Agronomic Management Strategies for Soybean and Corn

Manni Singh

Cropping Systems Agronomist

agronomy.msu.edu

msingh@msu.edu, 517-353-0226

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Cropping Systems Agronomy
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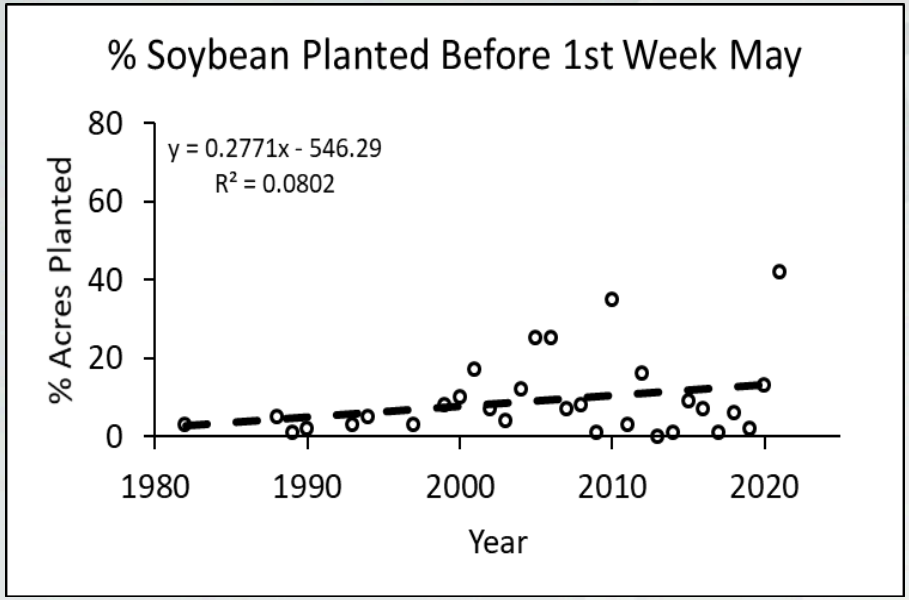
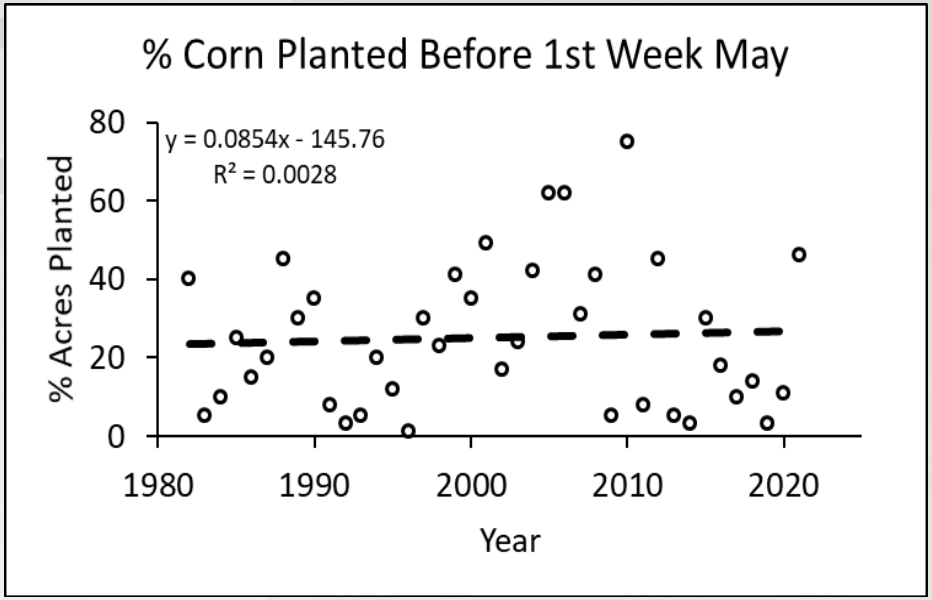
NCSRP NORTH CENTRAL SOYBEAN RESEARCH PROGRAM

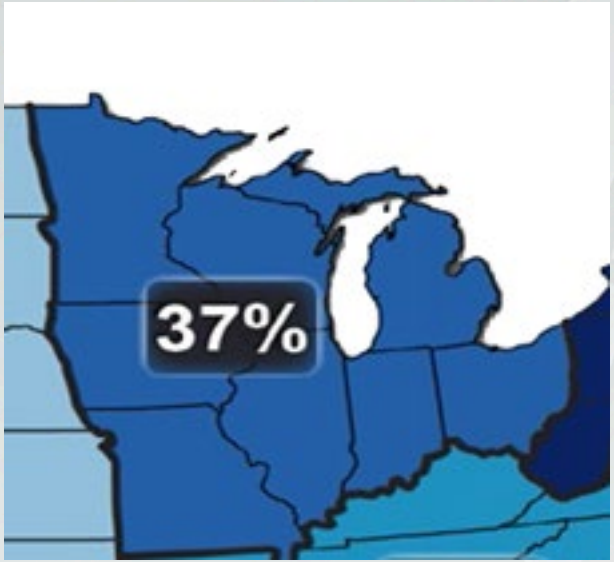
Planting Progress- Variability over years





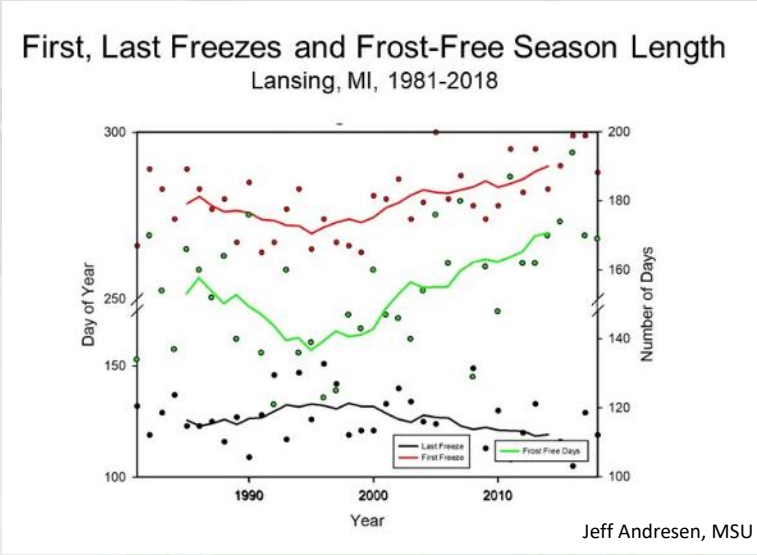
USDA NASS Date from 1982 – 2021, Week 18

Weather Trends: Wetter and Warmer



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

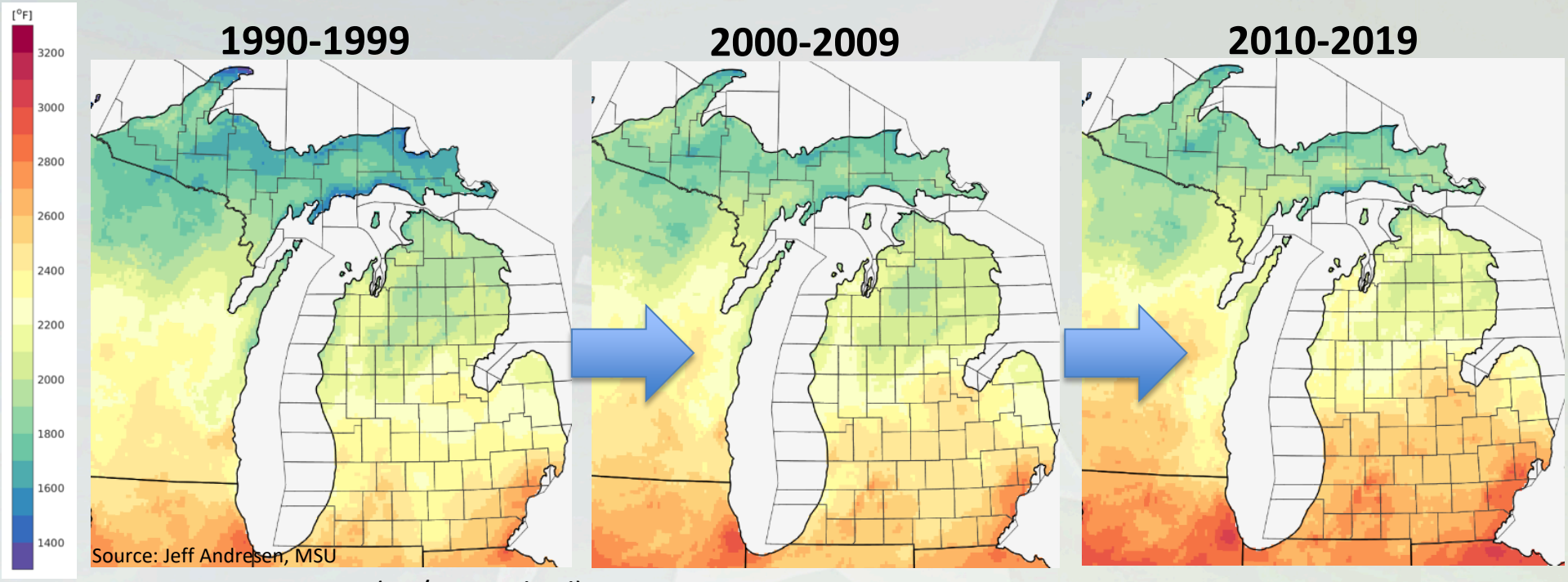
GLISA, 2019



Jeff Andresen, MSU

GLISA, 2019

Seasonal Heat Units (GDD) are Increasing over time

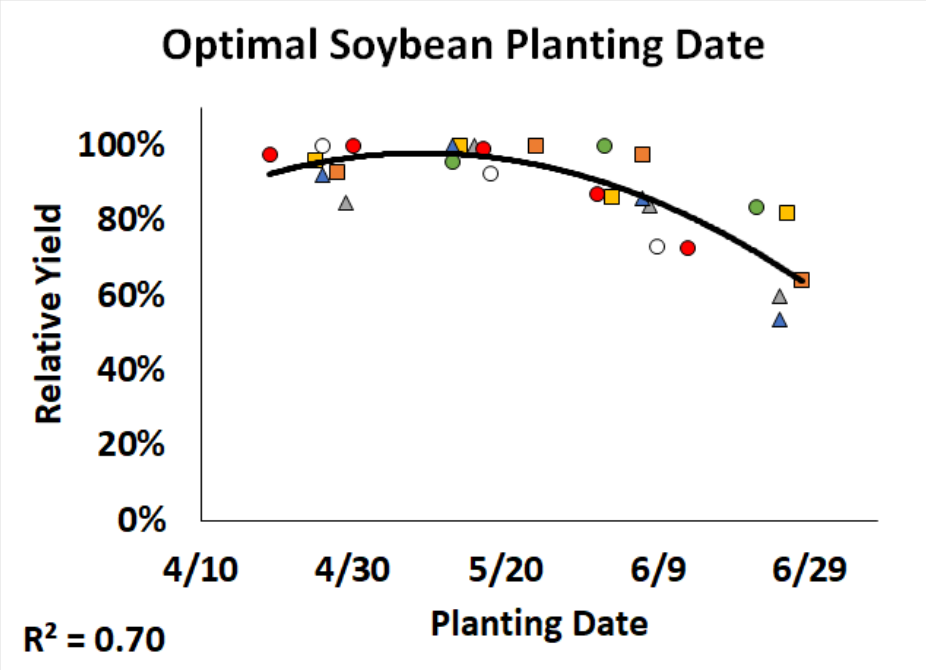


May 1- Sept 30 (86/50 method)

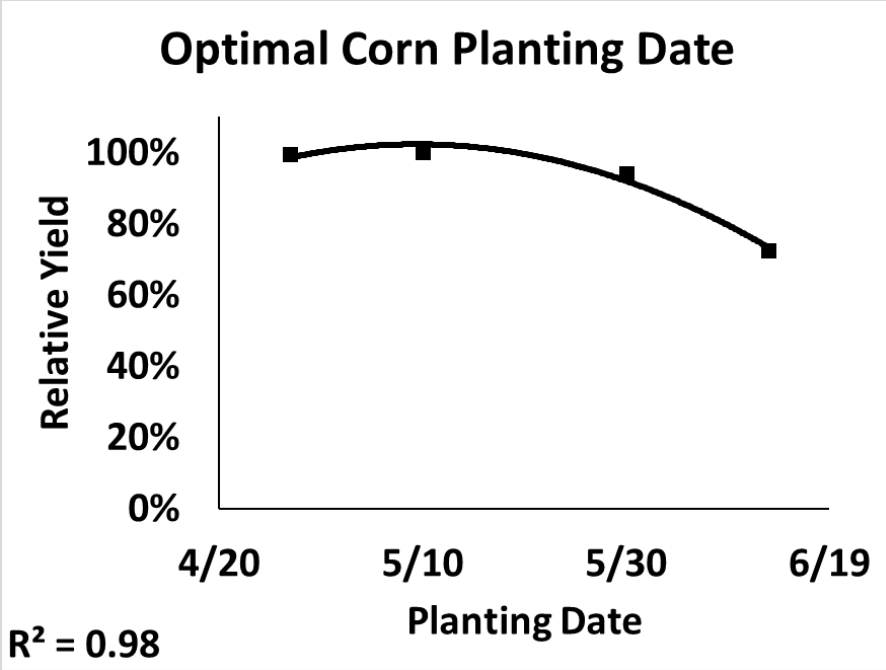
- Seasonal GDD (growing Degree Days) totals are increasing over time in Michigan
- Match “available GDDs” with **hybrid maturity selection**

Planting Time	Conditions
➢ **Early Season** (end April to early-May)	• Cool, wet soil- can lead to uneven stands • **Extended Growing Season**
➢ **Mid Season**	• Typically, adequate soil temp. and moisture
➢ **Late Season** (June)	• Lack of soil moisture • **Restricted Growing Season**

Planting Time Impacts Yield in Michigan



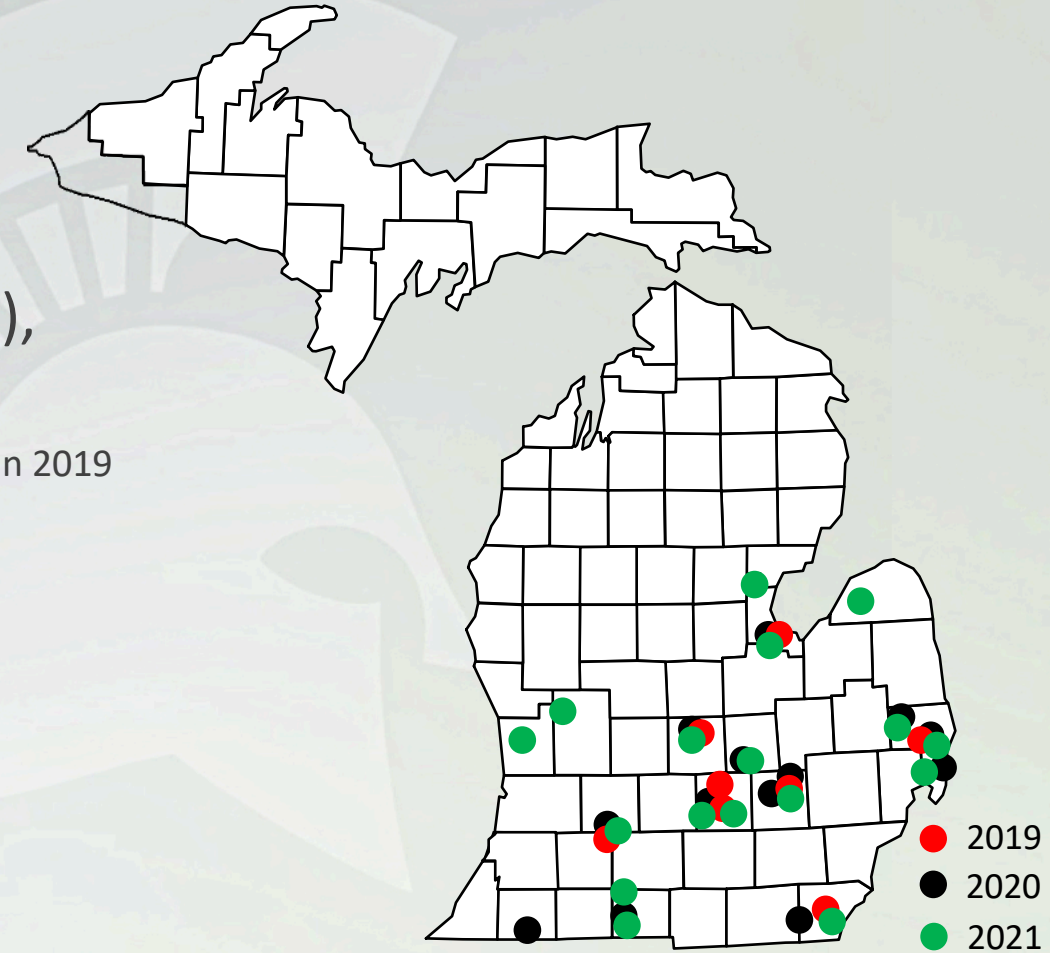
Data from 2018-2021
across multiple trials



Data from 2021

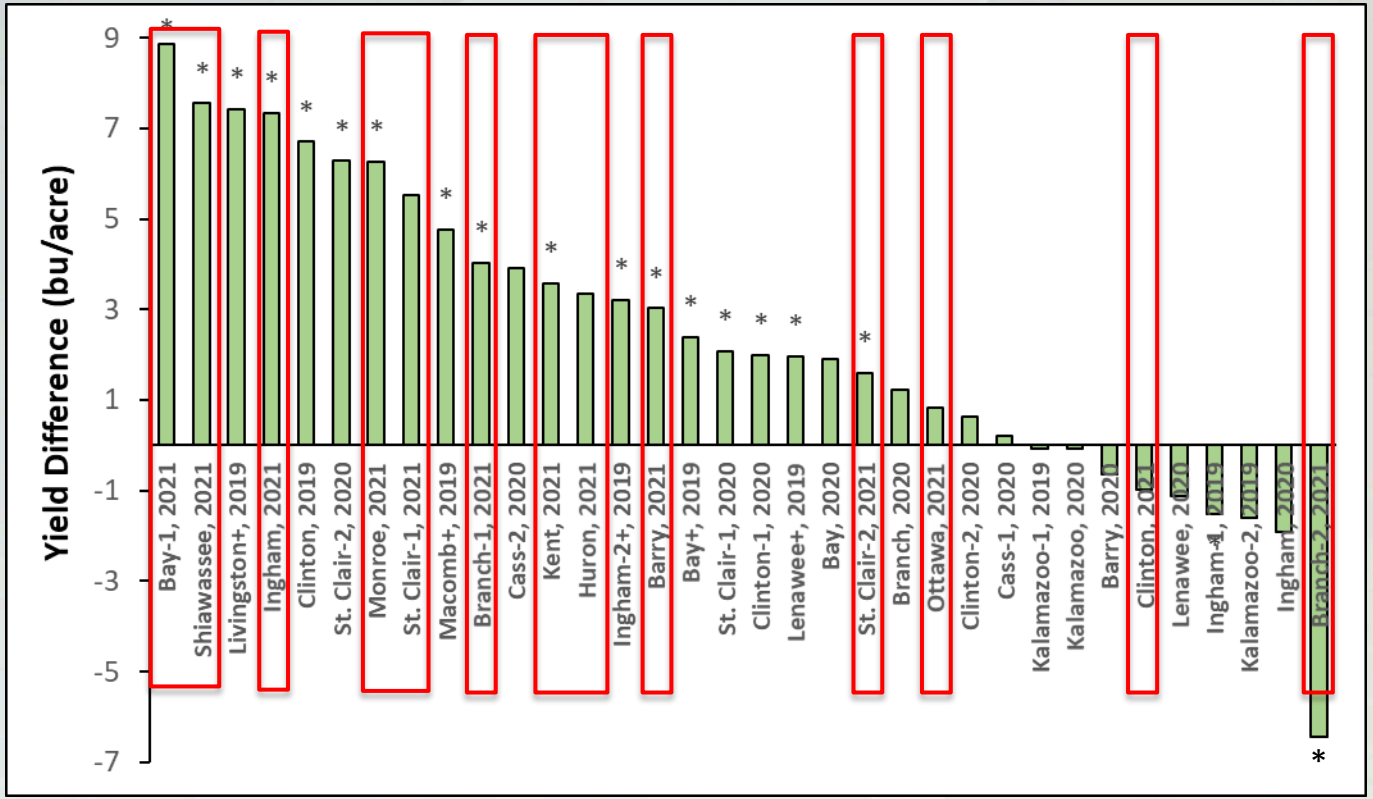
On-farm Soybean Trials

- 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



NCSRP NORTH CENTRAL SOYBEAN RESEARCH PROGRAM

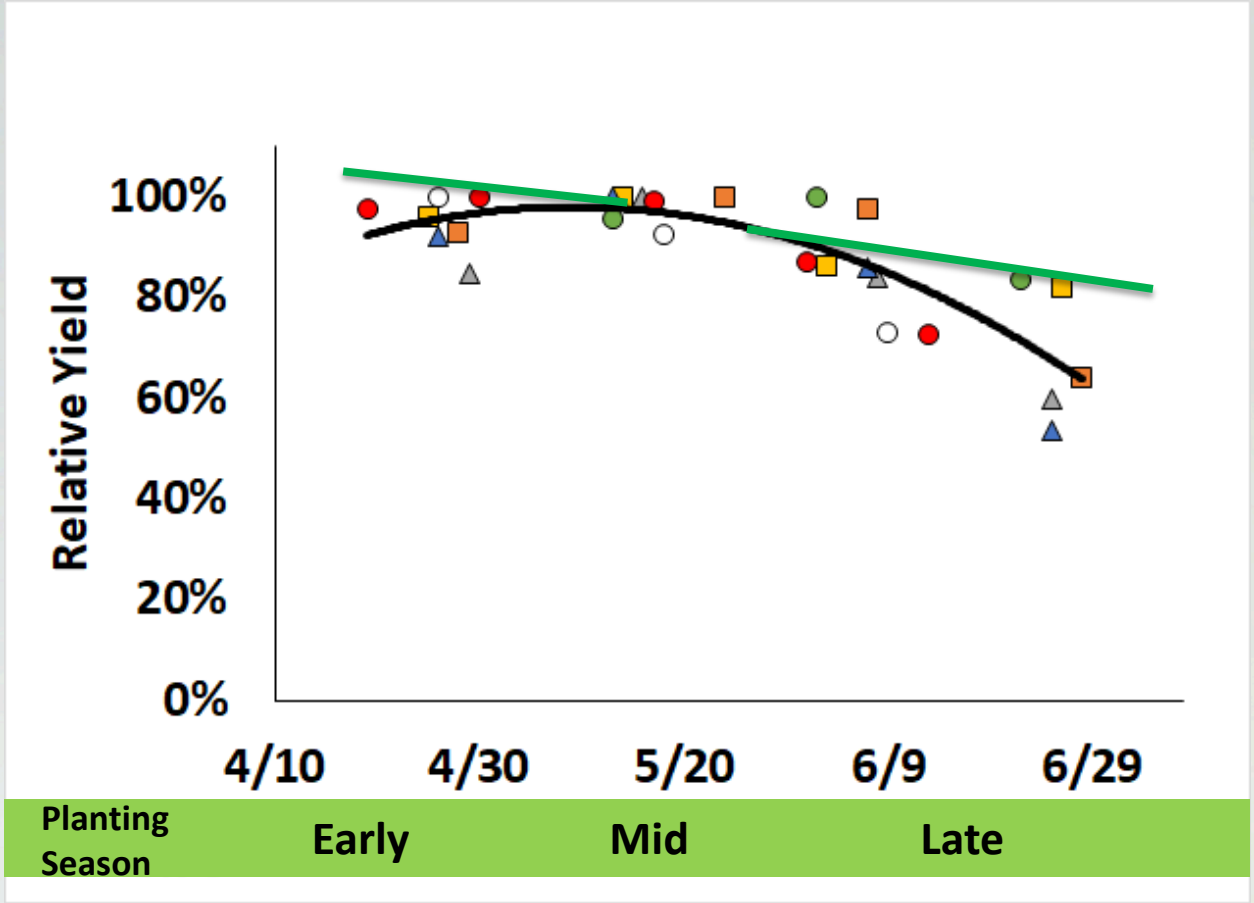
Yield: 2019 - 2021 Michigan Data



Yield diff. = Early planting- Normal planting time

* Denotes significant differences at P <0.10
\+ denotes fung./insect. spray at R3 in early planting in 2019

Planting Time: change other management?



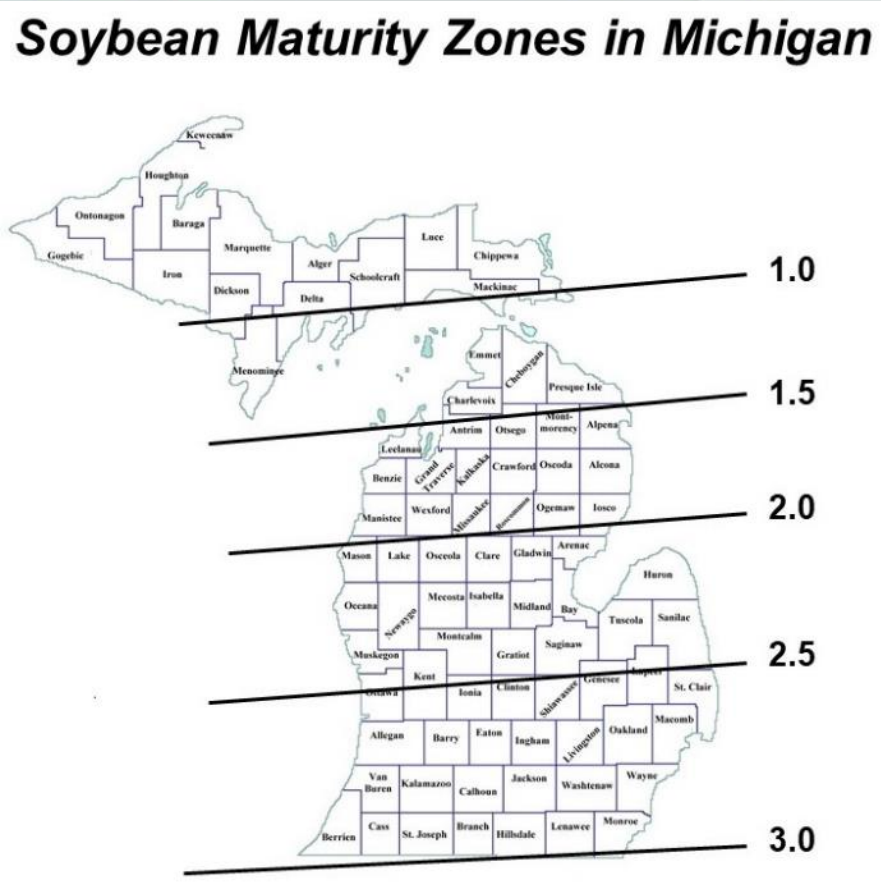
How to Improve Yield Potential

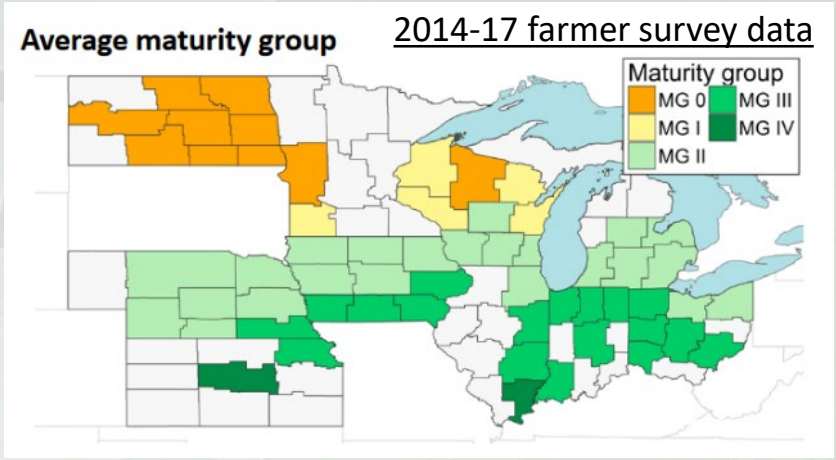
OR Minimize Input Cost

=Increased Profit

Data from 2018-2021 across multiple trials

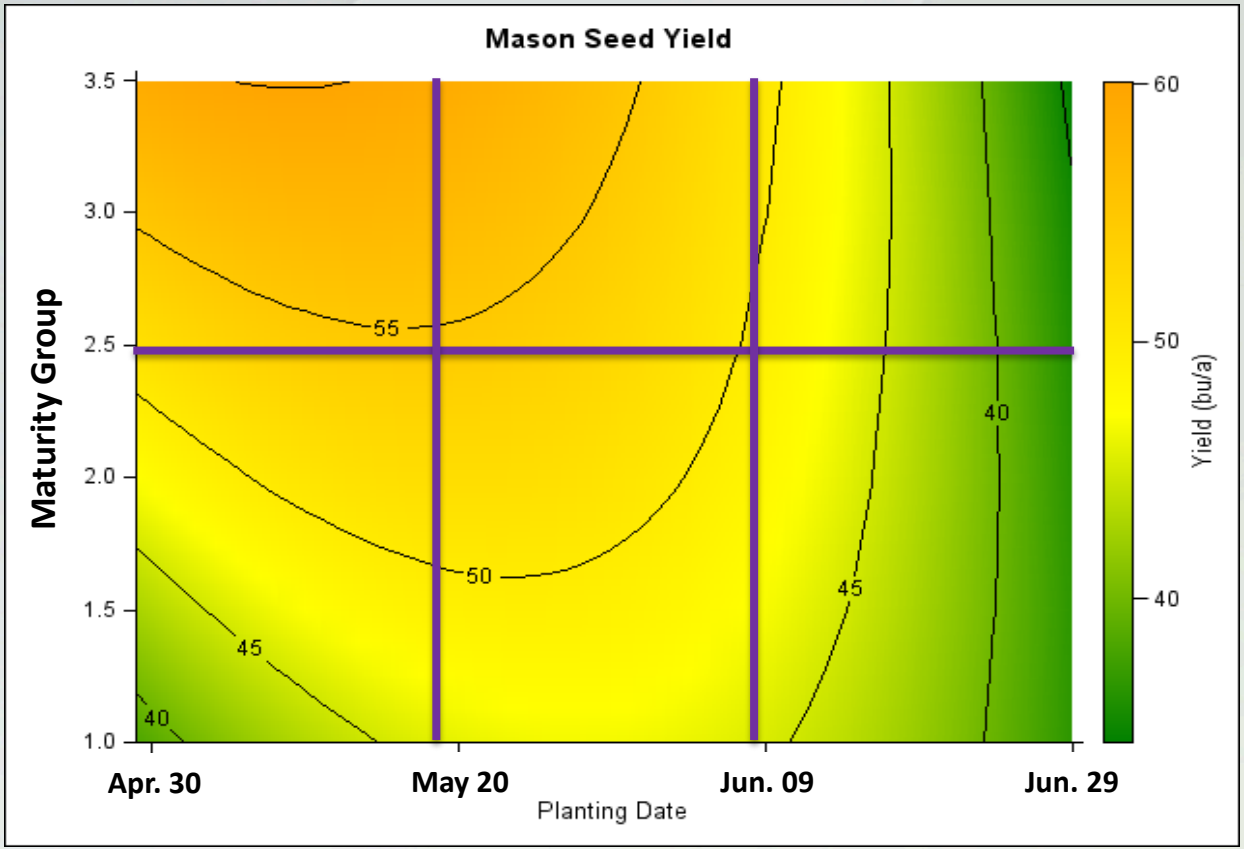
Optimal Maturity Selection: Role of planting date?





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

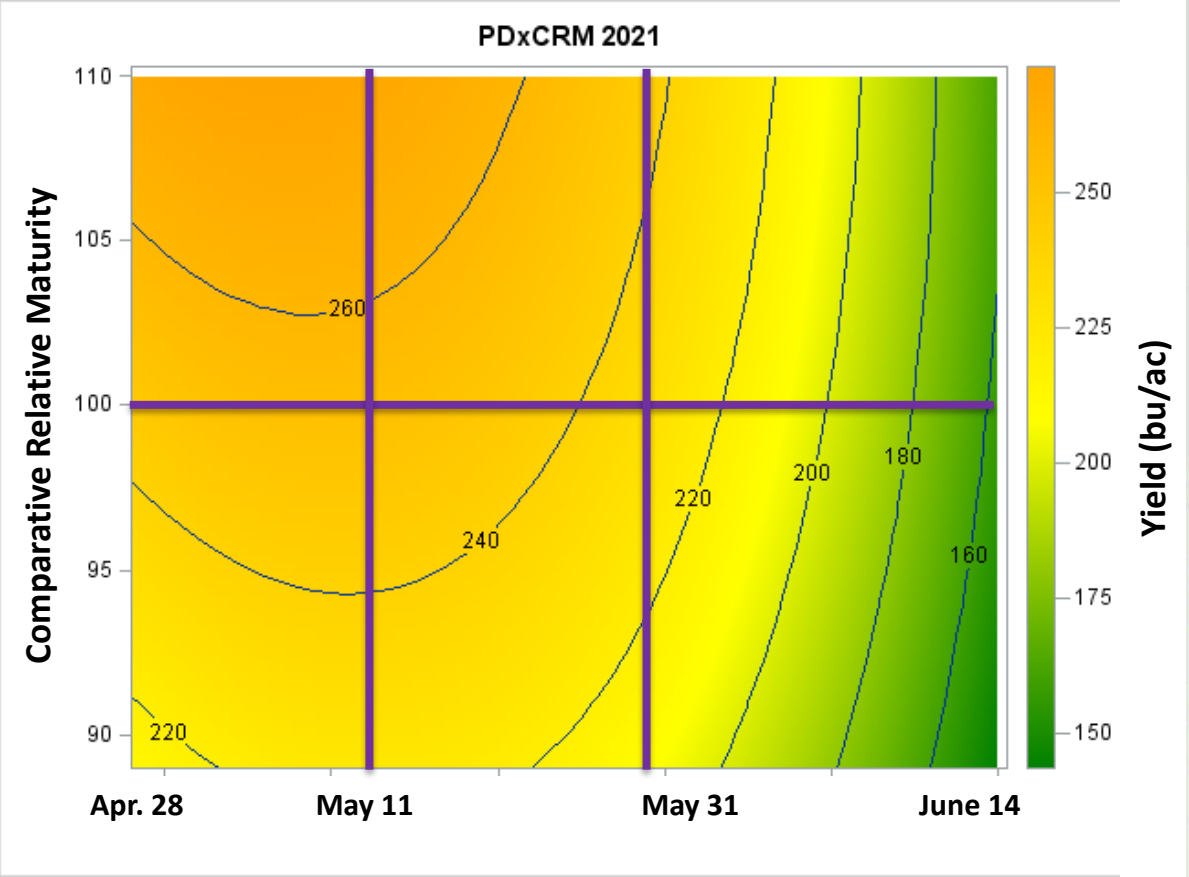
Optimal Maturity Selection: by planting date



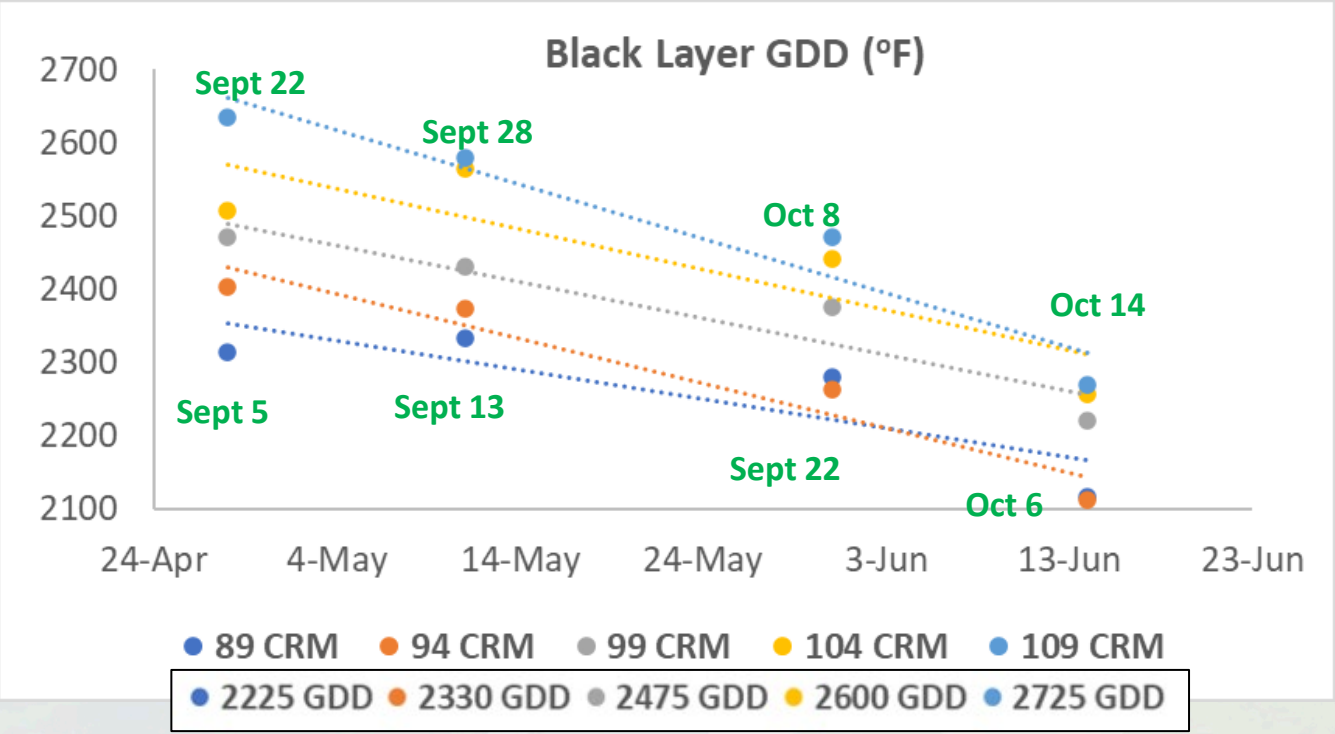
Physiology of Yield Increase

- 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

Corn Grain Yield- Lansing

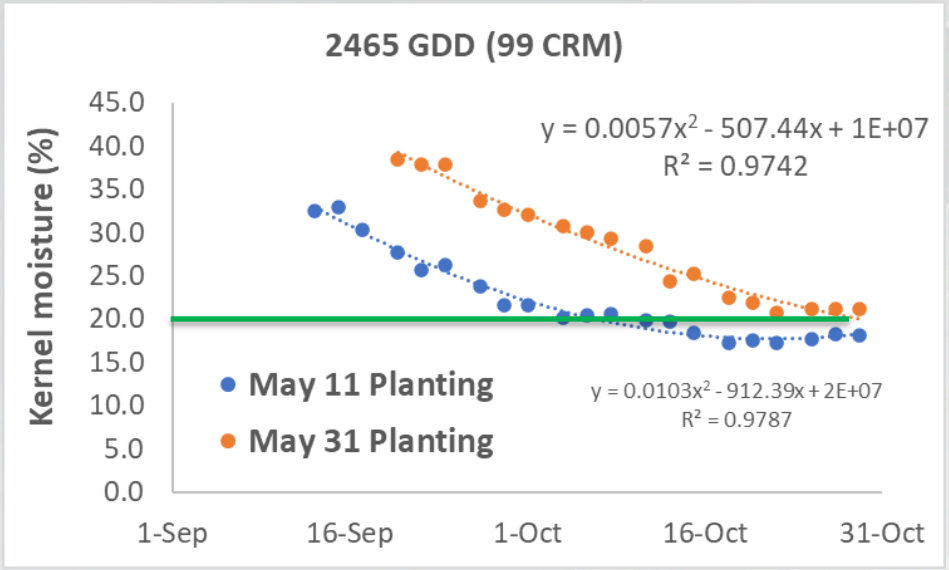


Time to Black Layer and GDD Compression



- **GDD Compression**: Decrease in hybrid GDD requirements with delayed planting
- Compression of ~**5.6 GDD (4.0 - 7.4) per day delay in planting** for Black Layer; rate of compression increased with late-maturity hybrids

Kernel Moisture Drydown



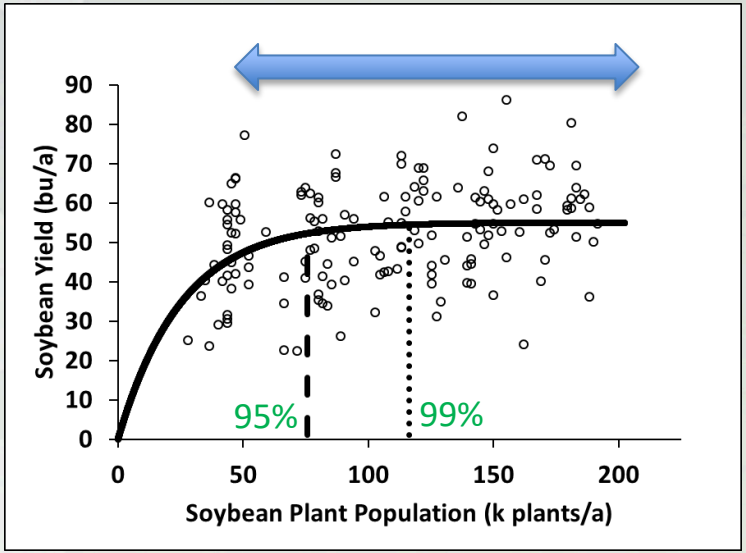
- Daily drydown dependent on weather, planting date, hybrid maturity
- Greater Moisture/low TW: late-maturity hybrid in late planting
- In-fields sensors and **new predictive tools** for kernel drydown

Plant date/ Maturity selection Summary

- Combine early planting with other management for higher yields
- 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 variety
- Select early-maturity variety to minimize yield loss/ moisture issues in delayed/replant situations
- **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 OR corn pollination
  - Plant ~20-30% acres to each of mid- and early-maturity variety

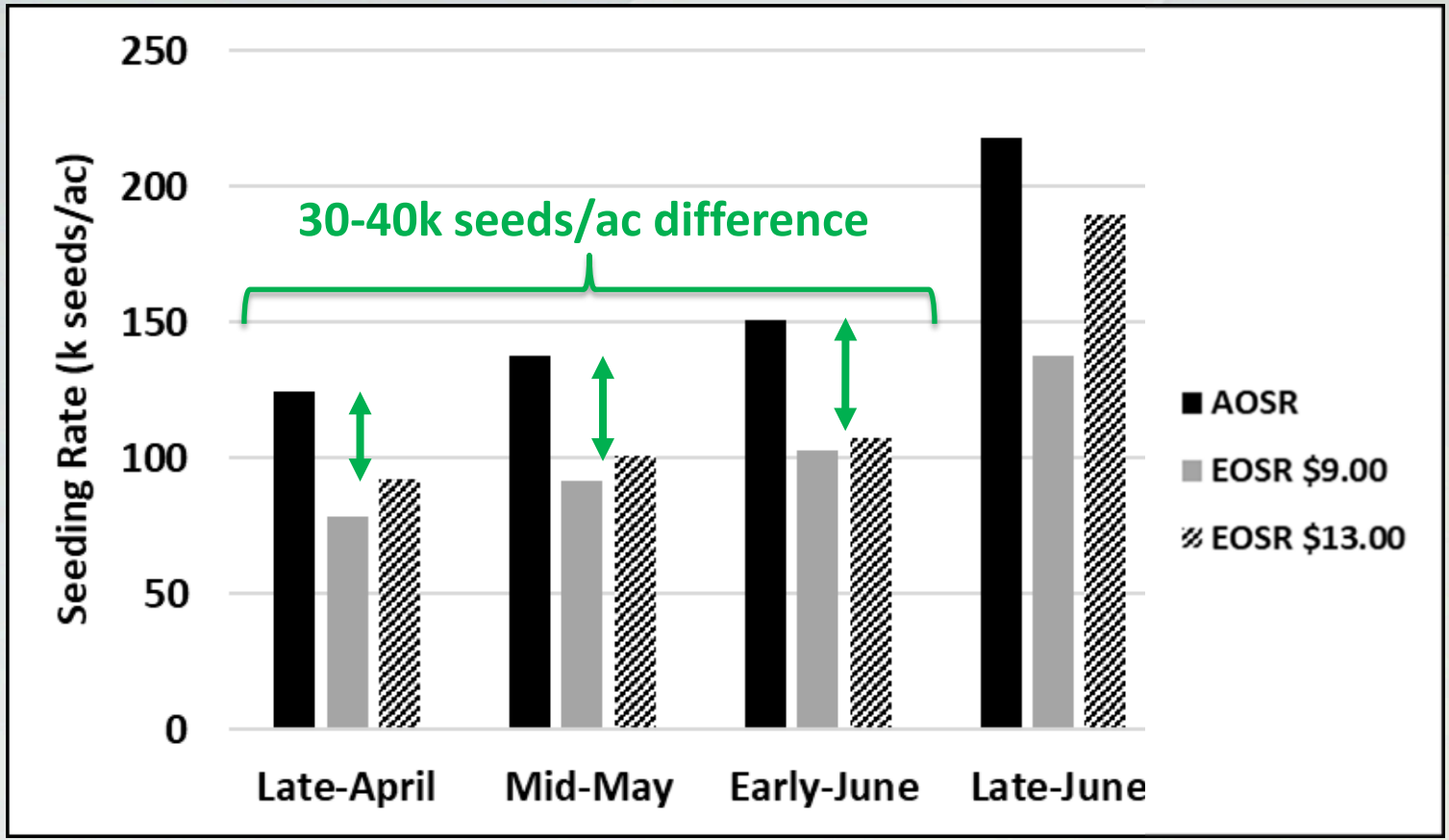
Soybean Seeding Rate

50,000 Seeds/A	90,000 Seeds/A	130,000 Seeds/A	170,000 Seeds/A	210,000 Seeds/A



Seed rate: ~20% higher

Soybean Seeding Rate- Agronomic vs Economic Optimal



Agronomic Optimal Seed Rate

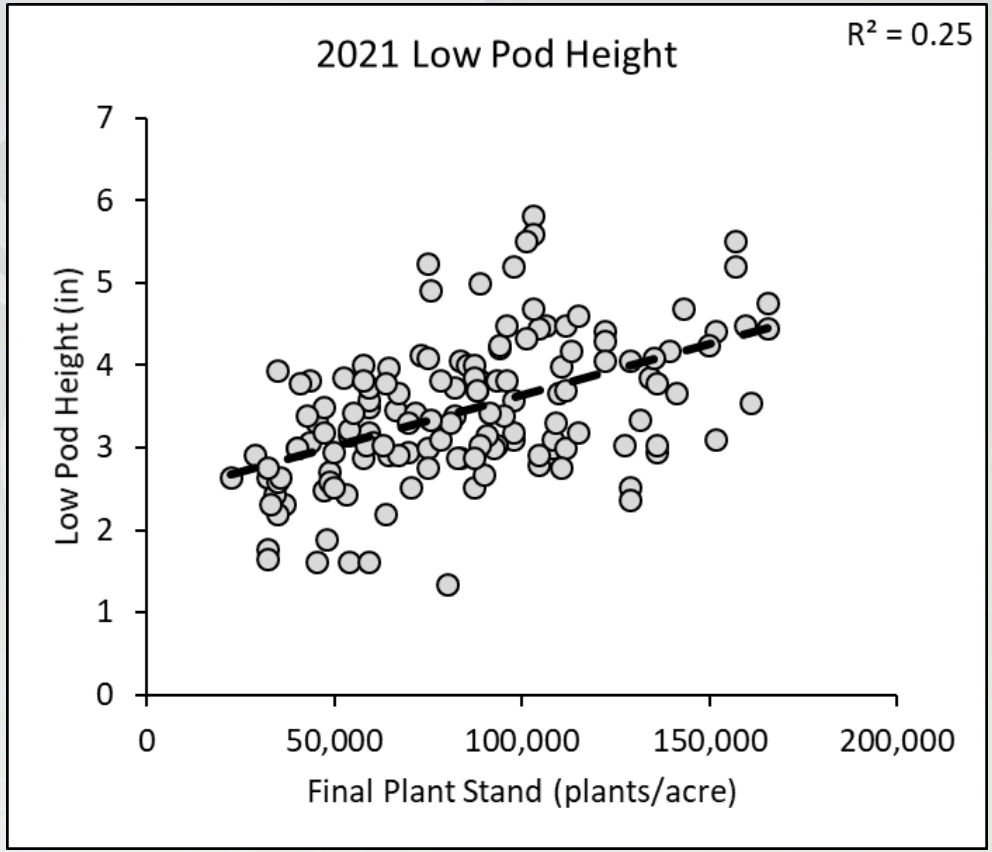
Economic Optimal Seed Rate

15-inch rows
4 site-years data

Seeding Rate- Plant architecture

Low Seed Rate

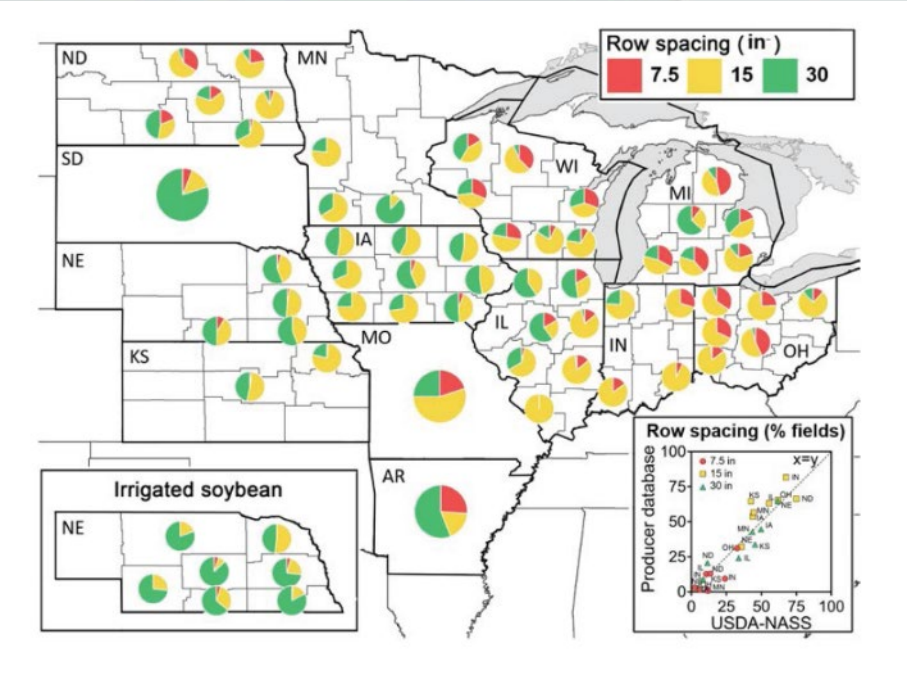
High Seed Rate



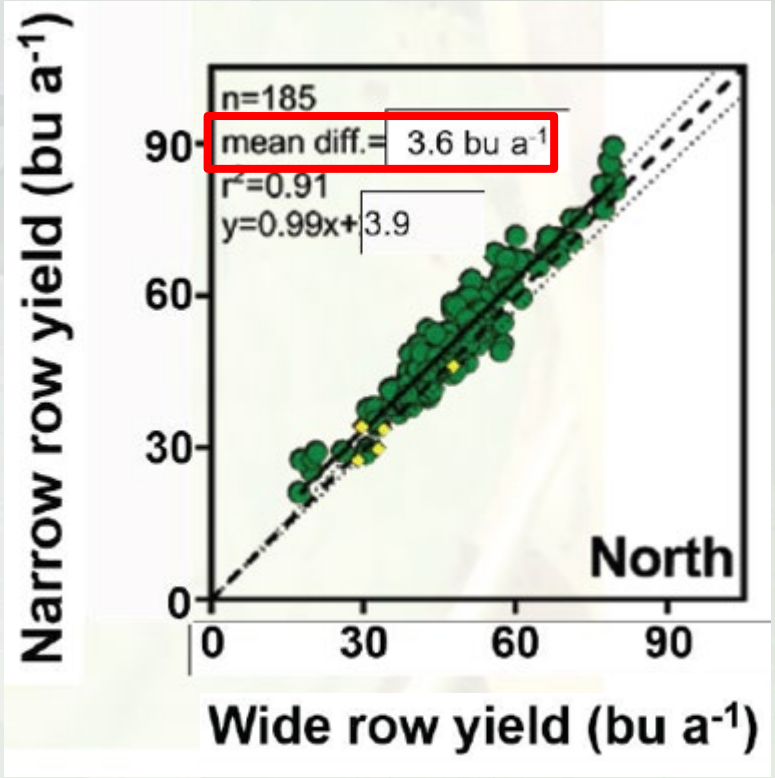
Seeding Rate Summary- Soybean

- For max yield: final plant stand of 100-120,000/ac for early/mid planting, 120-150,000 plants/ac for late planting (~20% higher for seeding rate)
- Economic optimum rates are lower (30-40k) than agronomic optimum rates
- Leave a strip in field with lower seeding rate (~10-30%) to evaluate response
- Early planted uniform stand of >50k/ac can produce high yield, plant into existing stand below that stand (inter-planting) rather than re-planting
- Stand count is important for evaluating yield potential

Row Spacing- Soybean



2014-17 farmer survey data

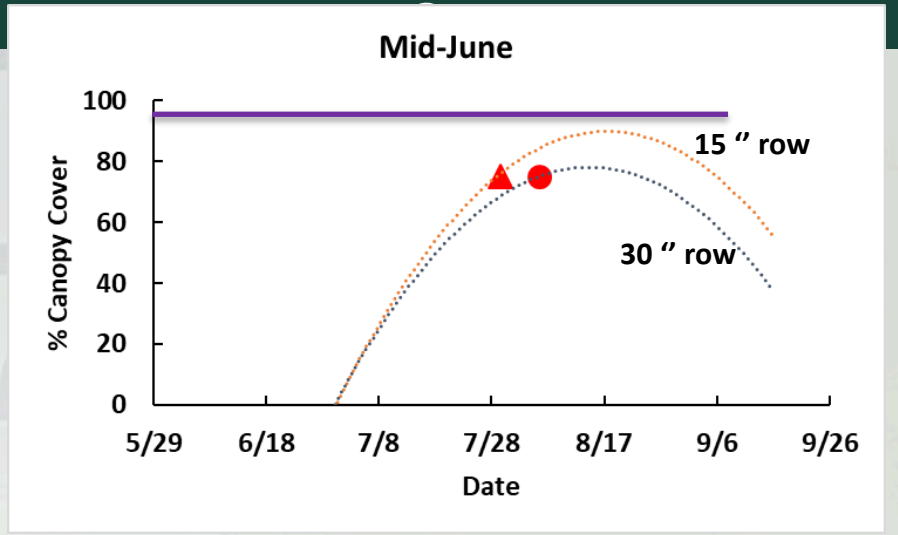


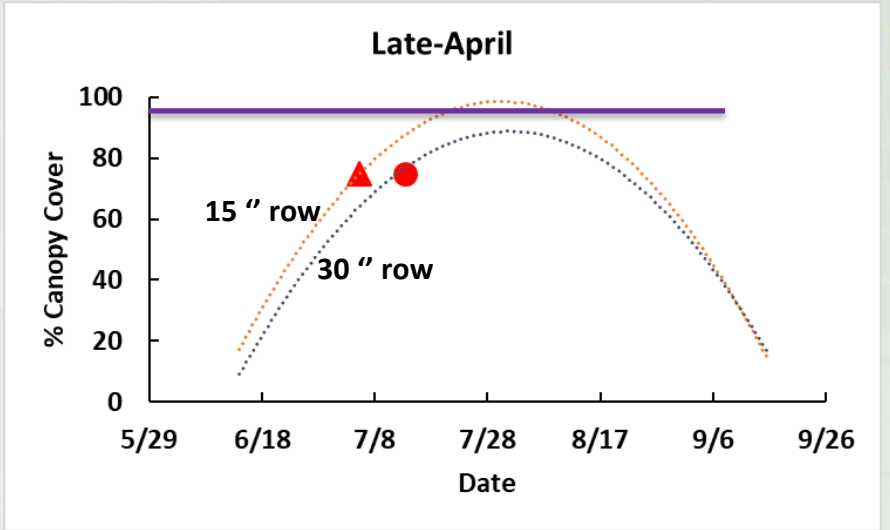
Andrade et al., 2019

Row Spacing- Soybean

30’’ spacing

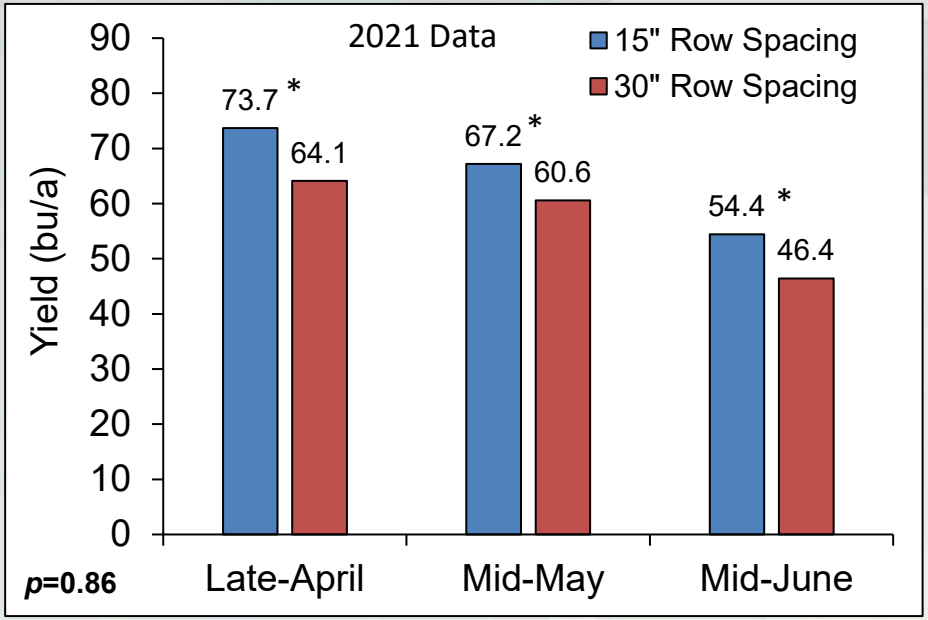
15’’ spacing

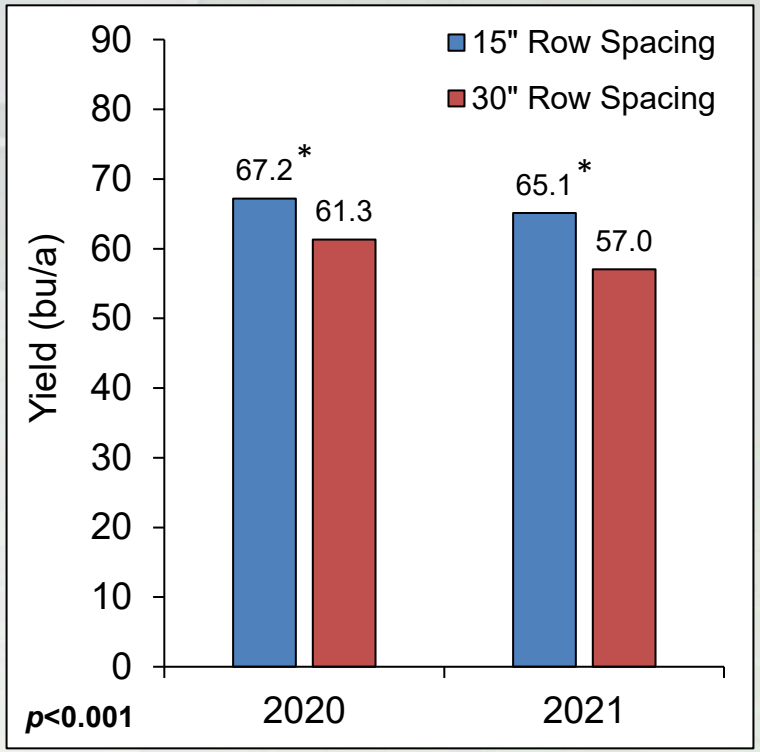




Row Spacing- Soybean

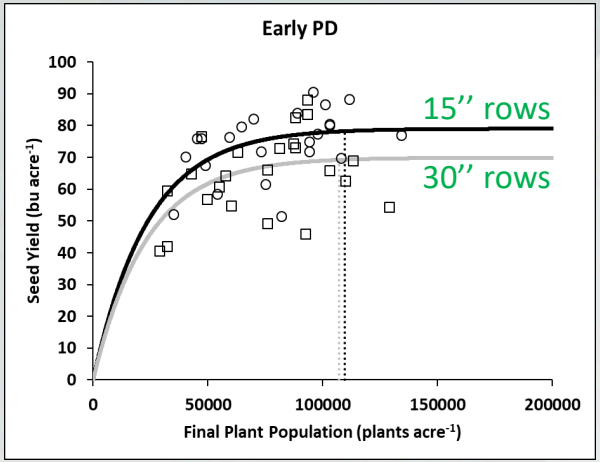
* Denotes significant differences at P <0.10

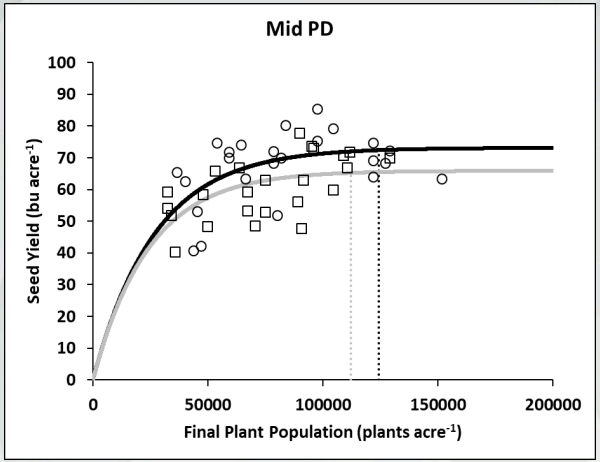


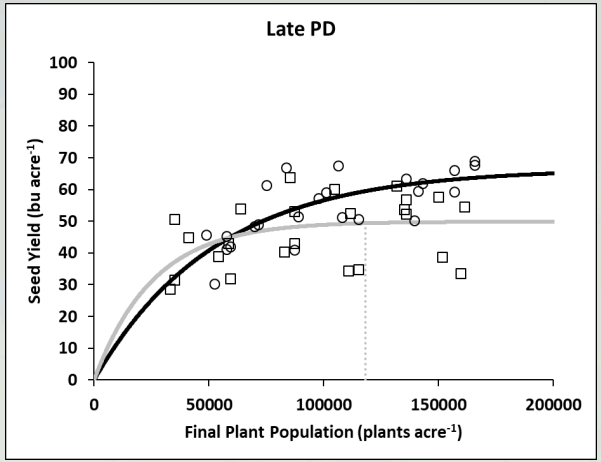


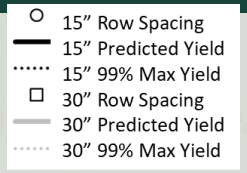
- Yield increase with narrow rows did not differ between planting dates

Row Spacing- Soybean: seeding rate responses









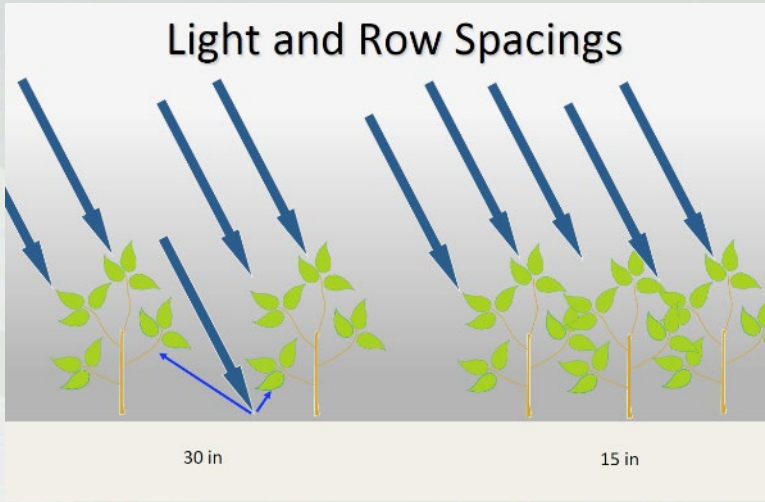
- Agronomic optimal seeding rate did not differ between the two row spacings
- Economic optimal seeding rate, across both row spacings
  - Early PD – 86,890 plants/acre
  - Mid PD – 85,281 plants/acre
  - Late PD – 118,081 plants/acre

Row Spacing Summary- Soybean

- **Narrow rows**: faster canopy closure, >95% light interception, moisture conservation, weed control

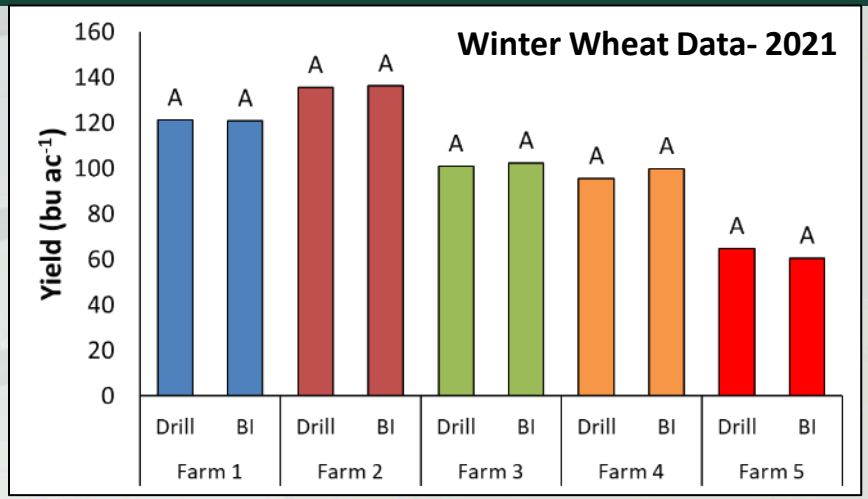
- **Yield benefit** under narrow rows: Limited time for vegetative growth before flowering
  - Northern production regions
  - Delayed planting/ Double crop
  - Early-maturing varieties

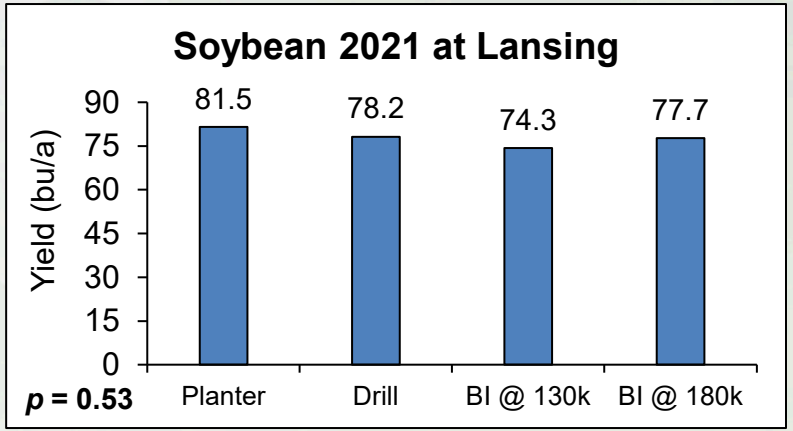
- **Yield loss**: Disease pressure- white mold
  - Use relatively lower seeding rates



Planting Systems

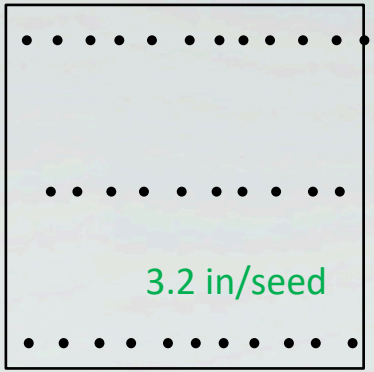
Broadcast Incorporation (BI)





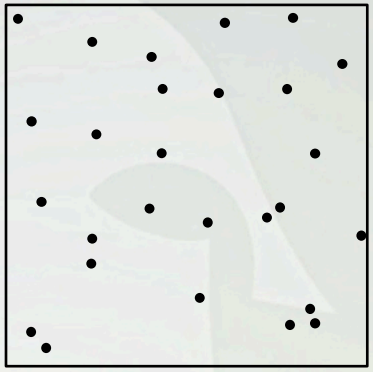
Planting Systems

Precision Planter
15'' Row Spacing
130,000 seeds/ac

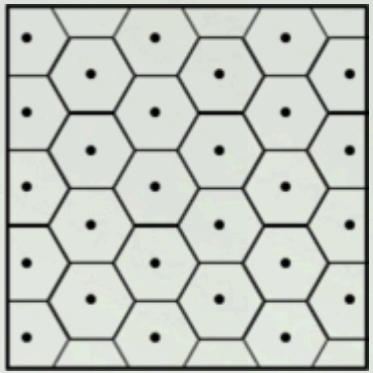


Precision Planter
30'' Row Spacing
130,000 seeds/ac

Broadcast Incorporated
130,000 seeds/ac



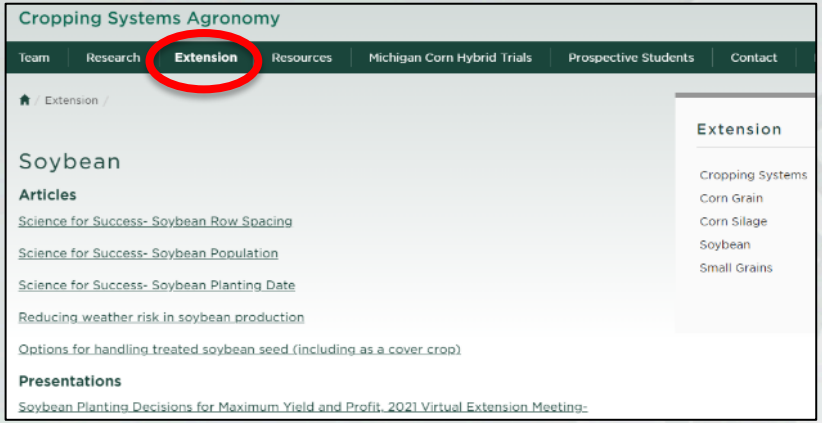
Ideal
130,000 seeds/ac

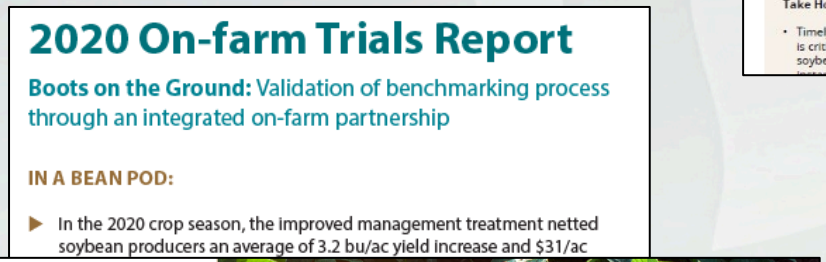


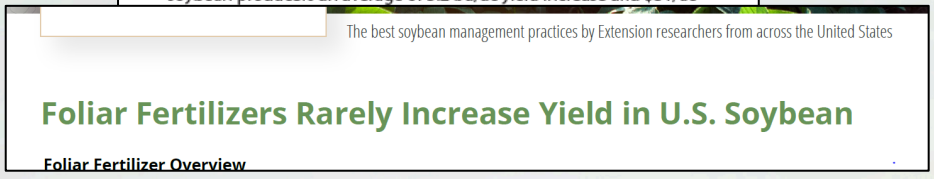
Take Home Messages

- Combining improved genetics (variety selection) with management can increase yield (reduce on-farm yield gap), quality, and profits
- Specific practices dependent on field specific conditions:
  - **Plant date**: early planting in optimal moisture, change other management, soy vs corn
  - **Maturity selection**: later-maturity variety with early planting
  - **Seeding rate**: lower seeding rate in soybean with minimum yield penalty
  - **Row Spacing**: narrow row spacing in soybean
  - Others- crop rotation, planting systems, seed treatment, fertility, pest management
- Not every practice will affect yield in a given field or year
  - Minimize field-specific yield limiting factors (**light, water**, nutrition, pests) to best utilize the growing season

Resources: agronomy.msu.edu

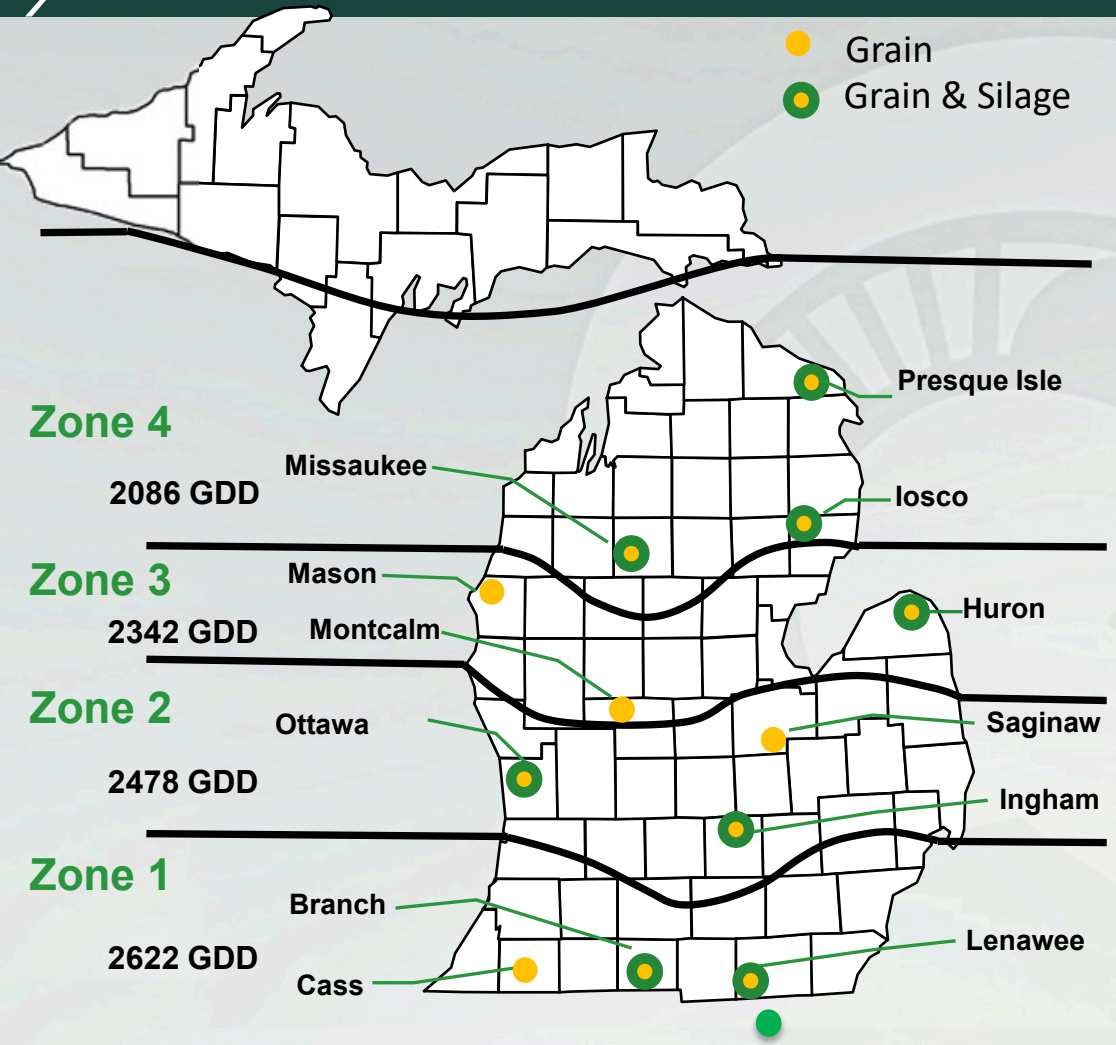


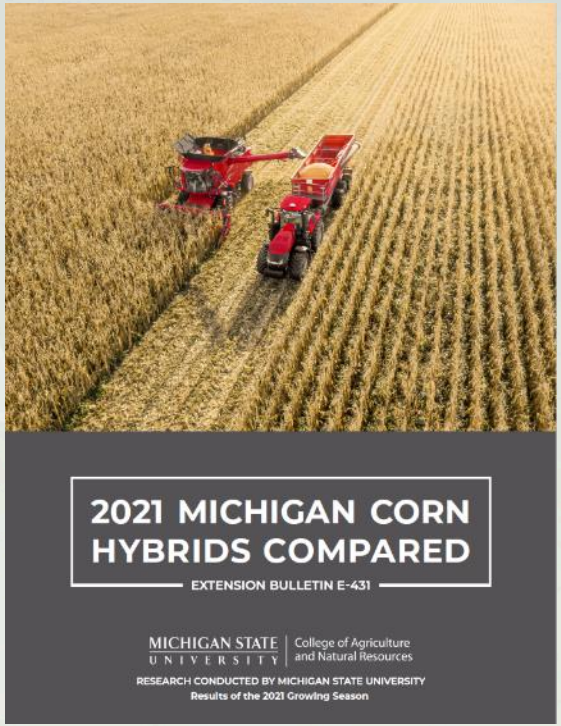




2021 Corn Hybrid Testing Locations

https://varietytrials.msu.edu/corn





- **Technicians**:
  - **Tom Siler**
  - **Micalah Blohm**
- **Graduate Students**
  - Harkirat Kaur
  - Patrick Copeland
  - Benjamin Agyei
- **Undergrad students**
- **Past students**
- Mike Particka
- Paul Horny
- Charles Scovill (Syngenta)
- **Farmer cooperators**

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

Manni Singh

msingh@msu.edu

517-353-0226

agronomy.msu.edu

Thanks!

Seed companies

Michigan Soybean Committee

MMPA Est. 1916

CMPM Corn Marketing Program of Michigan

Michigan Wheat Program

North Central SARE Sustainable Agriculture Research & Education

M-AAA Michigan Alliance for Animal Agriculture

Project GREEEN

Cropping Systems Agronomy Michigan State University

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NCSRP North Central Soybean Research Program

Michigan Crop Improvement Association

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