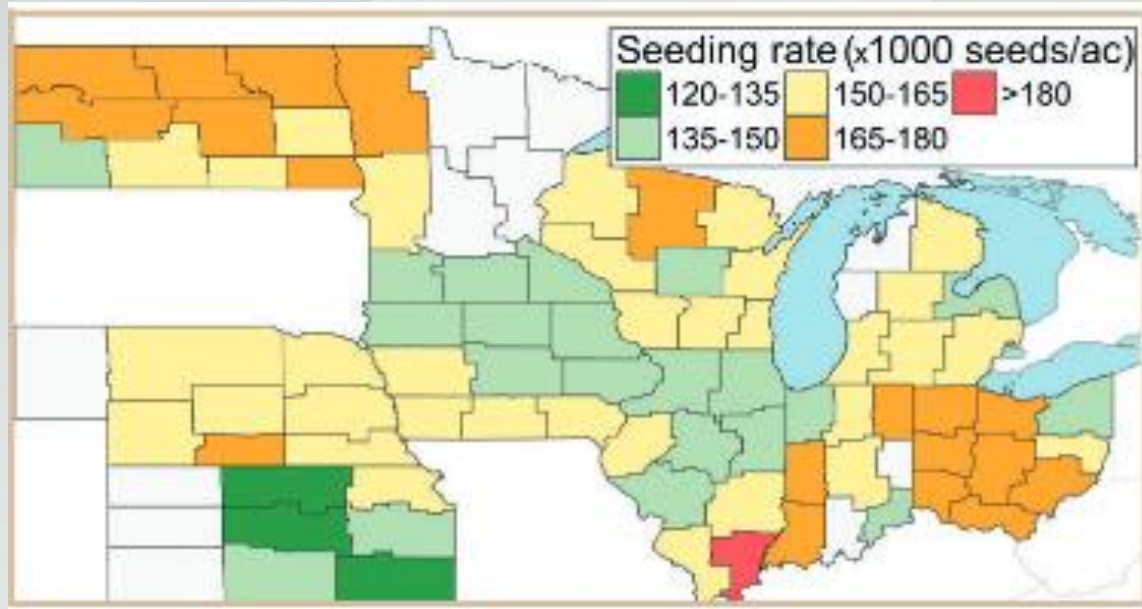
**170,000
Seeds/A**

**210,000
Seeds/A**



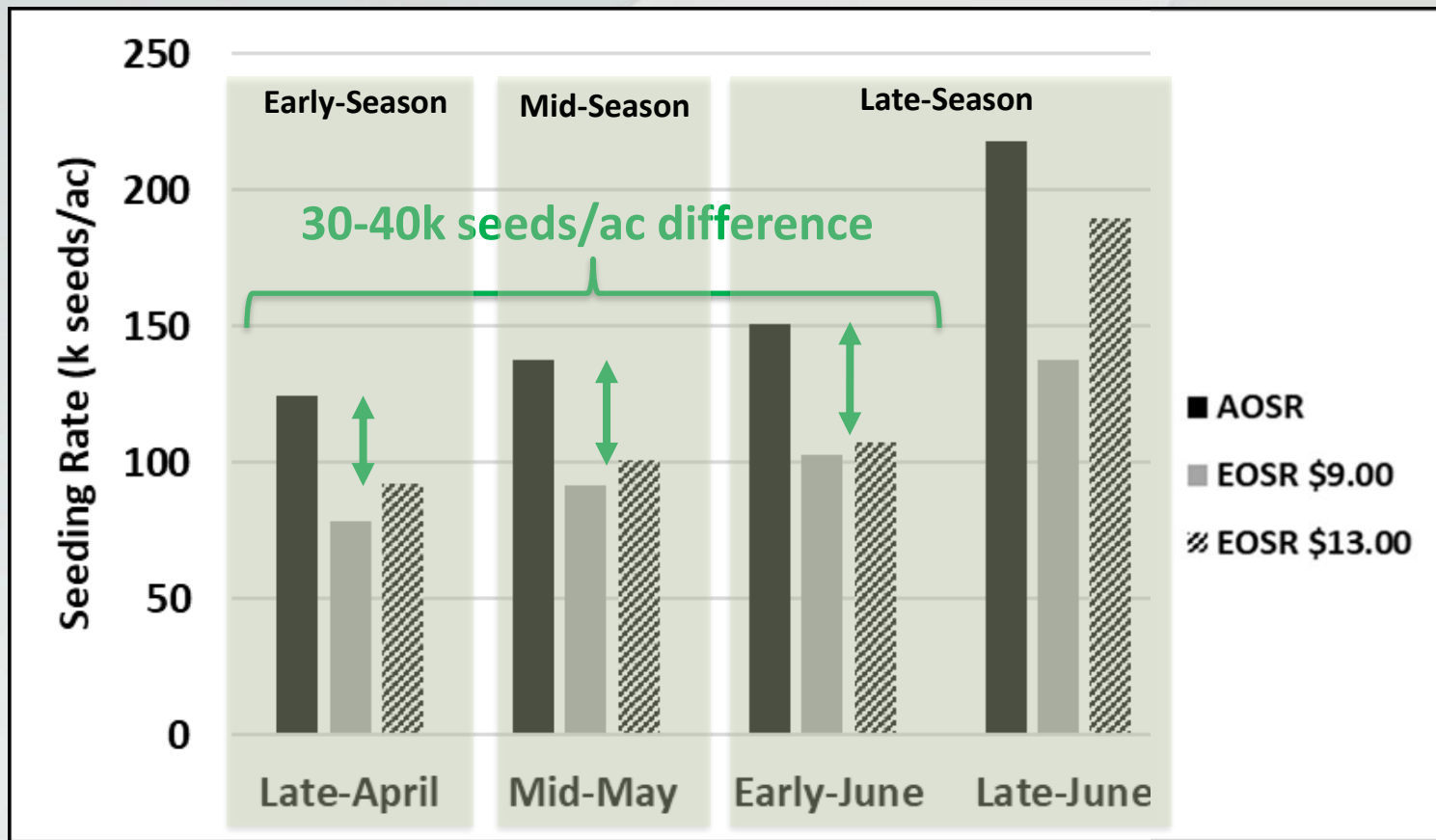
Seed rate: ~20% higher

Seeding Rate



2014-17 survey data

Soybean Seeding Rate- Agronomic vs Economic Optimal



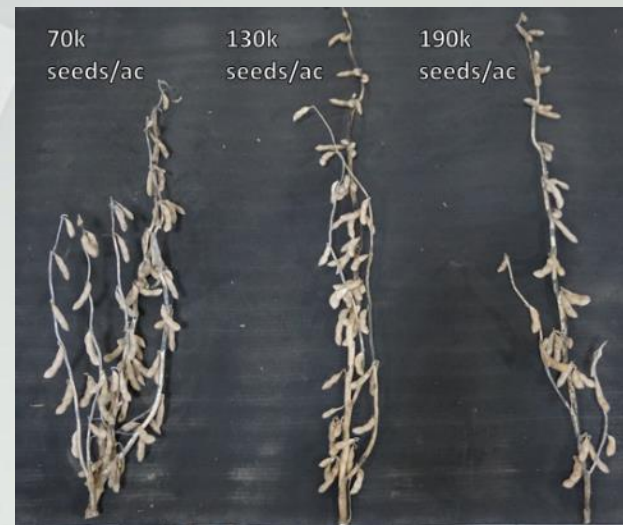
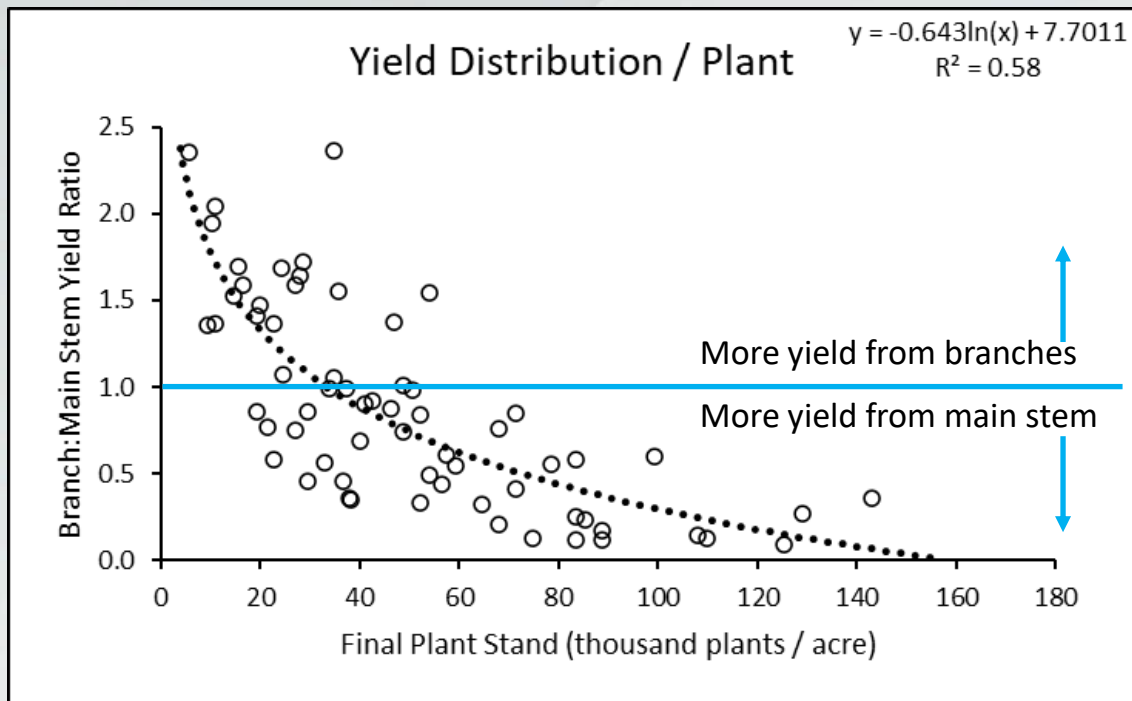
Agronomic Optimal Seed Rate (AOSR)

Economic Optimal Seed Rate (EOSR)

\$50 per unit (140k) seed cost, \$15 for seed trt

15-inch rows
Conventional till
4 site-years data

Seeding Rate- Plant architecture



	70k seeds/ac	130k seeds/ac	190k seeds/ac
# pods	49 36	14 43	7 36
# seeds	187	121	88

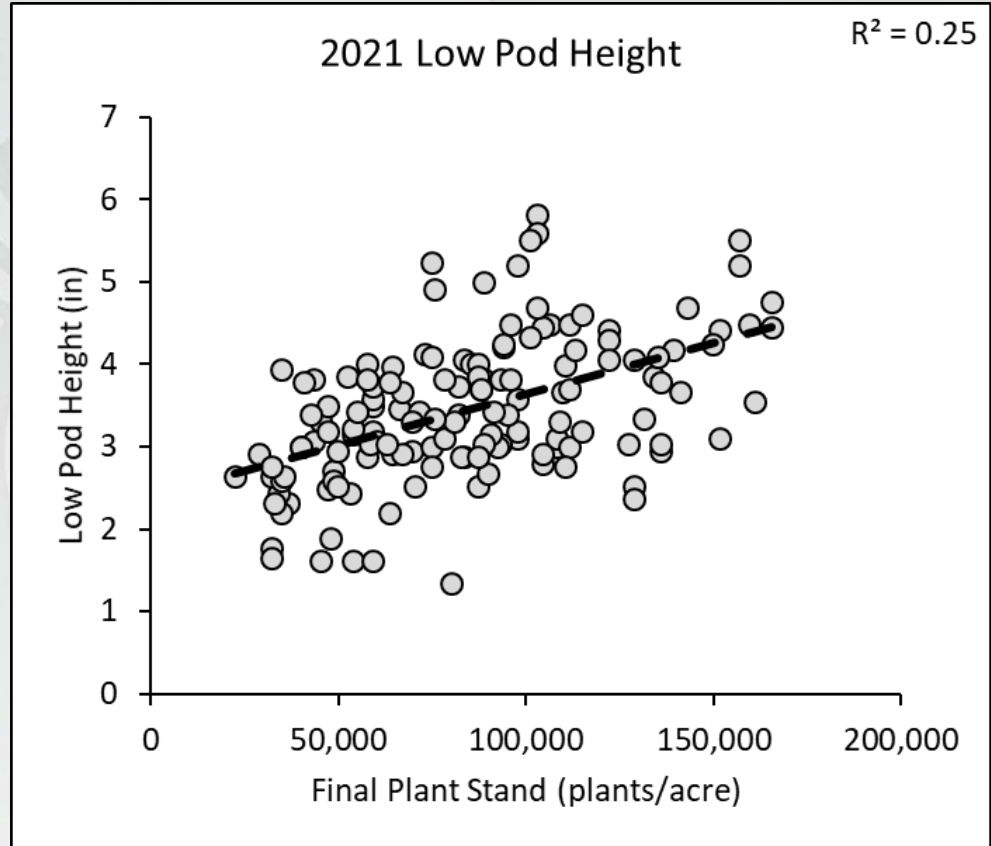
Seeding Rate- Plant architecture



Low Seed Rate



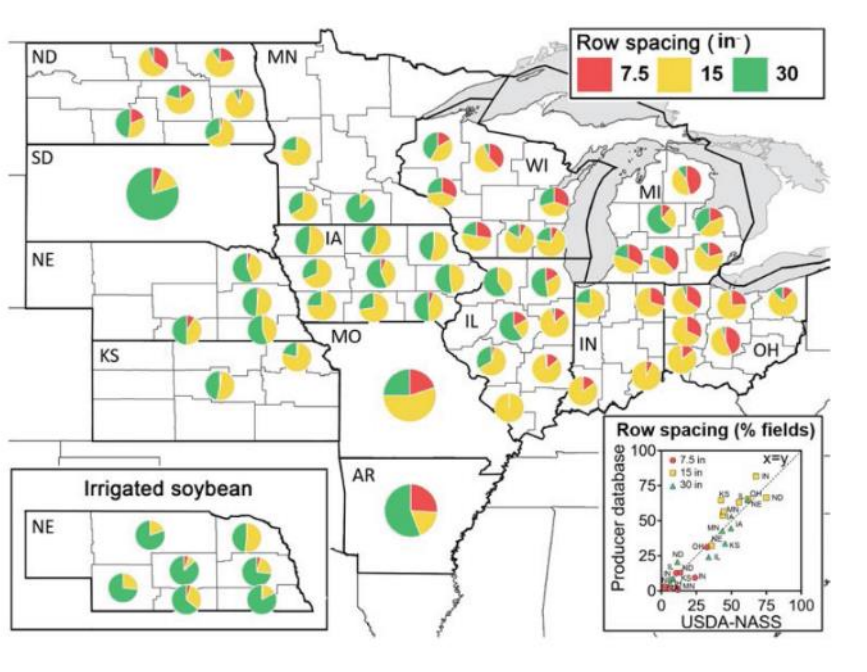
High Seed Rate



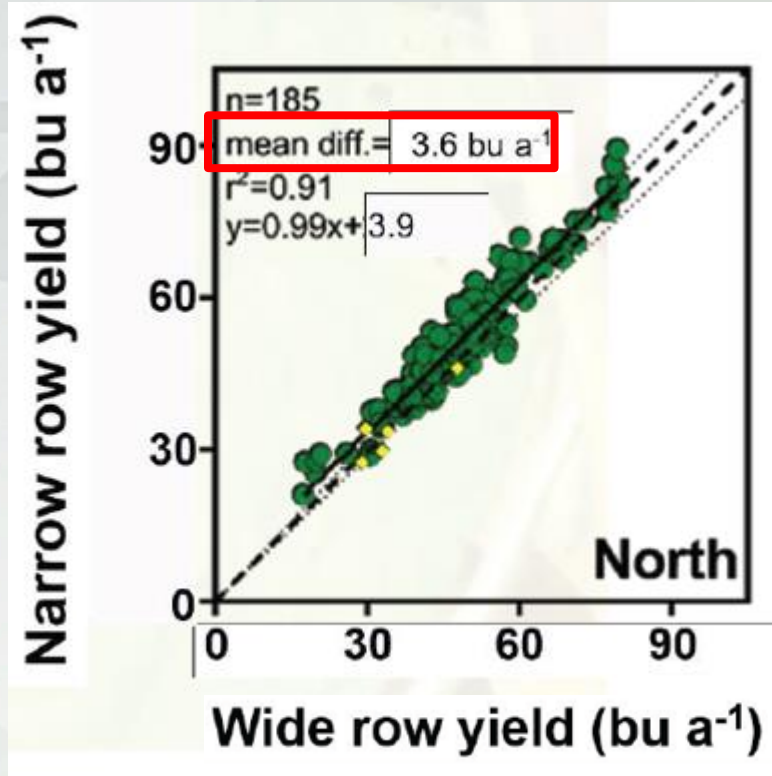
Summary: Seeding Rate

- For max yield: final **plant** stand of 100-120,000/ac for May planting, 120-150,000 plants/ac for June planting. ~20% higher for seeding rate
- Economic optimum rates are lower (30-40k) than agronomic optimum rates
- Lower seeding rate in high yielding areas/fields, higher rate in low yielding areas/fields (application in variable rate seeding)
- Leave a strip in field with lower seeding rate (~20-30%) for field testing
- Early-planted uniform stand of >50k/ac can produce high yield, plant into existing stand below that stand (repair-plant) rather than replanting
- Stand count is important for evaluating yield potential

Row Spacing



2014-17 survey data



Soybean Row Spacing

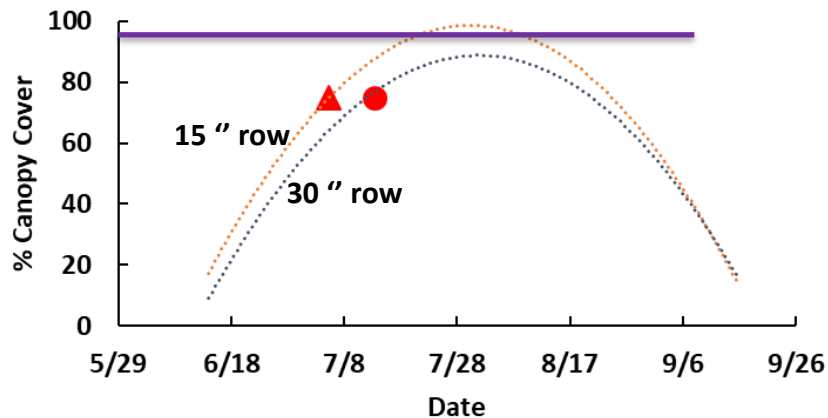


30" spacing

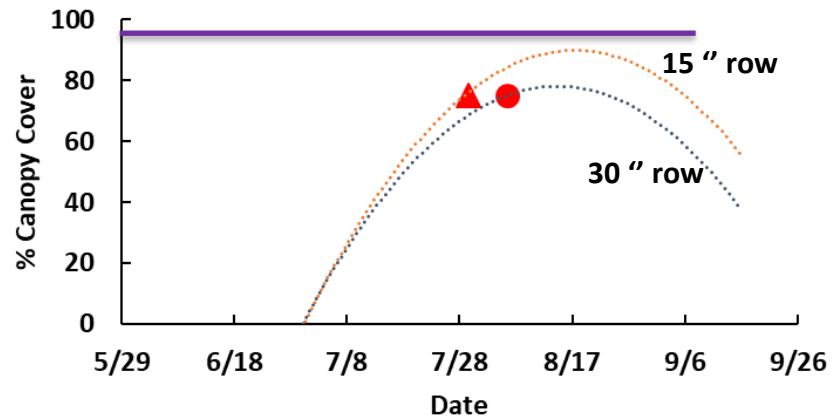


15" spacing

Late-April

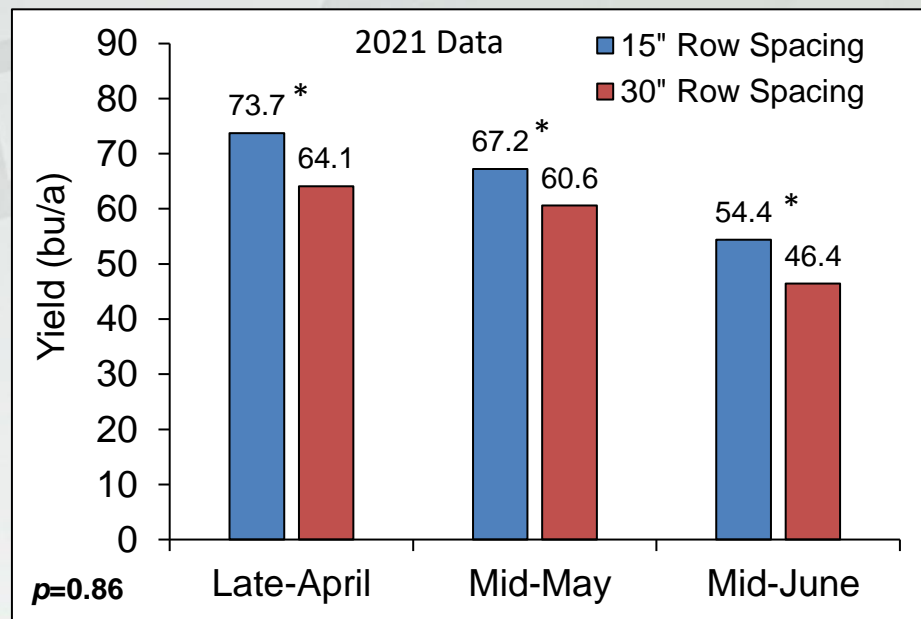
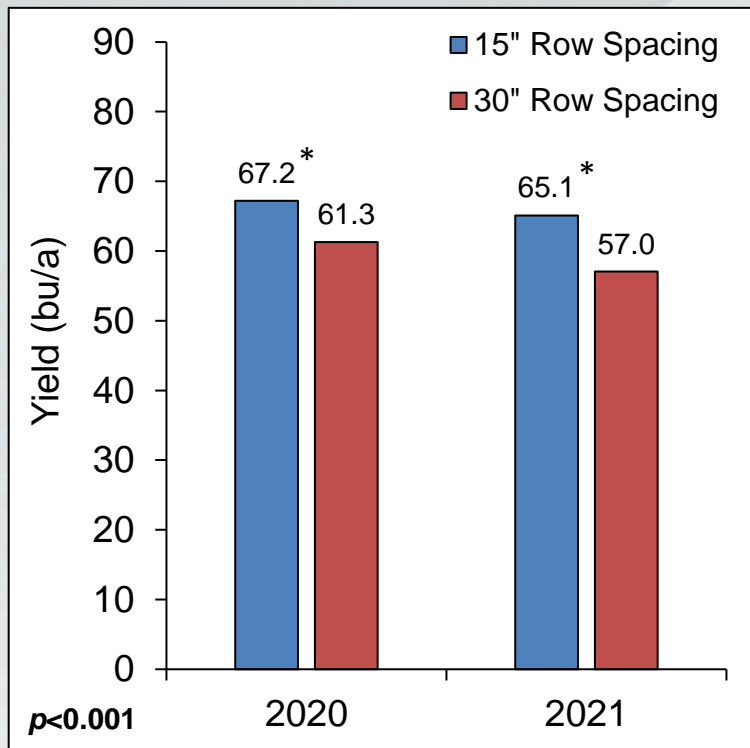


Mid-June



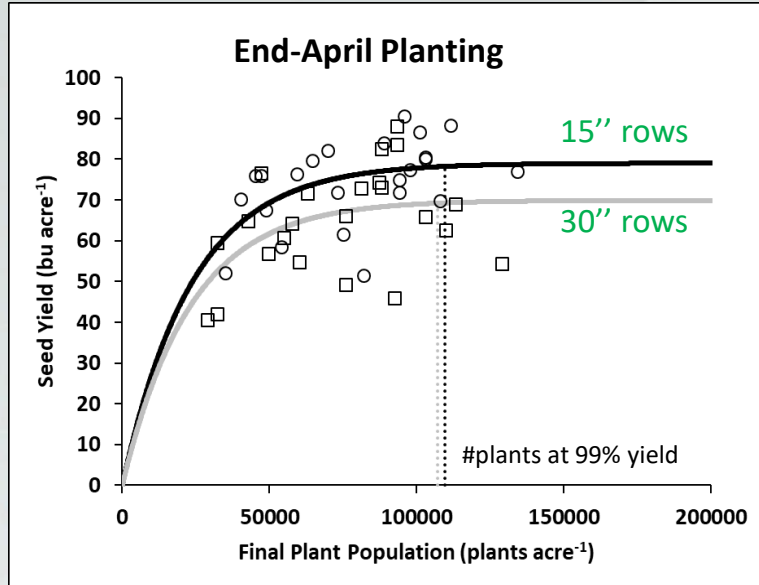
* Denotes significant differences at P < 0.10

Soybean Row Spacing

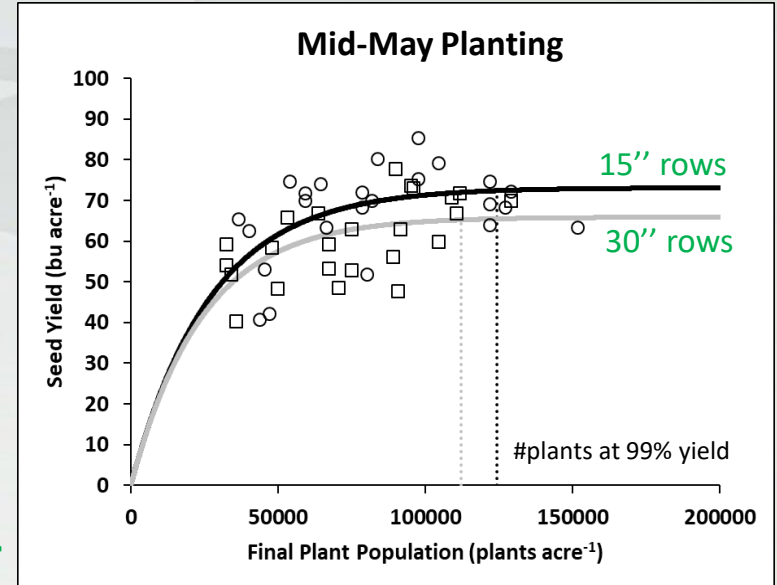


- Narrow rows (15") had yield advantage over 30" rows across all years (6-14%)
- Yield increase in 15" over 30" was similar across plant dates in 2020-21 (NOT in 2022)

Soybean Row Spacing



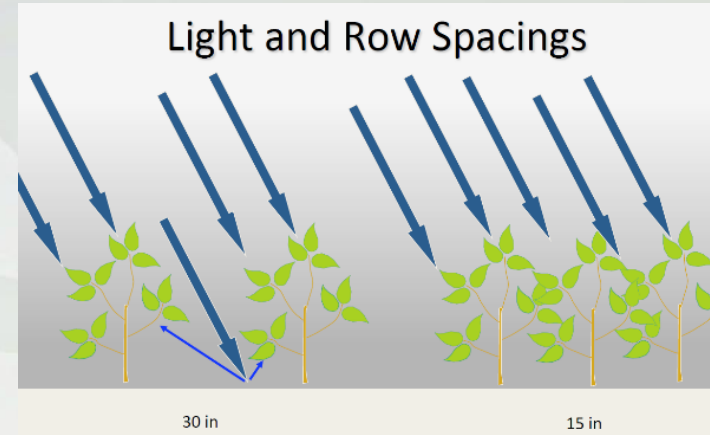
Seed rate:
~20% higher



- Optimal plant density: minimal differences between 30" and 15" (except late planting situations where narrow row benefit more from increase in seed rate)

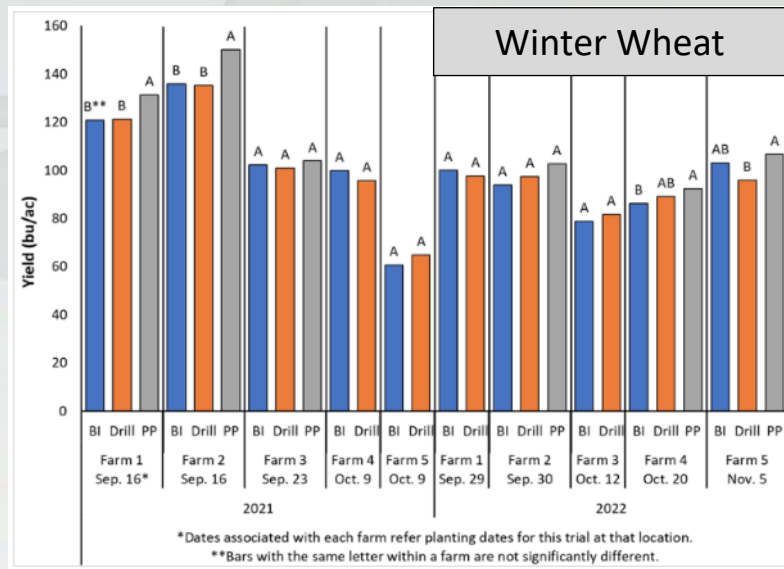
Summary: Row Spacing

- **Narrow rows:** faster canopy closure, >95% light interception, moisture conservation, weed control
- **Yield benefit** under narrow rows: Limited time for vegetative growth before flowering
 - Northern production regions
 - Delayed planting/ Double crop
 - Early-maturing varieties
- **Yield loss:** Disease pressure- white mold



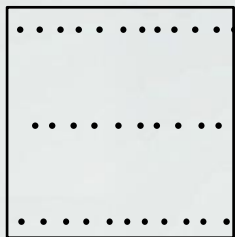
Soybean: Importance of Precise Seed Placement?

- Precise seed placement may be less important in soybean than in other crops such as corn
- Research in wheat showing potential for using broadcast incorporation to achieve earlier planting without yield penalty



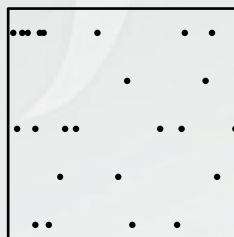
Precision Planter

15-in Row Spacing

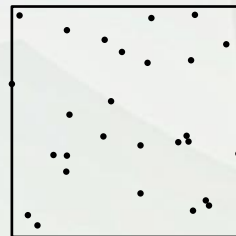


Seed drill

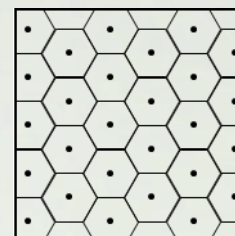
7.5-in Row Spacing



Broadcast



Ideal

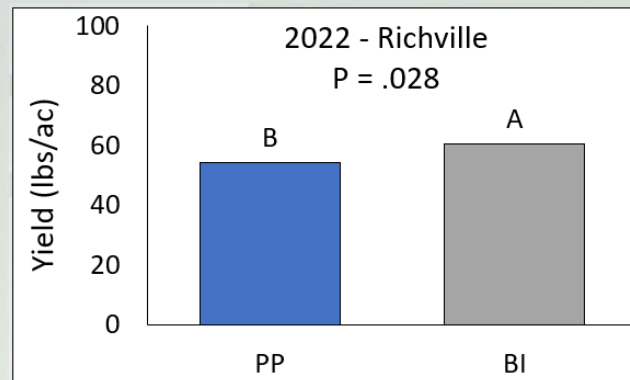
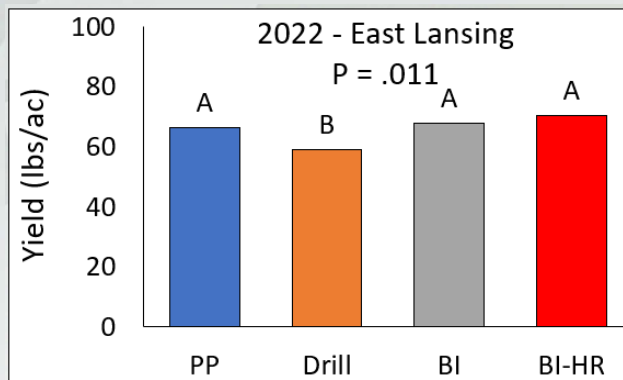
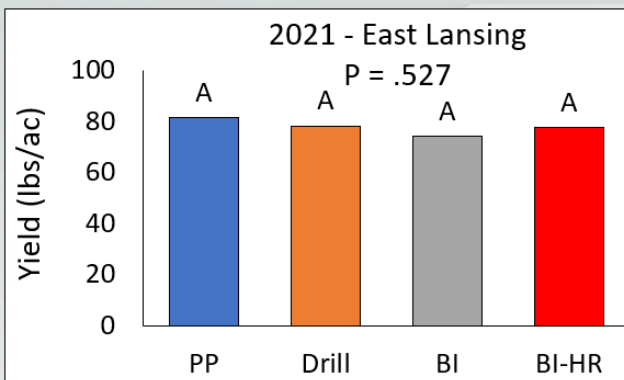


Soybean: Planting Methods

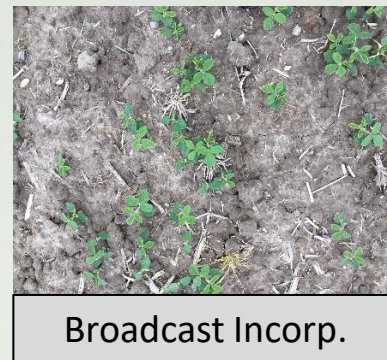
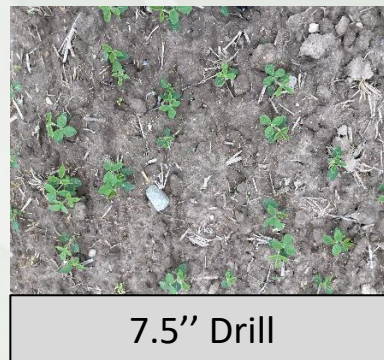
PP: Precision Planter

BI: Broadcast Incorporation (BI)

BI-HR: Broadcast Incorporation (higher seeding rate)

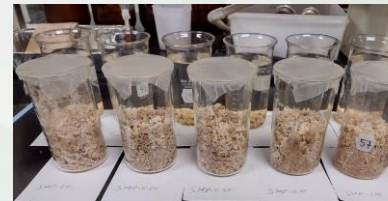
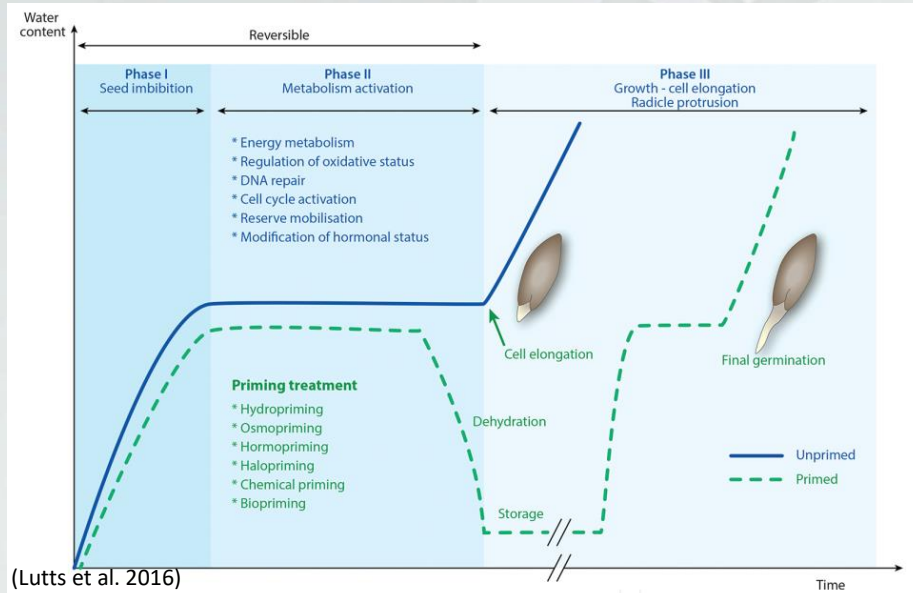
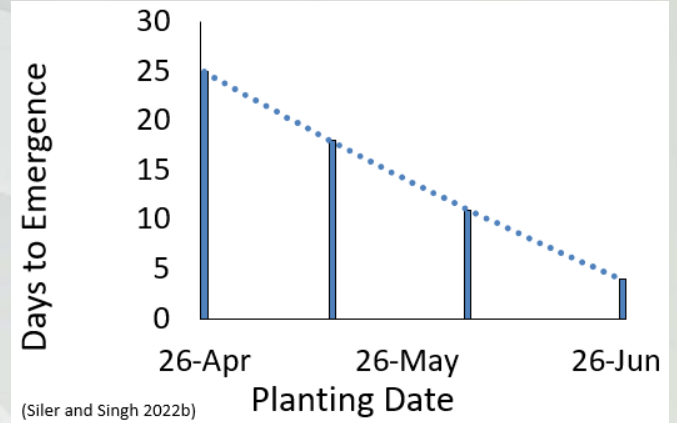


- Minimum yield penalty in soybean from less precise seed placement

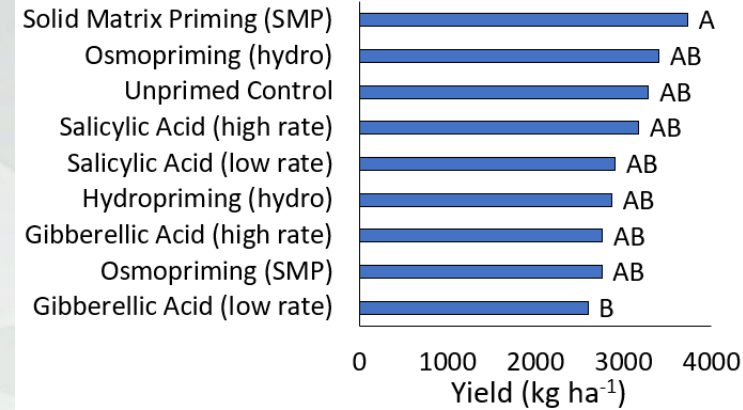
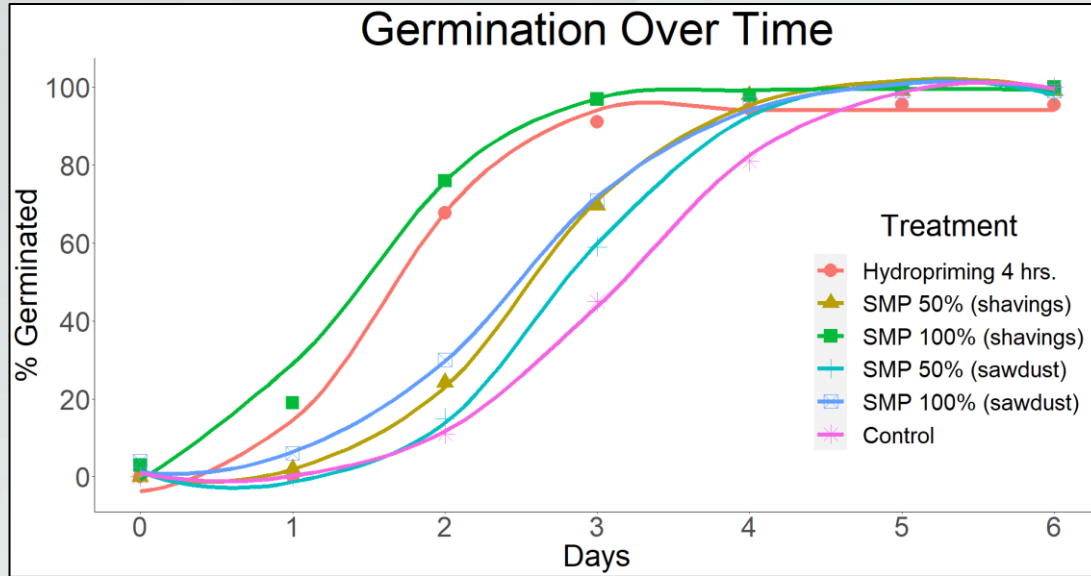


Soybean Seed Priming?

- Early planting: more time to emerge
- Concerns of frost damage
- Seed priming can minimize these issues



Soybean Seed Priming- 2022 data

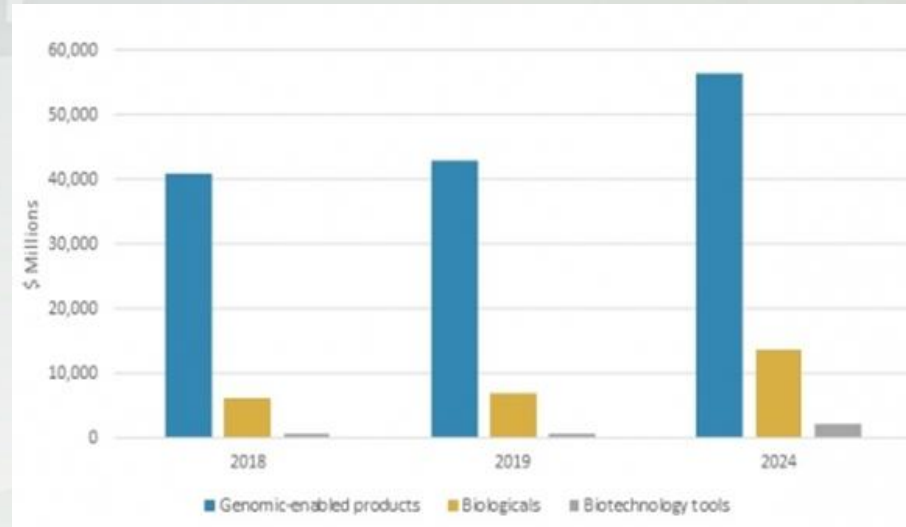


- More research is need on soybean seed priming methods
- Pre-treatment of seed (to higher moisture) might benefit

National Screen of Commercially Available Biological Seed Treatment for Soybean

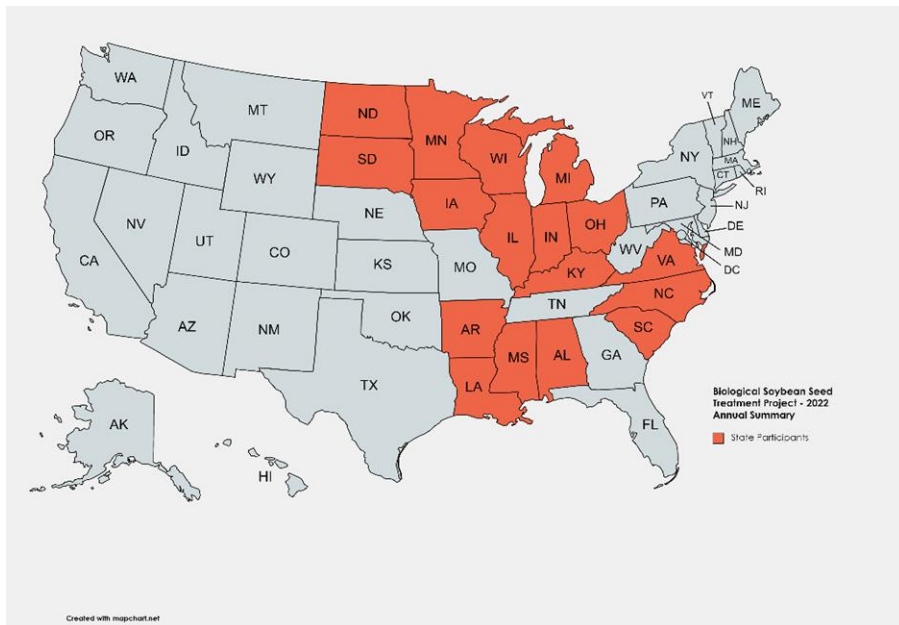
Some of the products claim that they:

- Improve N fixation
- Assimilate P from organic and inorganic sources
- Increase nutrient use efficiency and uptake
- Stimulate growth of efficient roots and expand root absorption
- Control of diseases and nematodes





Methodology



In 2022:

- 17 states
- 50 locations (3 in MI)- data from 40 reported
- Small plot trials
- Randomized complete block design with 6-8 reps at all sites.

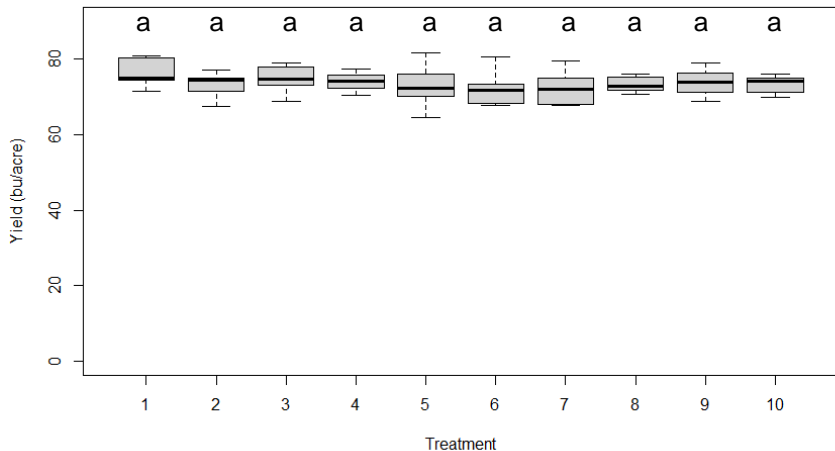


Table 1. List of treatments (products) and active ingredients in each biological product.

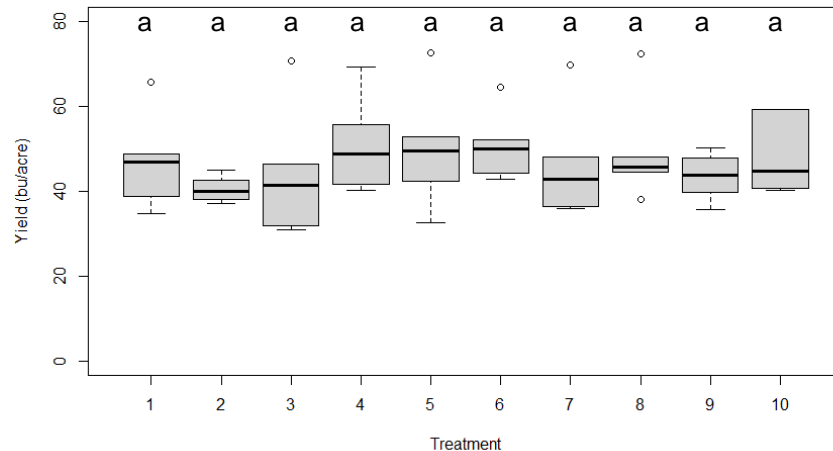
Treatment (product)	Active ingredients
1	<i>Azospirillum brasilense, Bacillus licheniformis, Bacillus amyloliquefaciens, Bacillus subtilis, Pseudomonas fluorescens, Rhizobium</i>
2	<i>Trichoderma virens</i>
3	<i>Bradyrhizobium spp.</i>
4	<i>Bacillus subtilis, Bacillus amyloliquefaciens, Bradyrhizobium japonicum</i>
5	<i>Pantoea agglomerans</i>
6	<i>Pseudomonas brassicacearum</i>
7	<i>Bradyrhizobium elkanii, Delftia acidovorans + Bacillus velezensis</i>
8	<i>Bacillus velezensis</i>
9	<i>Glomus intraradices, Glomus mosseae, Glomus aggregatum, Glomus etunicatum</i>
10	Untreated Control



Britton, Michigan 2022 (Lenawee county)

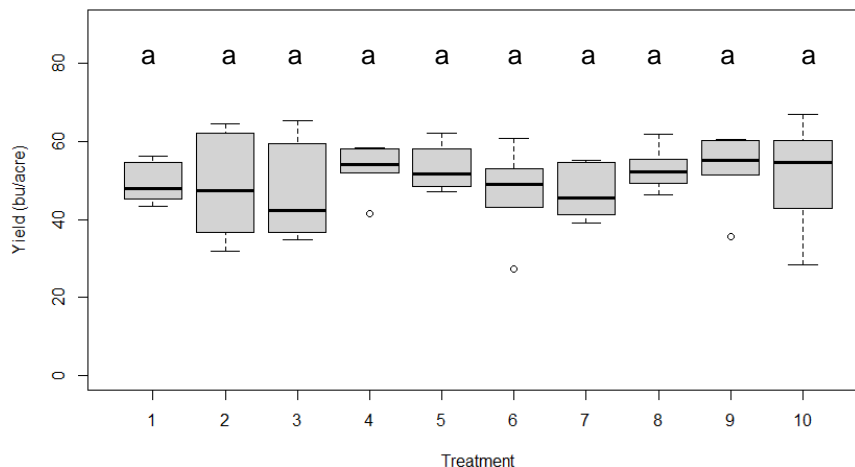


Mason, Michigan 2022 (Ingham county)



Treatment (product)	Active ingredients
1	<i>Azospirillum brasilense</i> , <i>Bacillus licheniformis</i> , <i>Bacillus amyloliquefaciens</i> , <i>Bacillus subtilis</i> , <i>Pseudomonas fluorescens</i> , <i>Rhizobium</i>
2	<i>Trichoderma virens</i>
3	<i>Bradyrhizobium</i> spp.
4	<i>Bacillus subtilis</i> , <i>Bacillus amyloliquefaciens</i> , <i>Bradyrhizobium japonicum</i>
5	<i>Pantoea agglomerans</i>
6	<i>Pseudomonas brassicacearum</i>
7	<i>Bradyrhizobium elkanii</i> and <i>Delftia acidovorans</i> + <i>Bacillus velezensis</i>
8	<i>Bacillus velezensis</i>
9	<i>Glomus intraradices</i> , <i>Glomus mosseae</i> , <i>Glomus aggregatum</i> , <i>Glomus etunicatum</i>
10	Untreated Control

Saginaw, Michigan 2022 (Saginaw county)



Treatment (product)	Active ingredients
1	<i>Azospirillum brasilense</i> , <i>Bacillus licheniformis</i> , <i>Bacillus amyloliquefaciens</i> , <i>Bacillus subtilis</i> , <i>Pseudomonas fluorescens</i> , <i>Rhizobium</i>
2	<i>Trichoderma virens</i>
3	<i>Bradyrhizobium</i> spp.
4	<i>Bacillus subtilis</i> , <i>Bacillus amyloliquefaciens</i> , <i>Bradyrhizobium japonicum</i>
5	<i>Pantoea agglomerans</i>
6	<i>Pseudomonas brassicacearum</i>
7	<i>Bradyrhizobium elkanii</i> and <i>Delftia acidovorans</i> + <i>Bacillus velezensis</i>
8	<i>Bacillus velezensis</i>
9	<i>Glomus intraradices</i> , <i>Glomus mosseae</i> , <i>Glomus aggregatum</i> , <i>Glomus etunicatum</i>
10	Untreated Control

Table 2. Treatment grain yield means (standard error) in bu/acre for each site in 2022

Site	Control	Trt 1	Trt 2	Trt 3	Trt 4	Trt 5	Trt 6	Trt 7	Trt 8	Trt 9
Madison, Alabama	23.5 (1.1)	23.7 (1.1)	25.3 (1.1)	23.7 (1.0)	24.9 (1.1)	-	-	24.1 (1.1)	23.6 (1.0)	25.2 (1.1)
Shorter, Alabama	40.8 (3.4)	38.6 (3.4)	39.7 (3.4)	37.8 (3.4)	40.0 (3.4)	-	-	42.7 (3.4)	40.5 (3.4)	40.6 (3.4)
Monmouth, Illinois	79.6 (2.9)	80.3 (2.9)	76.7 (2.9)	78.3 (2.9)	74.0 (2.9)	78.7 (2.9)	72.6 (2.9)	79.4 (2.9)	77.2 (2.9)	78.5 (2.9)
Urbana, Illinois	77.7 (1.9)	78.2 (1.9)	78.8 (1.9)	74.3 (1.9)	79.4 (1.9)	77.2 (1.9)	80.1 (1.9)	77.3 (1.9)	76.3 (1.9)	78.5 (1.9)
Boone, Iowa	55.2 (3.8)	53.1 (3.8)	50.0 (3.8)	53.3 (3.8)	49.6 (3.8)	-	-	51.1 (3.8)	49.0 (3.8)	54.7 (3.8)
Lexington, Kentucky (Site 1)	42.8 (4.0)	43.3 (4.0)	43.2 (4.2)	41.6 (4.0)	42.6 (4.2)	-	-	38.1 (4.0)	42.2 (4.0)	42.2 (4.0)
Lexington, Kentucky (Site 2)	66.3 (2.8)	67.4 (2.8)	64.0 (2.8)	63.0 (2.8)	63.1 (2.8)	-	-	64.6 (2.8)	62.1 (2.8)	65.0 (2.8)
Alexandria, Louisiana (Site 1)	66.7 (1.2)	66.0 (1.2)	69.0 (1.2)	68.4 (1.2)	68.2 (1.2)	-	-	66.3 (1.2)	66.8 (1.2)	66.7 (1.2)
Alexandria, Louisiana (Site 2)	61.0 (1.5)	61.9 (1.4)	60.4 (1.5)	63.4 (1.4)	62.4 (1.4)	-	-	63.6 (1.5)	62.5 (1.4)	63.8 (1.4)

Table 2. Treatment grain yield means (standard error) in bu/acre for each site in 2022

Site	Control	Trt 1	Trt 2	Trt 3	Trt 4	Trt 5	Trt 6	Trt 7	Trt 8	Trt 9
Britton, Michigan	73.4 (1.6)	76.1 (1.6)	73.3 (1.6)	74.6 (1.6)	74.0 (1.6)	72.8 (1.6)	72.3 (1.6)	72.4 (1.6)	73.3 (1.6)	73.9 (1.6)
Mason^b, Michigan	48.1 (4.3)	47.0 (4.3)	40.5 (4.3)	43.8 (4.3)	50.7 (4.3)	49.9 (4.3)	50.6 (4.3)	46.0 (4.3)	49.1 (4.3)	43.5 (4.3)
Saginaw, Michigan	51.3 (3.9)	49.2 (3.9)	48.3 (3.9)	46.8 (3.9)	53.0 (3.9)	53.2 (3.9)	47.1 (3.9)	46.8 (3.9)	52.9 (3.9)	53.0 (3.9)
St. Paul, Minnesota	62.7 (2.8)	65.1 (2.8)	61.9 (2.8)	66.5 (2.8)	64.0 (2.8)	60.7 (2.8)	63.8 (2.8)	65.2 (2.8)	63.4 (2.8)	63.8 (2.8)
Wells, Minnesota	67.8 (2.4)	66.8 (2.4)	69.6 (2.4)	67.2 (2.4)	67.3 (2.4)	66.4 (2.4)	68.9 (2.4)	63.9 (2.4)	65.9 (2.4)	60.6 (2.4)
Starkville, Mississippi	64.2 (2.4)	62.1 (2.4)	65.6 (2.5)	64.3 (2.4)	63.4 (2.4)	-	-	63.3 (2.4)	63.6 (2.4)	65.0 (2.4)
Beaufort, North Carolina	108.1 (4.9)	101.9 (5.5)	104.0 (5.5)	90.4 (5.5)	100.1 (4.9)	-	-	102.9 (4.9)	102.5 (5.4)	102.6 (4.9)
Camden, North Carolina	67.6 (5.1)	66.7 (5.1)	61.1 (5.1)	71.7 (5.1)	63.7 (5.1)	-	-	65.1 (5.1)	67.9 (5.1)	71.3 (5.1)
Johnston, North Carolina	74.7 (3.9)	66.9 (3.9)	76.2 (3.9)	74.6 (3.9)	73.7 (3.9)	-	-	75.4 (3.9)	82.7 (3.9)	75.6 (3.9)
Salisbury, North Carolina	97.6 (4.2)	90.0 (3.8)	91.5 (4.2)	96.3 (4.2)	97.1 (3.8)	-	-	100.1 (3.8)	103.6 (3.8)	92.8 (3.8)

Table 2 (cont.). Treatment grain yield means (standard error) in bu/acre for each site in 2022

Site	Control	Trt 1	Trt 2	Trt 3	Trt 4	Trt 5	Trt 6	Trt 7	Trt 8	Trt 9
Fargo, North Dakota	61.1 (1.7)	60.4 (1.7)	60.6 (1.7)	60.1 (1.7)	61.5 (1.7)	61.6 (1.7)	61.3 (1.7)	58.6 (1.7)	58.3 (1.7)	59.1 (1.7)
Celina, Ohio	75.2 (2.5)	73.0 (2.5)	75.4 (2.5)	75.9 (2.7)	75.2 (2.5)	72.8 (2.5)	75.5 (2.5)	77.5 (2.5)	74.1 (2.5)	70.0 (2.5)
Marysville, Ohio	51.4 (3.1)	53.0 (3.1)	51.3 (3.1)	55.0 (3.1)	51.2 (3.1)	56.8 (3.1)	54.4 (3.3)	55.0 (3.1)	51.2 (3.1)	53.2 (3.1)
Holgate, Ohio	87.5 (1.5)	87.3 (1.5)	90.0 (1.5)	88.8 (1.5)	88.4 (1.5)	87.8 (1.5)	88.7 (1.5)	86.8 (1.5)	90.3 (1.5)	91.3 (1.5)
Fremont, Ohio	75.2 (3.1)	78.1 (2.8)	77.4 (2.8)	76.3 (2.8)	79.9 (2.9)	75.1 (2.8)	75.7 (3.5)	73.3 (3.5)	77.5 (3.5)	77.9 (3.5)
West Manchester, Ohio	84.8 (2.9)	78.9 (2.9)	74.9 (2.9)	78.6 (2.9)	76.7 (2.9)	84.5 (2.9)	76.7 (2.9)	81.9 (2.9)	76.9 (2.9)	81.7 (2.9)
Wilmington, Ohio	85.5 (2.2)	85.8 (2.2)	82.4 (2.2)	77.4 (2.2)	81.8 (2.4)	88.5 (2.4)	80.8 (2.2)	83.1 (2.5)	84.3 (2.5)	85.3 (2.5)
Bath, South Dakota	70.7 (0.9)	68.7 (0.9)	69.1 (0.9)	68.8 (0.9)	69.6 (0.9)	67.5 (0.8)	69.0 (1.0)	67.5 (0.9)	68.4 (0.9)	67.7 (0.9)
Brookings, South Dakota	61.0 (1.7)	60.4 (1.6)	60.4 (1.7)	62.0 (1.7)	60.6 (1.7)	60.5 (1.7)	60.8 (1.7)	61.3 (1.7)	59.7 (1.7)	61.4 (1.7)
Miller, South Dakota	50.6 (1.3)	51.2 (1.3)	52.5 (1.3)	52.2 (1.3)	50.8 (1.3)	50.6 (1.3)	51.6 (1.3)	51.7 (1.3)	49.1 (1.3)	52.0 (1.3)
Renner, South Dakota ^d	53.1 a (1.2)	50.5 c (1.2)	50.1 bc (1.2)	51.6 ab (1.2)	54.2 ab (1.2)	55.0 a (1.2)	53.7 ab (1.2)	51.6 bc (1.2)	55.4 a (1.2)	51.6 bc (1.2)

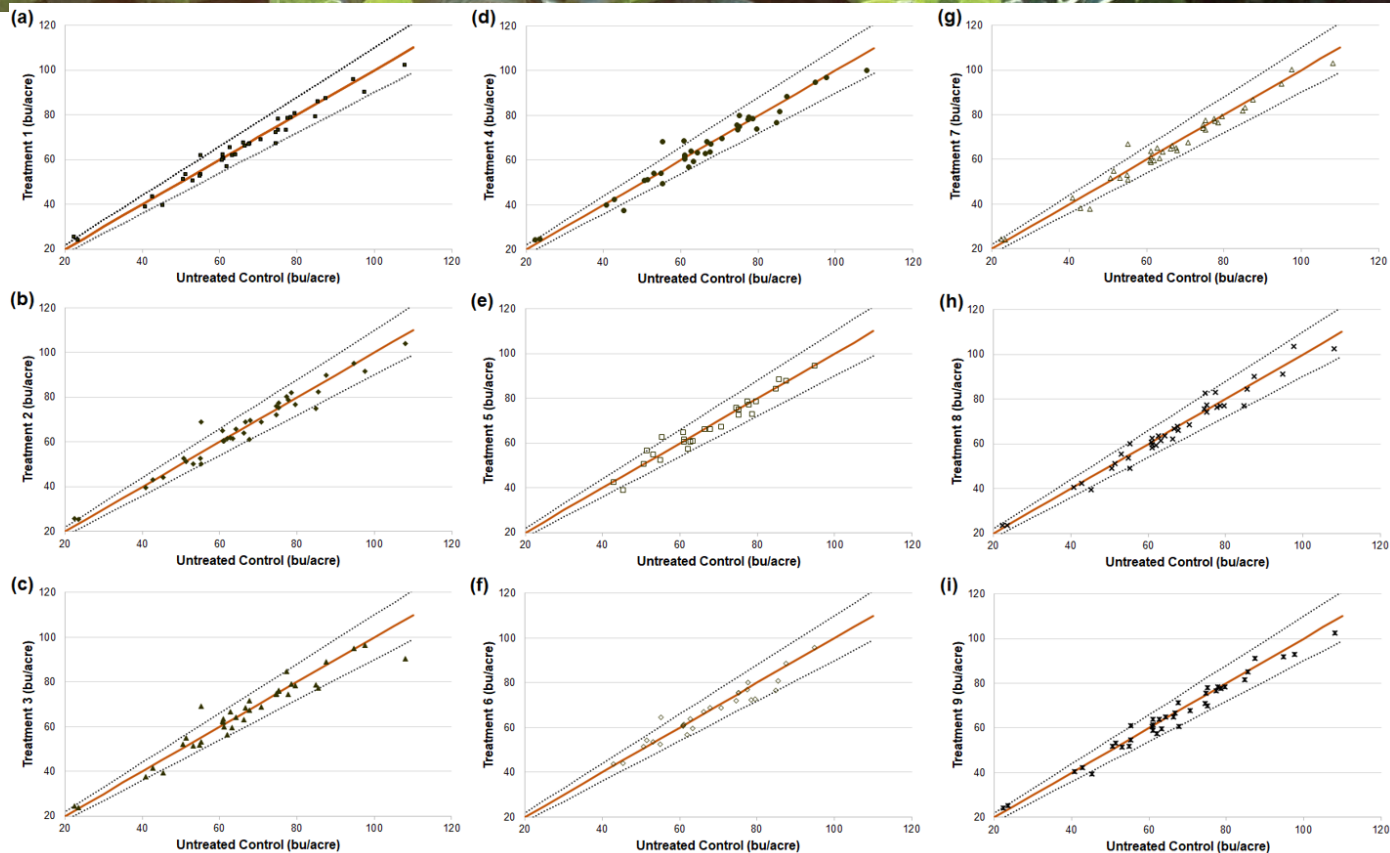
Table 2 (cont.). Treatment grain yield means (standard error) in bu/acre for each site in 2022

Site	Control	Trt 1	Trt 2	Trt 3	Trt 4	Trt 5	Trt 6	Trt 7	Trt 8	Trt 9
Arlington, Wisconsin	77.4 dc (2.2)	73.1 d (2.2)	80.2 abc (2.2)	84.7 a (2.2)	78.1 bcd (2.2)	78.8 bc (2.2)	77.0 cd (2.2)	78.3 bcd (2.2)	83.2 ab (2.2)	76.8 cd (2.2)
Clinton, Wisconsin	55.2 e (2.4)	61.6 cd (2.4)	68.9 ab (2.4)	69.0 a (2.4)	68.2 ab (2.4)	62.7 bcd (2.4)	64.6 bcd (2.4)	66.9 abc (2.4)	59.9 de (2.4)	61.0 cde (2.4)
Cuba City, Wisconsin	94.8 (1.8)	95.8 (1.8)	95.1 (1.8)	95.1 (1.8)	94.9 (1.8)	94.7 (1.8)	95.6 (1.8)	93.8 (1.8)	91.3 (1.9)	92.0 (1.8)
Eau Galle, Wisconsin	45.3 a (1.8)	39.5 bc (1.6)	44.3 a (1.6)	39.3 c (1.6)	37.4 c (1.6)	39.0 c (1.6)	44.0 ab (1.6)	37.9 c (1.6)	39.4 bc (1.6)	39.4 bc (1.6)
Fond du Lac, Wisconsin	60.8 (2.3)	59.4 (2.3)	65.2 (2.3)	62.3 (2.3)	68.7 (2.3)	65.0 (2.3)	61.1 (2.3)	59.4 (2.3)	60.7 (2.3)	60.7 (2.3)
Galesville, Wisconsin	78.6 (2.6)	78.6 (2.6)	81.9 (2.6)	79.1 (2.6)	78.5 (2.6)	73.1 (2.6)	72.4 (2.6)	76.6 (2.6)	76.9 (2.6)	77.7 (2.6)
Hancock, Wisconsin	62.0 (2.3)	56.7 (2.3)	61.4 (2.3)	56.3 (2.3)	57.0 (2.3)	57.5 (2.3)	56.8 (2.3)	59.5 (2.3)	59.5 (2.3)	57.4 (2.3)
Seymour, Wisconsin	74.6 (2.2)	72.0 (2.2)	72.1 (2.2)	74.9 (2.2)	75.9 (2.2)	75.7 (2.2)	72.1 (2.2)	74.1 (2.2)	75.5 (2.2)	71.1 (2.2)
Spoooner, Wisconsin	63.3 (1.3)	61.6 (1.3)	61.5 (1.3)	59.7 (1.3)	59.3 (1.3)	61.1 (1.3)	59.5 (1.3)	60.7 (1.3)	61.6 (1.3)	59.6 (1.3)
Stratford, Wisconsin	54.9 (1.5)	52.3 (1.5)	52.8 (1.5)	51.9 (1.5)	54.2 (1.5)	52.6 (1.5)	52.6 (1.5)	53.0 (1.5)	53.5 (1.5)	51.9 (1.5)

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Average grain yield (bu/acre) at each site for each treatment (product) plotted against the average grain yield (bu/acre) of the untreated control (treatment 10) at the same site. Solid red lines represent $x = y$, and the dashed lines represent $\pm 10\%$ of yield.



Summary: Biological Seed Treatments

- Data from 2022 has not shown yield increase across most environments
- Research is looking into unique situations where these products can provide return on investment (yield or other benefits)
- Challenges:
 - Understanding of how these products works
 - Performance in lab vs field conditions
 - Application- timing, method etc.
 - Not customized for unique field limitations
- Potential benefits (mainly rhizobia) in fields with limited/no soybean history or other unique stressors

Resources: agronomy.msu.edu

Cropping Systems Agronomy

Team Research **Extension** Michigan Corn Hybrid Trials Resources Prospective Students Contact

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Extension

The ultimate goal of our extension program is to provide current, unbiased, and scientifically sound agronomic management information to clientele in Michigan and elsewhere. Our program focuses on current and emerging issues faced by farmers with an overall goal to help farmers increase their profit within the constraints of available resources while minimizing potential adverse environmental consequences. We also focus on factors that could limit the quality of the crop in addition to yield to maximize farmer profit in the current and future marketplace.

Extension

- Soybean**
- Corn Grain
- Corn Silage
- Small Grains
- Multi-Crop Systems

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The best soybean management practices by Extension researchers from across the United States

The Soybean Growth Cycle: Important Risks, Management and Misconceptions

The soybean crop needs to encounter various conditions across growth stages to optimize yield. Sensitivity to stress varies across growth stages, resulting in an array of risks, some of which can be mitigated through management. This publication seeks to discuss risk and management options across important soybean growth

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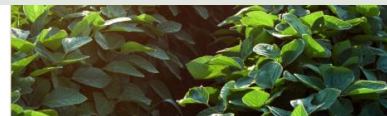


The best soybean management practices by extens

Planter Technologies

Keys to Success: Choosing the Right Soybean Variety

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The best soybean management practices by extension researchers from across the United States

Soybean Plant Stands: Is Replanting Necessary?

DEFINITIONS: Since terms may vary throughout the U.S., these definitions may clarify terms used in this paper.

Plant stand/Population | Number of plants emerged per acre.
Repair-plant/Fill-in | Replanting portions of the field.

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The Best Soybean Planting Date

Take Home Points

- Timely planting of soybean is critical to achieve high soybean yields. In many

Introduction

Soybean planting dates can vary greatly depending on soybean growing region (Mourtzinas et al. 2019). Timely soybean planting is just as critical for attaining high soybean yields as it is for other crops such as corn and wheat. Generally, soybean responds better to early planting but the degree of soybean yield response is dependent on field productivity, variety characteristics (i.e. pest tolerance or resistant traits), maturity group, growing season, pest control (i.e., weeds, insects, and diseases) and weather conditions. Early soybean planting requires additional

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The best soybean management practices by

HOW TO PICK THE RIGHT SOYBEAN ROW SPACING

Take Away Points

- Soybean producers across the US use row spacing from 7 to 40 inches; row

National Recommendations

- Mechanism behind narrow row of the yield advantage from row more sunlight driving more yield advantages are typically maturing varieties, and high till from VE (emergence) to R3 (in
- Data: Soybeans in 15-inch or soybeans in 20-inch rows, and

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The best soybean management practices by Extension researchers from across the United States

SOYBEAN PLANT POPULATION DENSITY

Take Home Messages

- Current soybean varieties efficiently respond to their

Introduction

Soybean seed costs are about 40% of the variable costs in soybean production, and optimizing seeding rate will help to produce high yields without overplanting on variable costs. Generally, soybeans require higher seeding rates and more plants per acre in the Northern United States and in later-planted fields across the US. Soybean typically requires fewer plants and lower seeding rates for much of the Midwestern and Southern US when timely planting occurs.

Foliar Fertilizers Rarely Increase Yield in U.S. Soybean

Foliar Fertilizer Overview

The best soybean management practices by Extension researchers from across the United States

- **Technicians:**
 - Micalah Blohm
 - Tom Siler
- **Graduate Students**
 - Harkirat Kaur
 - Patrick Copeland
 - Benjamin Agyei
- **Undergrad/Intern students**
- **Past students**
 - Mike Particka
 - Paul Horny
- **Farmer cooperators**

- Dr. Jeff Andresen
- Dennis Pennington
- Dr. Laura Lindsey (OSU)
- Dr. Ignacio Ciampitti (KSU)
- Dr. Shawn Conley (UW)
- Dr. Chris Difonzo
- Dr. Matt Gammans
- Dr. Erin Burns
- Dr. Dechun Wang
- Dr. Christy Sprague
- Dr. Kurt Steinke
- Dr. Marty Chilvers
- Mike Staton

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Thanks!

Project 
GREEN



Seed companies



Project: Data Driven Knowledge for Profitable Soybean Management Systems

- **GOAL:** Develop a field-specific System-level Predictive Tool
- We are seeking Info from **your Soybean Fields** (Yield & Management)
- More data from real world = Better predictions from tool
- Data from **your fields** (2 - 4) will help usability of tool for you
- We will add weather and satellite data to improve precision
- All data will stay confidential

- **Receive a coupon** to access Tool in 2023 (<https://agroptimizer.com/>)
- **Prize drawings** for Michigan growers

- Fill out the survey ONLINE (QR code or link):
- Contact us if need a Paper copy OR any Questions



MI Contact:

Manni Singh

517-353-0226

msingh@msu.edu

Project Lead: Shawn Conley (UW)



<https://arcg.is/1anP4r>

Resources- agronomy.msu.edu OR contact Manni

- Fill **Signup Sheet** if need a Paper copy or our help and project updates
- Article with project details:

<https://www.canr.msu.edu/news/michigan-soybean-producers-can-help-develop-a-new-online-tool-for-optimizing-soybean-production>

Project Website (Shawn Conley): <https://coolbean.info/soybean-research/data-driven-knowledge/>

Paper copy

Overview

This survey is intended to collect information pertaining to field characteristics and production/yield from soybean fields in the Midwest United States. The survey is broken down into sections, and we ask that you provide as much information as possible. Results from this survey, coupled with environmental variables will be used to analyze and model productivity at a farm-specific scale. All Data Collected for This Survey Are Confidential and Anonymous. Unless Otherwise Specified, All Questions are Pertaining to the 2022 Season.

- Once you have completed the survey, please return it by mail using the provided return envelope.
- If you need assistance or have any questions about this, please contact Patrick Copeland by phone (989-817-8570) or email copel113@msu.edu or Manni Singh msingh@msu.edu
- If you would rather complete this survey online, use this link: <https://arcg.is/1anP4t> or by using the QR code.



General Information

Name: _____ Date: _____
 Email: _____ Phone: _____
 Field Location: Lat. _____ Lon. _____
 Field size (acres): _____ Average Soybean Yield (bu/acre): _____

Field Information

Predominant Soil Type

- | | |
|-------------------------------------|--|
| <input type="checkbox"/> Silt loam | <input type="checkbox"/> Sandy loam |
| <input type="checkbox"/> Silty clay | <input type="checkbox"/> Silty Clay Loam |
| <input type="checkbox"/> Loam | <input type="checkbox"/> Other _____ |
| <input type="checkbox"/> Sand | |

Information needed to fill the survey

What information will I need to fill out the survey?

1. Interviewer Name
2. Cooperator/Farmer Name
3. Cooperator/Farmer Email
4. Please Upload (if available) Yield Monitor Data for 2022
5. If Yield Monitor Data Are Not Available, Please indicate the Acreage of the Field you are Describing or Entering Data for.
6. Please Indicate the Average Yield for the Field (bu/Acre)
7. Click on the Circle to Record Field Location
8. Select Predominant Soil Type
9. Is Your Field Irrigated
 -if yes: Irrigation Number of Applications + Irrigation Total Inches
10. Drainage Type
11. Tillage Type
 -if other than NT and field cultivator: When was Your Last Tillage (in relation to/prior to the 2022 growing season)?
12. Do You Use Cover Crops?