

# Macros, Micros, and Magical Mixes: *Further Understanding Input-Intensive Management of Corn*

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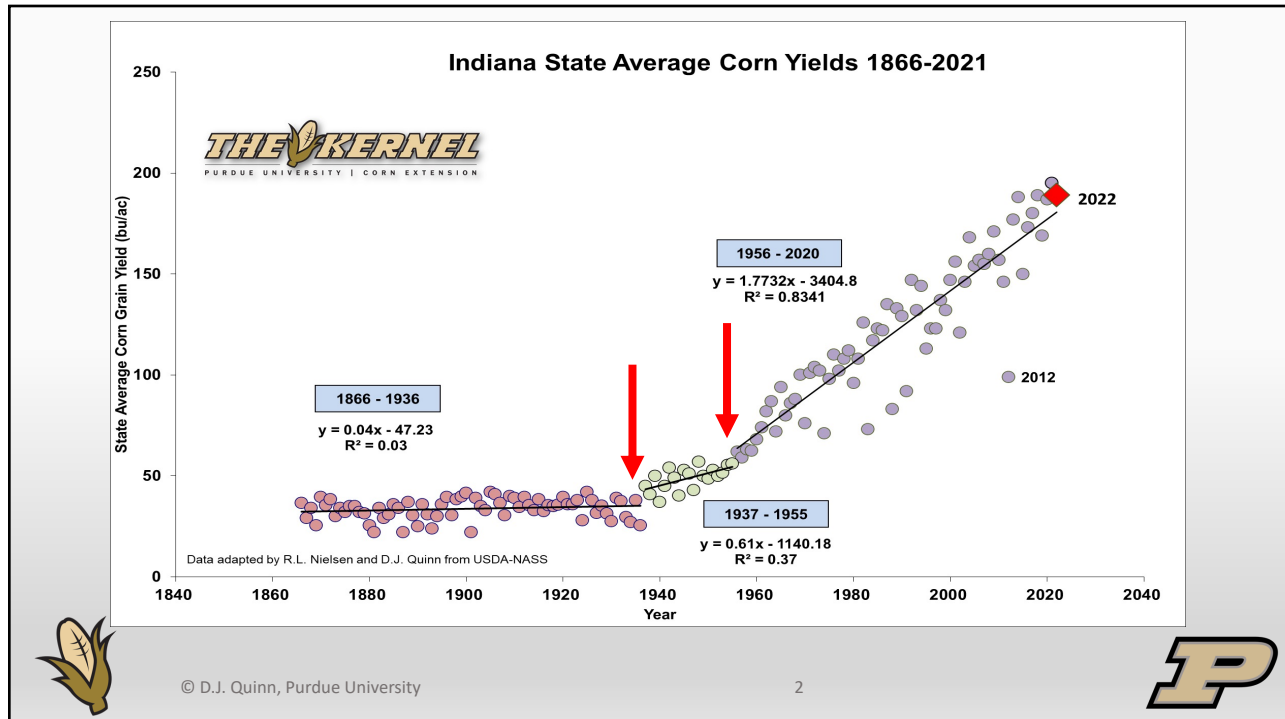


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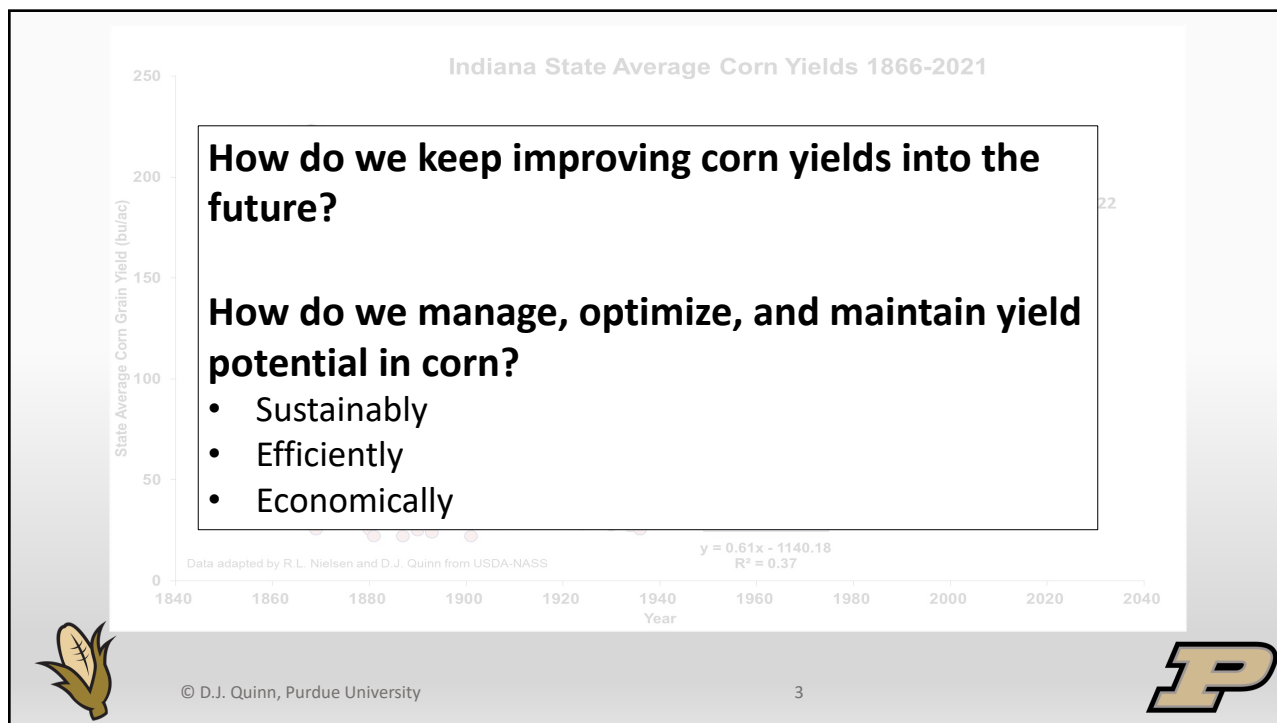
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## What Constitutes Corn Grain Yield?

**Corn Yield Boils Down To....**

- **Optimizing Kernel Number Per Unit Area**
- **Optimizing Kernel Weight**
- **Reducing Yield-Limiting Factors throughout the Season**

Seeding Rate, Starter Fertilizer and Fungicide      Sulfur, Micronutrients, Sidedress N Applications      Foliar Fungicide      Improved Plant Health = Longer Grain Fill Period = More Yield

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### Research Treatments Examined

- Control Treatment (C) – University seed rate and fertilizer recommendations (N only)
- C + Sub-surface banded (2x2) starter fungicide (Xyway)
- C + 20% increase in recommended seed rate (e.g., 30 to 36K seeds/ac)
- C + Sulfur fertilizer (5.2 gal/ac as ATS at V5 sidedress)
- C + Foliar micronutrients (Zn, Mn, and B at V6 growth stage)
- C + Late-season N (2x2 N + V5 sidedress N + V10-12 sidedress N)
- C + Foliar fungicide (Delaro Complete applied at R1)
- Intensive Treatment (All additional inputs applied together)



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### What are our Research Questions?

**1. Can we use input-intensive management practices to optimize and maintain corn plant health and yield throughout the season?**

- *Is this economical?*

**2. Does input-intensive management improve late-season corn health, kernel fill dynamics, and kernel weight?**

- *Specifically, fungicide applications*



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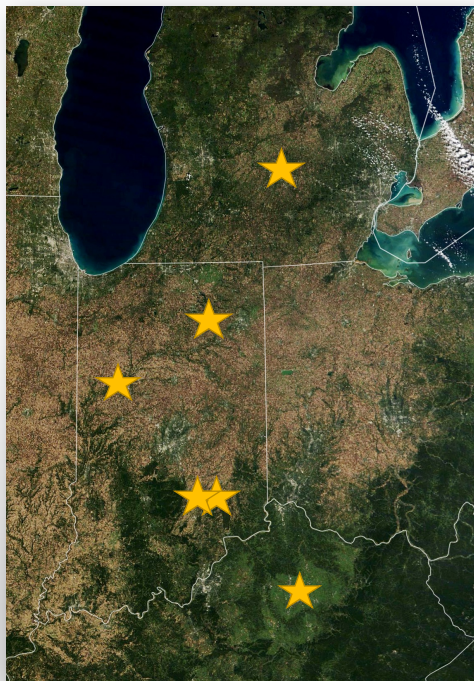


Research Trial Locations

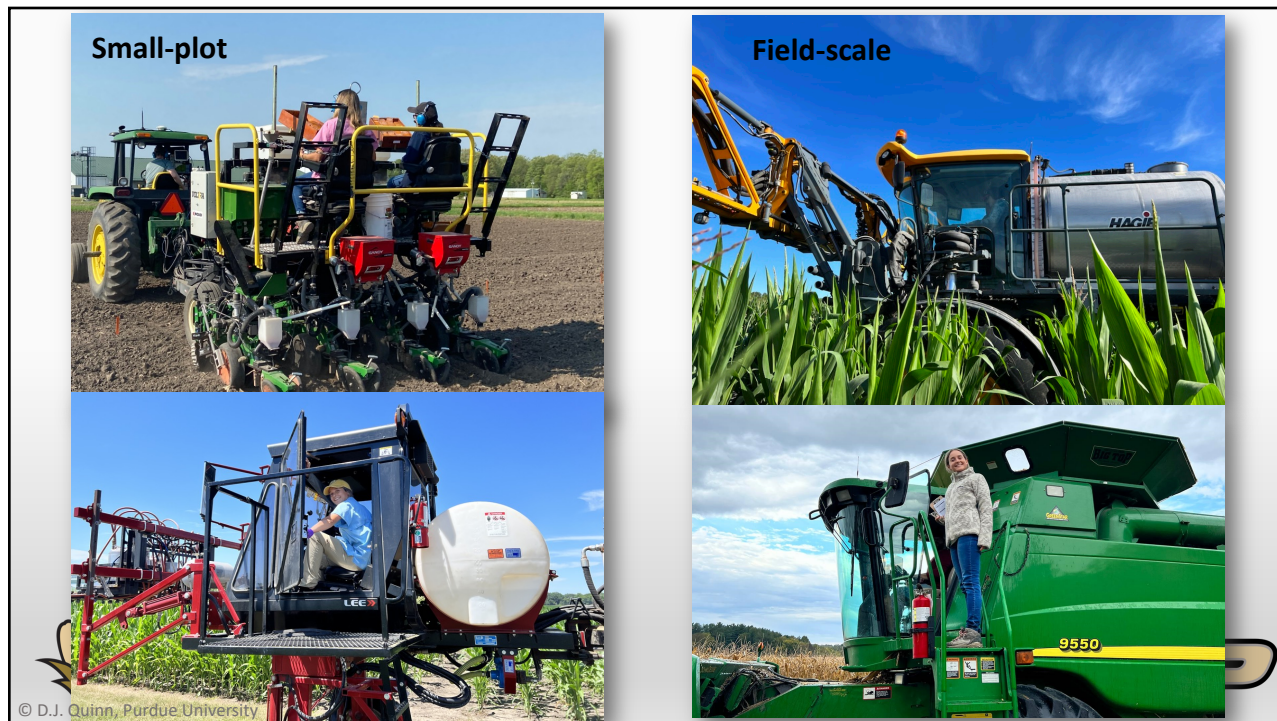
- **East Lansing, MI (Small-Plot)**
  - Conv. Till, Corn-Soybean, Rainfed
- **Columbia City, IN (Field-Scale)**
  - Conv. Till, Corn-Soybean, Rainfed
- **West Lafayette, IN (Small-Plot)**
  - Conv. Till, Corn-Soybean, Rainfed
- **Butlerville, IN (2x Field-Scale)**
  - No-till, Corn-Soybean, Rainfed
- **Lexington, KY (Small-Plot)**
  - No-till, Corn-Soybean, Irrigated



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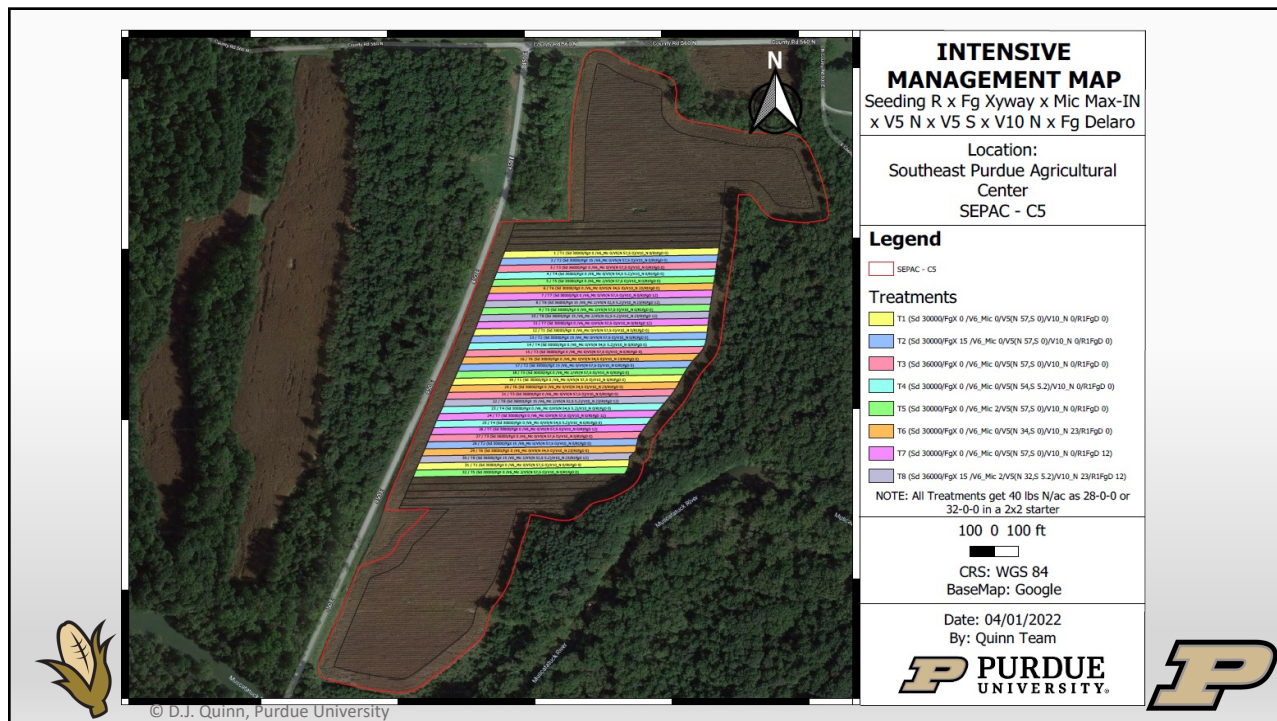
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### Benefits of Field-scale Research

- Research trials across bigger fields and larger plots
- Geospatial yield data, evaluate crop responses to examined treatments across different areas of the field

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Treatment Name	Columbia City, IN	West Lafayette, IN	Butlerville, IN	Lexington, KY	East Lansing, MI
----- Corn Grain Yield (bu/ac) -----					
Control (C)	221.1 d	199.9 c	261.4 d	226.1 ab	230.5 a
C + Starter Fungicide (Xyway)	228.1 bcd	201.5 c	267.9 ab	231.0 ab	228.5 a
C + High Seed Rate (36K)	230.3 bcd	212.4 bc	261.6 d	237.3 ab	233.8 a
C + Sulfur (ATS)	233.5 b	212.4 bc	266.5 bc	222.7 b	228.7 a
C + Foliar Micronutrient	231.3 bcd	208.4 bc	263.1 cd	234.8 ab	229.4 a
C + V10 Nitrogen	222.9 d	225.4 ab	267.5 ab	224.4 b	224.3 a
C + R1 Fungicide (Delaro Complete)	231.9 bc	220.8 ab	271.3 a	243.5 a	237.2 a
Intensive (All Inputs Applied)	249.2 a	233.2 a	270.9 a	222.8 b	239.5 a

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



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Treatment Costs

Treatment Name	Treatment Cost
	----- \$/acre -----
Control (C)	253.40
C + Starter Fungicide (Xyway)	280.83
C + High Seed Rate (36K)	272.72
C + Sulfur (ATS)	270.65
C + Foliar Micronutrient	274.14
C + V10 Nitrogen	261.06
C + R1 Fungicide (Delaro Complete)	277.89
Intensive (All Inputs Applied)	356.12

† Treatment costs were calculated as the combined cost of corn seed, fertilizer cost, chemical input cost, and application cost. Prices were calculated as an average from various local retailers. Net profit was calculated based on average harvest corn grain cash price + average grain yield – treatment costs.



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Treatment Name	Columbia City, IN	West Lafayette, IN	Butlerville, IN	Lexington, KY
	----- Net Income (\$/ac) -----			
Control (C)	1226.18	1108.84	1487.82	1252.43
C + Starter Fungicide (Xyway)	1238.72	1113.50	1503.12	1257.63
C + High Seed Rate (36K)	1260.81	1184.06	1469.80	1307.70
C + Sulfur (ATS)	1284.52	1180.81	1504.13	1212.53
C + Foliar Micronutrient	1266.39	1156.70	1478.01	1289.63
C + V10 Nitrogen	1223.59	1278.51	1520.38	1233.44
C + R1 Fungicide (Delaro Complete)	1266.76	1238.60	1528.69	1343.82
Intensive (All Inputs Applied)	1303.75	1304.08	1448.27	1127.73



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What about ROI (Net Income/Treatment Investment)?

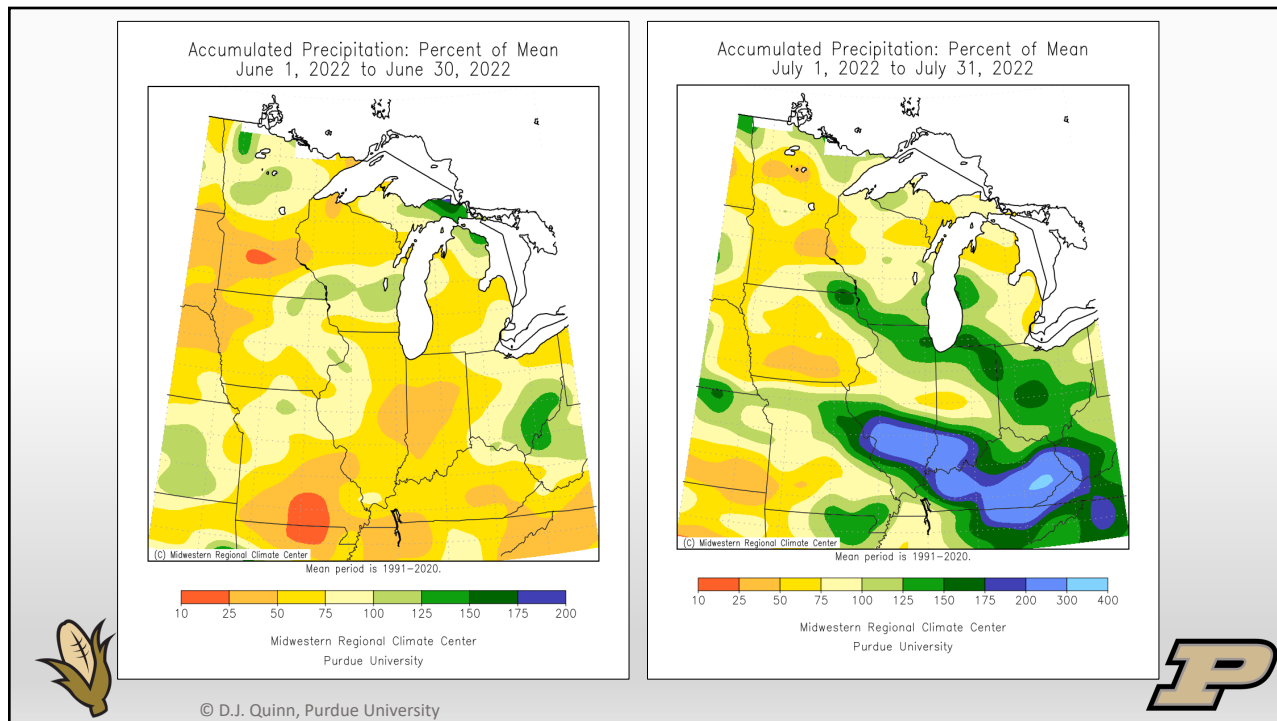
Treatment Name	All Locations Combined
	----- ROI (%) -----
Control (C)	-
C + Starter Fungicide (Xyway)	133
C + High Seed Rate (36K)	290
C + Sulfur (ATS)	261
C + Foliar Micronutrient	242
C + V10 Nitrogen	377
<b>C + R1 Fungicide (Delaro Complete)</b>	<b>393</b>
Intensive (All Inputs Applied)	110



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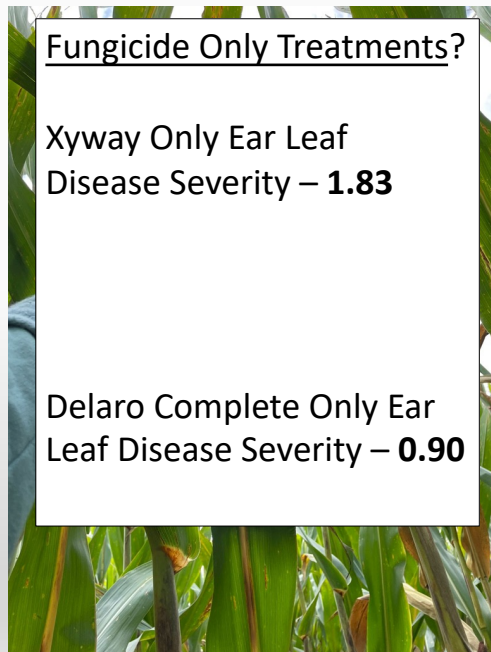


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Corn ear leaf disease incidence differences at the R5 growth stage. Butlerville, IN 2022



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Visual differences between control and intensive treatments at the R6 growth stage. West Lafayette, IN 2022



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### Take Home Points – Yield and Economics

- The Intensive Treatment (all inputs applied) out yielded the control by an average of **16** bushels across all locations examined
- Despite higher cost, the intensive treatment increased net income average by **\$115** and ROI was **110%** across all locations examined.
- **Sulfur, Late-season Sidedress N (V10-12), and R1 Fungicide drove observed yield responses at responsive locations**
  - S deficiencies, Dry conditions at V5 sidedress, and Foliar disease presence



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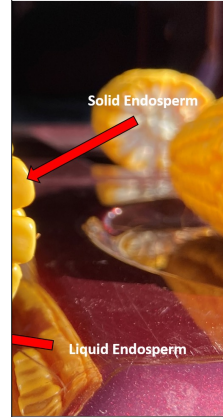
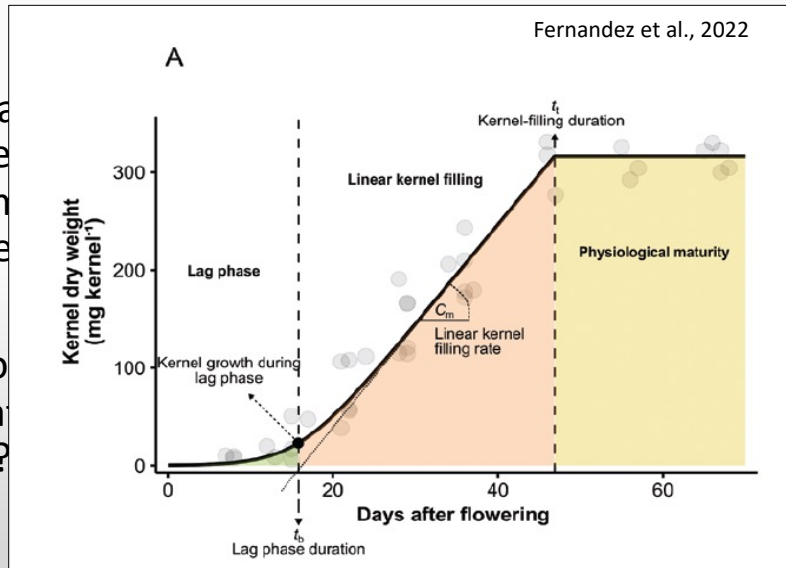


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Kernel Weight and Grain Fill Duration Importance

- If I visualize stay-green and corn management
- How do fill duration weight?



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Kernel Sampling Methods

- Ear samples from each plot of each study – kernel number and weight
  - How and when did treatments impact yield?
- Tracked kernel moisture, weight, dry matter, water content, grain fill duration in West Lafayette, IN



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Total Kernel Number and Weight Reference

Reference	1000 Kernel Weight (g)	Total Kernel Number
70,000 Kernels per Bushel	360	-
90,000 Kernels per Bushel	280	-
18 x 40 Ear (Rows x Length)	-	720
16 x 25 Ear (Rows x Length)	-	400



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Total Kernel Number and Weight

Treatment Name	Columbia City, IN		Butlerville, IN	
	Total Kernel #	1000 Kernel Wt (g)	Total Kernel #	1000 Kernel Wt (g)
Control (C)	630.6 cd	272.5 bc	592.5 bc	343.3 bc
C + Starter Fungicide (Xyway)	671.2 a	288.8 ab	602.1 abc	354.5 ab
C + High Seed Rate (36K)	623.4 c	258.2 c	600.8 abc	336.5 cd
C + Sulfur (ATS)	653.7 abc	289.8 ab	616.3 ab	351.0 bc
C + Foliar Micronutrient	639.9 bcd	278.7 b	626.8 a	352.0 ab
C + V10 Nitrogen	669.8 a	274.5 bc	614.1 ab	359.4 a
C + R1 Fungicide (Delaro Complete)	665.2 ab	303.2 a	626.9 a	351.0 ab
Intensive (All Inputs Applied)	632.5 cd	280.5 b	574.0 c	325.5 d

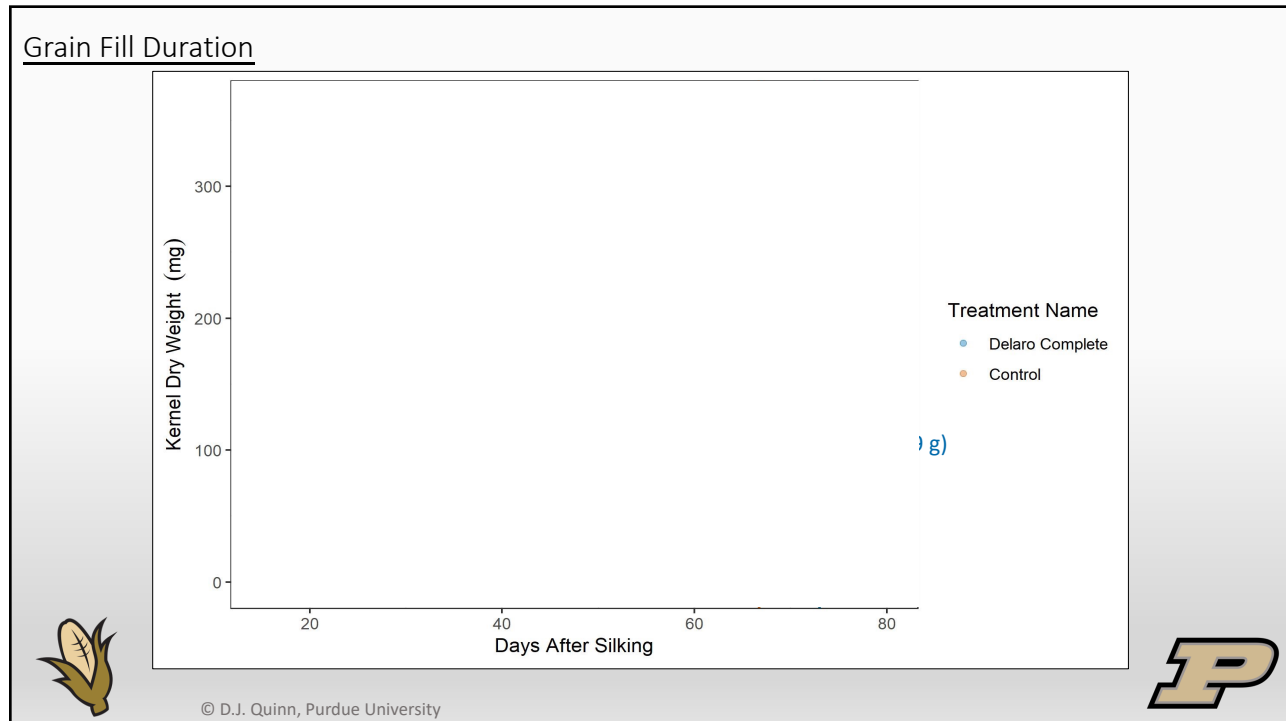


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### Take Home Points – Kernel Fill Dynamics and Kernel Weight

- Both R1 Fungicide and Late-season Sidedress N were the most consistent in improving plant stay green, total kernel number and kernel weight **WHEN** conditions were conducive for a response
  - Foliar disease presence
  - Dry conditions causing reduced plant N uptake
- R1 Fungicide has the potential to extend corn grain fill duration, thus driving the increase in kernel weight
- Preliminary results, data still being collected and processed

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## Overall Take Home Points - 2022

- Intensive management practices can increase corn yield and net profit
  - **WHEN** specific conditions are present to drive responses
  - Understand yield-limiting factors each year and how to manage them
- A 20% increase in seed rate (30 – 36K) **DID NOT** increase corn yield at **ANY** of the locations
- Foliar fungicide applications can increase corn grain fill duration, total kernel number, and kernel weight
  - **WHEN** foliar disease is present and adequate control is observed
  - **BE CAREFUL** with fungicide use - resistance
- **PRELIMINARY RESULTS**, more data, locations, and years needed and being processed



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## Questions?

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