

Planting Date by Management Interactions in Corn and Soybean

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Dec 9, 2025, Indiana CCA meeting



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Project
GREEN



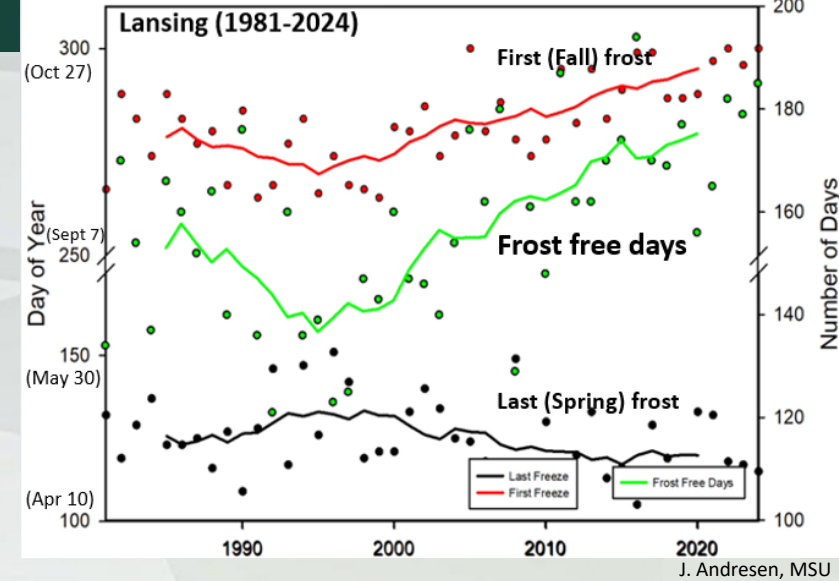
NCSRP NORTH CENTRAL SOYBEAN
RESEARCH PROGRAM

Topics: Planting date x Management Interactions

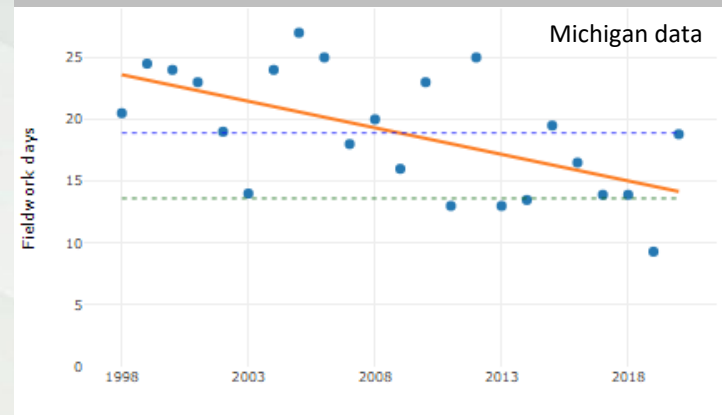
1. **Planting date** impacts on Corn vs Soybean (northern US)
2. Planting date **Interactions** with other management factors
 - Variety selection (**Relative Maturity**)
 - Impact on Yield, Phenology, and Dry down
 - Other factors (Systems approach)
3. Take home messages and Resources

Weather Trends

- (Relatively) short growing season
 - is expanding over time, later fall frost and earlier spring frost
- More rainfall during planting/harvesting window
 - Wet spring, leading to planting challenges
 - Wet fall, leading to harvest issues (and winter crop plantings)



Decline in #days for Field work (mid-April to mid-May)



Planting Time Impacts Crop Growth in Michigan/northern US



Pictures taken mid-July

Planting date: Late April

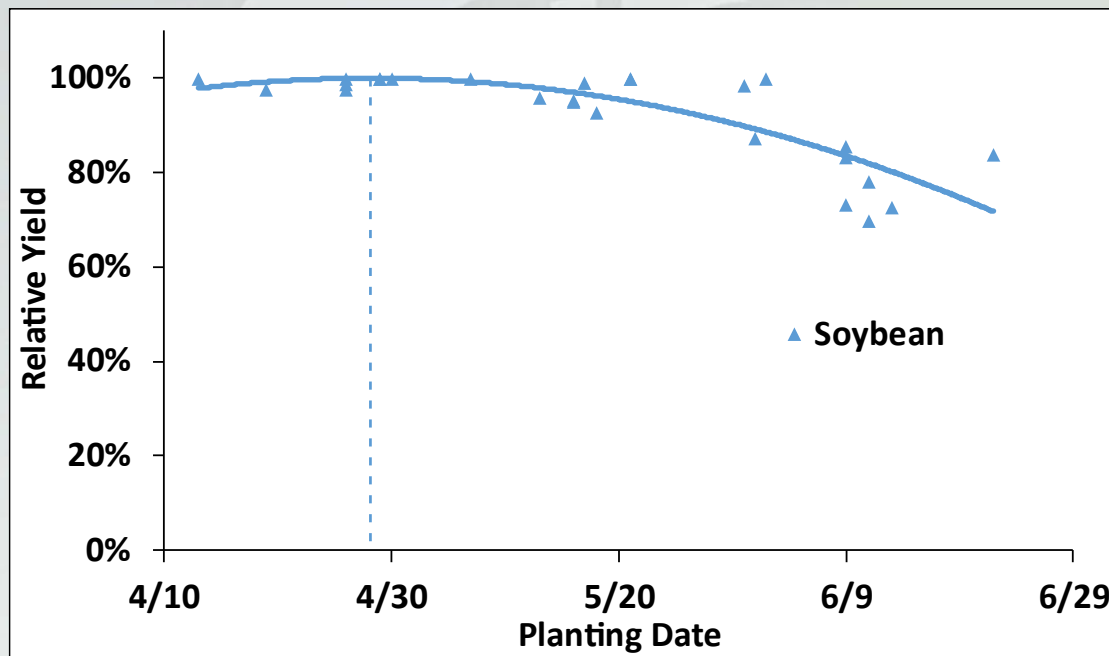
Mid-May

Late May - early June

Early/Mid June

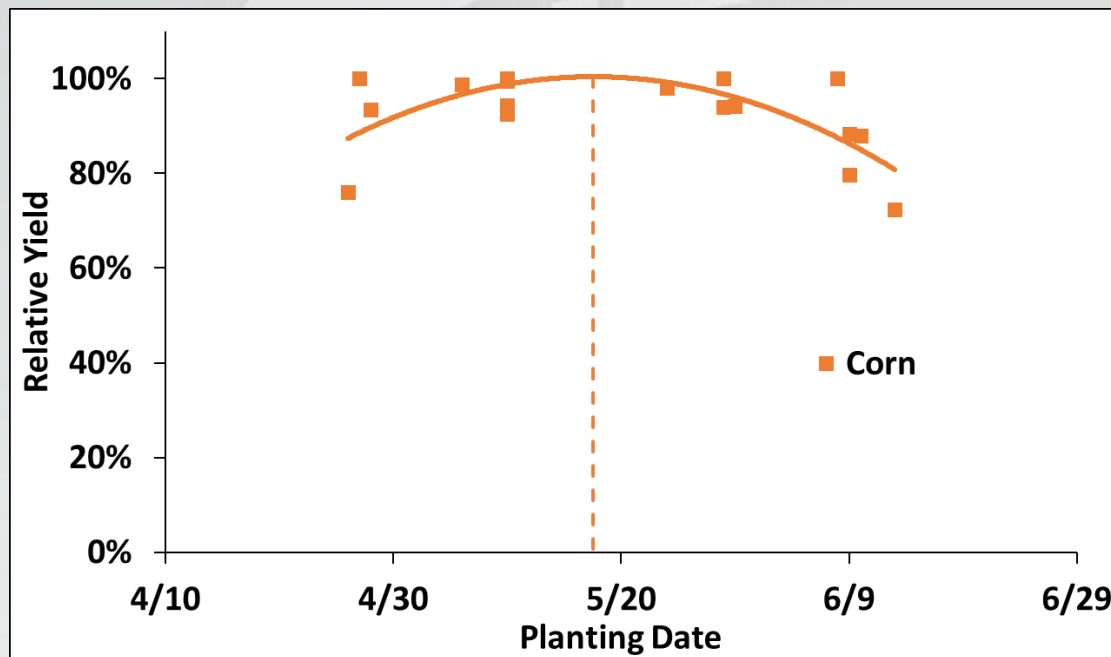


Planting Time Impacts Crop Yield in Michigan/northern US



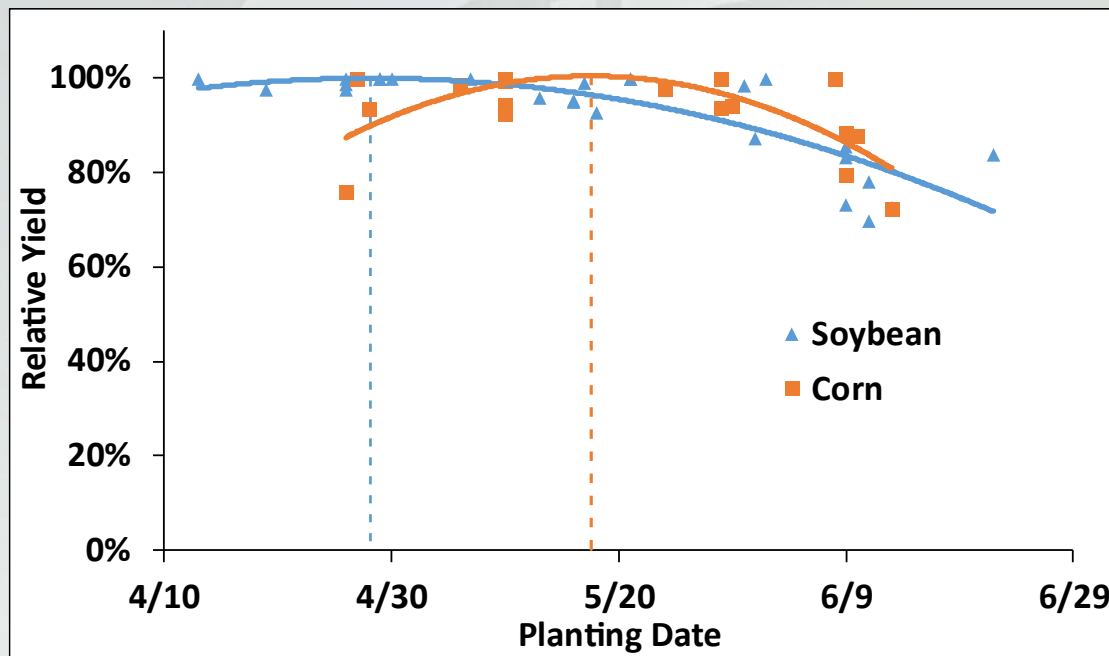
Data from Lansing & Richville, MI (2018-2024)
Each data point is average of ≥ 16 plots

Planting Time Impacts Crop Yield in Michigan/northern US

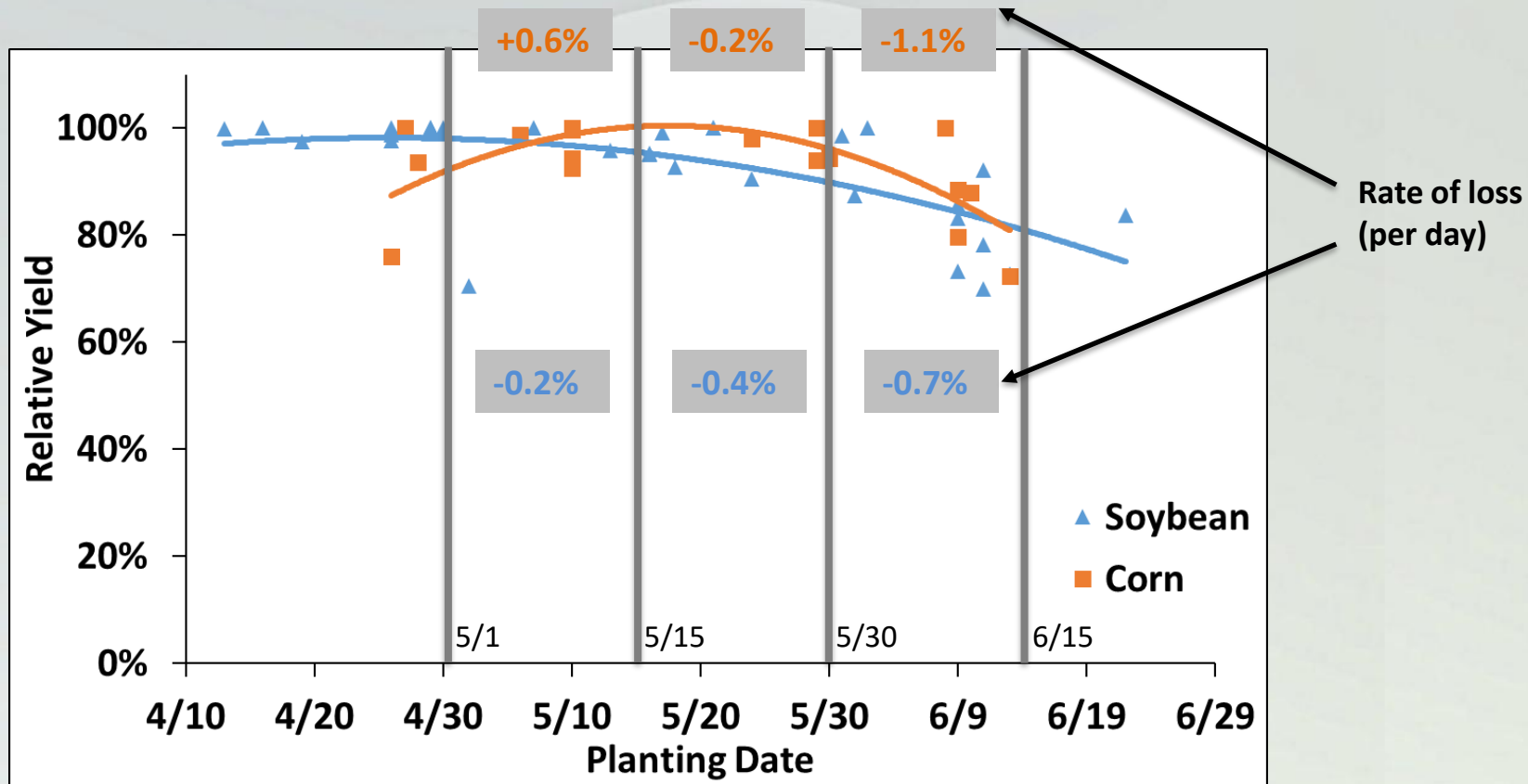


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Planting Time Impacts Crop Yield in Michigan/northern US

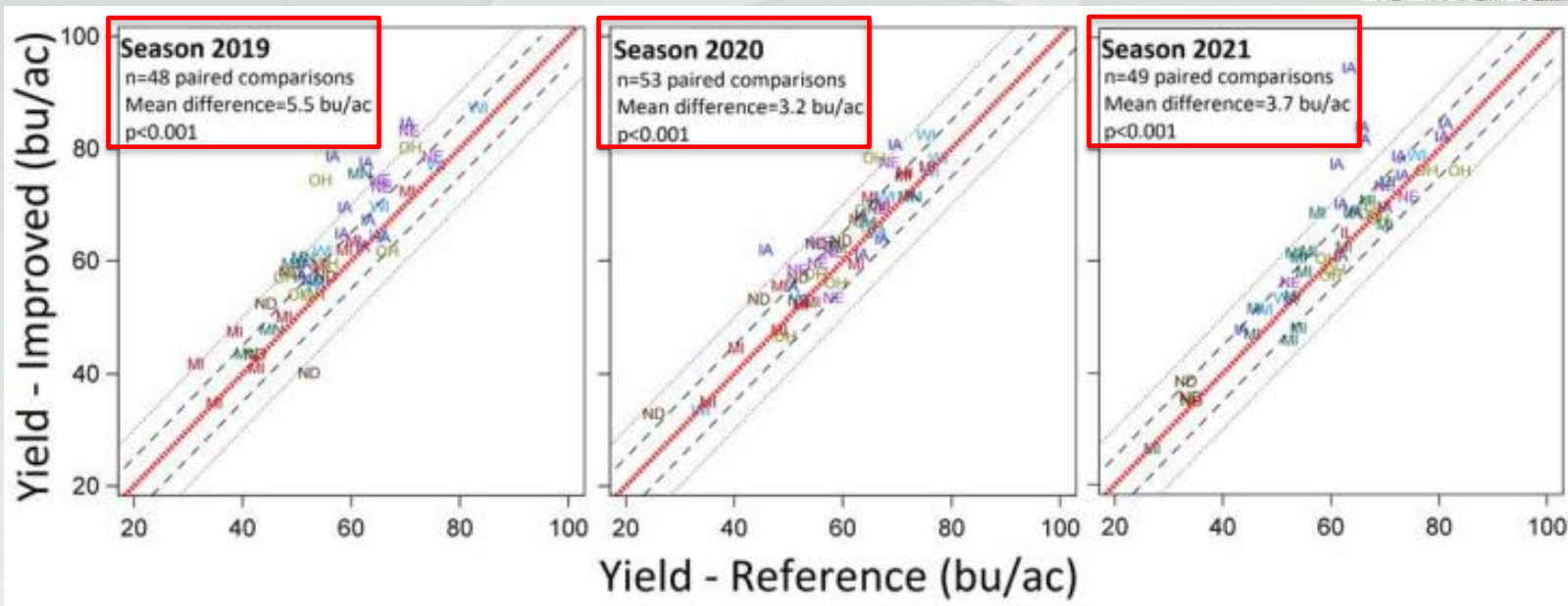
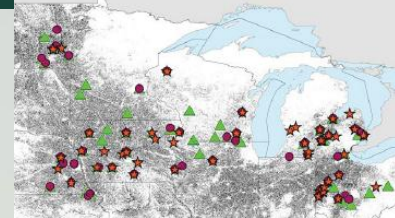


Data from Lansing & Richville, MI (2018-2024)
Each data point is average of ≥ 16 plots



Data from Lansing & Richville, MI (2018-2024)
Each data point is average of ≥ 16 plots

Soybean: On-farm trials



Reference is Typical planting

Improved is Early Planting + other management

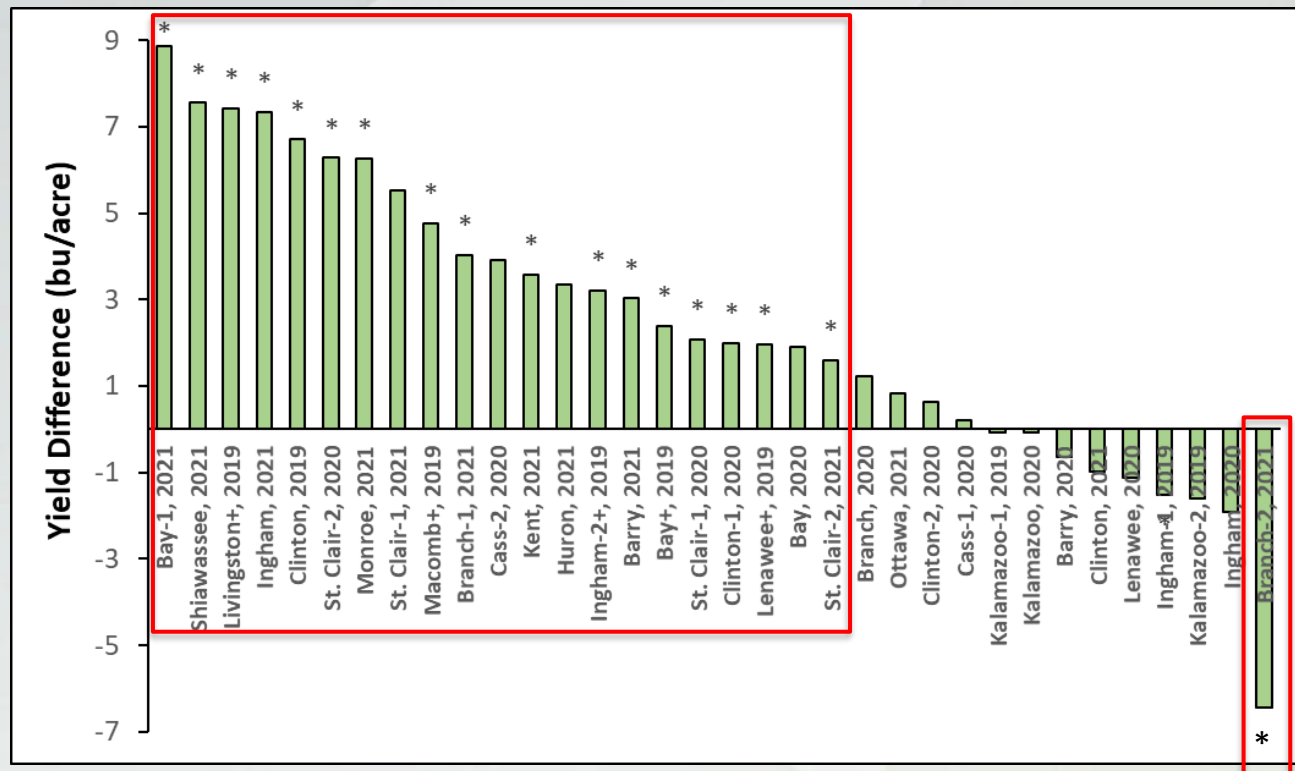
(e.g., fung./insect. spray, late-MG, lower seed rate)

Profit increase in Improved trt:

\$51 (2019), \$31 (202), \$53 (2021)

Soybean Planting date: On-farm trials (Michigan)

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:

- Increase in yield
- Extended planting window
- Minimize yield penalty from late planting

➤ Risks:

- Poor germination/emergence, plant stand
- Freeze damage to emerged plants
- Crop insurance coverage dates (updated)

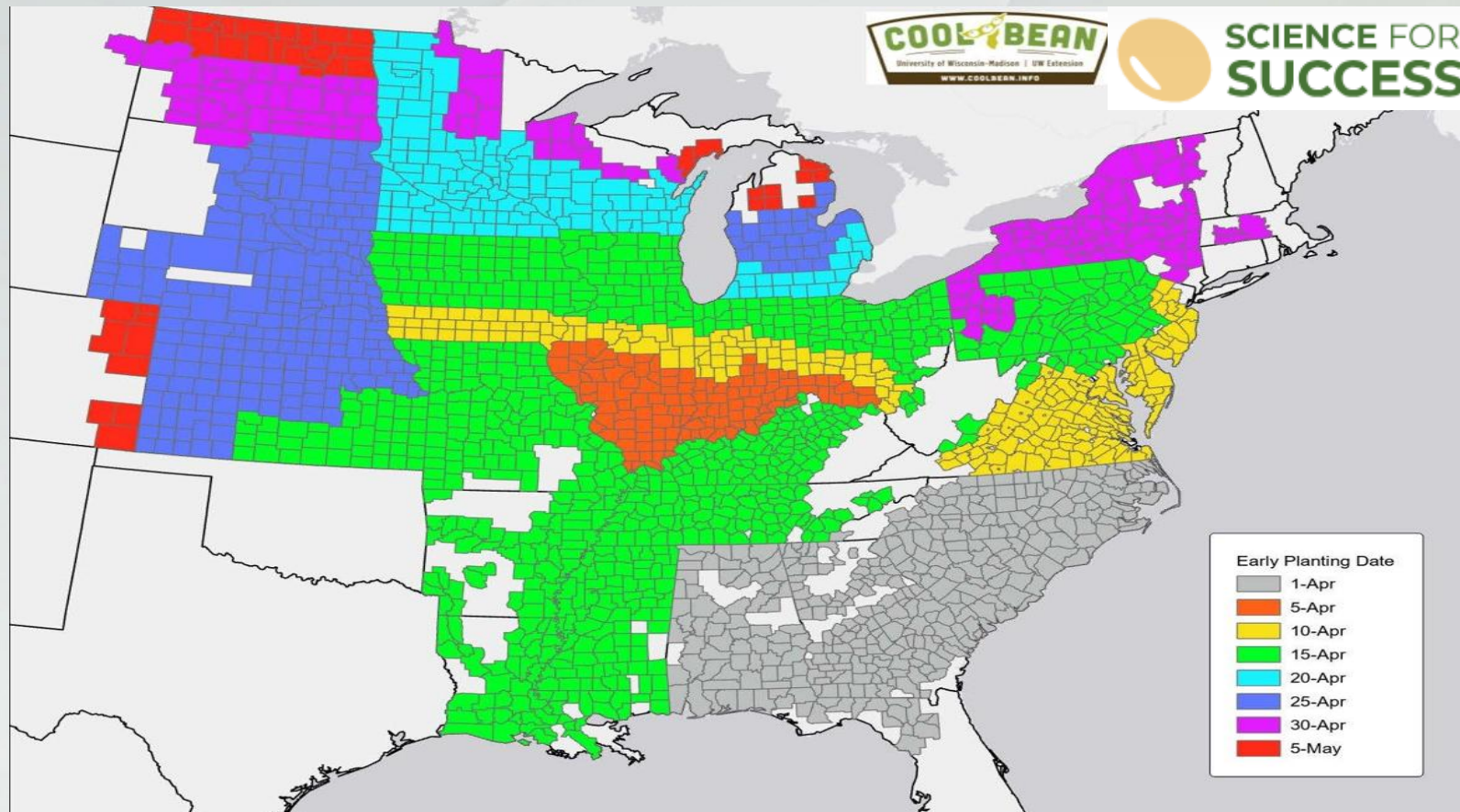
➤ Optimal time:

- Based on field conditions and crop responses (corn vs soy)
- Target fields suitable for early planting, high yields
- Do NOT plant if forecast of cold rain in 24 hrs

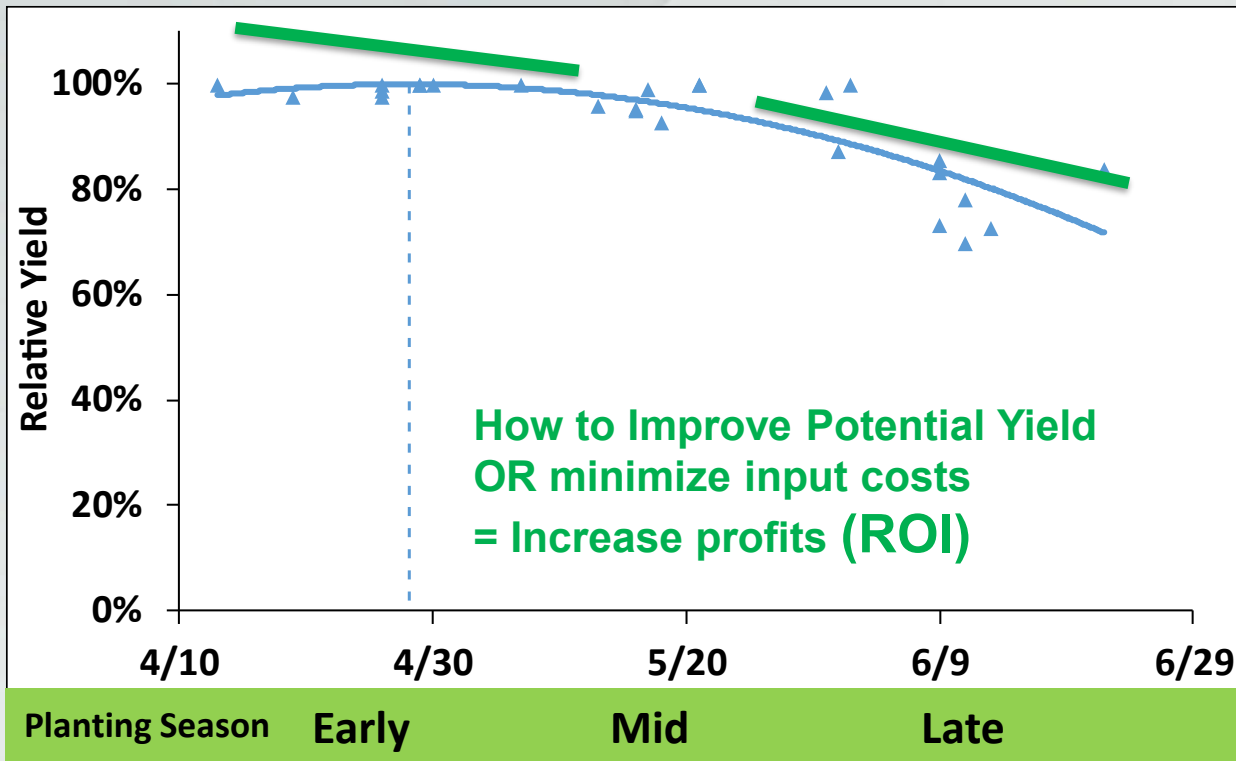


Mike Staton

Crop insurance replant dates for Soybean: moved earlier



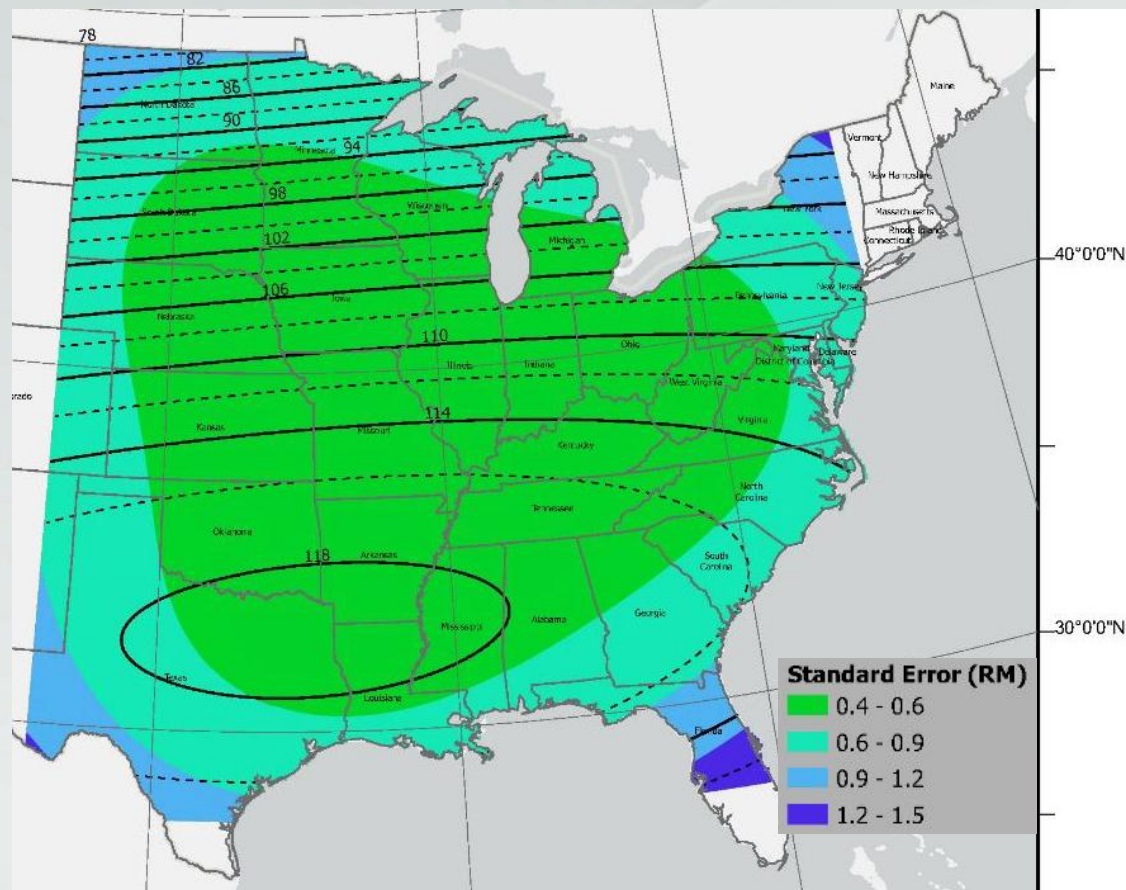
Planting Time: change other management?



Factors to consider:

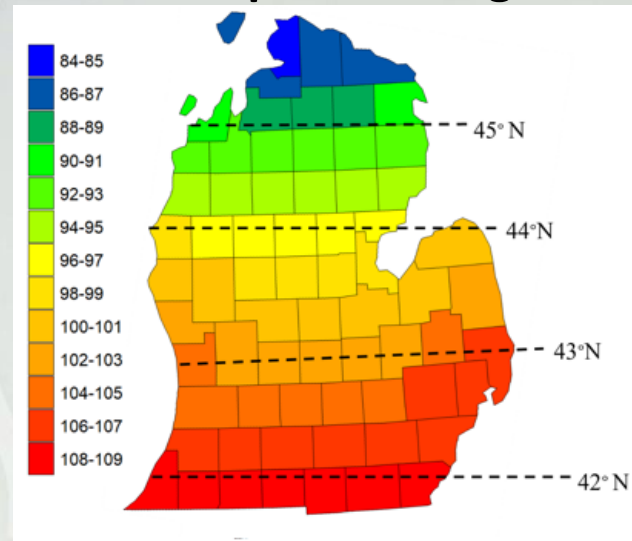
- Variety Selection:
 - **Relative Maturity**
 - Traits
- Seedbed preparation
- Planting method/Seed placement/Row Spacing
- Planting depth
- Seed rate
- Seed quality
- Seed treatment
- Pest control
- Fertility
- Harvest Decisions

Corn: Relative Maturity (RM) for max yield



Mourtzinis et al (2025), Agron J. OVT Data from 30 states (2014-2023)

RM map for Michigan

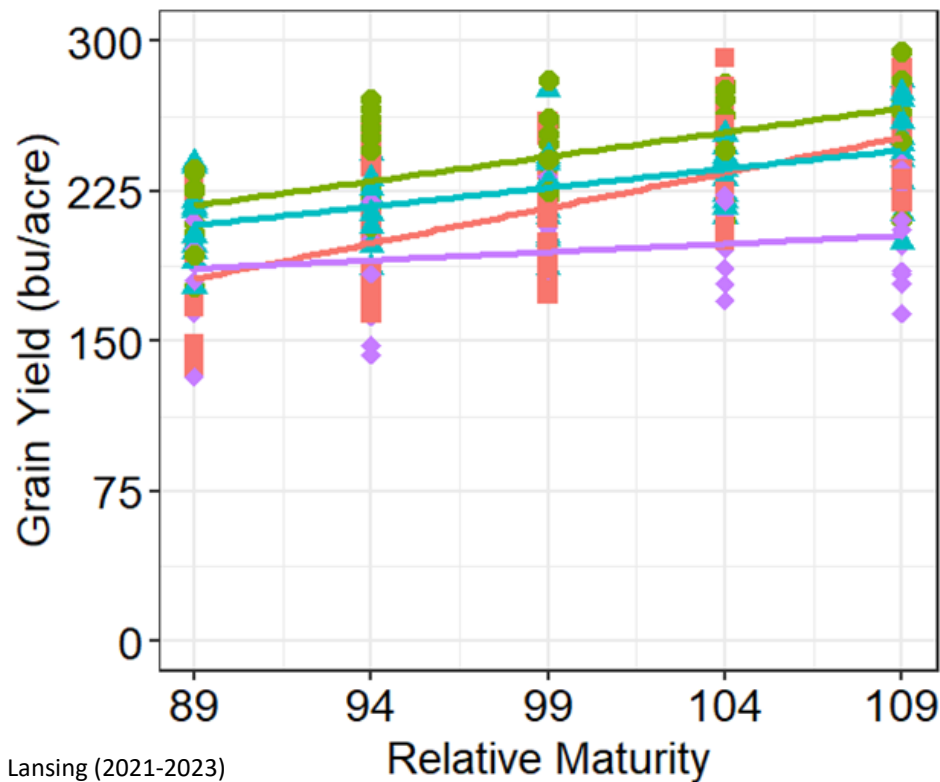


Aggei et al (2024, Data from ~12 MI location (2006-2022))

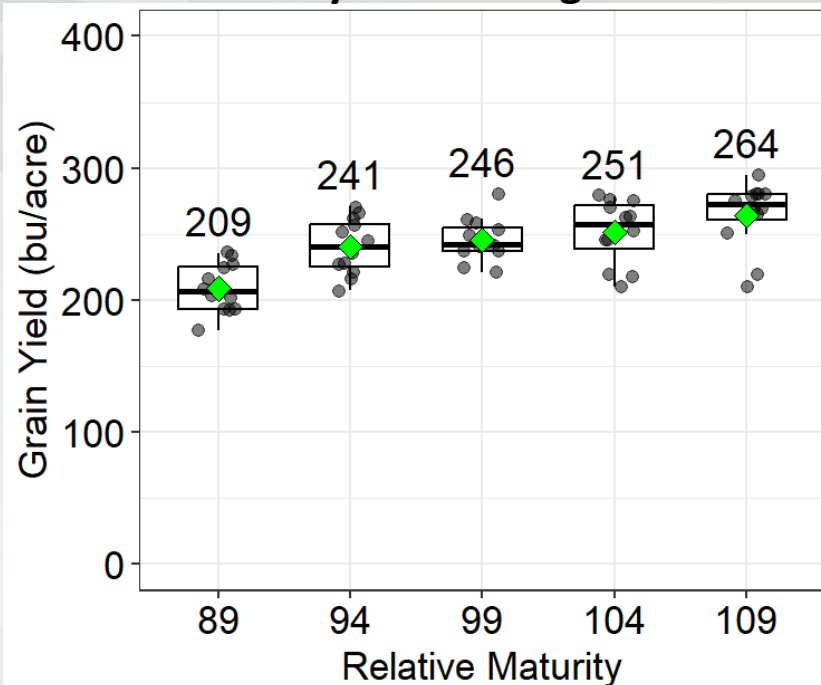
**Based on Typical
planting date ONLY**

Corn Yield: Relative Maturity vs Planting date

Apr 30 May 10 May 30 Jun 10

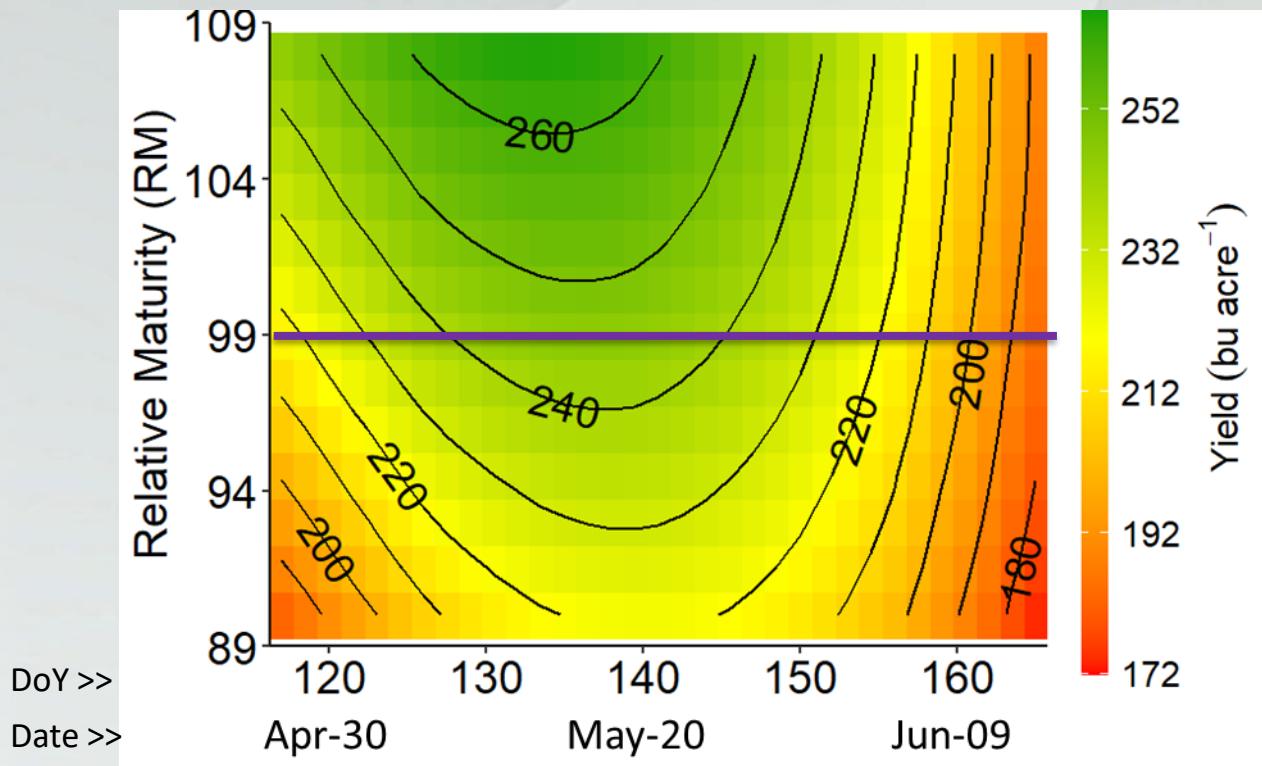


May 10 Planting



➤ Use **Late-maturity** hybrids for early planting

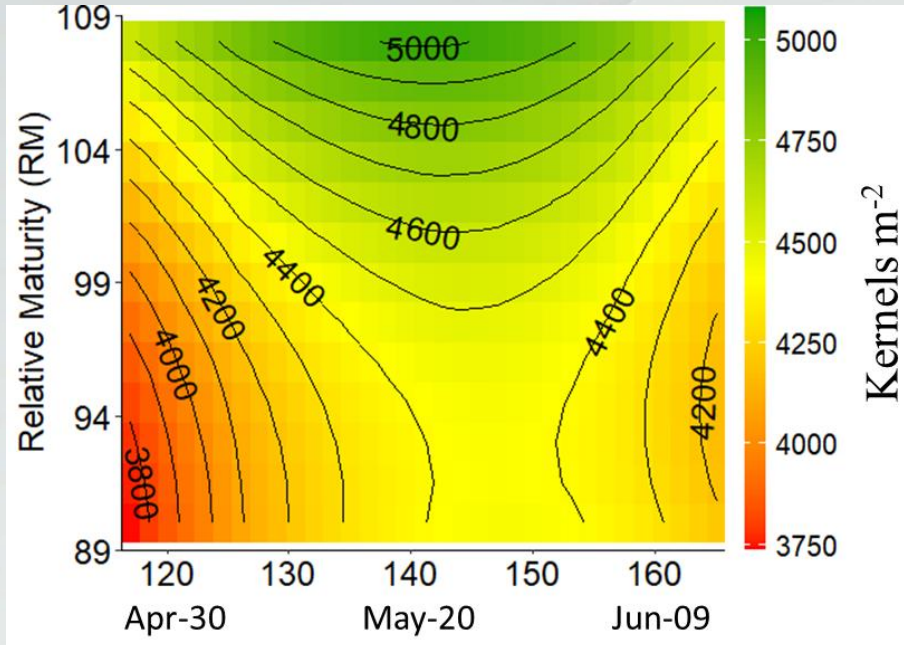
Corn Yield: Relative Maturity vs Planting date



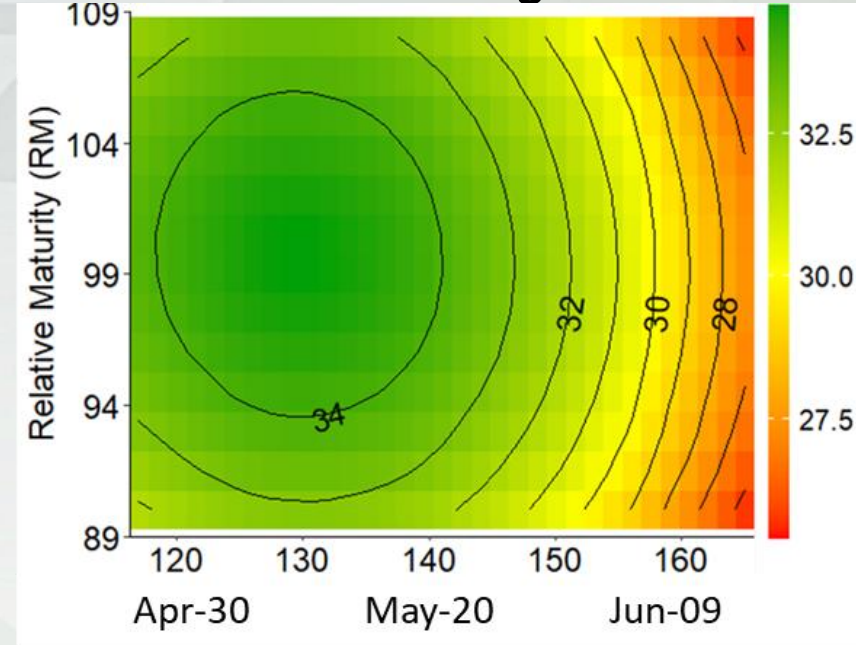
- Use **Late-maturity** hybrids for early season planting

Corn Kernel Number vs Weight

Kernel number



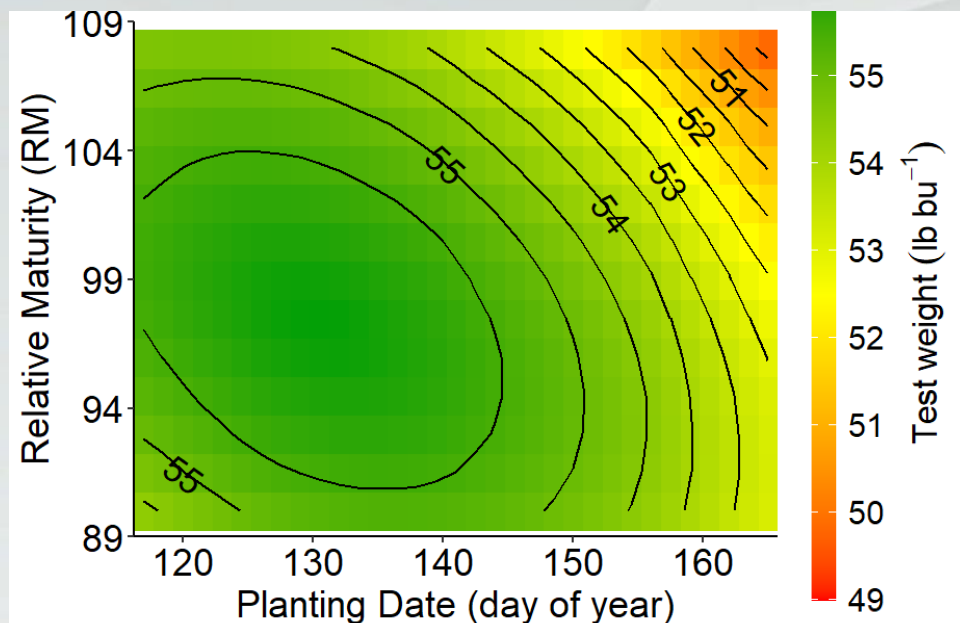
Kernel weight



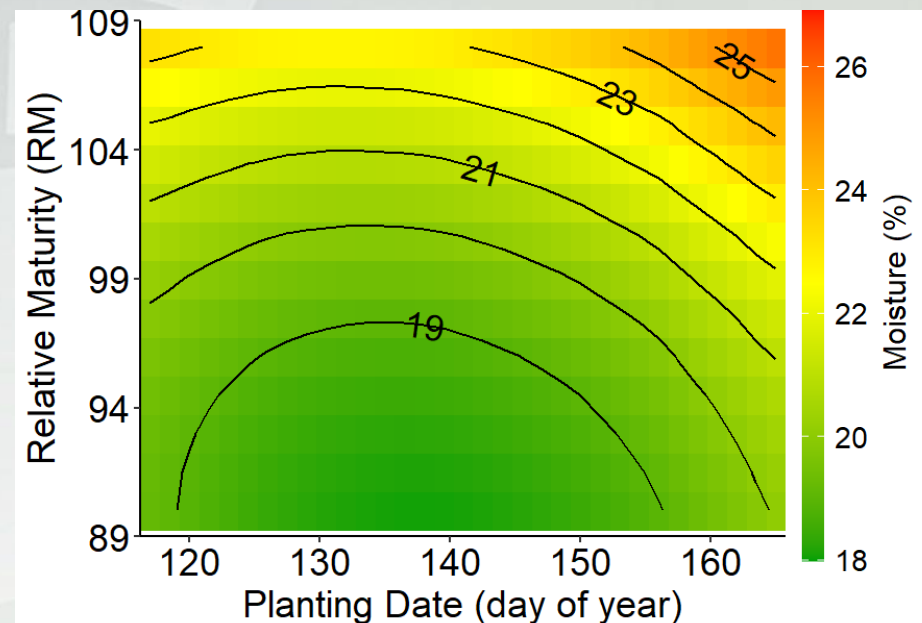
- Under timely planting, greater kernel number while maintaining high kernel weight

Corn Kernel Test Weight & Moisture

Test Weight

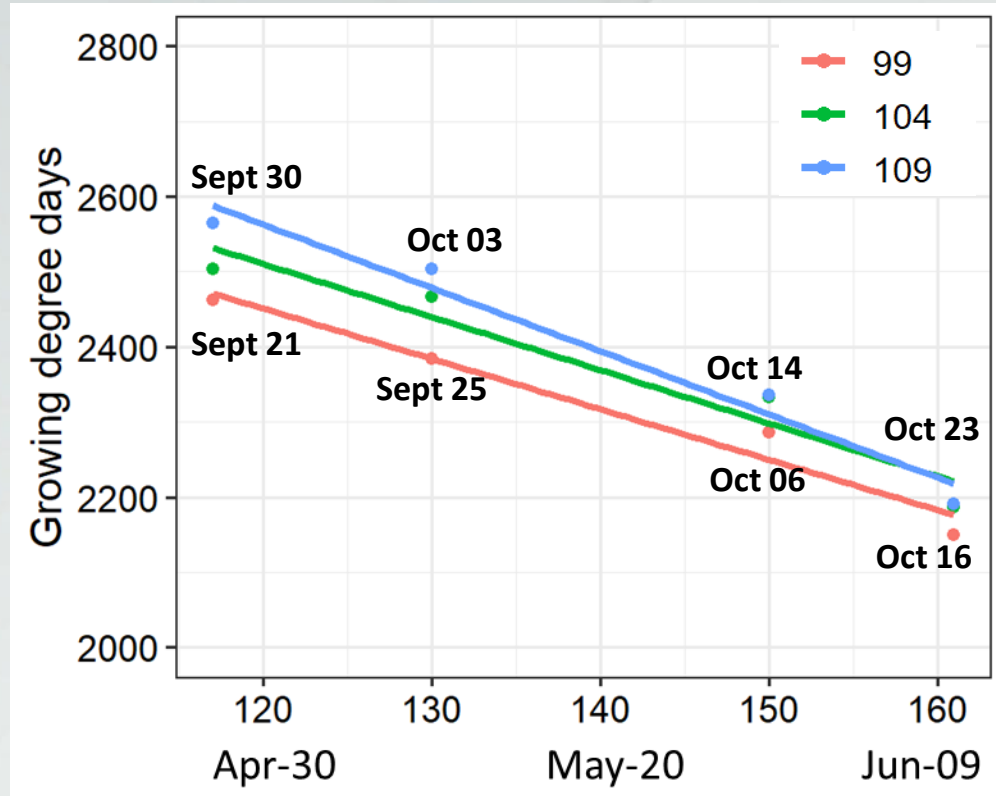


Moisture



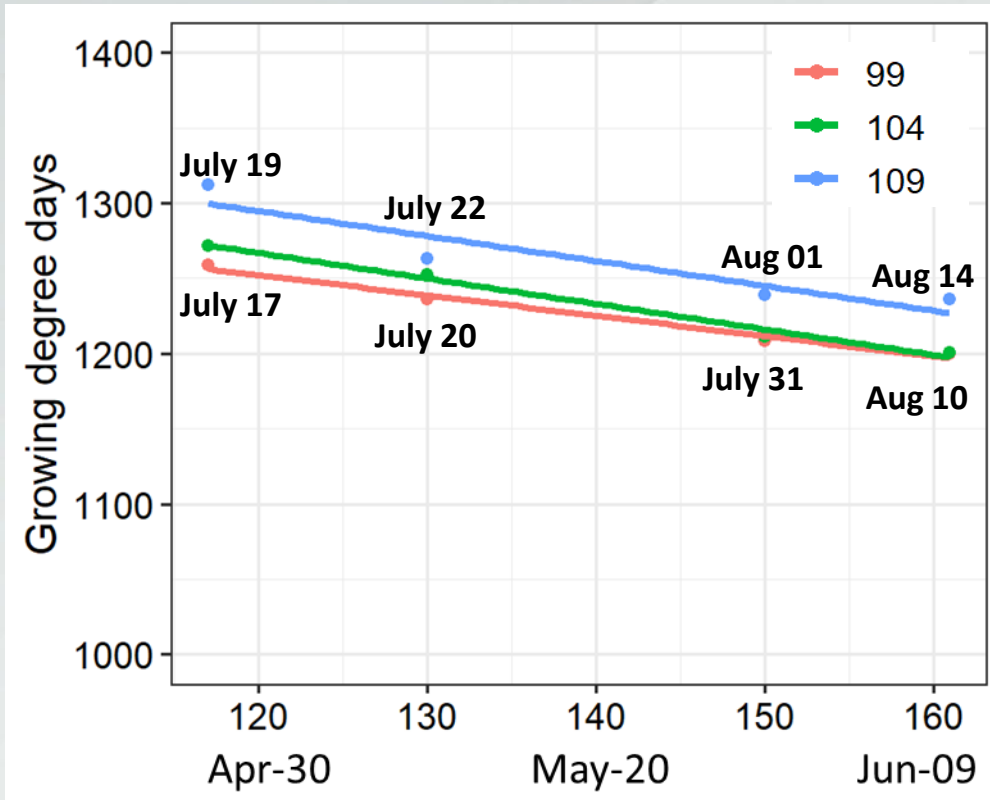
- High test weight and low moisture when using late-maturity hybrid under early plantings

Corn: Time to Black Layer vs GDD Compression



- **GDD Compression:** Decrease in hybrid GDD requirements with delayed planting
- Compression of **6.4 GDD (4.1 - 8.6) per day delay in planting** for Black Layer

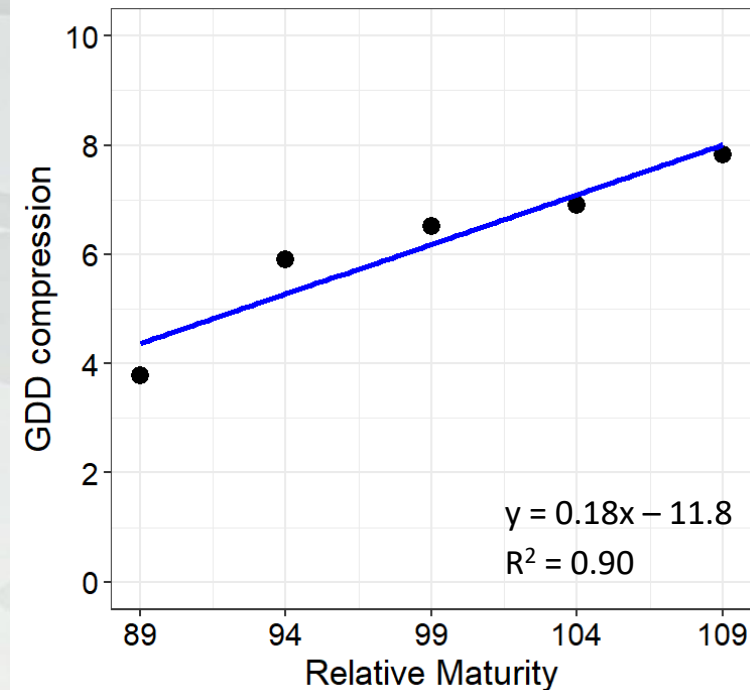
Corn: Time to Silking vs GDD Compression



- **GDD Compression:** Decrease in hybrid GDD requirements with delayed planting
- Compression of **1.4 GDD (1.0 – 1.9)** per day delay in planting for Silking

Corn: GDD Compression

Year	To Silking	To Black Layer
2021	1.5 (1.1 - 2.0)	5.5 (4.0 - 7.1)
2022	1.9 (1.3 - 2.6)	7.4 (3.9 - 11)
2023	0.8 (0.5 - 1.1)	6.4 (4.3 - 7.8)
Average	1.4 (1.0 - 1.9)	6.4 (4.1 - 8.6)

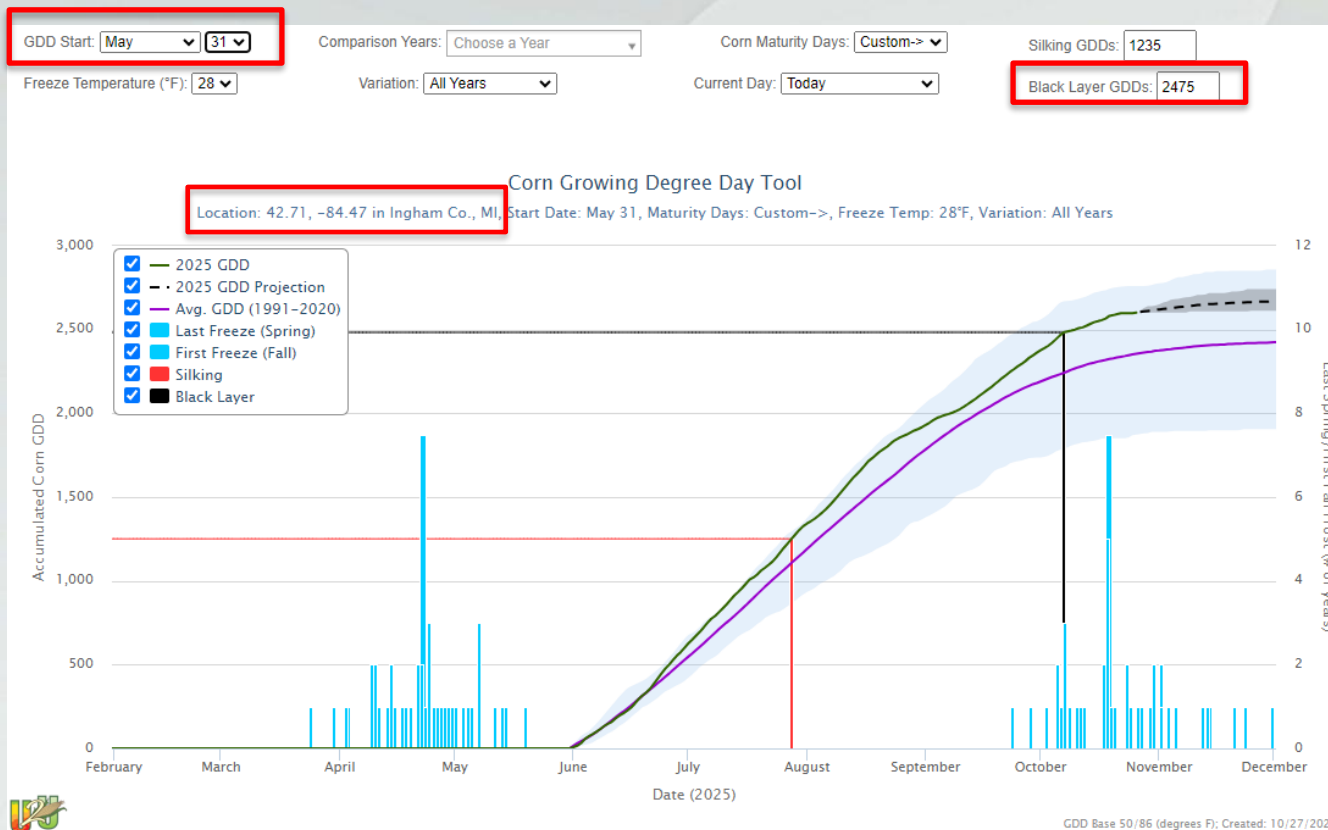


Data from 5 hybrids (89, 94, 99, 104, 109 RM) over 3 yrs, Lansing, MI

- Compression to silking was only ~25% of total GDD compression
- Rate of GDD compression increased with late-maturity hybrids

Corn: Useful 2 Usable Tool (U2U)

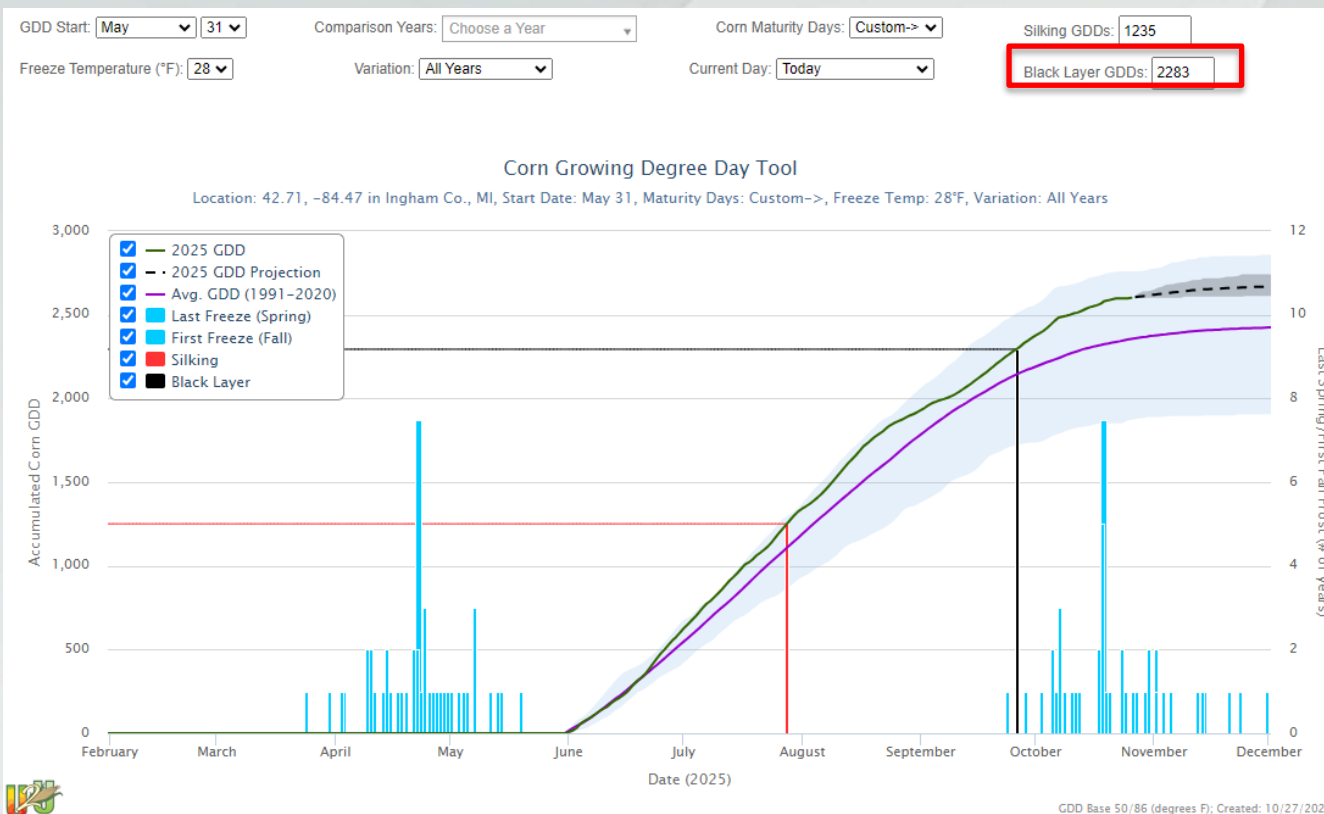
https://mygeohub.org/groups/u2u/purdue_gdd



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

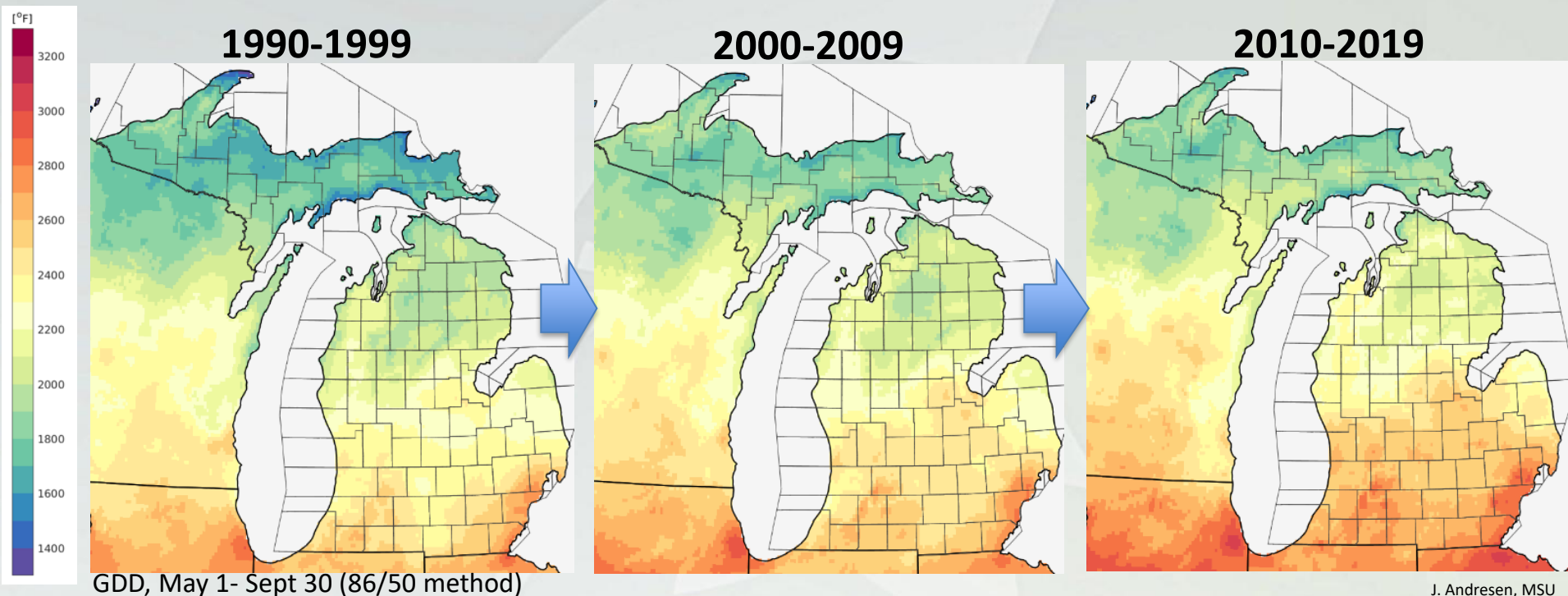
Corn: Useful 2 Usable Tool (U2U)

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



New Black layer GDD for delayed planting:
 $2475 - (30 \times 6.4) = 2283$

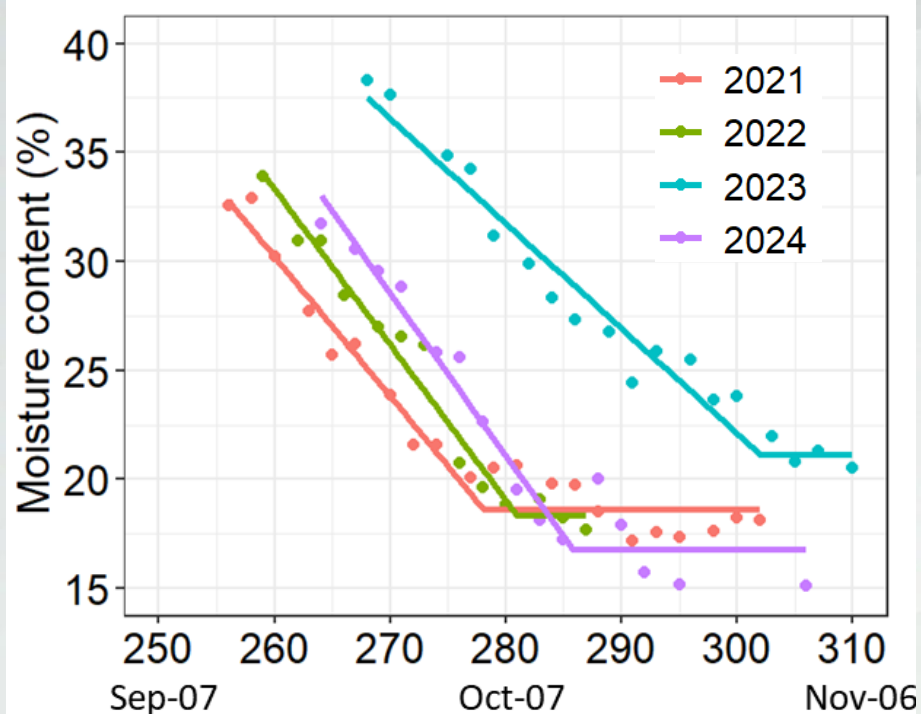
Corn: GDD changes over time



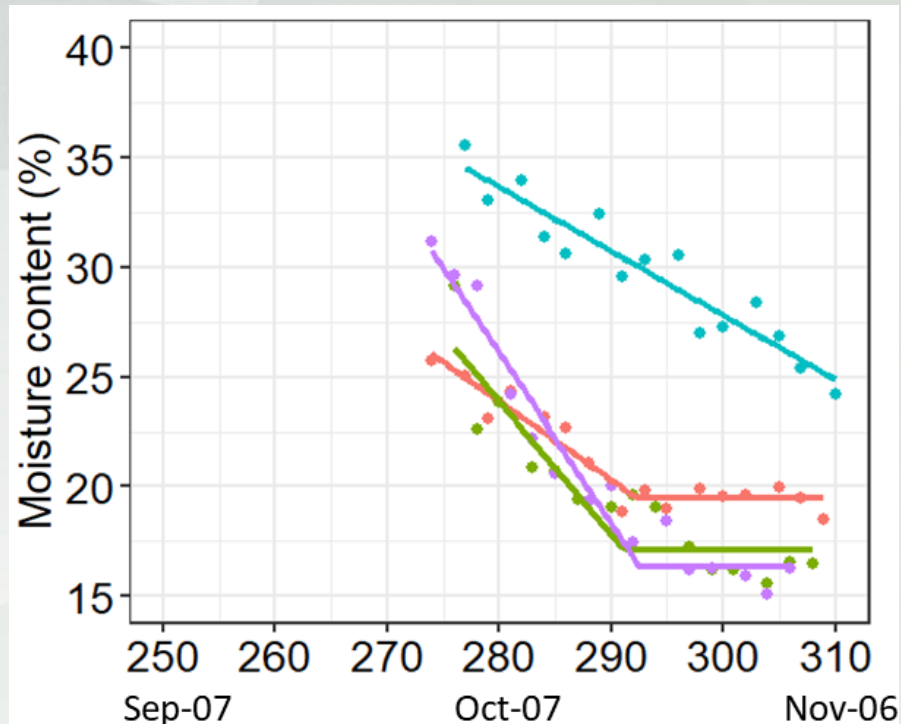
- Seasonal GDD totals are increasing over time in Michigan and other northern states
- Use hybrid GDD information in addition to RM ratings

Corn: Drydown (for maximum Profits)

99 RM, May 10 planting



109 RM, May 10 planting

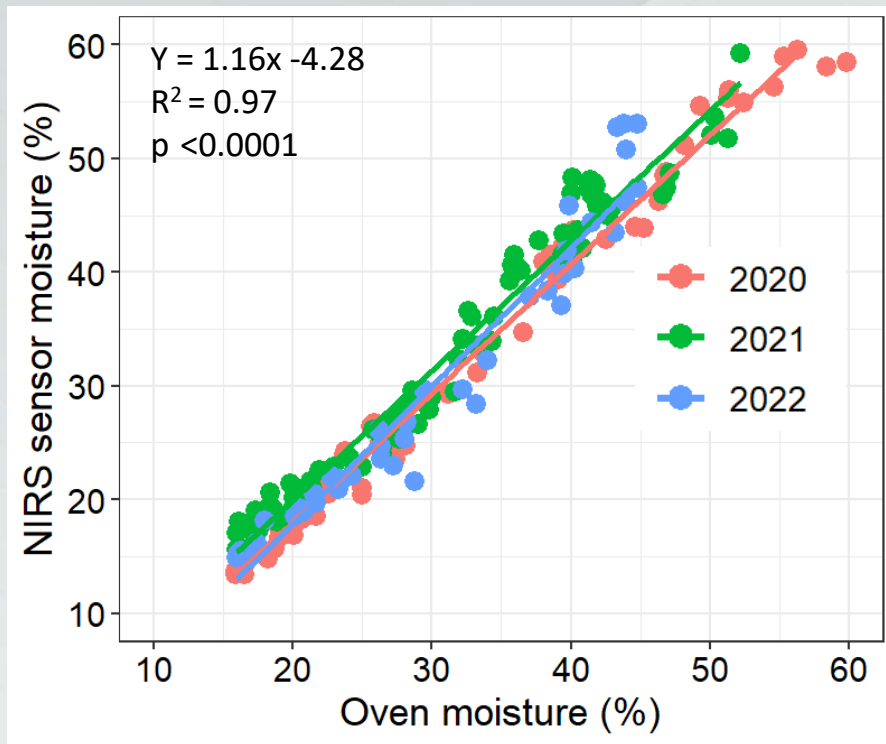


Corn: Drydown (for maximum Profits)

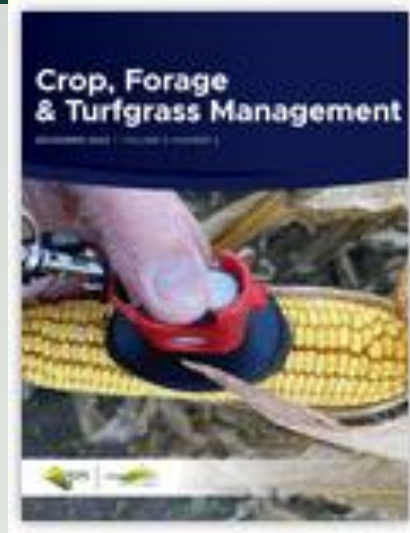
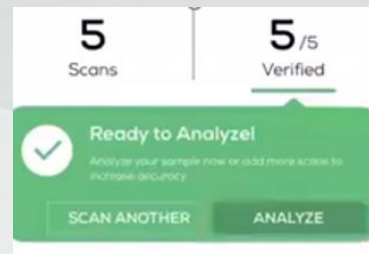
Variable	2021/22/24	2023
Moisture- Black Layer	26 - 35%	32 - 39%
Moisture- Plateau	14 - 23%	20 - none
Drydown Rate (per day) <i>99 RM, May 10 Planting</i>	0.70%	0.47%
Drydown Rate (per day) <i>99 RM, May 30 Planting</i>	0.64%	0.45%
Drydown Rate (per day) <i>109 RM, May 10 Planting</i>	0.56%	0.39%

Wet Fall

Corn: Measure moisture In-field?



Agyei et al. (2023; Crop, Forage & Turfgrass Mgmt.)

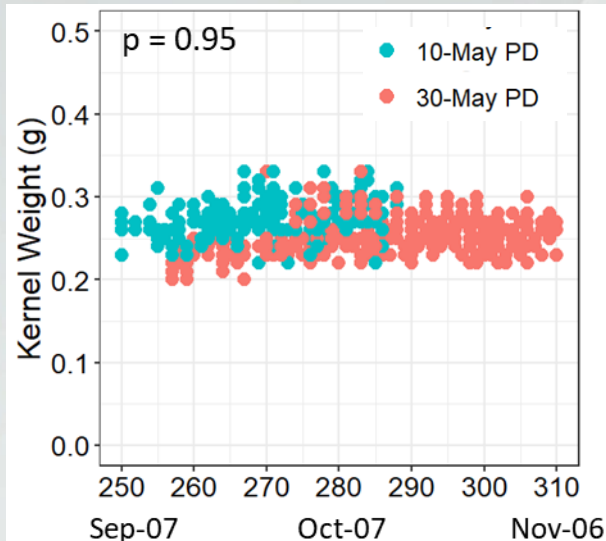


- NIR sensor (e.g., SCiO, annual cost)
- Other options?

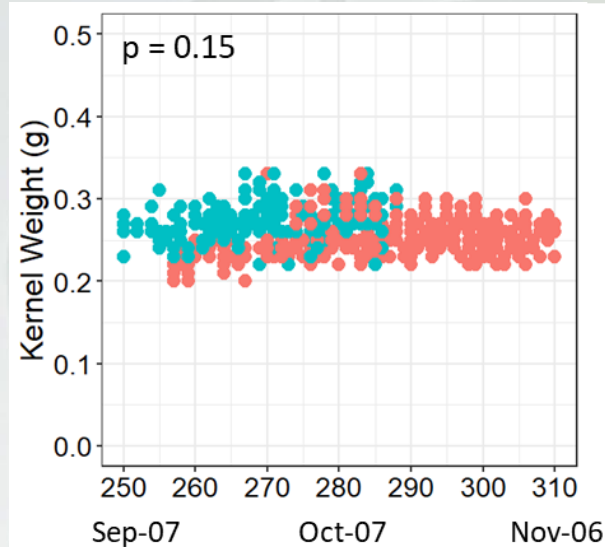
➤ Fast and non-destructive estimation of kernel moisture is important for harvest planning

Corn: Kernel weight after Black Layer

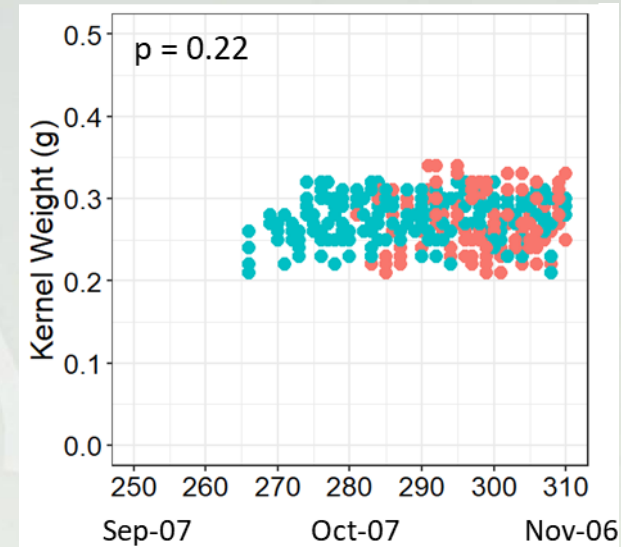
89 RM



99 RM



109 RM



- No change in kernel weight after black layer (i.e. No Phantom yield loss) across hybrid RMs and planting dates

[illegible]

1.0

1.5

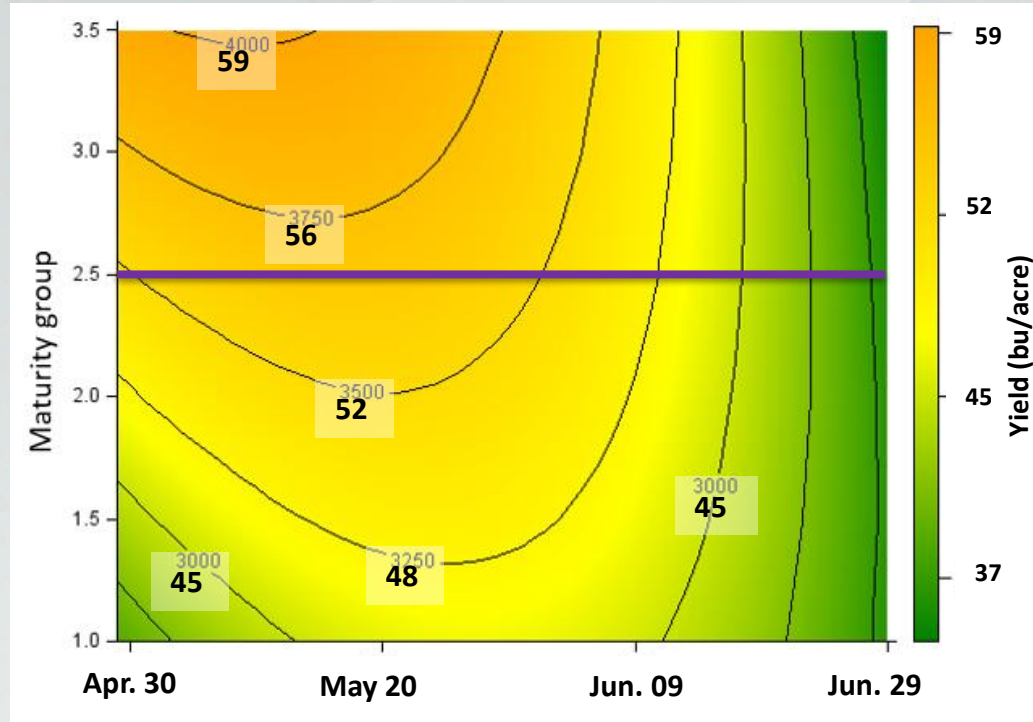
2.0

2.5

3.0

**Based on Typical
planting date ONLY**

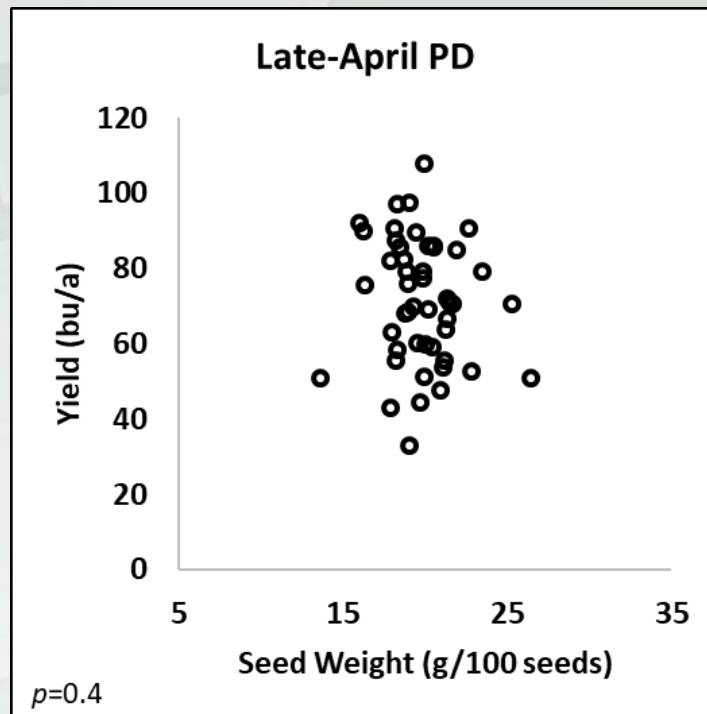
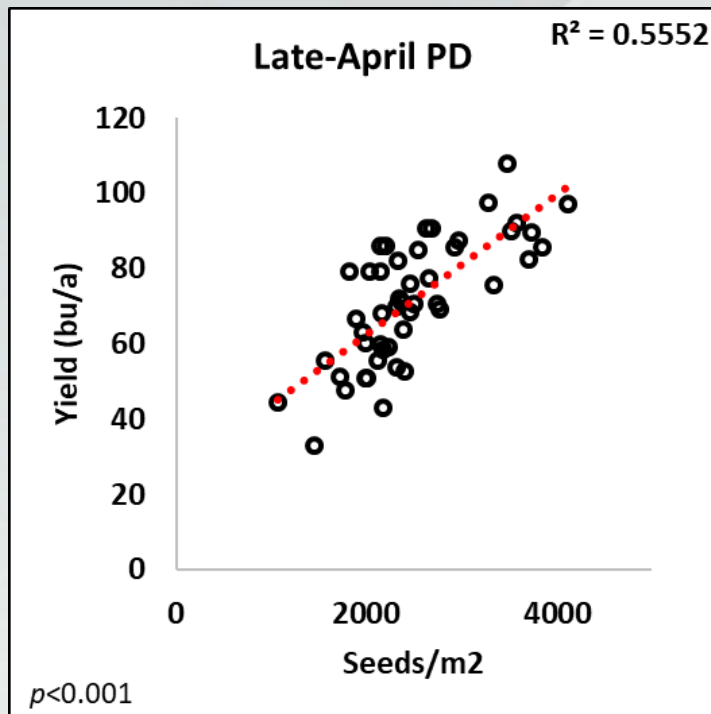
Soybean: Maturity Group vs Planting date



2 Years data (Lansing, MI)
Siler & Singh (2022, Crop Sci.)

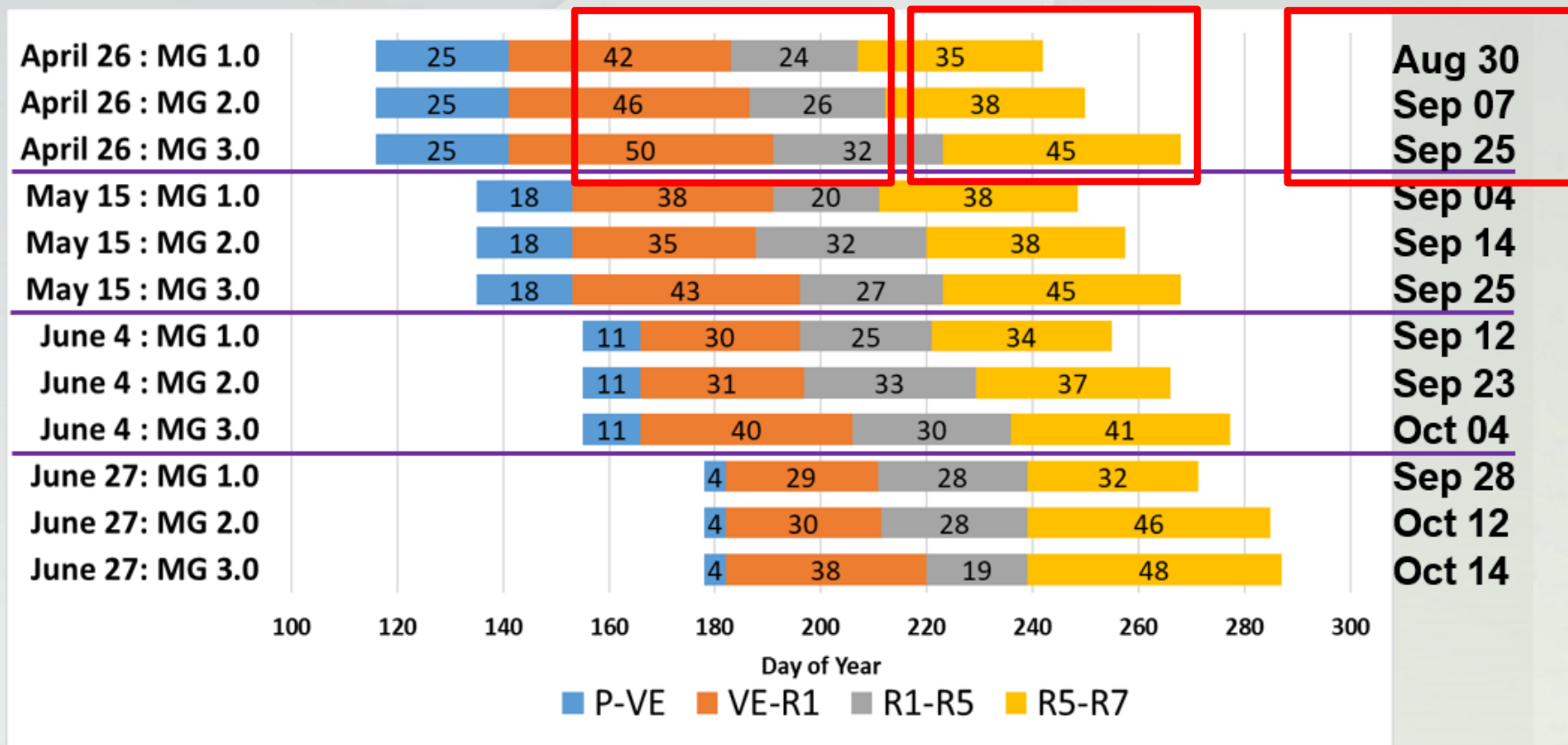
- Late maturity variety for early-season planting (till 1st week of May)
- Switch to early maturity with delay in planting (starting early June) OR Double crop soy

Driver of soybean yield increase: Seed Number vs Weight



- Combination of early planting and longer maturity: more time spent in V stages (increased # nodes/pods/seeds), as well as R stages (more time to fill increased number of seeds)

Soybean Phenology



Physiology of Yield Increase

- Adjust planting date and soybean maturity 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

Soybean PD x MG trials: On-farm

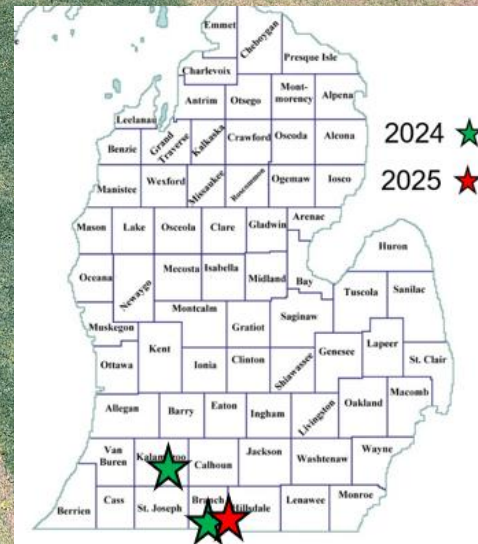
E1.5 E2.5 L1.5 L2.5 L1.5 E2.5 E1.5 L2.5 E2.5 L1.5 E1.5 L2.5

Planting date:

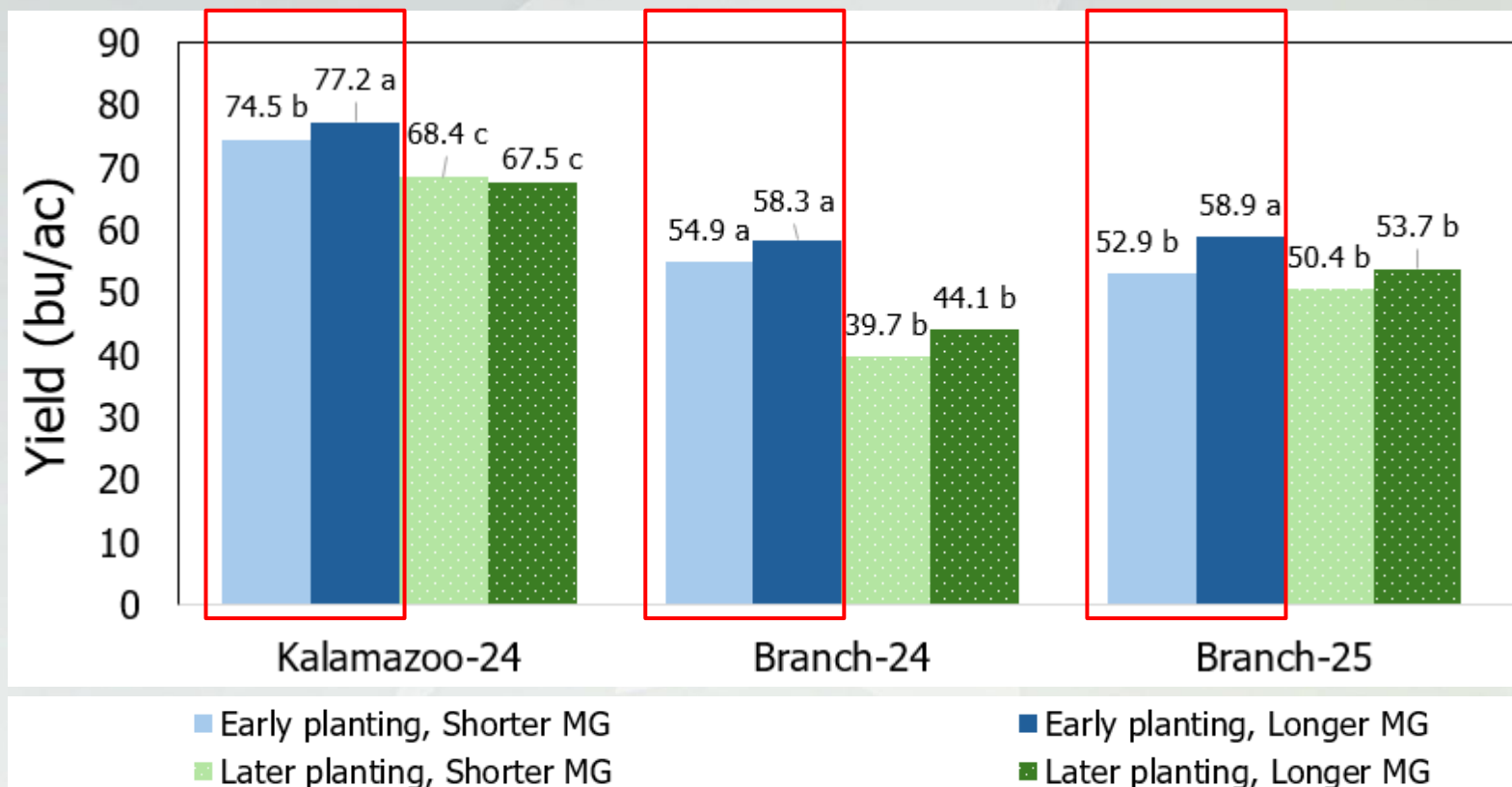
- Early (E): ~late-April
- Later (L): ~mid-May

Maturity Group:

- Shorter (e.g., 1.5)
- Longer (e.g., 2.5)



Soybean PDxMG trials: On-farm



Take Home Messages

- Optimal planting time is critical, however planting in marginal soil conditions can reduce yield (more so in corn)
- Other management practices (e.g., maturity) can be adjusted based planting time (Systems approach) to improve yields and profits
- Benefits of early-season planting can be expanded upon with the use of late-maturity varieties (conduct on-farm trials for your location)
- **Portfolio approach** in maturity selection (also provide genetic diversity)
 - Plant late-maturity varieties 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 varieties

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

Kernel dry down insights for corn growers

Benjamin Kwadwo Agyei and Maninder Singh, Michigan State University Department of Microbial Sciences, and Jeffrey Andresen, Michigan State University Department of Environmental Microbiology

Soybean planting considerations for maximum profits

Maninder Singh and Thomas Siler, Michigan State University Extension, Department of Plant, Soil and Microbial Sciences - April 21, 2022

Share Tweet Save Share Print Email

Matching planting time with other management decisions can increase yield while minimizing input costs.



Soybean Presentations



ROI and Soybean Production, Maninder Singh - Updated with the most recent research!!!

Science for Success Initiatives

Across the US, soybean Extension Specialists are working together on a 'Science for Success' initiative. Please check out this tab for exciting information on soybean

Science for Success Articles

Articles



SOYBEAN PLANTING CONSIDERATIONS: PLANTING DATE, SEEDING RATE AND ROW SPACING IMPLICATIONS

PUBLISHED ON APRIL 28, 2022

Optimal planting date, seeding rate and row spacing are

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF



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

SCIENCE FOR SUCCESS
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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

Introduction

Soybean planting dates can vary greatly depending on soybean growing region (Bourgeois 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, weather characteristics (i.e., pest tolerance or resistance traits, maturity group, growing season, pest control (i.e., weeds, insects, and diseases) and soil conditions. Early soybean planting creates additional



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

Repair-plant/Fill-in/Overseed | Replanting portions of the

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 overspending 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.

➤ Technicians:

- Patrick Copeland
- Lorato Wood

➤ Graduate Students

- Benjamin Agyei
- Wallas da Silva
- Aadil Rahman
- Previous students

➤ Undergrad/Intern students

- Past students
- Mike Particka
- Tom Wenzel

➤ Farmer cooperators

- Dr. Christy Sprague
- Dr. Chris Difonzo
- Dr. Jeff Andresen
- Dr. Laura Lindsey (OSU)
- Dr. Ignacio Ciampitti (KSU)
- Dr. Shawn Conley (UW)
- Dr. Erin Burns
- Dr. Dechun Wang
- Dr. Kurt Steinke
- Dr. Sarah Lebeis
- Dr. Lisa Tiemann
- Mike Staton

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Thanks!

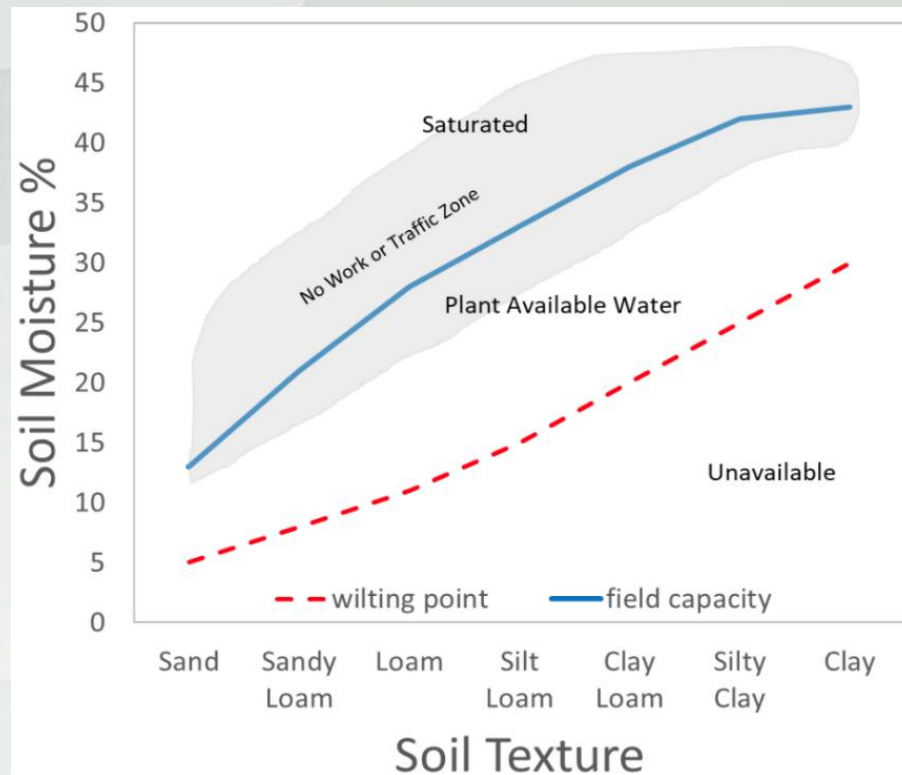


Seed companies

Field Conditions at Planting- Optimal **Soil Moisture**

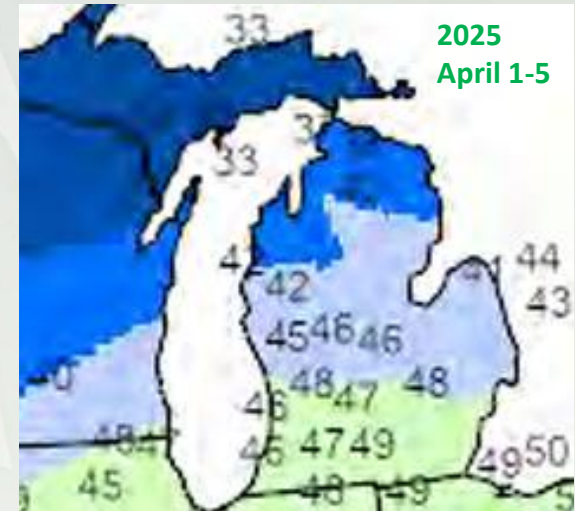
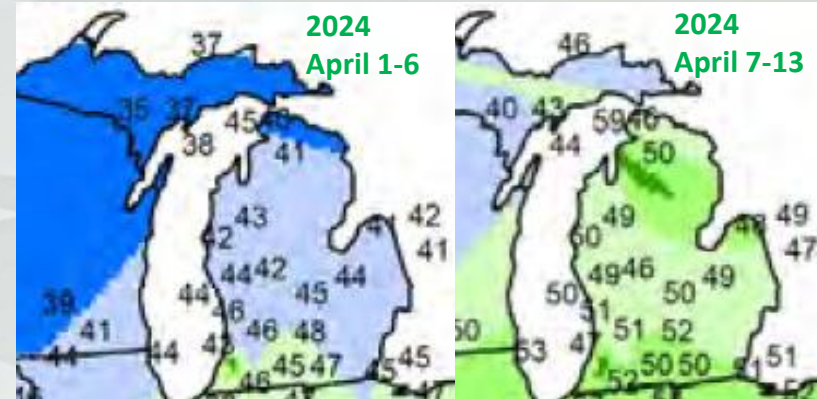
- Avoid tilling/planting when soil is wet “mudding it in”
 - Side-wall compaction
 - Non-ideal seed placement
 - Poor seed-to-soil contact
 - **Soil Compaction**

- Soil too wet to plant?
 - When soil at desired planting depth just deforms, ok if crumbles
 - Use soil moisture sensor



Field Conditions at Planting- Optimal Soil Temperature

- Wait for soil temp 45-50° F and **rising**
- **Imbibitional chilling injury** at <50° F for first 24 hrs (soybean), 48 hrs (corn)
- Slow emergence and uneven stand (of greater concern in corn)



Source: USDA (top 4")

Seed Quality

- Germ. % on seed tag
- Early plantings: use high quality seed
- Test seed vigor (use same lab)
 - Cold test
 - Saturated cold test



Source: OSU



Source: Tom Siler (MCIA)

Length of Growing Season (1999-2023)

