New Corn Planting Strategies

Manni Singh & Dan Quinn

Cropping Systems Agronomist (MSU) &
Corn Agronomist (Purdue)

Feb 3, 2025, MSUE Webinar

Cropping Systems Agronomy
MICHIGAN STATE UNIVERSITY

MICHIGAN STATE UNIVERSITY | Extension

CORN MARKETING PROGRAM
CMPM
OF MICHIGAN
www.micorn.org

INDIANA CORN
Marketing Council

PURDUE UNIVERSITY
Corn Agronomy

NORTH CENTRAL SARE
Sustainable Agriculture Research & Education

Project GREEEN

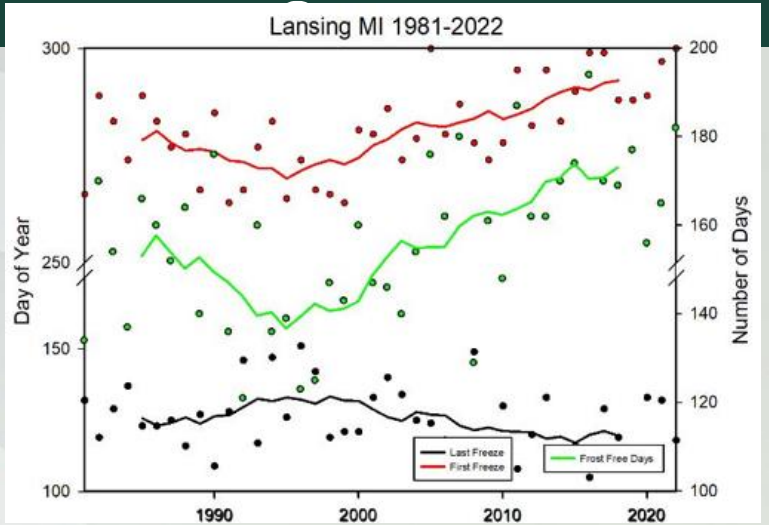
USDA NIFA

Topics for today

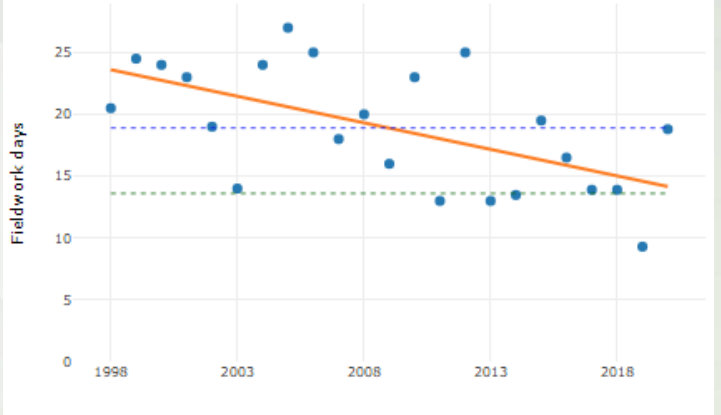
- Recent **weather** trends
- Corn yield and its **components**
- Importance of **planting time**
- Influence of planting date on corn **hybrid maturity**
- **Short corn** hybrids (& potential of **narrow rows**)
- **Seeding rate** responses in corn

Weather Trends

- (Relatively) short growing season
  - is expanding over time, earlier spring frost and later fall frost
- More rainfall (during the time of field operations)
  - Wet spring, leading to planting challenges
  - Wet fall, leading to harvest issues (and corn dry down)



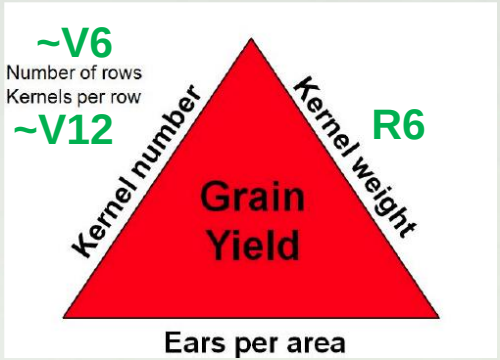
Decline in #days for Field work (mid-April to mid-May)



Yield formation in Corn

- Develop uniform and healthy crop canopy (**Source**) for max light capture
  - Knowledge of crop growth and development
  - Identify field-specific yield limiting factors
  - Make sound agronomic decisions to minimize them

- Optimize components of grain yield (**Sink**)
  - Know what they are and when determined, and limit stress in that period
  - Lost yield potential can not be recovered later in season



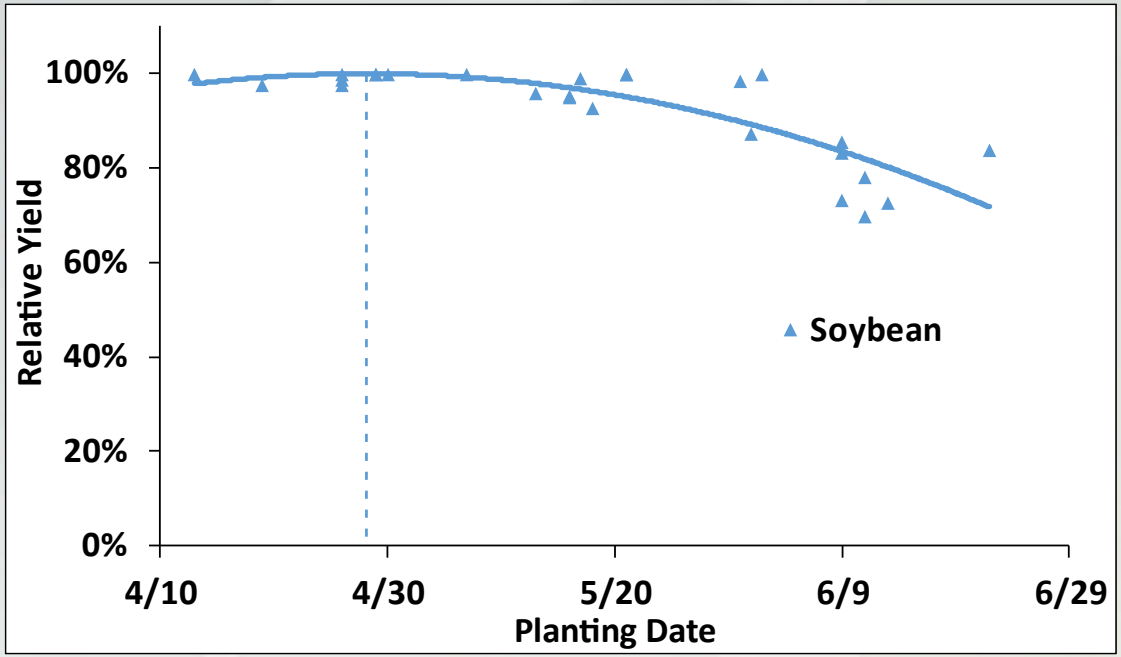
How does planting date influence corn (vs soybean) yield?

Planting Time Impacts Crop Growth in Michigan

Pictures taken mid-July

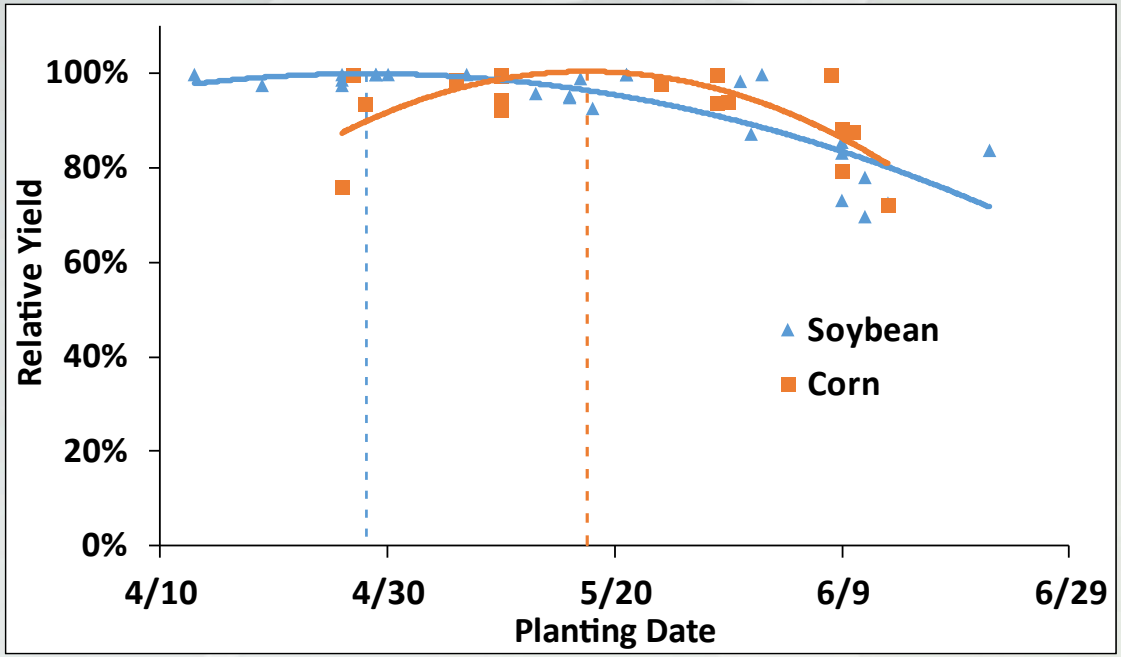
Planting date:	end-April	Mid-May	end May-early June	early-mid June

Planting Time Impacts Crop Yield in Michigan



Data from 2018-2024 across multiple trials.
Each data point is average of ≥16 plots.

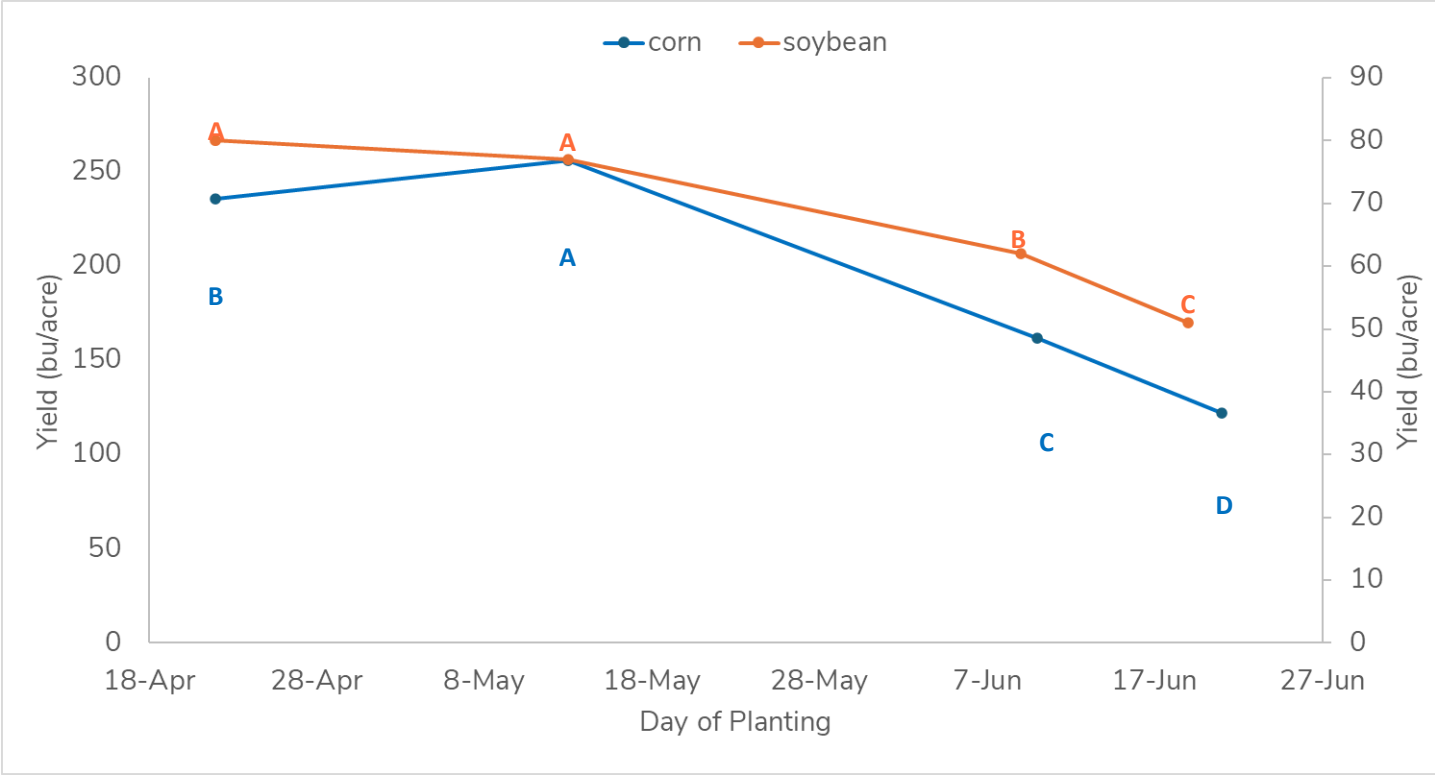
Planting Time Impacts Crop Yield in Michigan



Data from 2018-2024 across multiple trials.
Each data point is average of ≥16 plots.

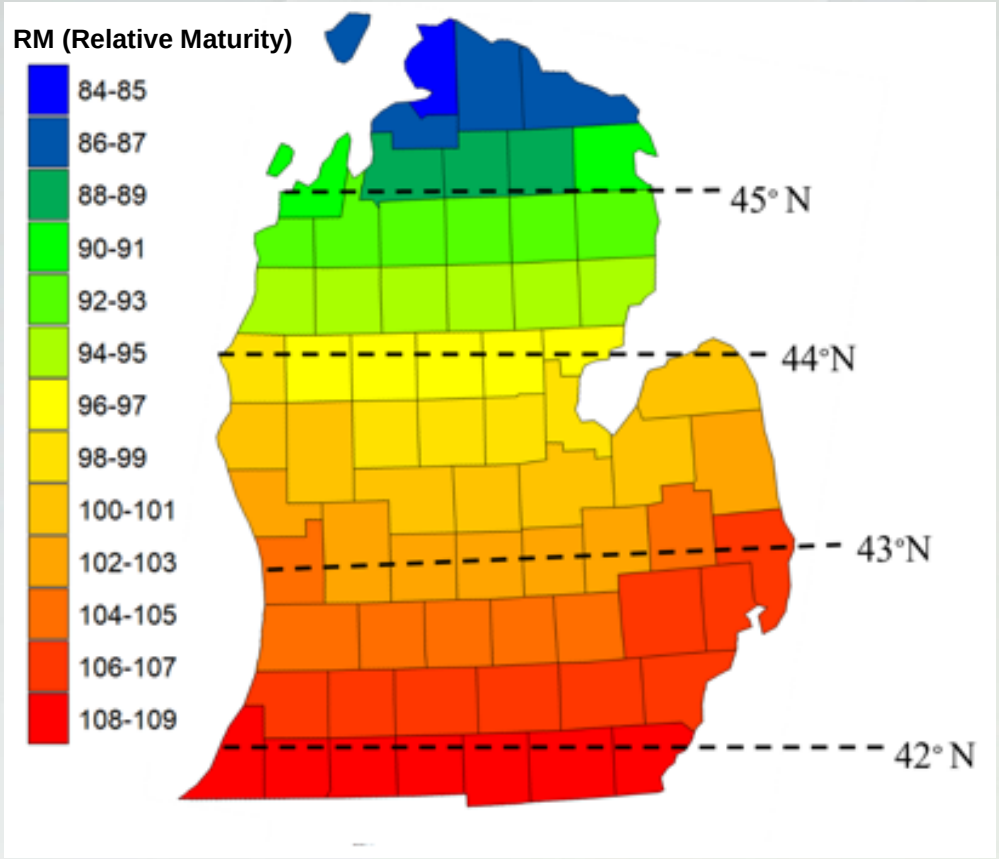
Indiana: Corn vs. Soybean

CFAES



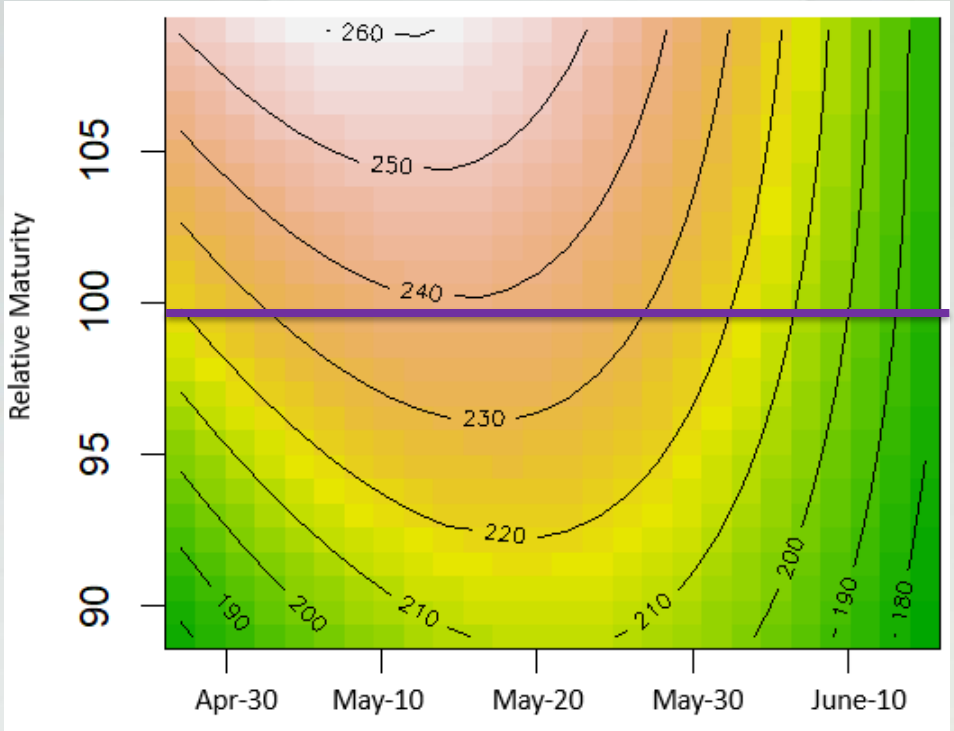
How does planting date influence corn hybrid maturity selection

Corn: Hybrid Maturity Selection



Data from ~12 MI location (2006-2022)

Corn: Hybrid Maturity Selection vs Planting Date

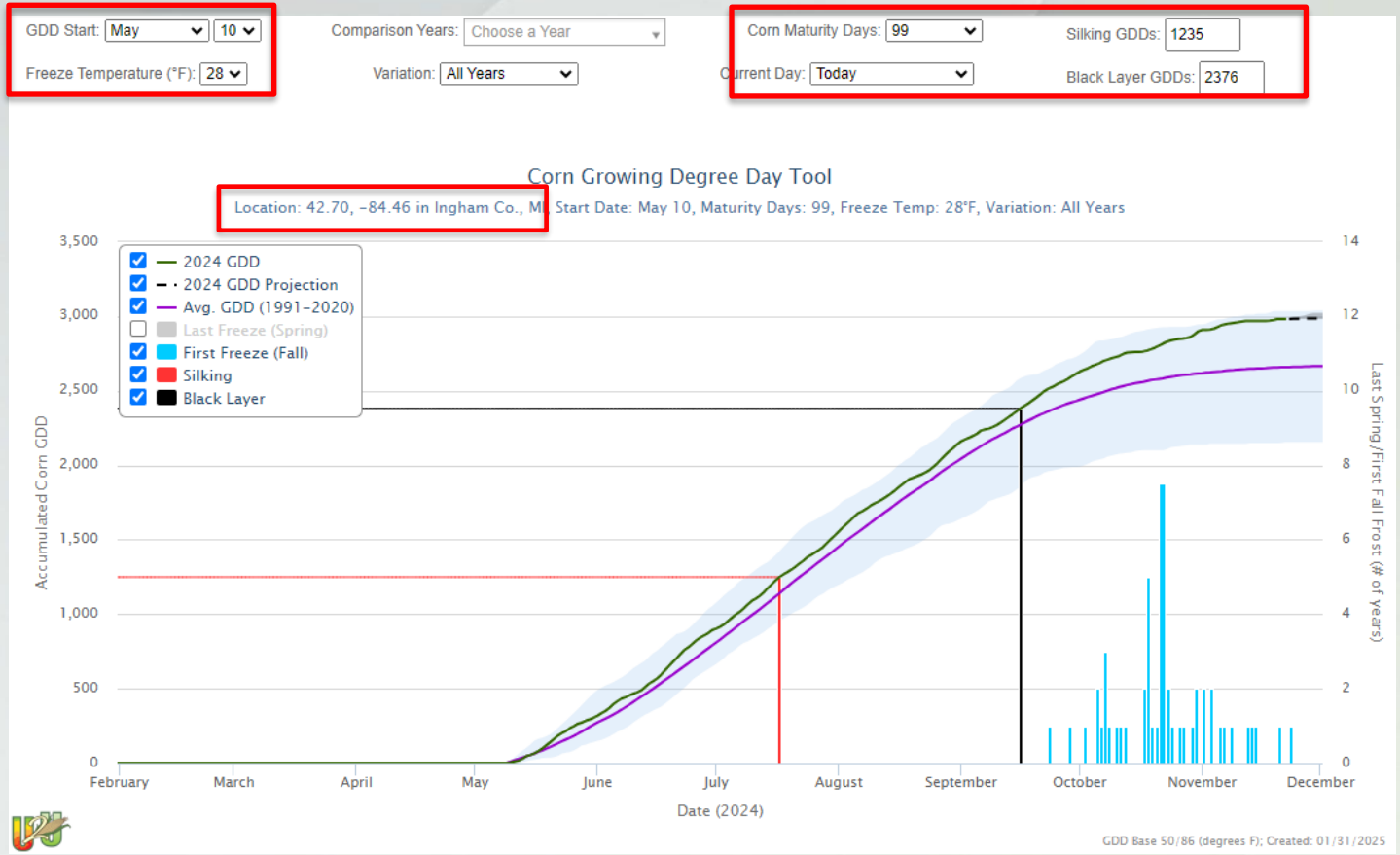


Data from Lansing, MI
Pooled across 2021, 2022, 2023
34,000 seeds/ac; 30” rows

- **Late maturity** hybrids for early-season planting
- **Portfolio approach** (~10 RM apart) in maturity selection, accounting for planting time

Corn: Useful 2 Usable Tool (U2U)

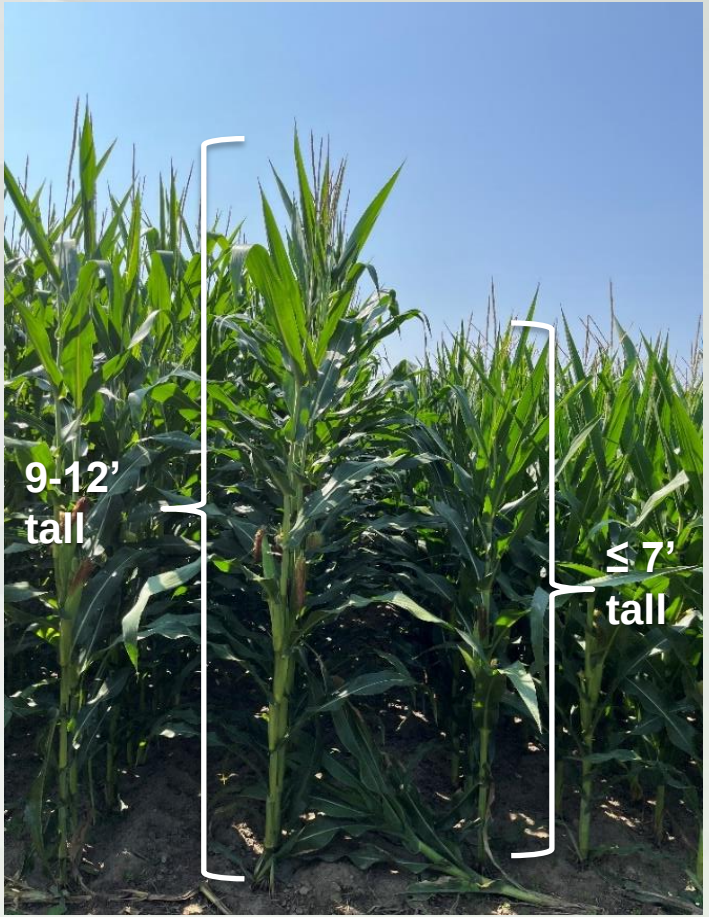
https://mygeohub.org/groups/u2u/purdue_gdd



Potential of Short corn hybrids? (& interaction with row spacing, seeding rate)

Short Corn

- A novel genetic platform
  - More resilient to extreme weather
  - Improve on-farm yield and profits
- Potential benefits:
  - Lodging resistance
  - Tolerance to higher plant populations
  - Easier in-season access for
    - Pesticide applications
    - Fertilizer applications
- More response to higher seeding rates or narrow row spacings?



Narrow-row production system

- Yield impacts of narrow rows (& seeding rates) have been inconsistent
- Short-stature hybrids might benefit more from narrow rows, especially under northern environments
- Potential for multi-crop narrow row equipments in Michigan
- Optimal seeding rate might also be higher under narrow rows

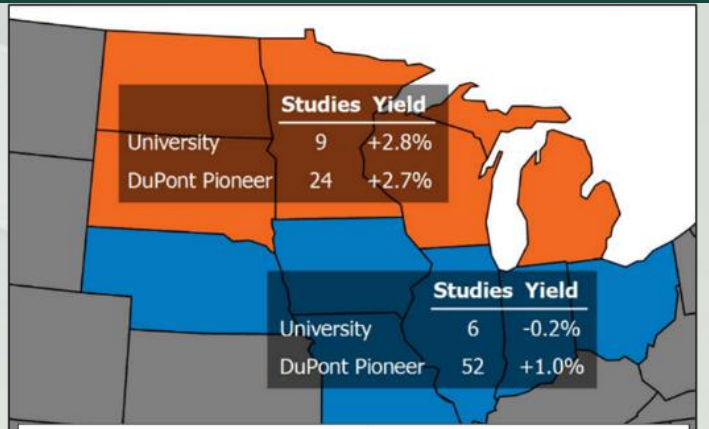
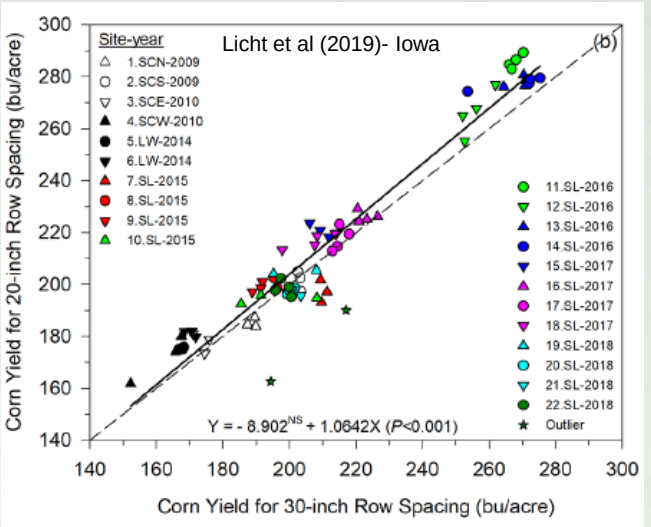
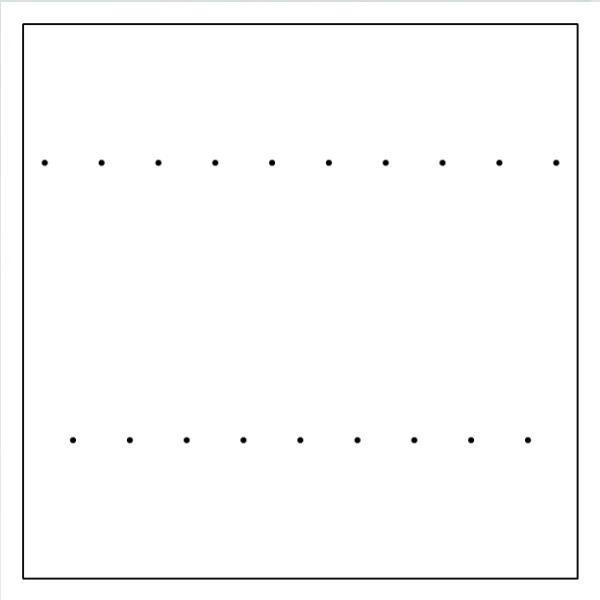


Fig 1. Impact of narrow row spacing (<30") in corn. Source: Jeschke 2018. DuPont Pioneer Agronomy Res. Summary Vol.10. No. 9



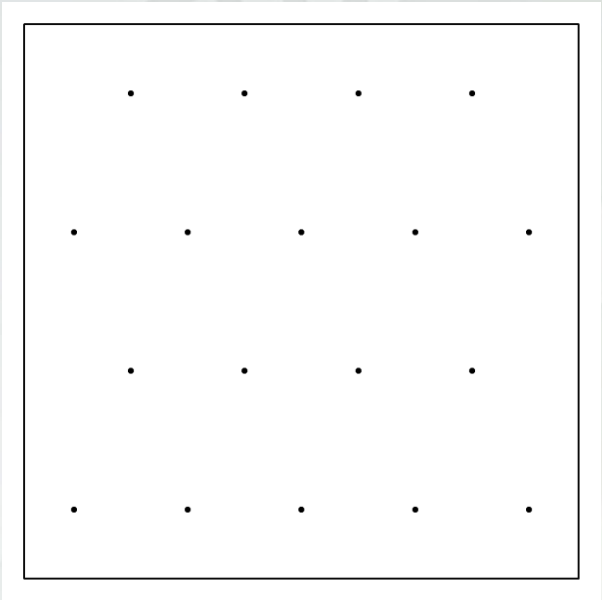
Corn Seed Distributions

Precision Planter
30'' Row Spacing, 34k s/a



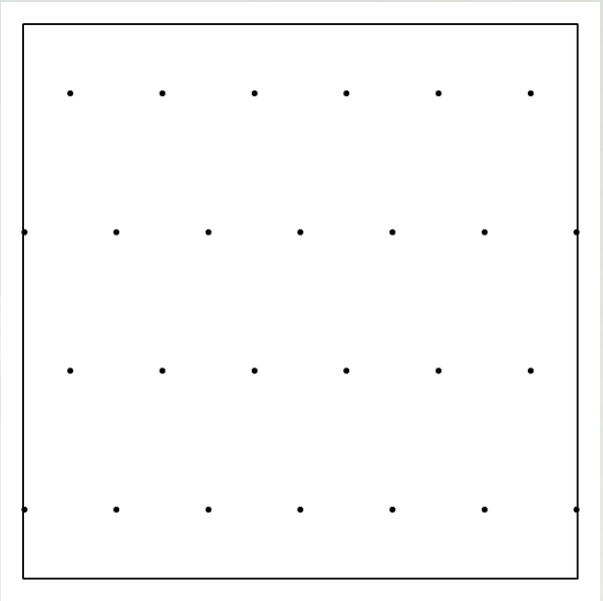
6.1" seed spacing

Precision Planter
15'' Row Spacing, 34k s/a



12.3" seed spacing
(8.4" in 22" rows)

Precision Planter
15'' Row Spacing, 42k s/a



10.0" seed spacing
(6.8" in 22" rows)

Comparing Row Spacings (Short corn hybrids)

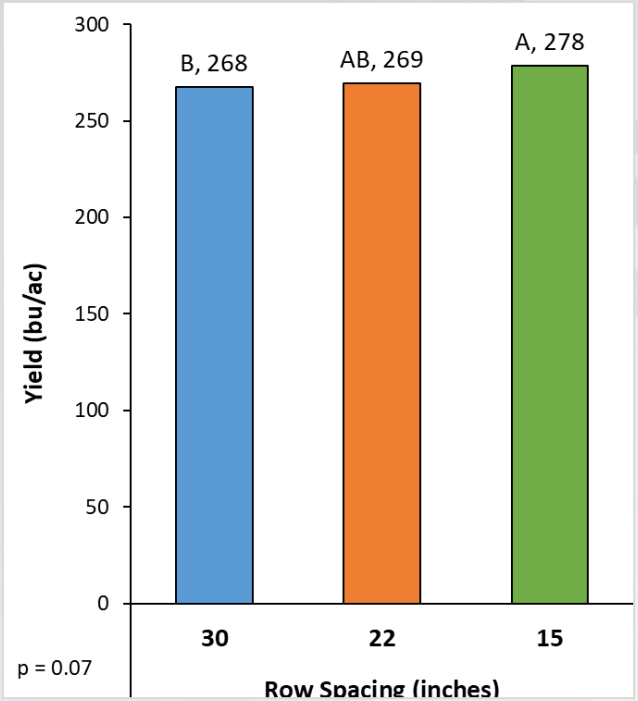
30” row spacing

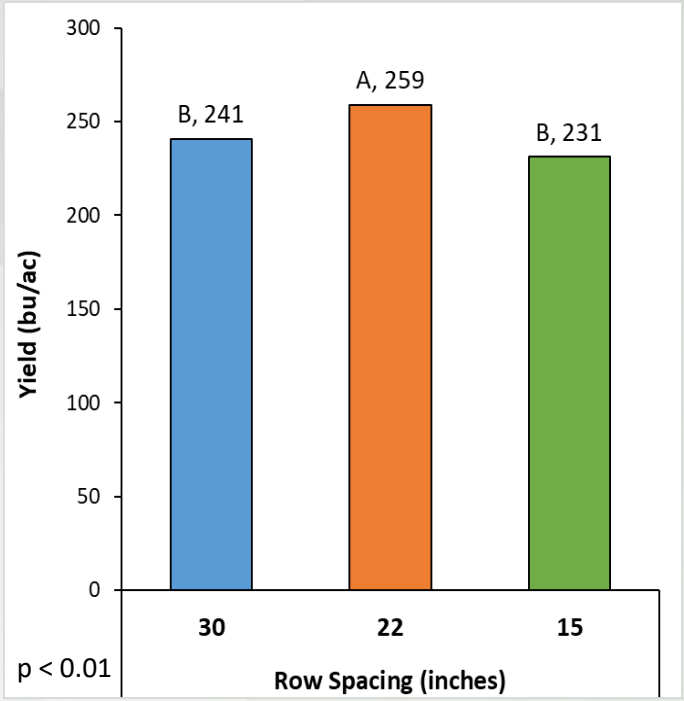
22” row spacing

15” row spacing

Yield (Michigan, 2024):

Field 1





Field 2

- No yield difference between short and tall hybrids
- Narrow rows showed yield improvement (varied by field)

30 inch rows at V10

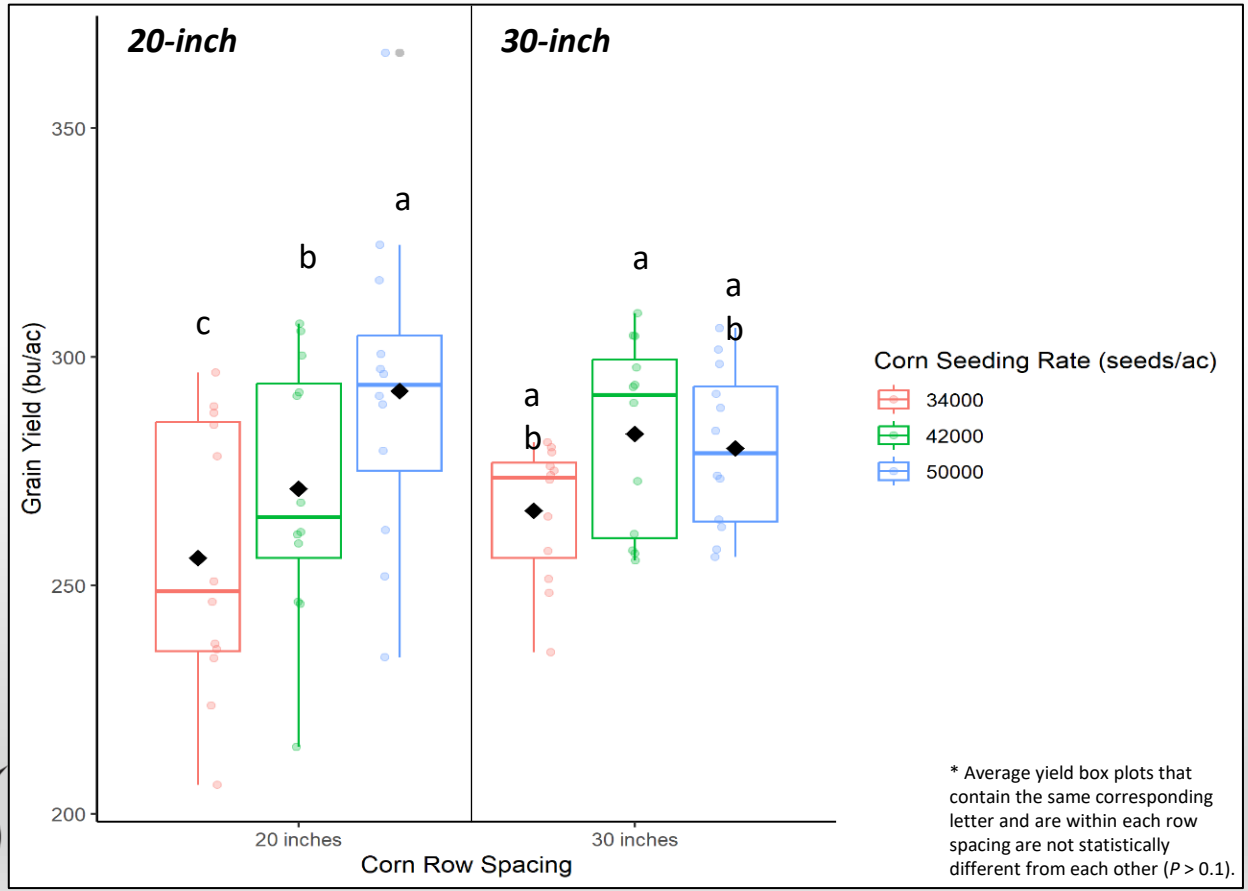
20 inch rows at V10

Short-Stature Corn Yield Response to Row Spacing

Location	Row Spacing	Yield
	---- in ----	---- bu/ac ----
West Lafayette, IN	20	275.1 a*
	30	276.5 a
Wanatah, IN	20	268.3 a
	30	249.0 b

* Average corn grain yield values that contain the same corresponding letter and are within the same location are not statistically different from each other ($P > 0.1$).

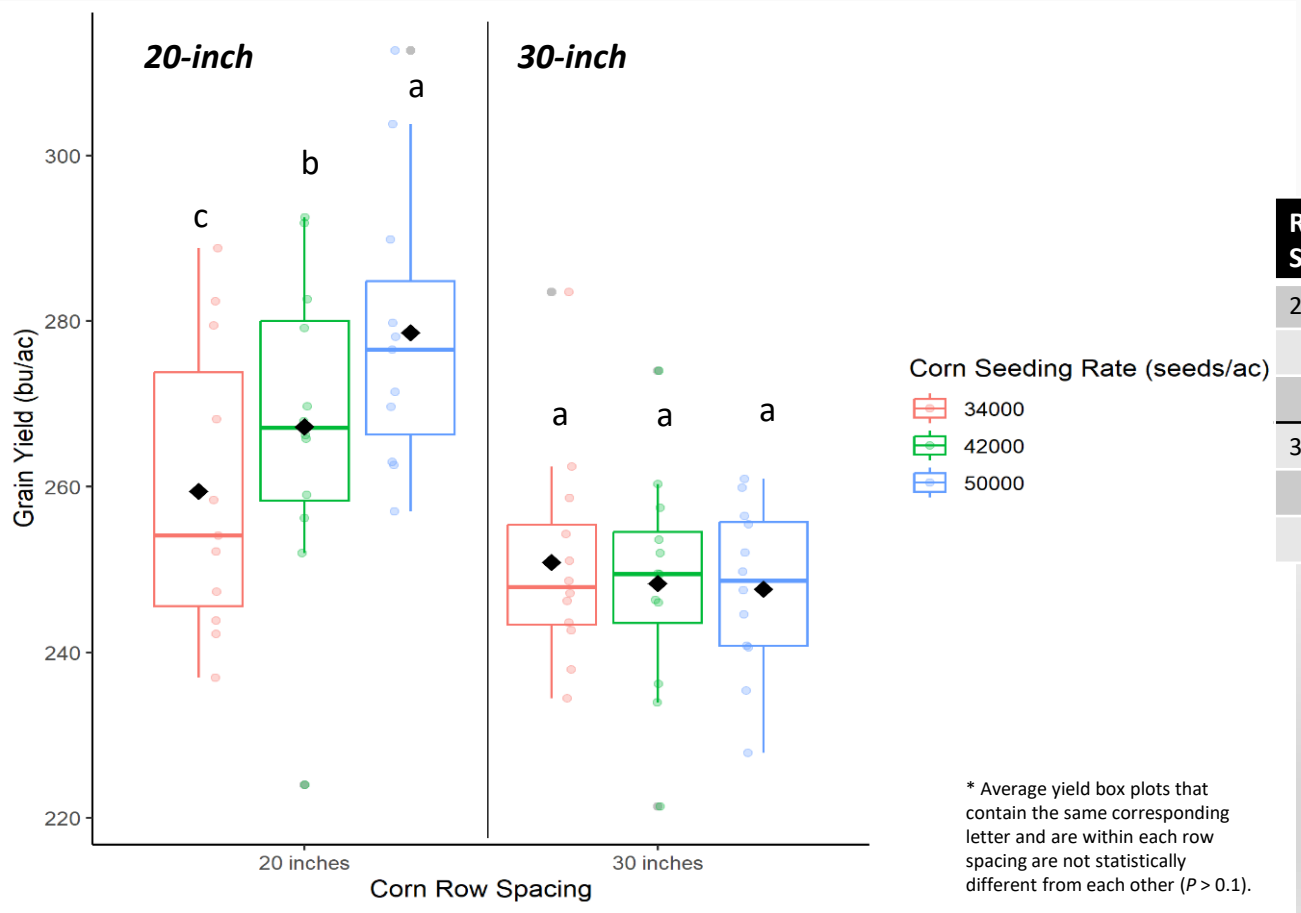
Interaction between corn seeding rate and row spacing (West Lafayette, IN)



* Average yield box plots that contain the same corresponding letter and are within each row spacing are not statistically different from each other ($P > 0.1$).

Row Spacing	Seed Rate	% Stand Est.
20”	34K	93%
	42K	94%
	50K	91%
30”	34K	95%
	42K	87%
	50K	82%

Interaction between corn seeding rate and row spacing (Wanatah, IN)



Row Spacing	Seed Rate	% Stand Est.
20”	34K	94%
	42K	94%
	50K	92%
30”	34K	96%
	42K	93%
	50K	84%

* Average yield box plots that contain the same corresponding letter and are within each row spacing are not statistically different from each other ($P > 0.1$).

Short-stature corn yield, ear height, and plant height response to hybrid type. West Lafayette, IN 2023

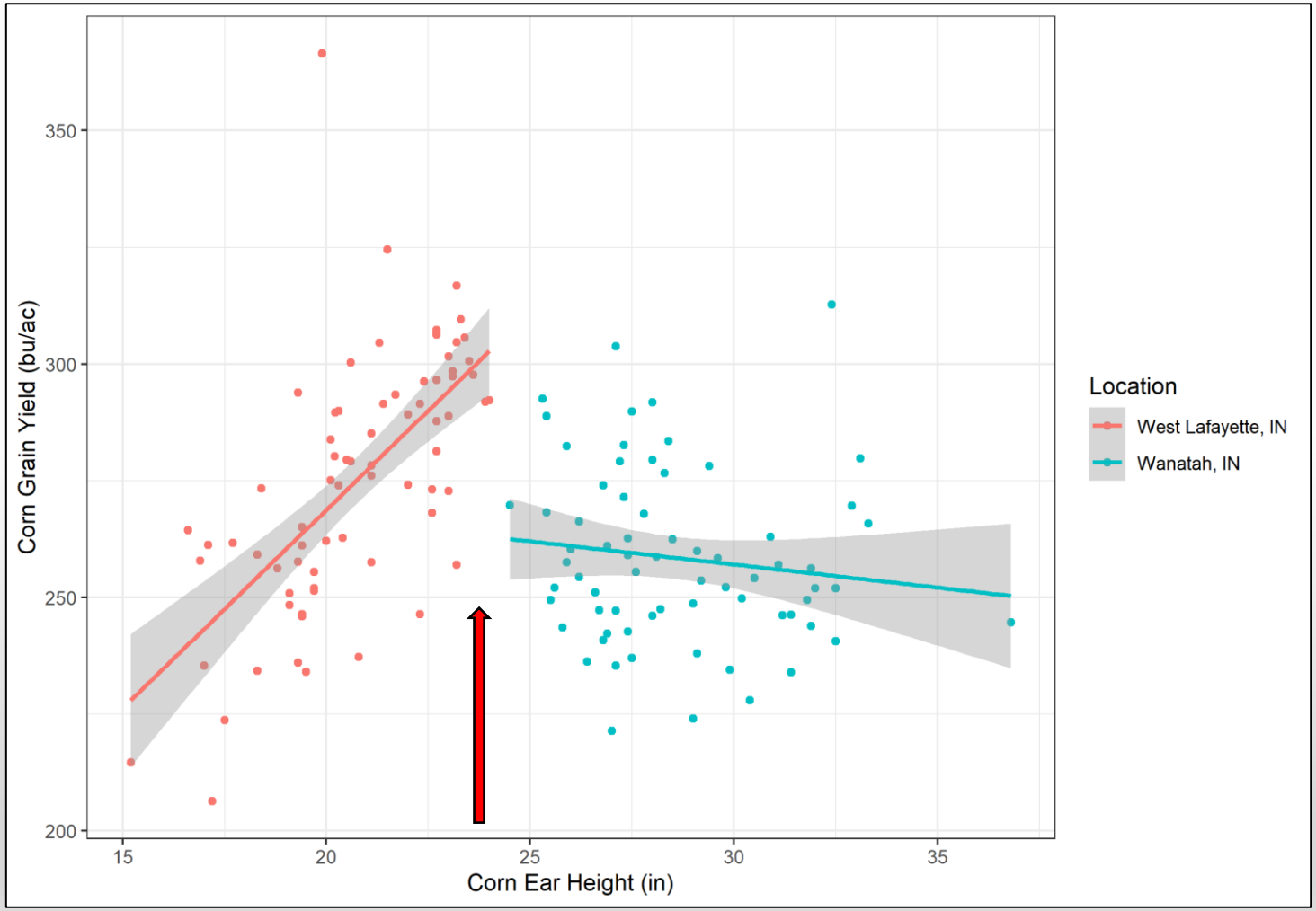
Hybrid	Yield	Ear Height (measured from shank attachment)	Plant Height (R3 growth stage)
	-- bu/ac --	-- inches --	-- inches --
RT6203TVXZ†	294.1 a*	22.4 a	67.3 a
RV6205TVXZ	280.7 b	21.1 b	65.1 b
RW5419KTFZ	252.5 c	18.7 c	65.0 b

* Average corn grain yield and height values that contain the same corresponding letter and are within the same column are not statistically different from each other ($P > 0.1$).

Short-stature corn yield, ear height, and plant height response to hybrid type. Wanatah, IN 2023

Hybrid	Yield	Ear Height (measured from shank attachment)	Plant Height (R3 growth stage)
	-- bu/ac --	-- inches --	-- inches --
RT6203TVXZ†	258.1 b*	29.4 ab	66.7 c
RV6205TVXZ	251.5 b	31.4 a	80.1 a
RW5419KTFZ	266.1 a	27.3 b	72.5 b

* Average corn grain yield and height values that contain the same corresponding letter and are within the same column are not statistically different from each other ($P > 0.1$).


Corn Grain Yield (bu/ac)
350
300
250
200
15
20
25
30
35
Corn Ear Height (in)
Location
West Lafayette, IN
Wanatah, IN

Preliminary Conclusions (Hybrid x Row Spacing x Seed Rate)

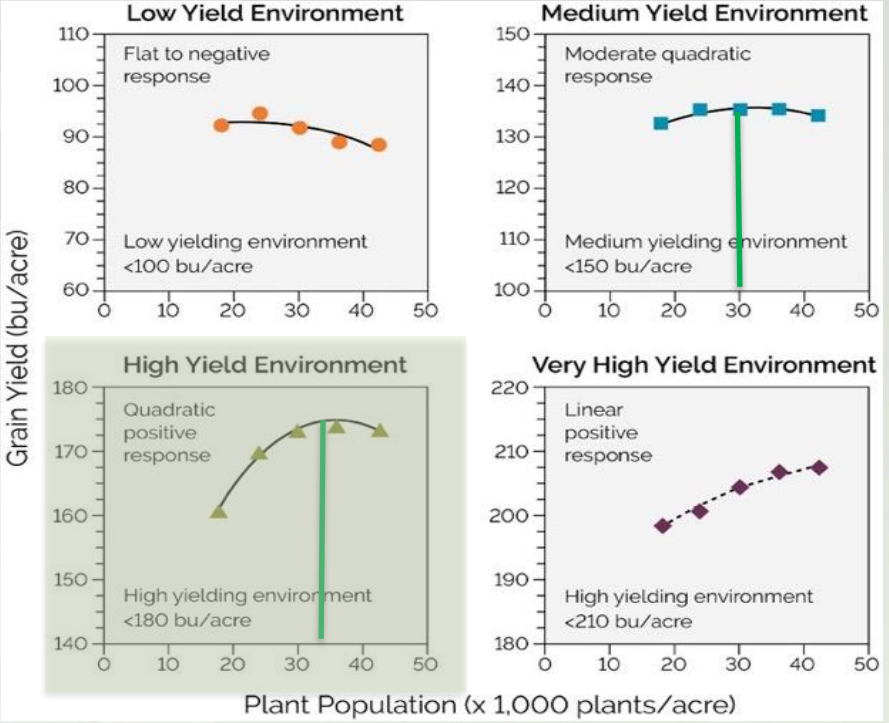
- Short-stature hybrids have higher optimum seeding rates and yield potential in narrow rows

- Ear Height is KEY
  - Hybrid selection
  - Environment
  - Management practices

How much seed is too much?

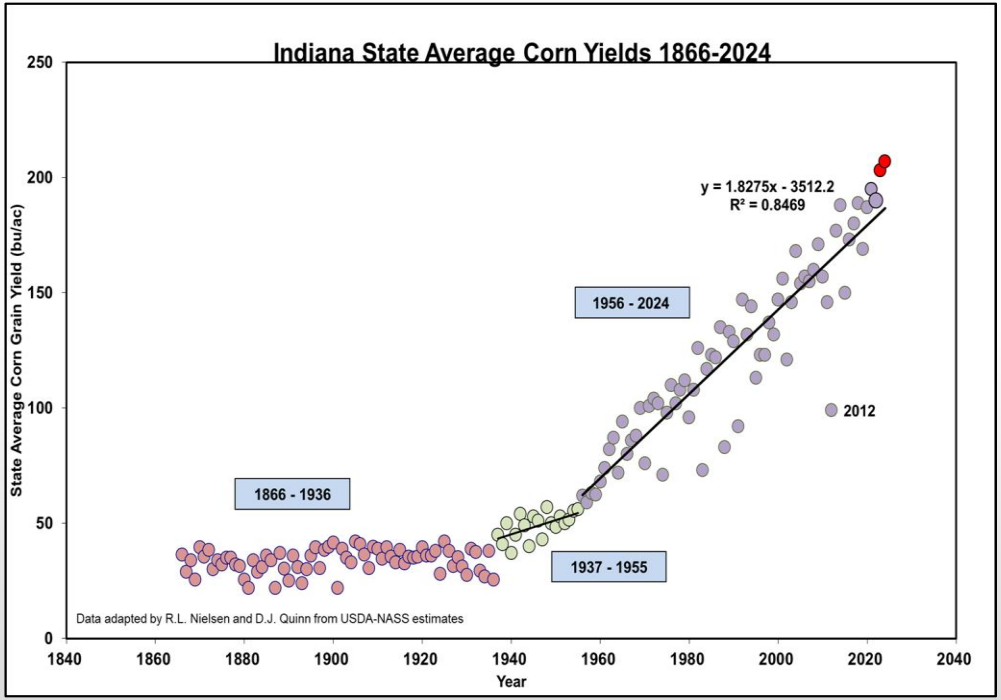
Corn Seeding Rate

- Based on <u>Yield Environment of Field</u>:
  - Low Yield Environments
    - **< 30k** plants/ac
  - Medium Yield Environments
    - **~30k** plants/ac
  - **High Yield Environments**
    - **32-34k** plants/ac
  - Very High Yield Environments
    - **> 34k** plants/ac
- Target Plant Stand vs Seeding rate (5-10% extra seed). Max yield vs profit?

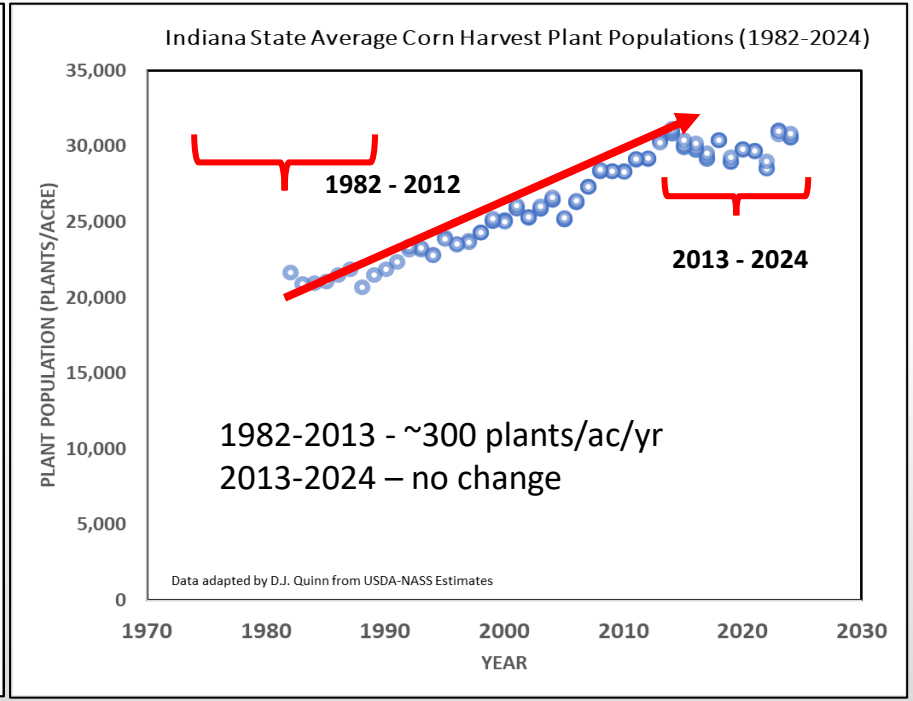


Source: Assefa et al., 2016

Historic State Yield Averages – Indiana (1866 – 2024)



Historic Harvest Plant Population Averages – Indiana (1982 – 2024)

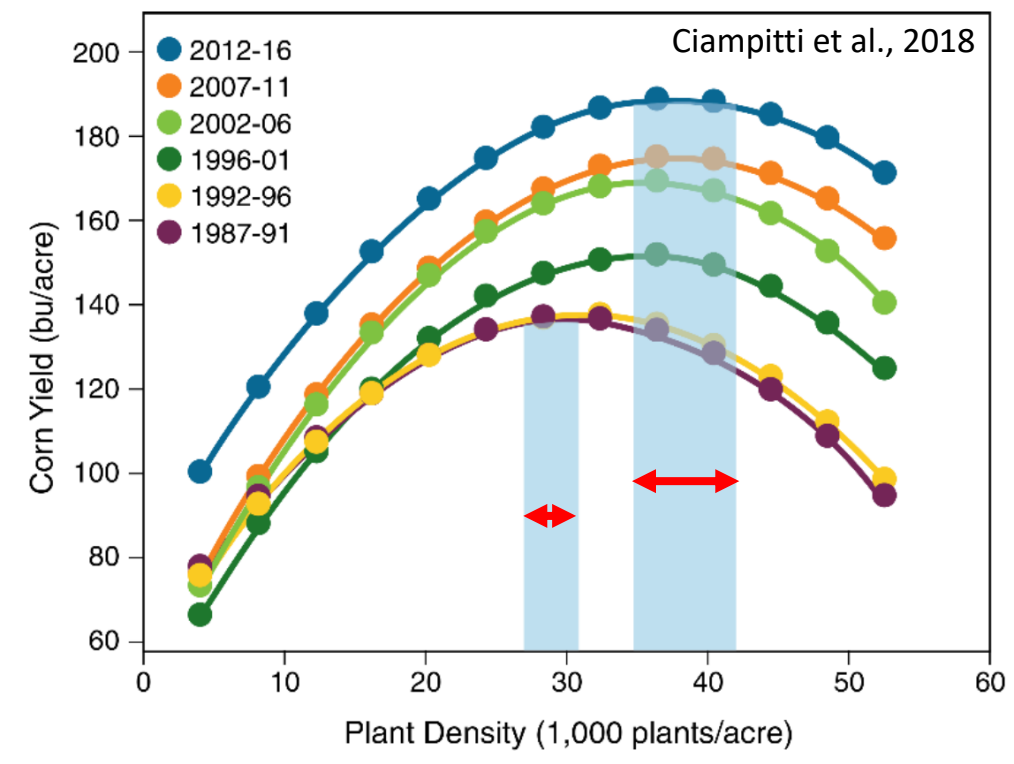


Indiana – 1.8 bu/ac/yr since 1956

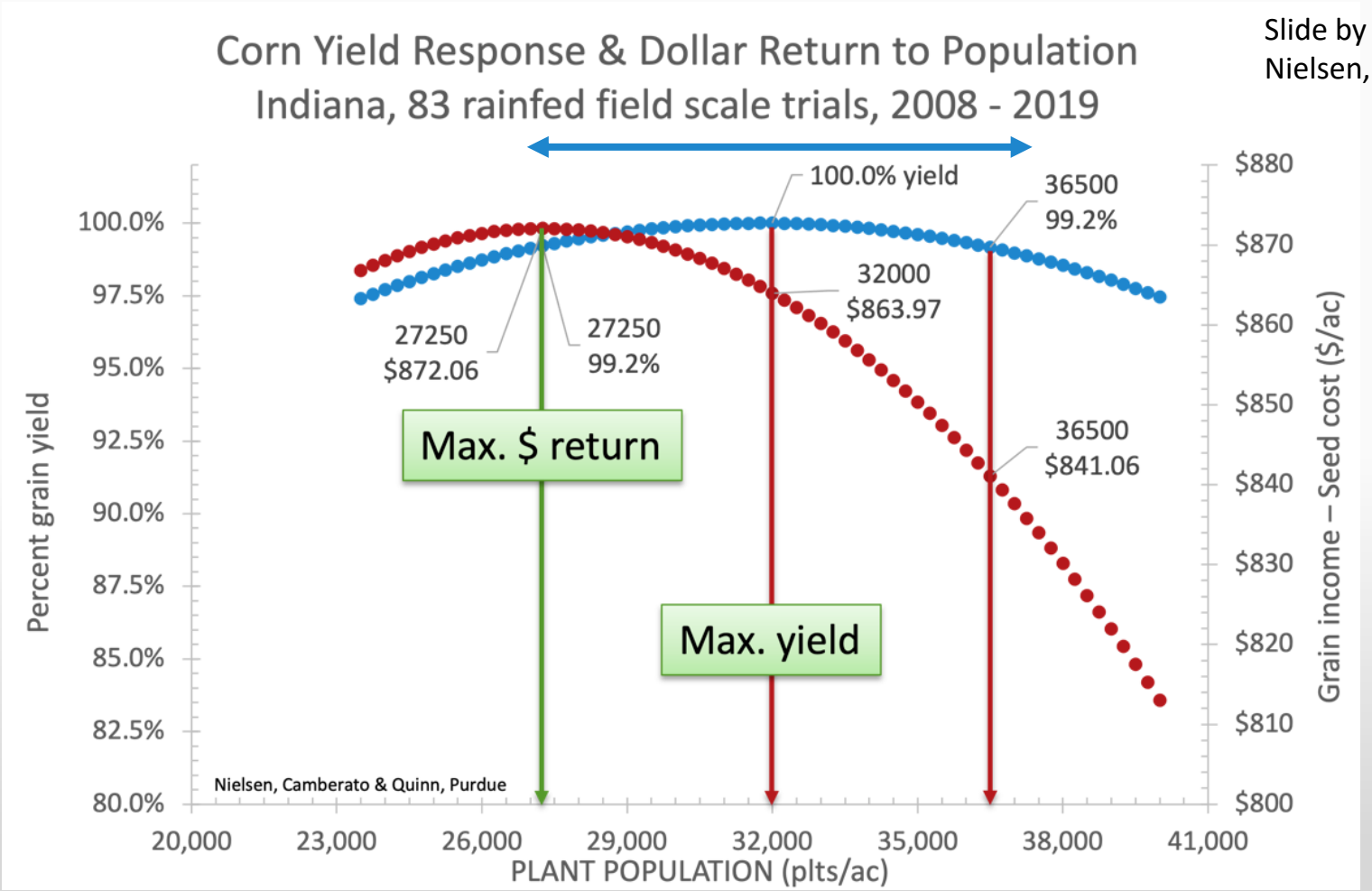
Minimal plant population changes from 2013 – 2024 (~-22 plants/ac/yr, R^2 of 0.01)

Do hybrids today require higher plant populations?

- Yes, ***but….***
- Current corn hybrids respond better to higher populations due to higher stress tolerance
- Optimum plant populations is wider in current hybrids
  - Plasticity ⬆



Slide by R.L. Nielsen, 2021



Why are Variable Seed Rate Prescriptions Challenging?

- Corn hybrids today obtain higher yields at higher plant populations (but also tolerate lower populations better, wider AOSR range)
  - Can we realize benefits outside of “extremes”

- Management zones (who, what, where?)
  - Spatially variable in the field, positionally stable over time
  - Ex: Variable rate P, K, and Lime vs. Variable rate N

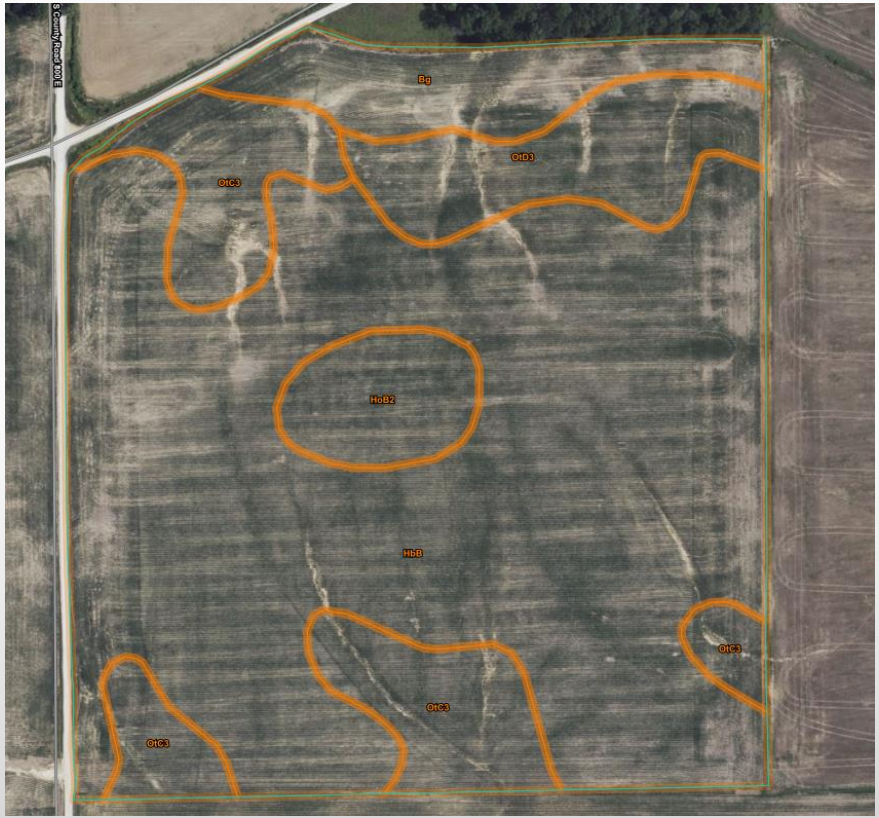
- Factor influence on optimum seeding rate (can I predict this?)
  - Stand establishment (planter, soil conditions, weather, pests)
  - In-season precipitation timing and amount

- Available data to back up the developed prescription?
  - Yield Response x Seed Rate (AOSR) within different in-field zones.

Factors to First Consider with Spatial Seeding Rate Responses

- ***Spatially variable in the field, positionally stable over time***

- **Soil Type**
- Soil Organic Matter
- Soil Electrical Conductivity
- **Elevation and Slope**
- Historical Yield Variability
- Combinations of above



Snapshot of Preliminary Results

- Agronomic Optimum Seeding Rate (AOSR) does differ spatially across fields
  - Soil type, drainage, slope, etc.
  - Well-drained Silt Loams – Highest AOSR (>38K seeds/ac)
  - Well-Drained Sandy Loams – Lowest AOSR (<30K seeds/ac)
  - Poorly-Drained Silt and Clay Loams – In the Middle (31 – 35K seeds/ac)

- Plant Stand Conclusions (70+ Seed rate Trials, 2008 – 2019)
  - Good capacity to hold water, and high soil productivity – >30K final stand
  - Poor capacity to hold water, and lower soil productivity –mid 20K final stand

- One shoesize does not fit all
  - Just because one assumption holds true in one location/field, doesn't mean it holds true in others.
  - Importance of localized data to evaluate and build variable rate prescriptions
  - ***Remember this for all agronomic management…***

Does planting multiple hybrids pay off?

Take home points

- Michigan weather is changing over time (warmer & wetter)
- Sound agronomic knowledge of the crop is critical for maximizing yield (and profits)
- Timely planting is critical, corn prefers stand uniformity (soybean can tolerate marginal field conditions/stand better than corn)
- Diversify hybrid maturities (use long RMs for early planting)
- Short corn hybrids have greater optimal seeding rate and yield potential under narrow rows. Managing ear height is key
- Variable rate seeding has the potential to improve profits, building prescriptions can be a challenge

Thanks!

Questions?

Manni Singh msingh@msu.edu 517-353-0226

agronomy.msu.edu

Dan Quinn djquinn@purdue.edu 765-494-524

thekernel.info

- **MSU/Purdue Technicians, grad/undergrad students**

Project GREEEN

CORN MARKETING PROGRAM CMPM OF MICHIGAN www.micorn.org

INDIANA CORN Marketing Council

MICHIGAN STATE UNIVERSITY | Extension

Seed companies

PURDUE UNIVERSITY | Corn Agronomy