

Agronomy Research Updates: Optimizing Planting Decisions

Manni Singh

Cropping Systems Agronomist

agronomy.msu.edu

msingh@msu.edu, 517-353-0226

Feb 14, 2023, SVREC Extension meeting



Cropping Systems Agronomy
MICHIGAN STATE UNIVERSITY



Project GREEN

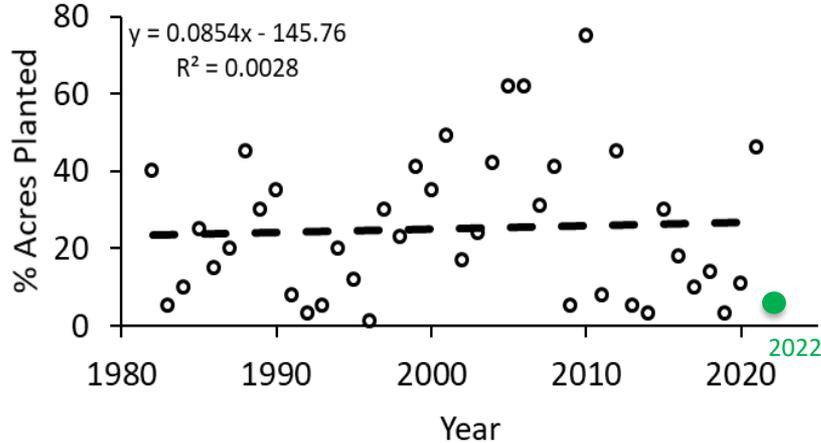


MICHIGAN STATE UNIVERSITY | Extension

NCSRP NORTH CENTRAL SOYBEAN RESEARCH PROGRAM

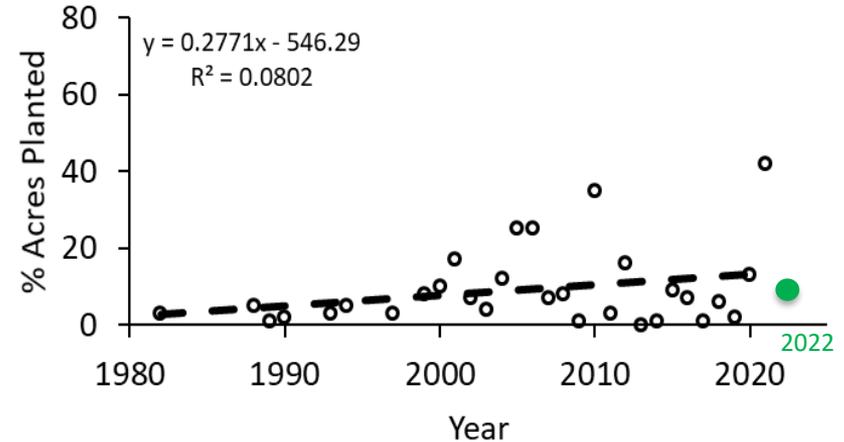
Early-season Planting Progress: Variability over years

% Corn Planted by 1st week of May



Source: USDA NASS, Week 18

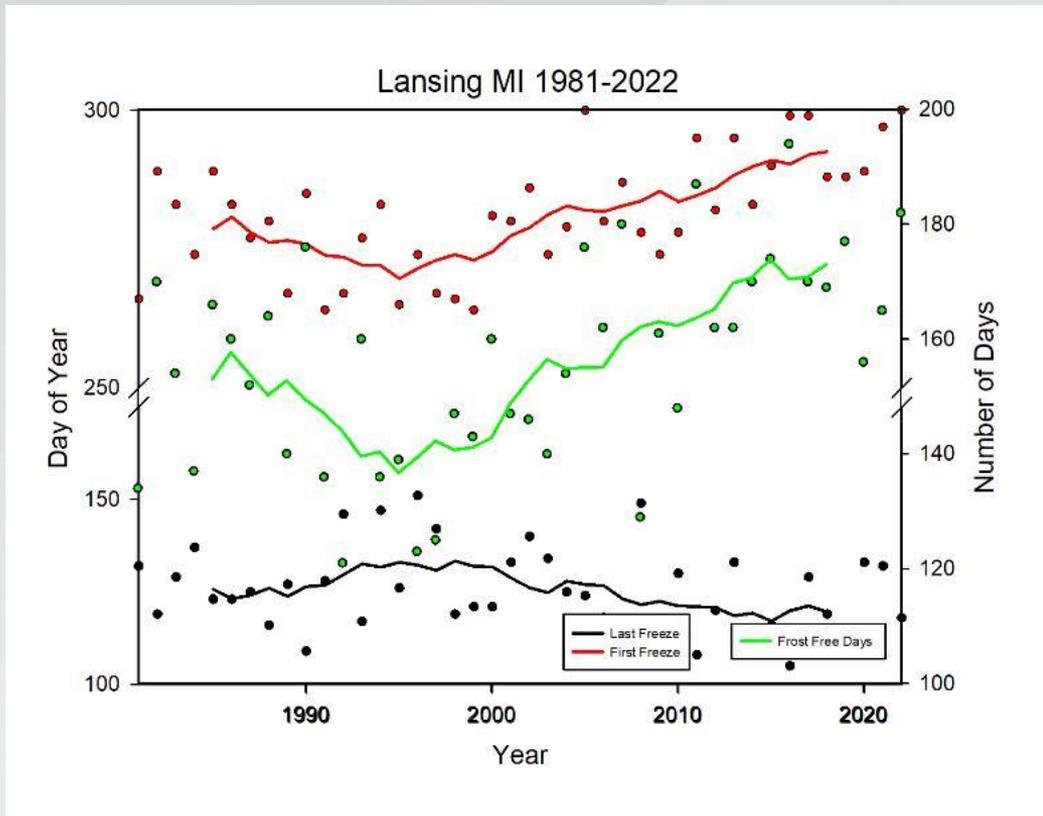
% Soybean Planted by 1st week of May



Topics for today:

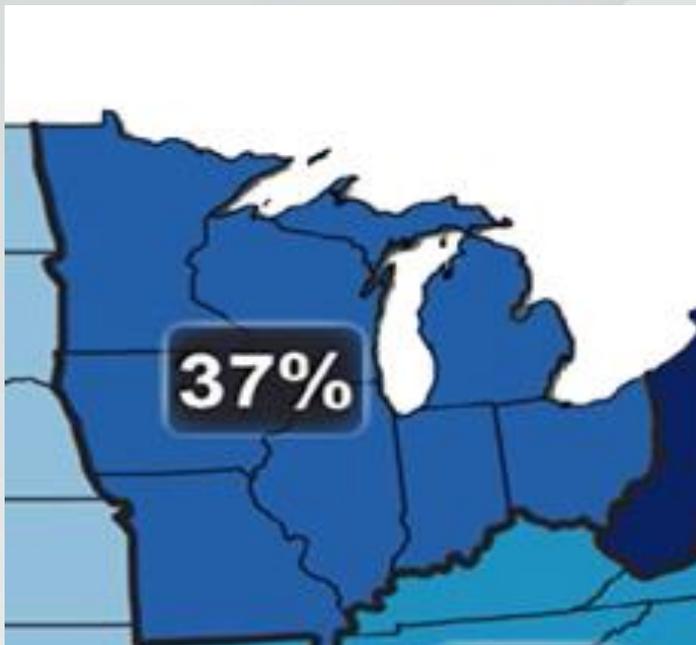
1. Recent weather trends
2. Planting date (PD) impacts
3. PD x other management strategies
4. Biological seed treatments in soybeans

Weather Trends: Longer frost-free season



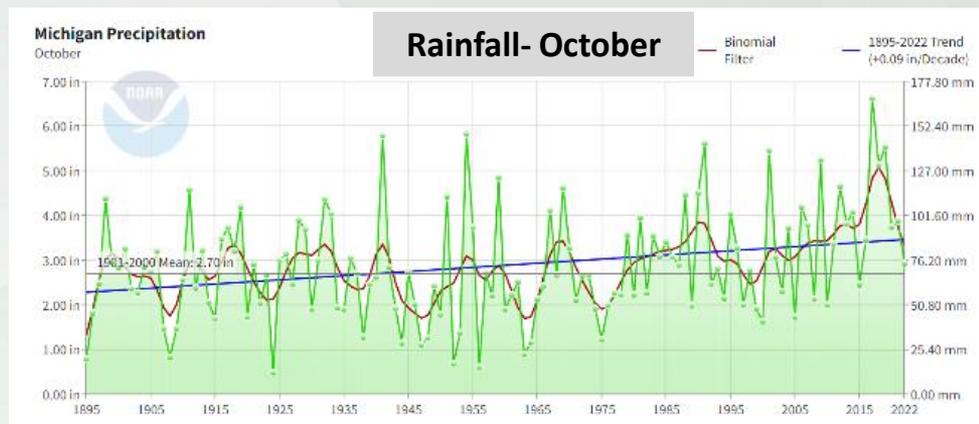
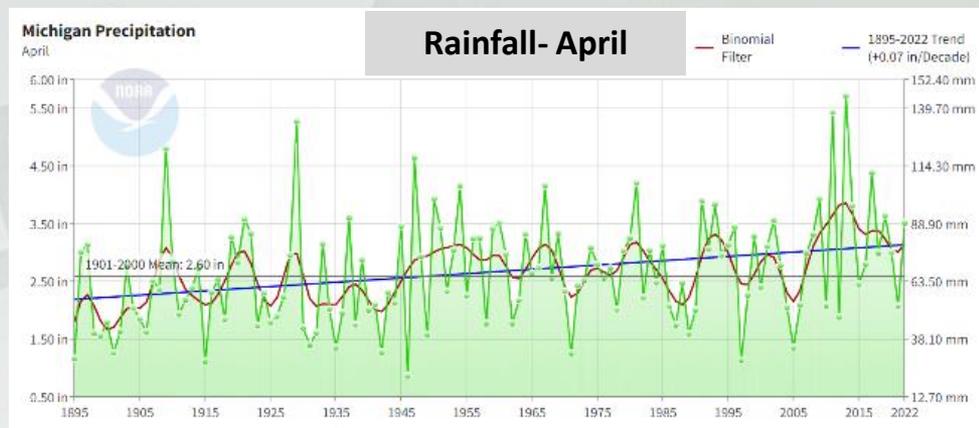
GLISA, 2019

Weather Trends: Wetter, mainly in Spring/Fall



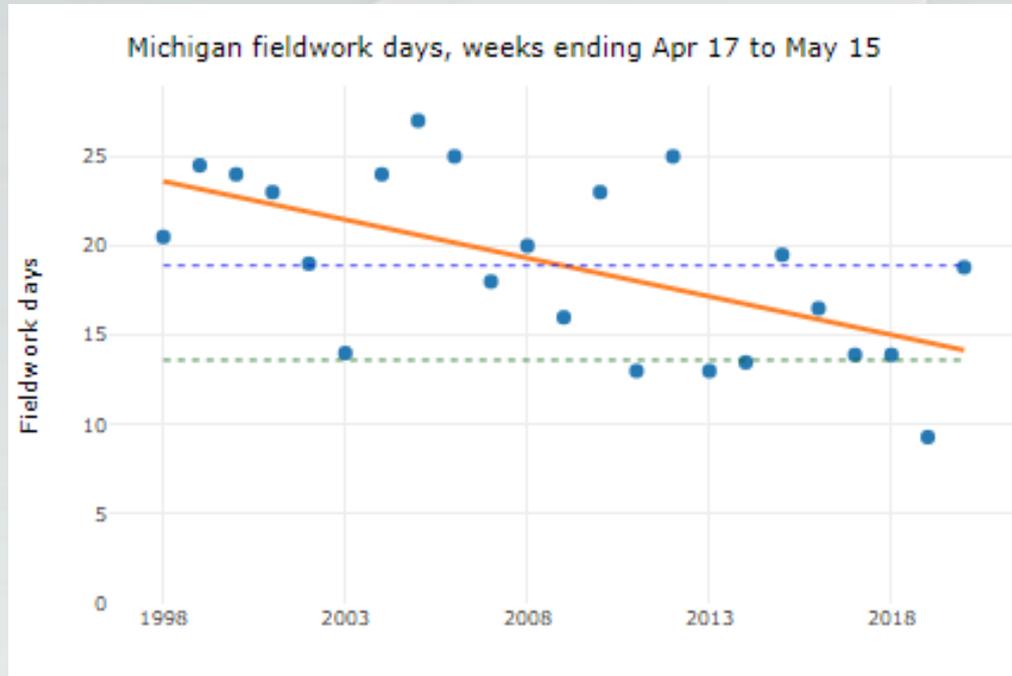
Increase in extreme precipitation
(during top 1% of severe storms)

GLISA, 2019



Jeff Andresen, MSU

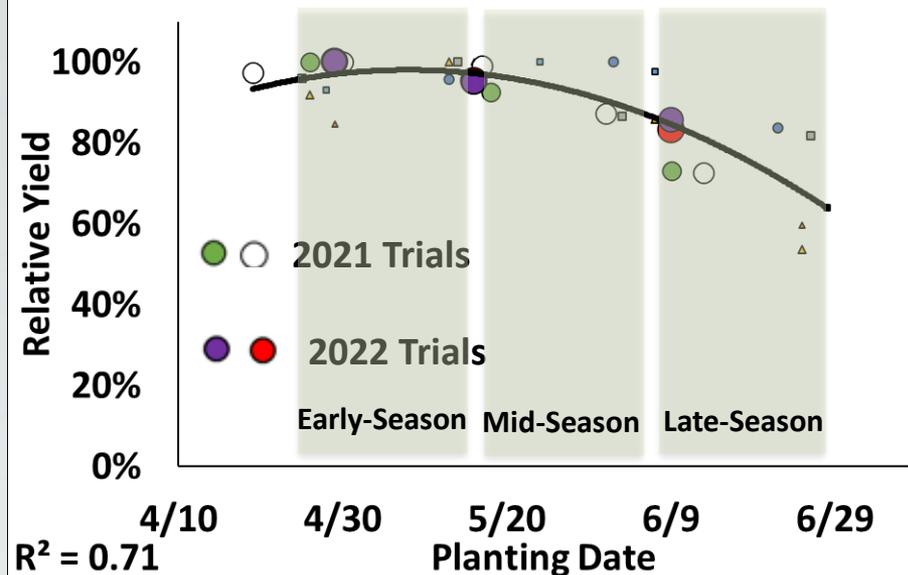
Weather Trends: Less #days for field work in Spring



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

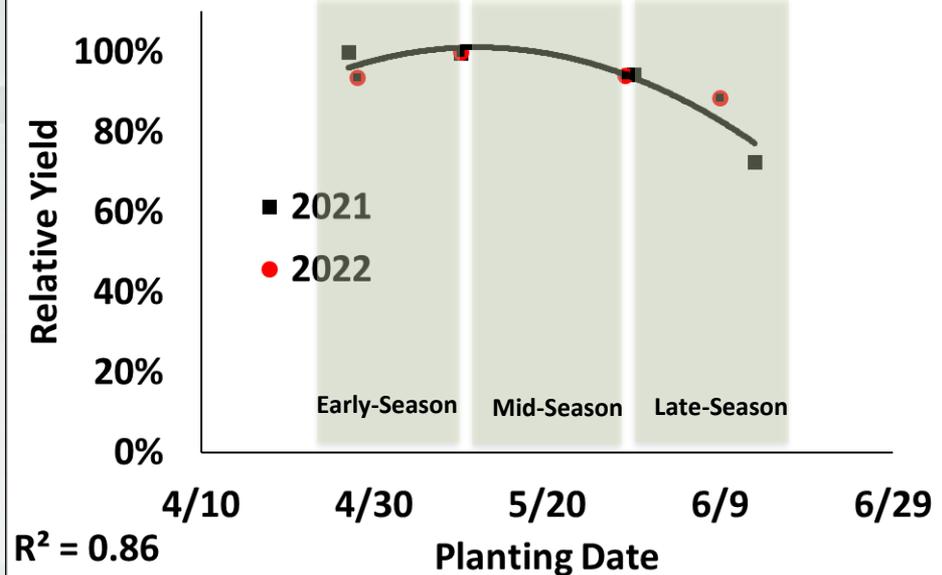
Planting Time Impacts Yield in Michigan

Optimal Soybean Planting Date



Data from 2018-2022 across multiple trials

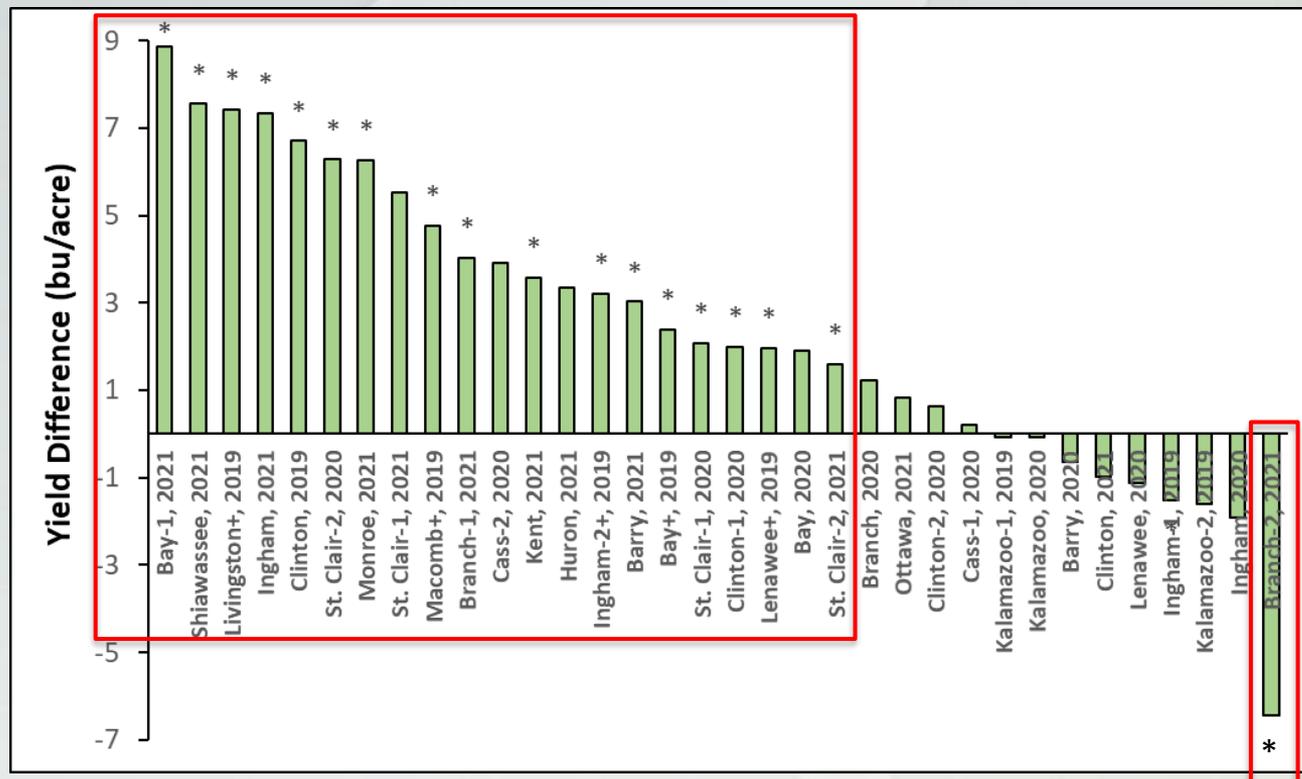
Optimal Corn Planting Date



Data from 2021-22 Trials

Soybean Yield: Michigan On-Farm Trials

Yield diff. =
Early planting -
Typical planting



* Denotes significant differences at P < 0.10

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

Soybean Early-season Planting: Rewards vs Risks

➤ Rewards:

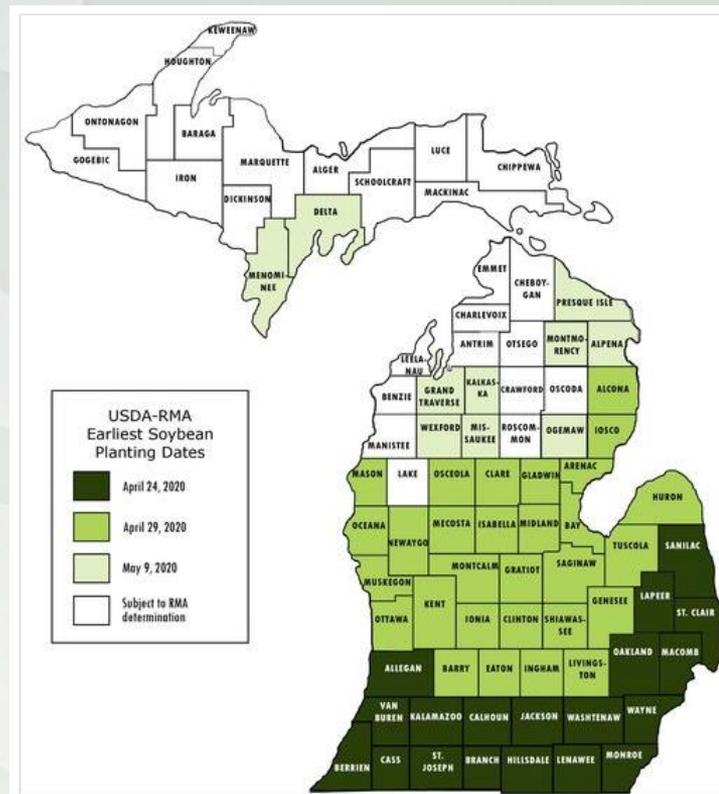
- Extended planting window
- Increase in yield

➤ Risks:

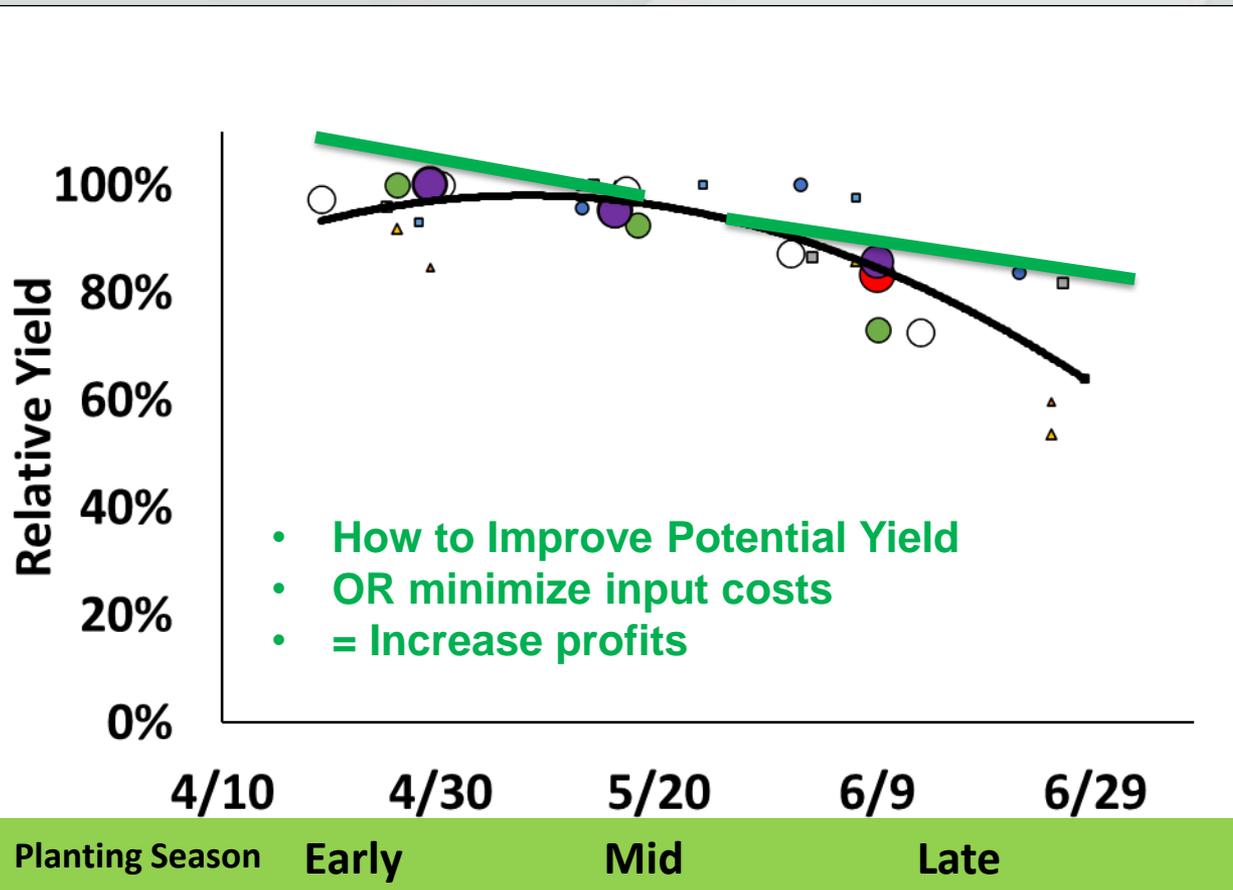
- Poor germination/emergence, plant stand
 - Imbibitional injury, insect/disease, crusting
- Freeze damage to emerged plants
- Crop insurance coverage

➤ Optimal time: typically starts end-April

- Do NOT plant if forecast of cold rain in 24 hrs
- Target fields suitable for early planting



Planting Time: change other management?

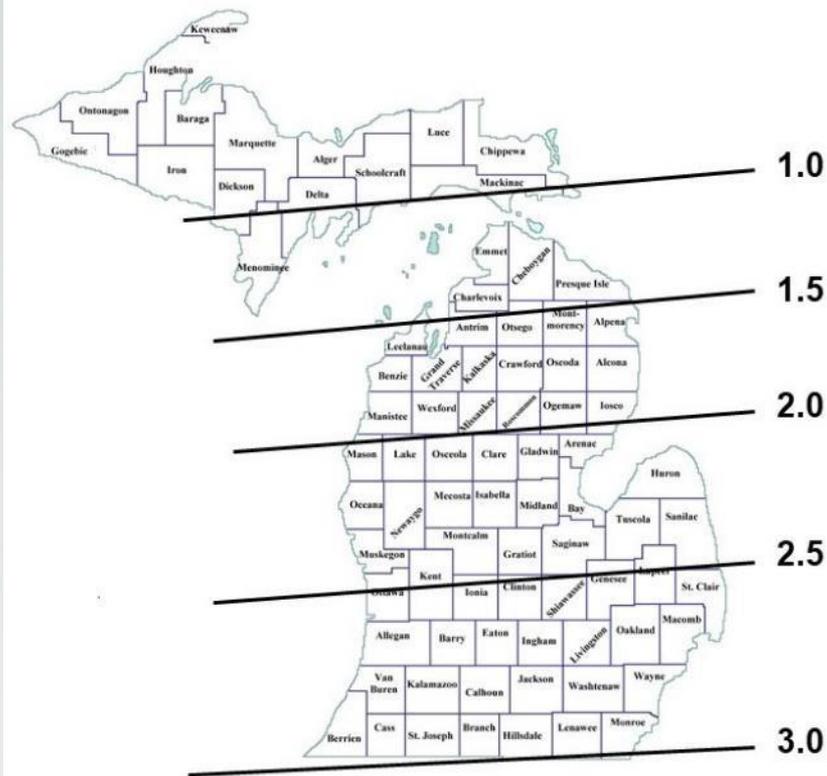


Things to consider:

- Variety Selection:
 - **Maturity**
 - Traits
- **Seed rate**
- Seed quality
- Seed treatment
- Seedbed prep.
- **Planting method**
- **Row spacing**
- Fertility
- Weed control
- Harvest decisions

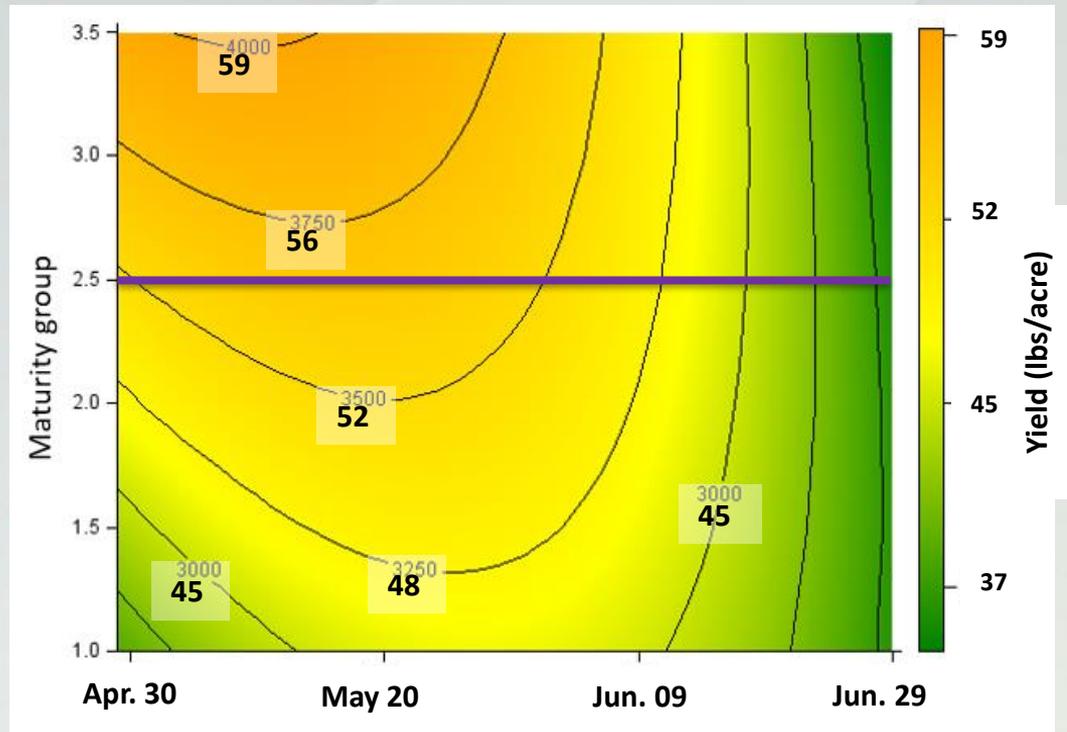
Soybean Maturity Selection: Role of planting date?

Soybean Maturity Zones in Michigan



- Based on one planting date (mid-season)
- Does NOT account for early or 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) OR Double crop soy

Maturity/Quality concerns: Late planted soybean



2020- Frost on Oct. 16

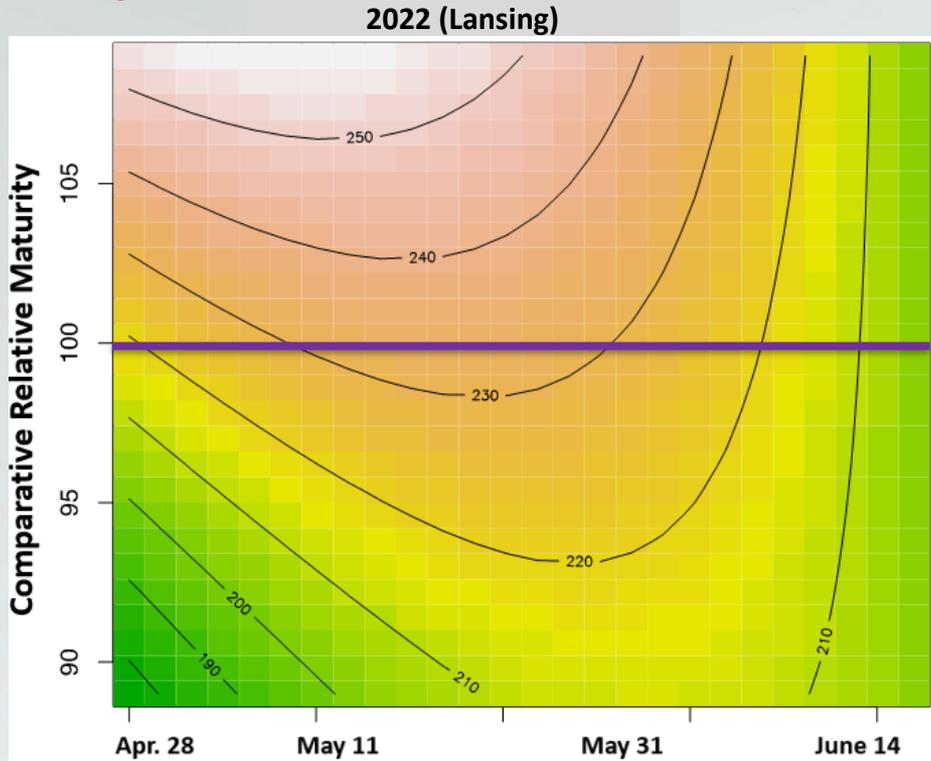


2021- Frost on Nov. 3



2022- Frost on Oct 8

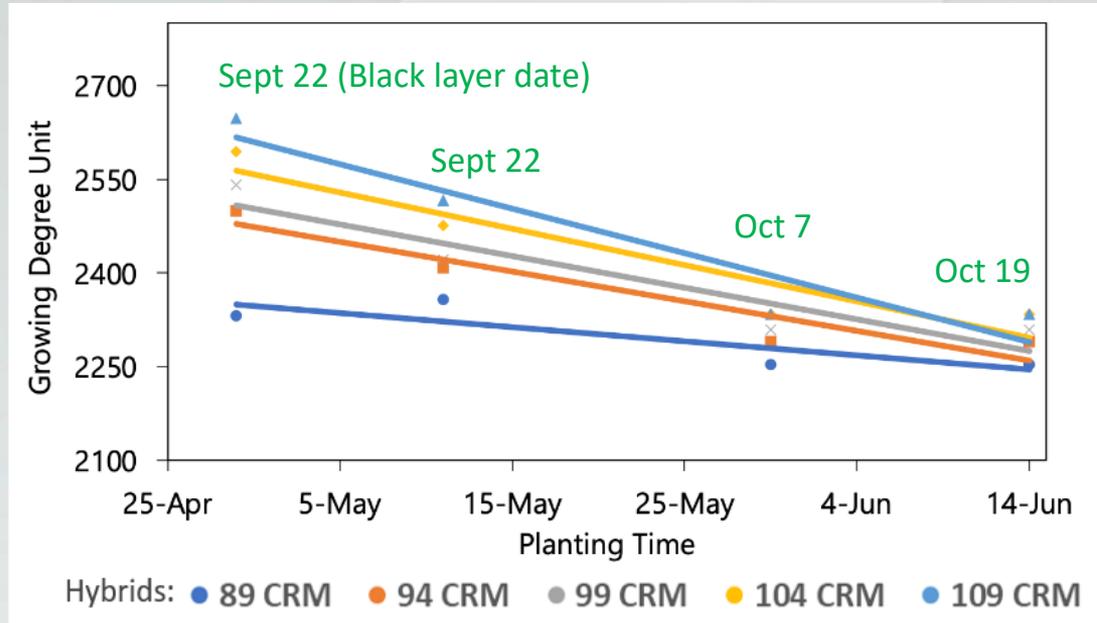
Corn: Hybrid Maturity Selection vs Planting Date



2022- Frost on Oct 8

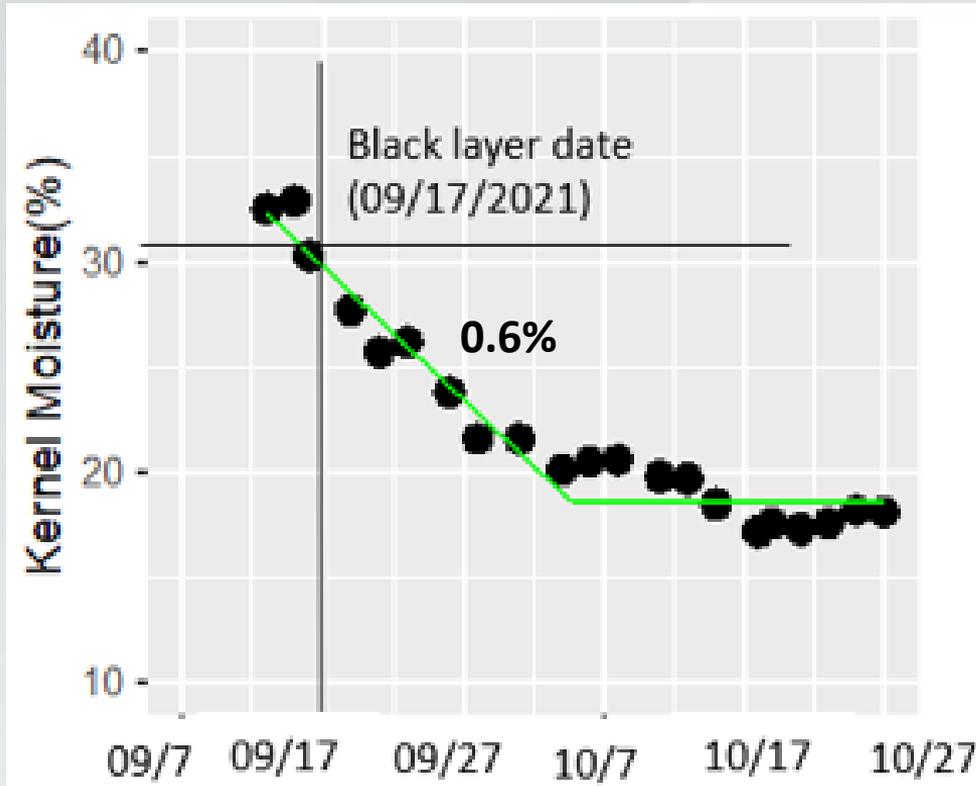
- Late maturity hybrids for early-season planting
- Can switch to early maturity hybrids under late planting be delayed?

Corn- Time to Black Layer (i.e. maximum Yield)



- Decrease in hybrid GDD requirements with delayed planting (**GDD Compression**)
- Compression of **7.2 GDD** (1.0 – 12.0) per day delay in planting (average in 2021 was **5.6**)
- So, 2500 GDD (~100 d) hybrid will behave as ~2300 GDD (~94 d) hybrid if planted May 31

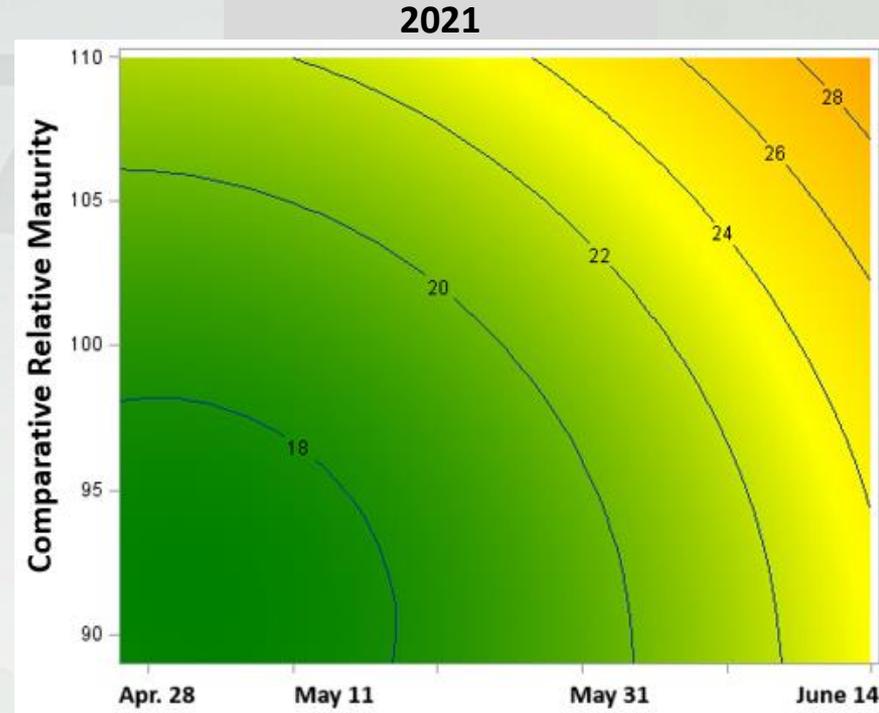
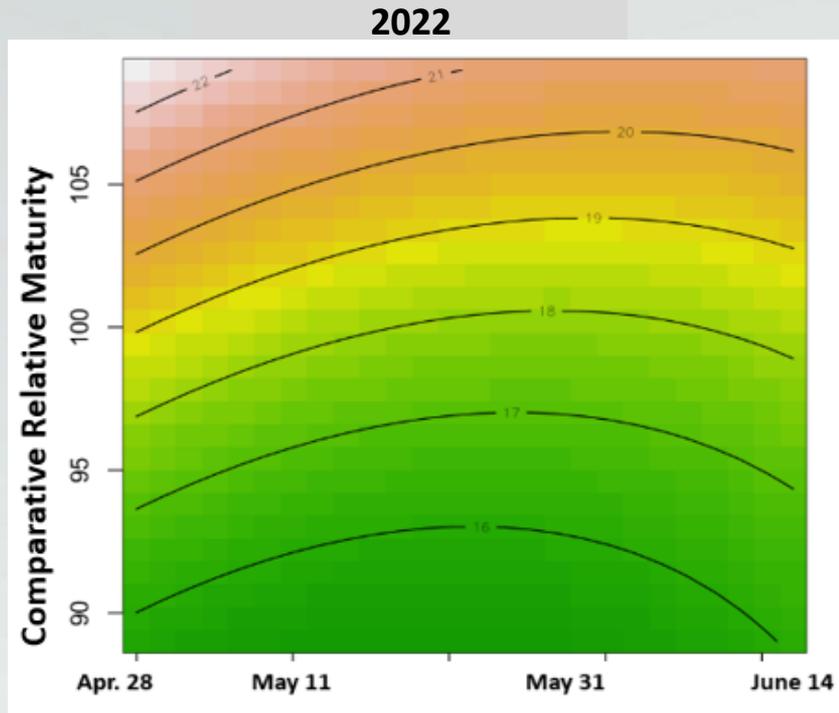
Corn- Dry down (for maximum profits)



Variable	2021	2022
Moisture at Black Layer	~30%	<30%
Plateau Moisture	~19%	~19%
Drydown Rate (99 RM) May 11 Planting	0.6%	0.8%
Drydown Rate (99 RM) May 30 Planting	0.5%	0.6%
Drydown Rate (May 11) 109 RM	0.5%	~0.7%

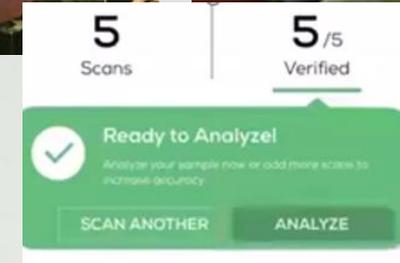
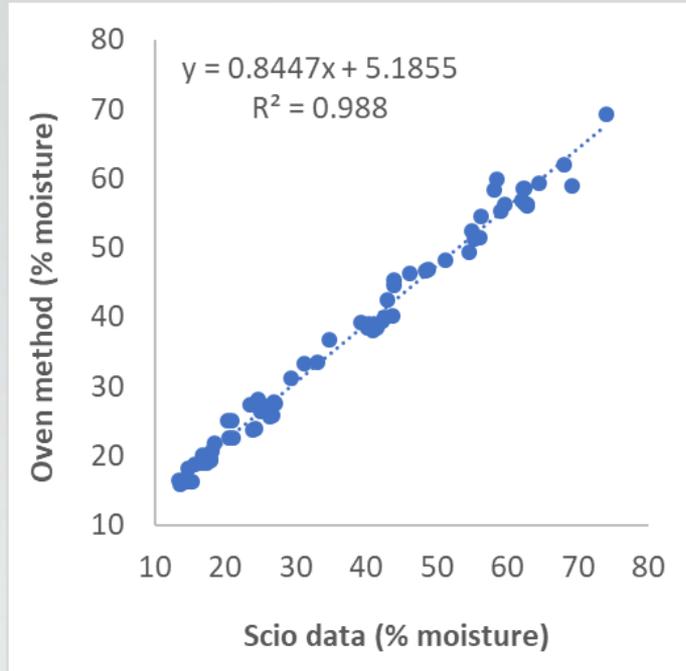
Planting- May 11, 2021. 99 RM hybrid

Corn Harvest Moisture- 2021 and 2022



- More field dry down in 2022 than 2021
- Even late-hybrids under delayed planting had low moisture in 2022

Corn Moisture: Measure In-field?



SCiO Info: hardware and software

<https://www.consumerphysics.com/ear-corn-analysis/>

- Fast and non-destructive prediction of grain moisture is important for timely harvest
- SCiO can also capture increase in moisture after rainfall

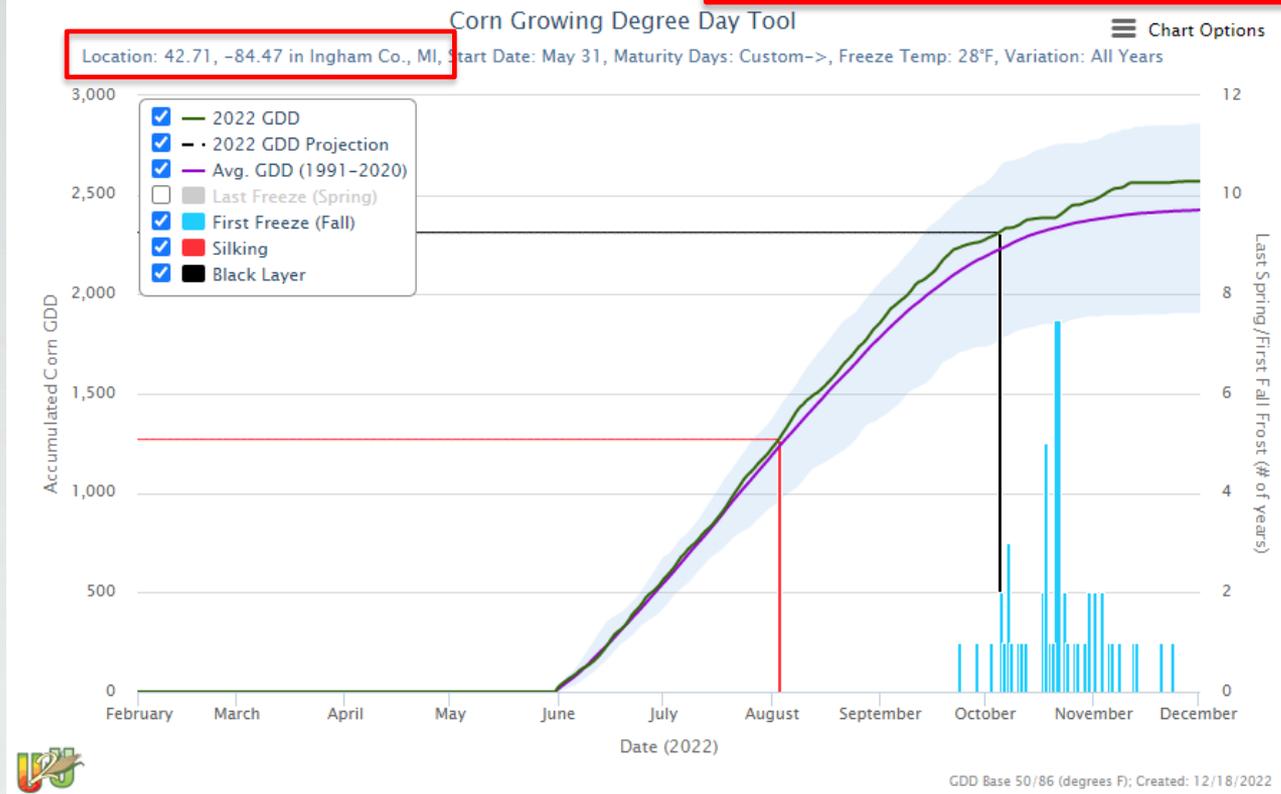
Corn: Useful 2 Usable Tool (U2U)

https://mygeohub.org/groups/u2u/purdue_gdd

GDD Start:
 Comparison Years:
 Corn Maturity Days:
 Silking GDDs:

Freeze Temperature (°F):
 Variation:
 Current Day:
 Black Layer GDDs:

Does NOT account for GDD compression, so **manually change black layer GDDs**



Future- provide estimation of dry down (e.g., **date of 20% moisture**)

Summary: Plant date (x Variety maturity)

- Combine early planting with other management for higher yields/profits
- For mid-season planting, select varieties best suited for your operations
- Early-season planting: use late-maturity varieties
- In delayed/replant situations- use early-maturity varieties
- **Portfolio approach** in maturity selection (also provide genetic diversity)
 - Plant late-maturity varieties first (20-30% acres)
 - Plant mid/early maturity varieties to “stack” soybean pod/seed set OR corn pollination
 - Plant ~20-30% acres to early-maturity varieties

Soybean Seeding Rate



**50,000
Seeds/A**

**90,000
Seeds/A**

**130,000
Seeds/A**

**170,000
Seeds/A**

**210,000
Seeds/A**

3.9 Branches

3.3 Branches

2.3 Branches

2.0 Branches

1.6 Branches

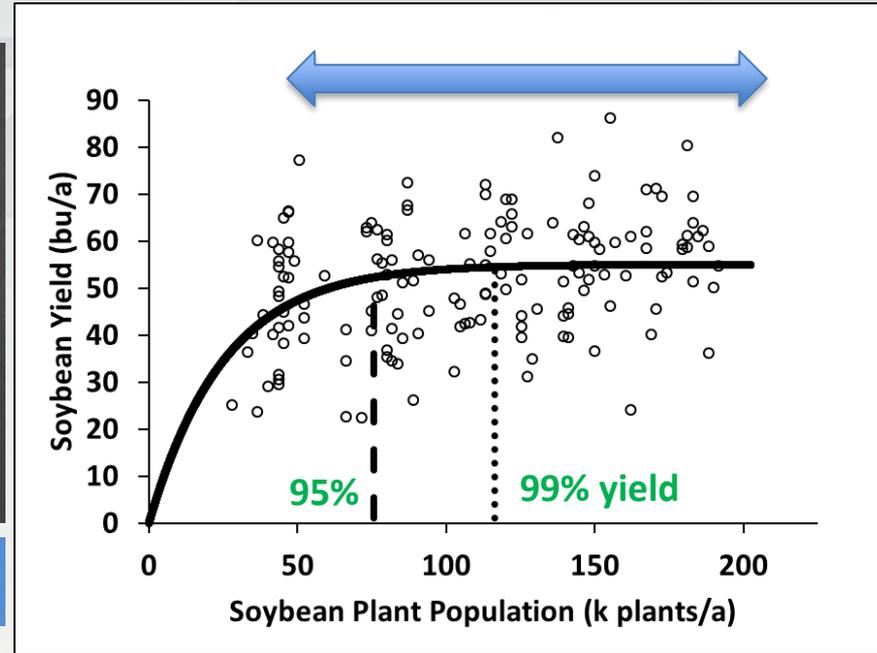
Low pod: 2.8"

Low pod: 3.2"

Low pod: 3.8"

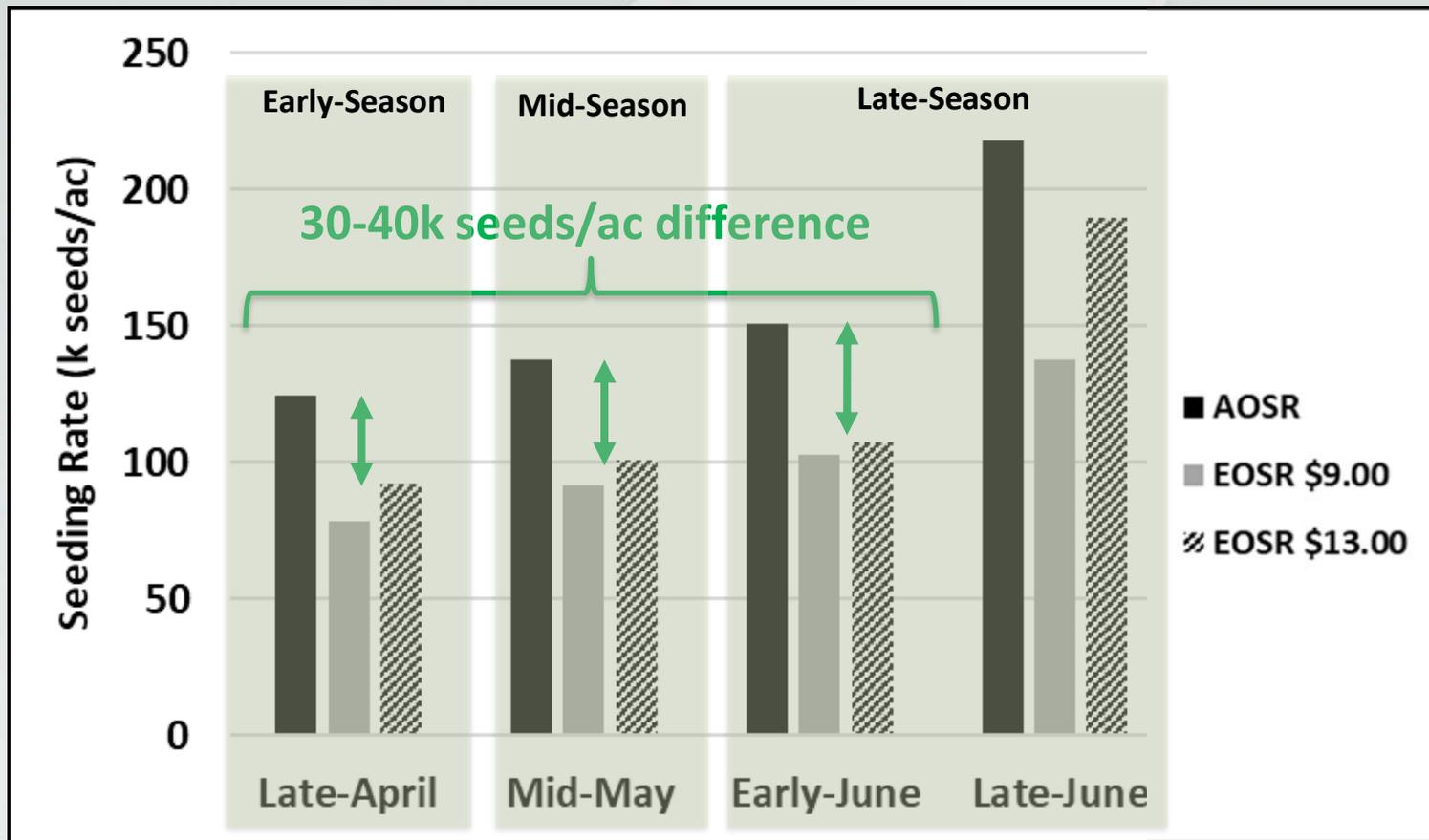
Low pod: 4.2"

Low pod: 4.5"



Seed rate: ~20% higher

Soybean Seeding Rate- Agronomic vs Economic Optimal



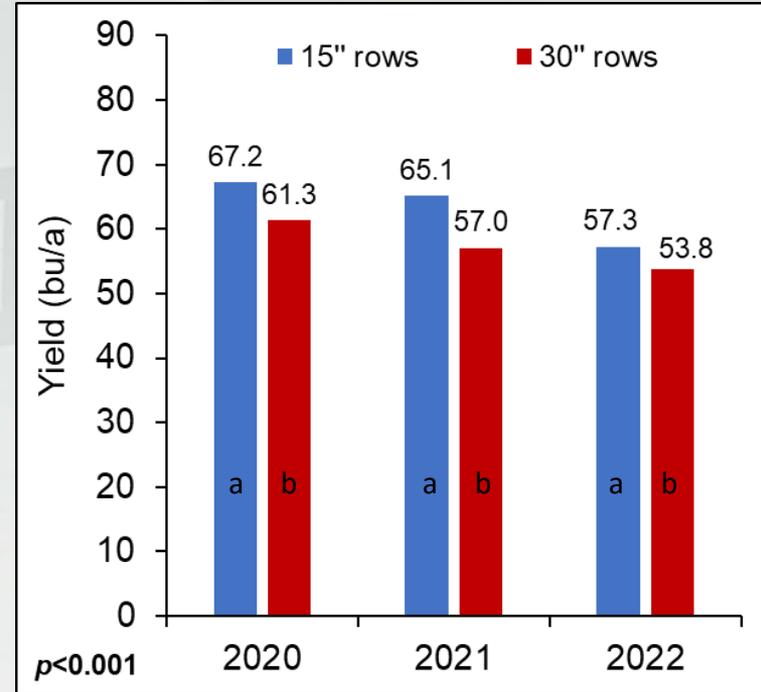
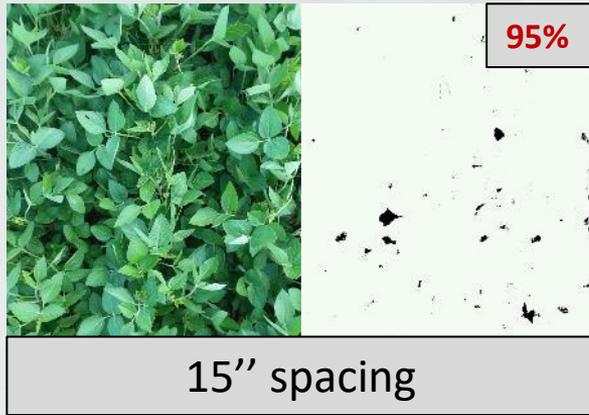
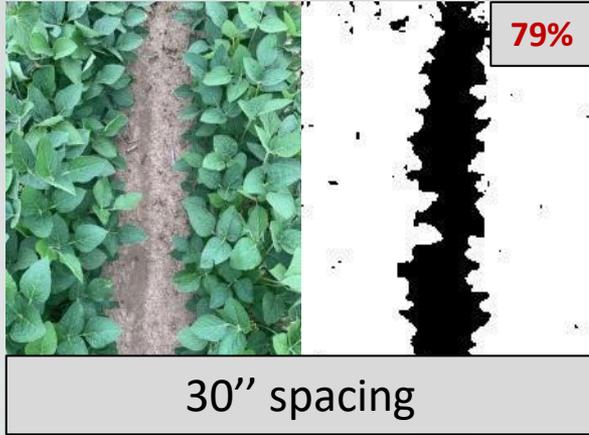
Agronomic Optimal Seed Rate (AOSR)

Economic Optimal Seed Rate (EOSR)

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

15-inch rows
Conventional till
4 site-years data

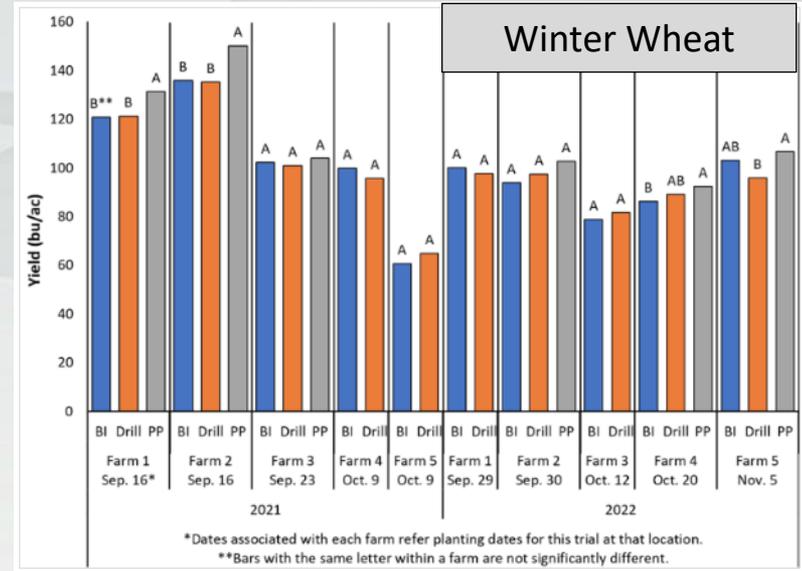
Soybean Row Spacing



- Narrow rows (15") had yield advantage over 30" rows across all years (7-14%)
- Benefit of narrow over wide rows was consistent across planting dates in 2 out of 3 years

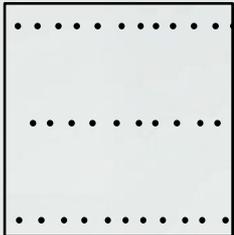
Soybean: Importance of Precise Seed Placement?

- 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



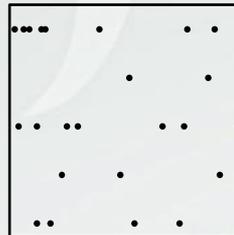
Precision Planter

15-in Row Spacing

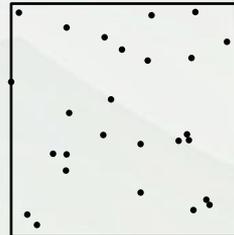


Seed drill

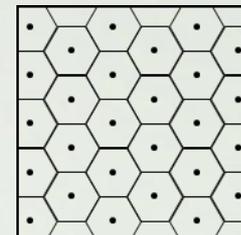
7.5-in Row Spacing



Broadcast

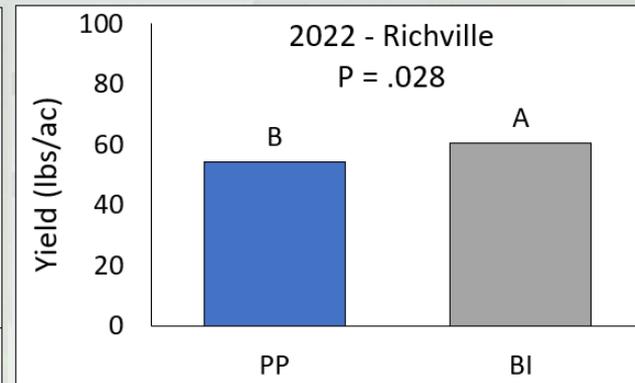
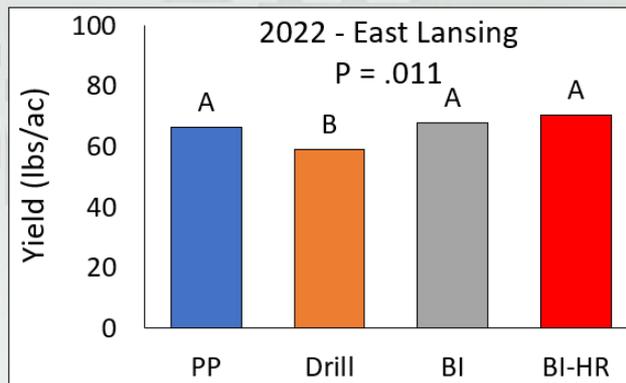
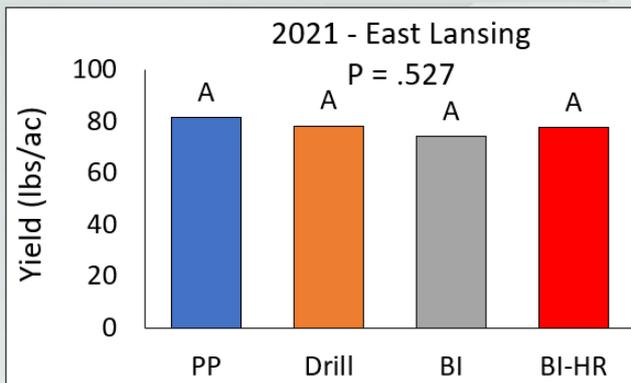


Ideal



Soybean: Planting Methods

- Minimum yield penalty in soybean from less-precise seed placement



PP: Precision Planter
BI: Broadcast Incorporation (BI)
BI-HR: Broadcast Incorporation, higher seeding rate



15" Planter



7.5" Drill

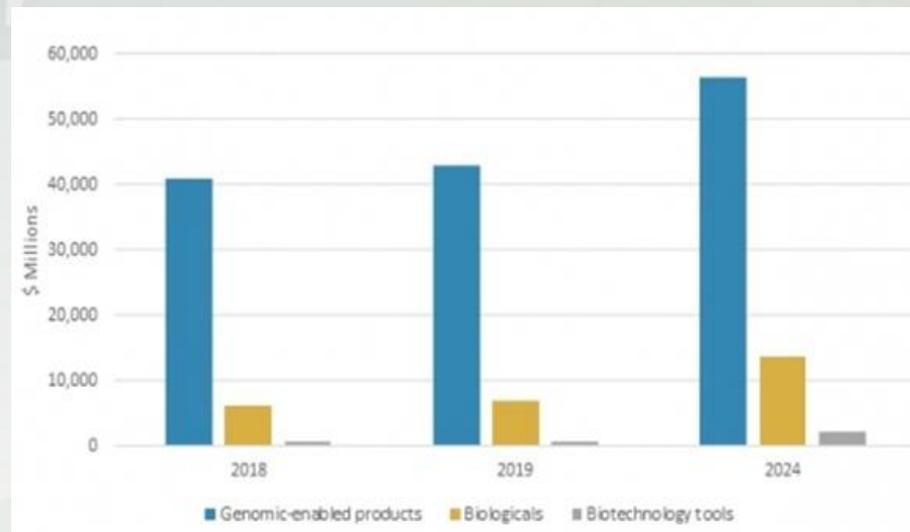


Broadcast Incorp.

Evaluation of Commercially Available Biological Seed Treatment in Soybean

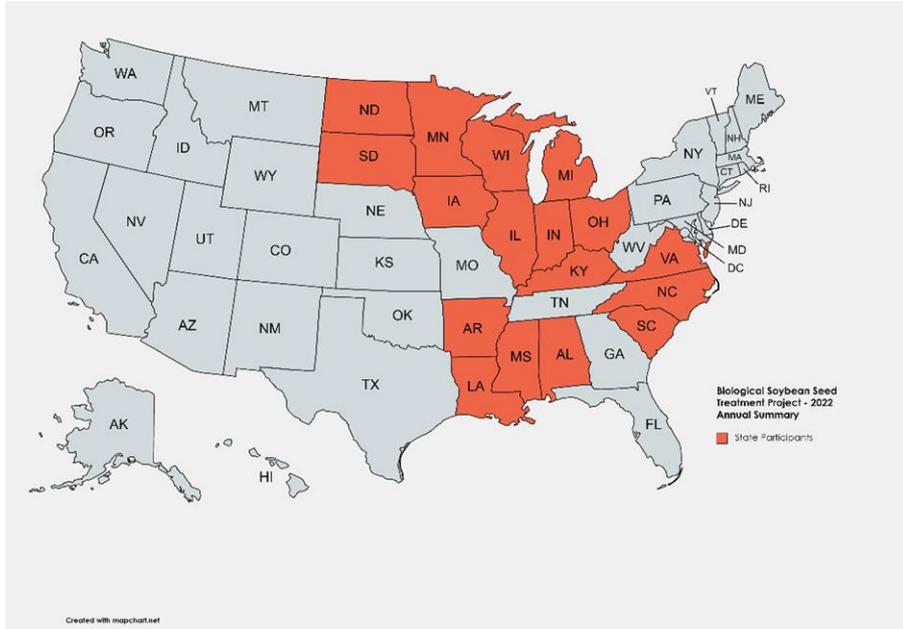
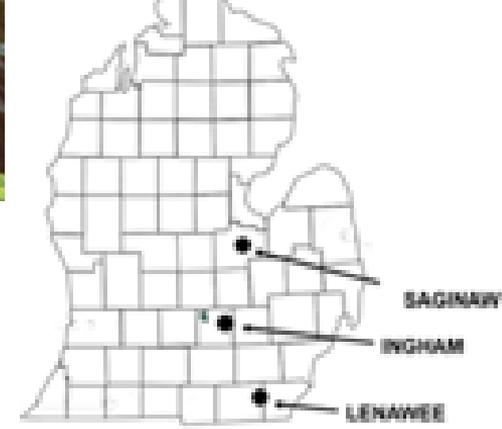
Some of the products claim that they:

- 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:

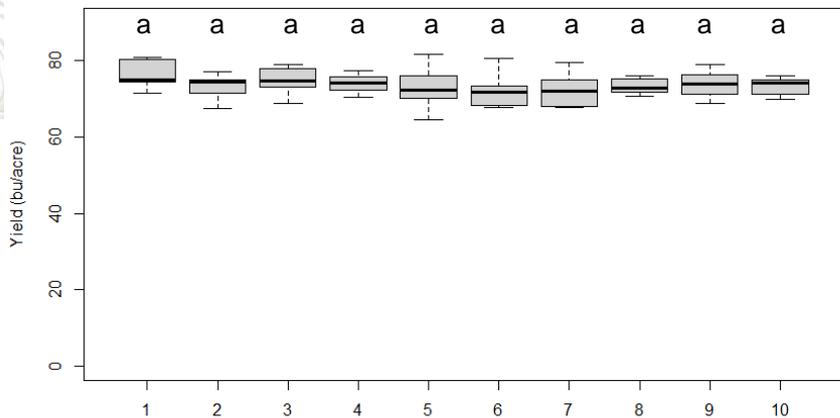
- 17 states
- 50 locations (3 in MI)- data from 40 reported
- Small plot trials
- Randomized complete block design with 6-8 reps at all sites.



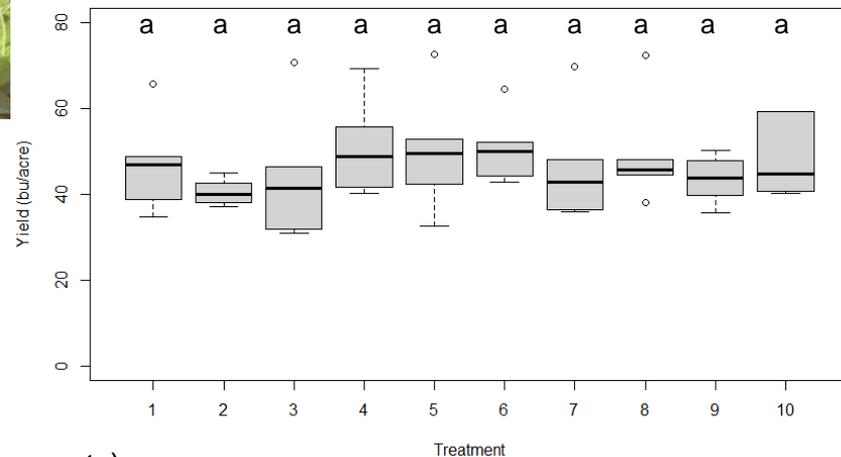
Table 1. List of treatments (products) and active ingredients in each biological product.

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

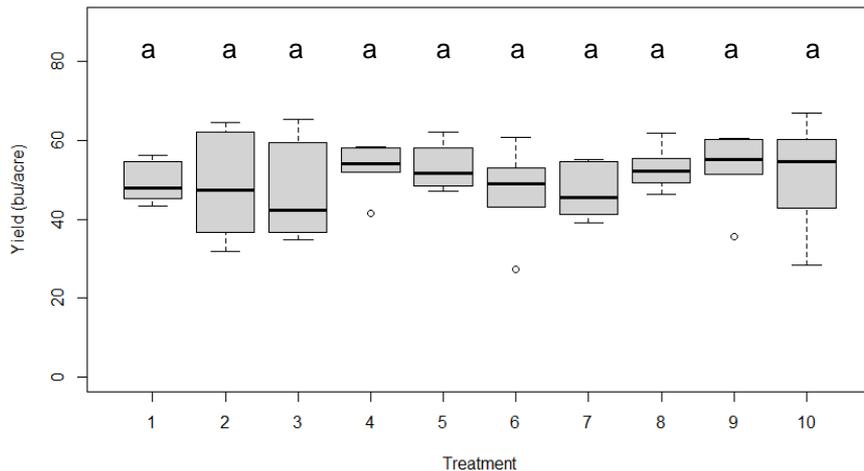
Britton, Michigan 2022 (Lenawee county)



Mason, Michigan 2022 (Ingham county)



Saginaw, Michigan 2022 (Saginaw county)

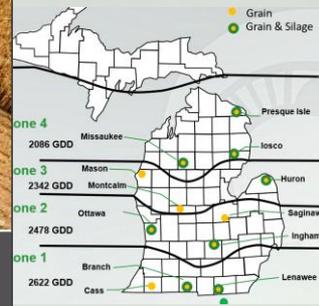
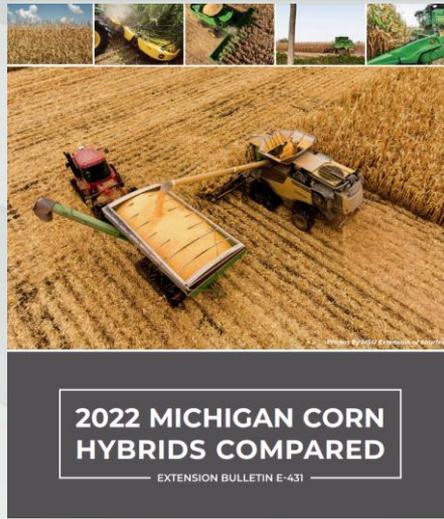


- No response in Michigan
- Only 2 of 49 sites showed limited positive response

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 work
 - Performance in lab vs field conditions
 - Application- timing, method etc.
 - Not customized for unique field limitations
- Potential benefits 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

Home / Extension /

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



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

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

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

The Best Soybean Planting Date

Take Home Points

- Timely planting of soybean is critical to achieve high soybean yields. In many cases, the degree of soybean yield is critical to achieve high soybean yields. In many cases, the degree of soybean yield is critical to achieve high soybean yields. In many cases, the degree of soybean yield is critical to achieve high soybean yields.

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

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

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 spacing of 30 inches is the most common.

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

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

SOYBEAN PLANT POPULATION DENSITY

Take Home Messages

- Current soybean varieties are typically spaced at 30-40 plants per acre.

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

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.

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 stages.

SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

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

Keys to Success: Choosing the Right Soybean Variety

Introduction

Soybean seed costs are about 40% of the variable production, and optimizing seeding rate will help without overdepending on variable costs. General higher seeding rates and more plants per acre in States and in later-planted fields across the US, 3 fewer plants and lower seeding rates for much of Southern US when timely planting occurs.

- **Technicians:**
 - Patrick Copeland
 - Micalah Blohm
 - Tom Siler
- **Graduate Students**
 - Harkirat Kaur
 - 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

Manni Singh

msingh@msu.edu

517-353-0226

agronomy.msu.edu

Thanks!

Project 
GREEN



Seed companies

