Coton Production and Irrigation Management in Thermo-Limited Environments

Ogallala Aquifer "Big Cotton" Program Review

Texas Agronomic Report: Jourdan M. Bell, Dana Porter, and Thomas Marek

2025 OAP Project Meeting – Lubbock, Texas

February 13, 2025

Texas A&M AgriLife Research | Extension

USDA Agricultural Research Service

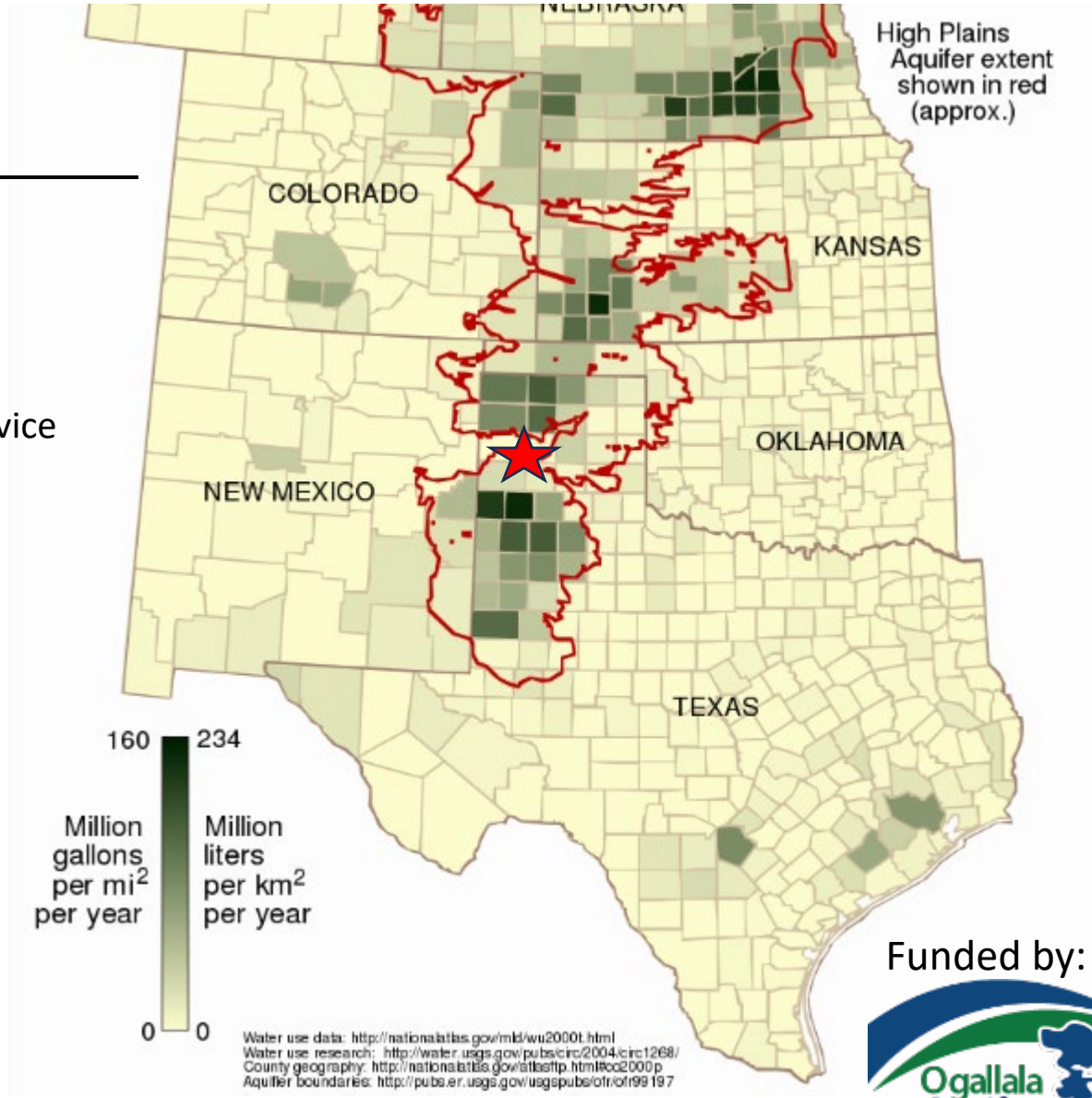
Ogallala Aquifer Program

Inconsistencies in cotton management led to collaborative cotton research initiative between Texas and western Kansas to optimize lint yield and quality in the Texas Panhandle and western Kansas.

Project Team

Investigators:

- Jonathan Aguilar, Kansas State University
- Louis Baumhardt, USDA ARS-CPRL
- Jourdan Bell, Texas A&M AgriLife Research and Extension Service
- Craig Bednarz, West Texas A&M University and Texas A&M AgriLife
- Andrew Wright, Texas A&M AgriLife Extension Service
- Bill Golden, Kansas State University
- Bridget Guerrero, West Texas A&M University
- Lucas Haag, Kansas State University
- Gary Marek, USDA-ARS-CPRL
- Thomas Marek, Texas A&M AgriLife Research
- Donna McCallister, Texas Tech University
- Dana Porter, Texas A&M AgriLife Extension Service
- Aleksey Sheshukov, Kansas State University



Funded by:

Ogallala Aquifer Program

Texas A&M AgriLife Research | Extension

Kansas State University

West Texas A&M University

Texas Tech University

USDA United States Department of Agriculture Agricultural Research Service

Objective 1

Develop cotton production recommendations through a multi-disciplinary systems approach in thermo-limited regions:

- Field research to improve existing cotton production recommendations for northern High Plains Environment
- Development of a revised cotton development curve – Bednarz

Timeline of Texas Events

2021	2022	2023	2024
Planting Date 1: 5/3/2021	Planting Date 1: 5/6/2022	Planting Date 1: 5/2/2023	Planting Date 1: 4/29/2024
Hailstorm 5/21/2021	Windstorm 5/10/2022	Waterlogged Field 5/15- 6/15/2023	Planting Date 2:
Planting Date 2: 5/24/2021	Planting Date 2: 5/31/2022	Planting Date 2: 6/19/2023	5/28/2024
Harvested 11/3 – 11/4/2021	Harvested 11/21-11/22/2022	Harvested 11/6 – 11/7/2023	Harvested 11/20 – 11/22/2024

Field Methods

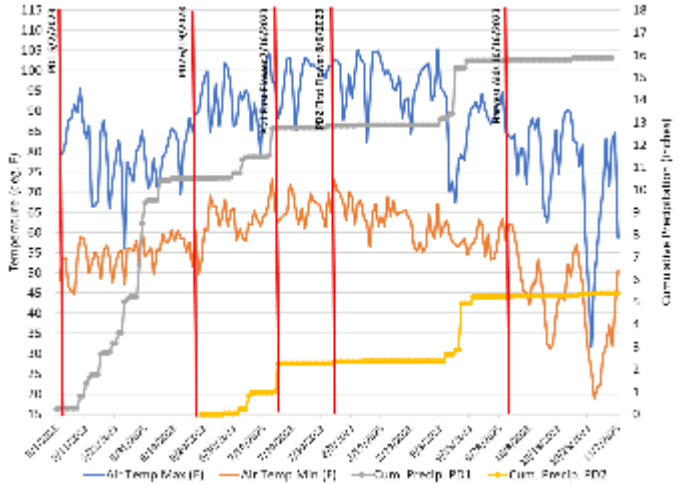
- Texas field plots - USDA-ARS Conservation and Production Research Laboratory and Texas A&M AgriLife Research Farm at Bushland under center pivot irrigation.
- Treatments represent genetic x environmental x management interactions and follow the same protocol at both locations.
- Two Enlist (2,4-D tolerant) varieties evaluated
  - Phytogen 205 W3FE: a broadly adapted early, more determinant variety
  - Phytogen 332 W3FE: early-med maturing less determinant variety
- Three populations (25K, 50K, and 75K plants ac^{-1}). Plots over planted and thinned to the desired population.
- Two planting dates (early- and late- May) and two irrigation levels (2- and 6- gallon per minute per acre well capacities).
  - Irrigation limited to capacity – no applications in response to MAD level

Year	Planting Date 1		Planting Date 2	
	2 GPA	6 GPA	2 GPA	6 GPA
	acre-inches /acre			
2021	7.3	11.2	7.3	11.2
2022	9.8	14.6	6.5	9.2
2023	7.3	10.3	5.5	7.3
2024	7.8	11.3	5.6	9.1

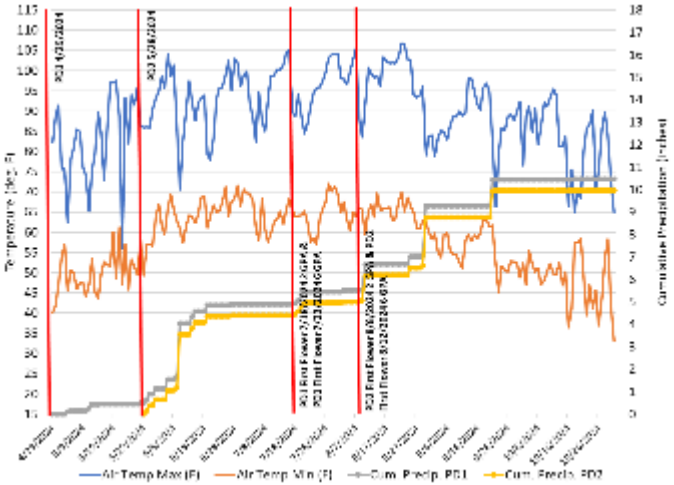
Weather Driven Fiber Development

- Long staple (>35 or 1.08”)
- **Premium mic (3.8-4.6)**
- High strength (>28 g/tex)
- High uniformity (>82)
- Smooth leaf (21/31 grades; 2-3 lf)

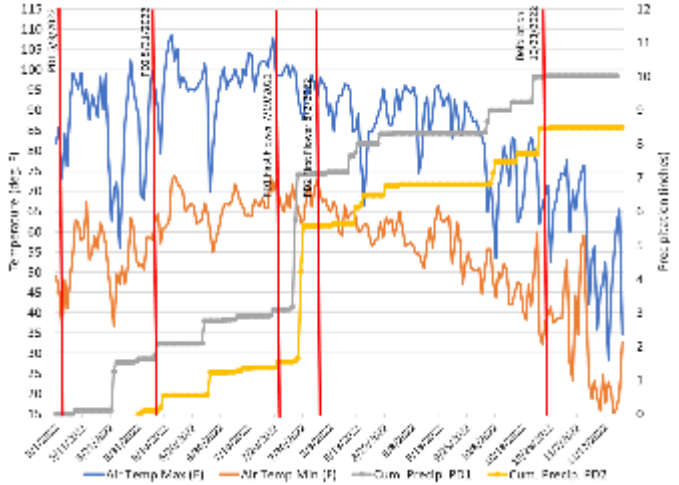
2021



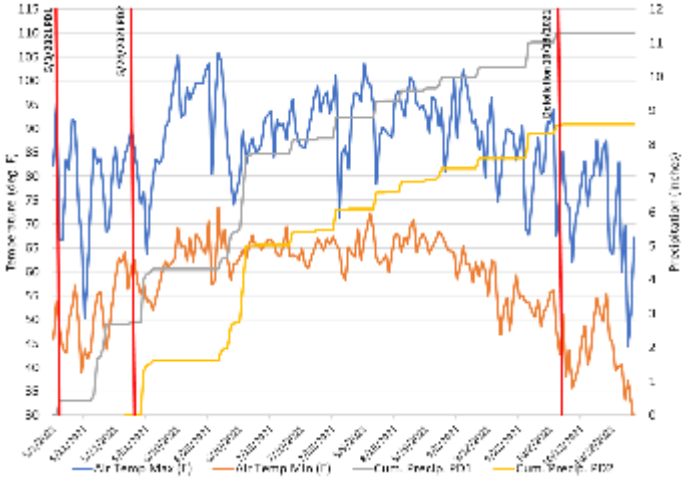
2023

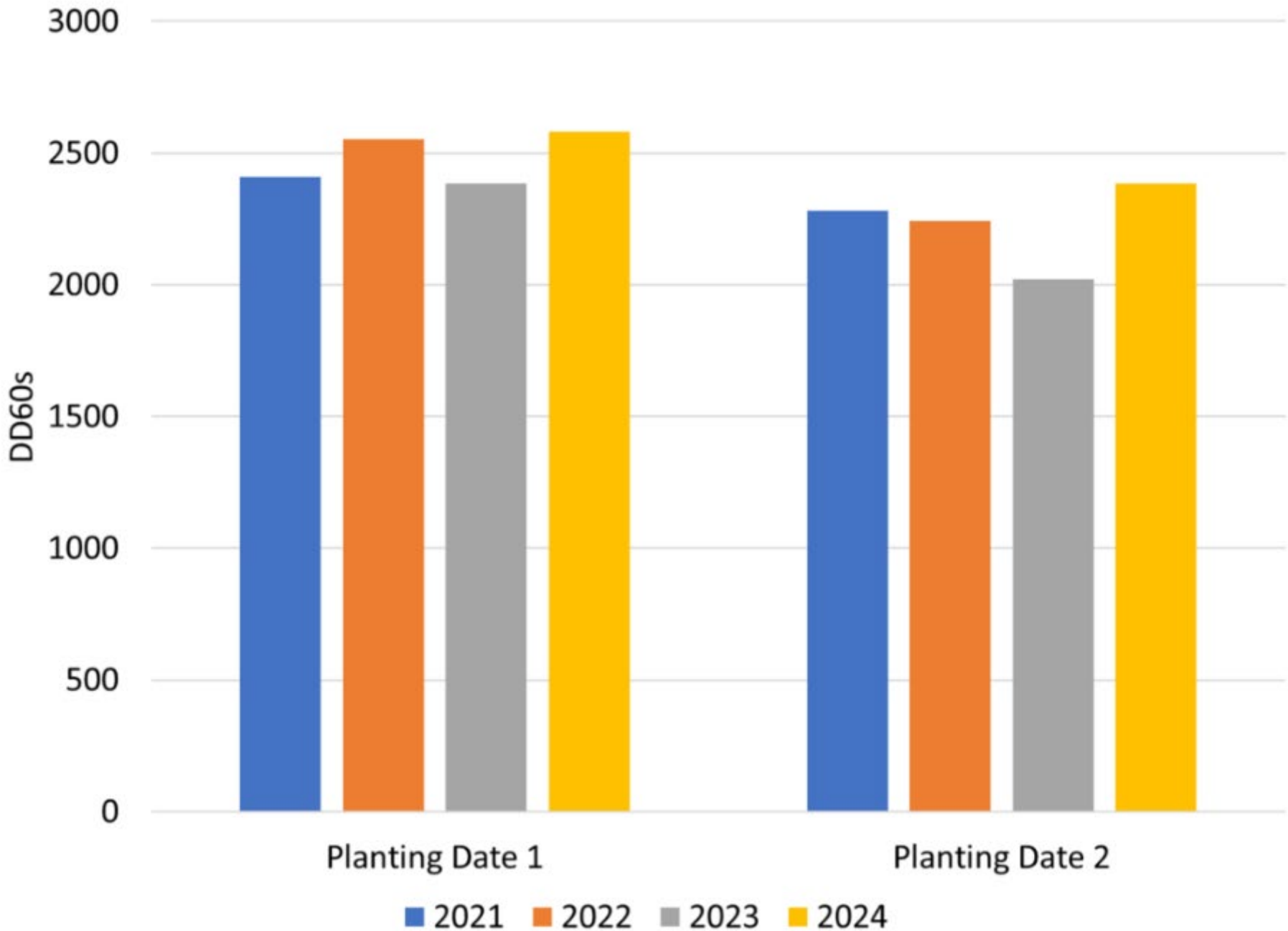


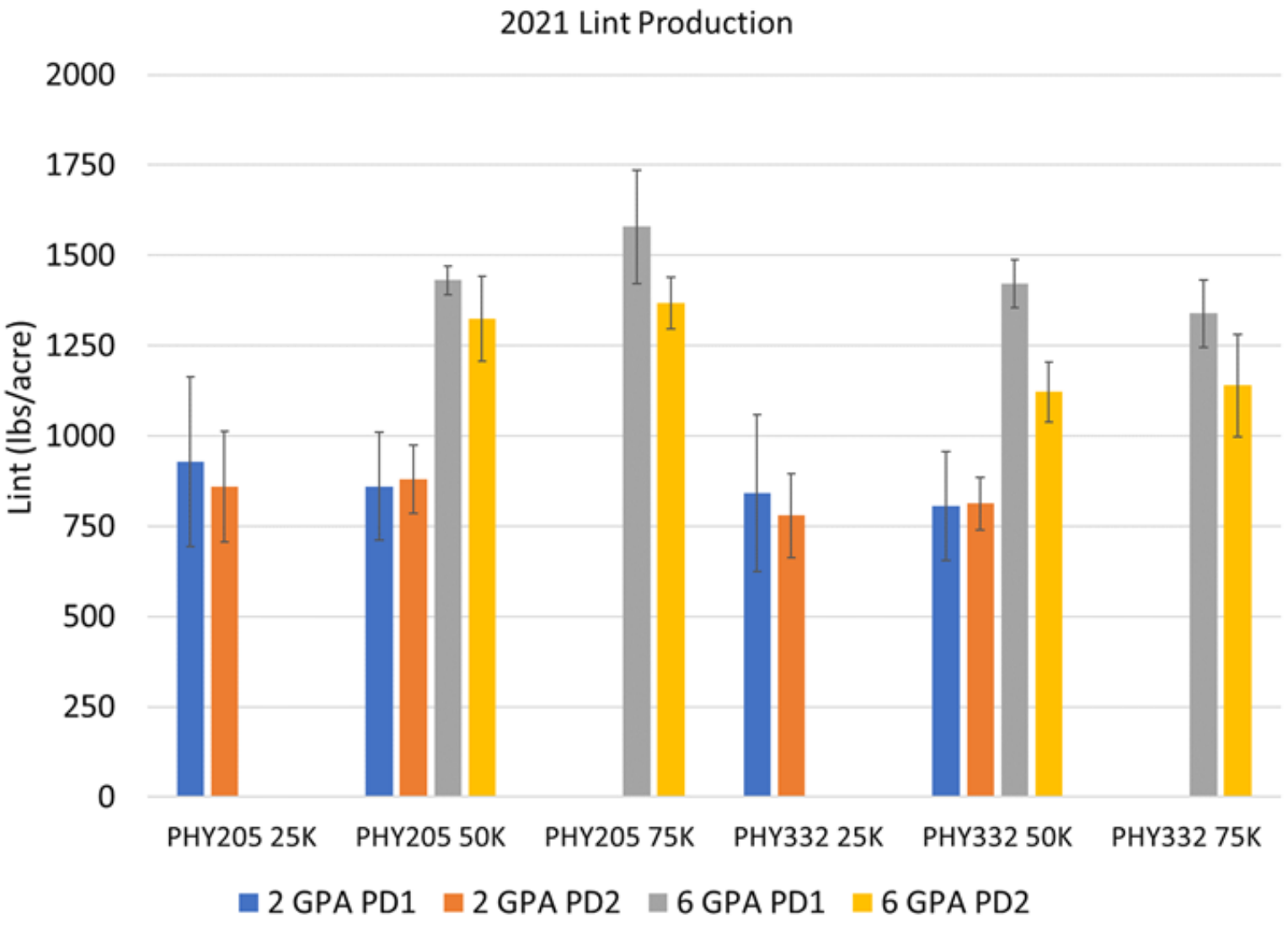
2022



2024

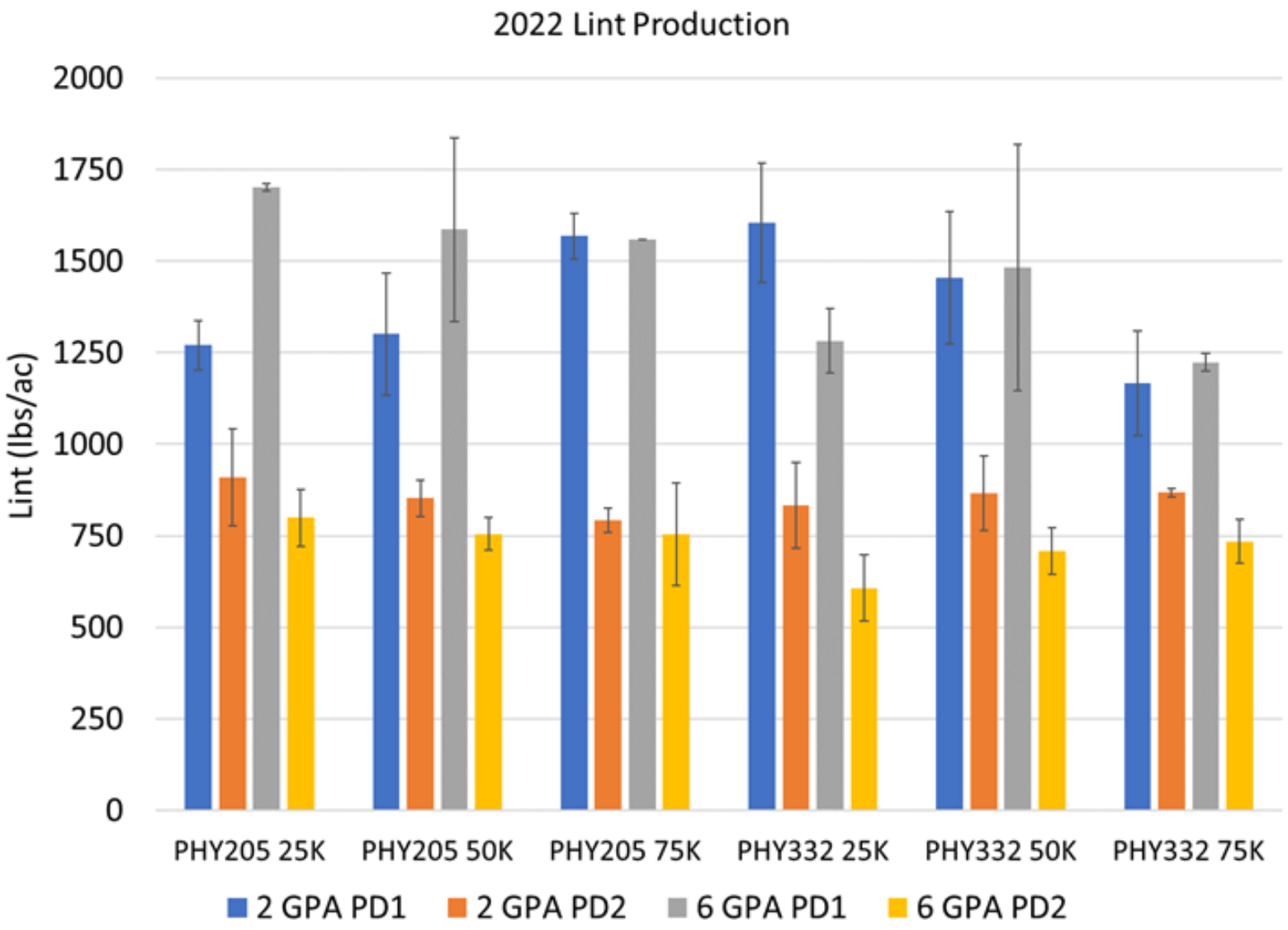



3000
2500
2000
1500
1000
500
0
DD60s
Planting Date 1
Planting Date 2
2021
2022
2023
2024



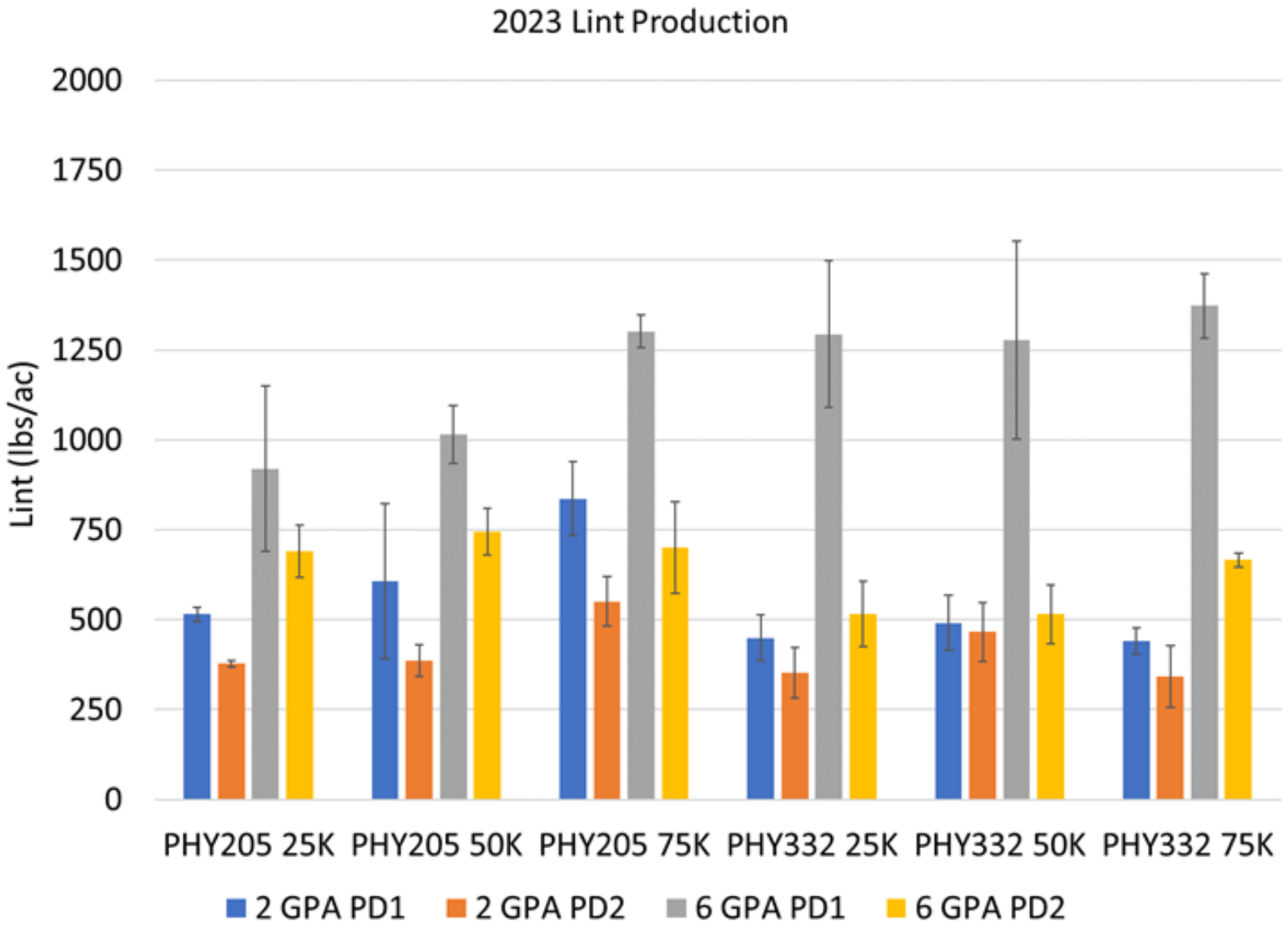
2021

- No difference between planting dates (p=1.0)
- Significant response to irrigation (p<0.0001)
- Varietal difference across planting dates (p=0.0107) No varietal difference within same planting date (p=0.0837)
- No difference between seeding rate (unbalanced) (p=0.5072)



2022

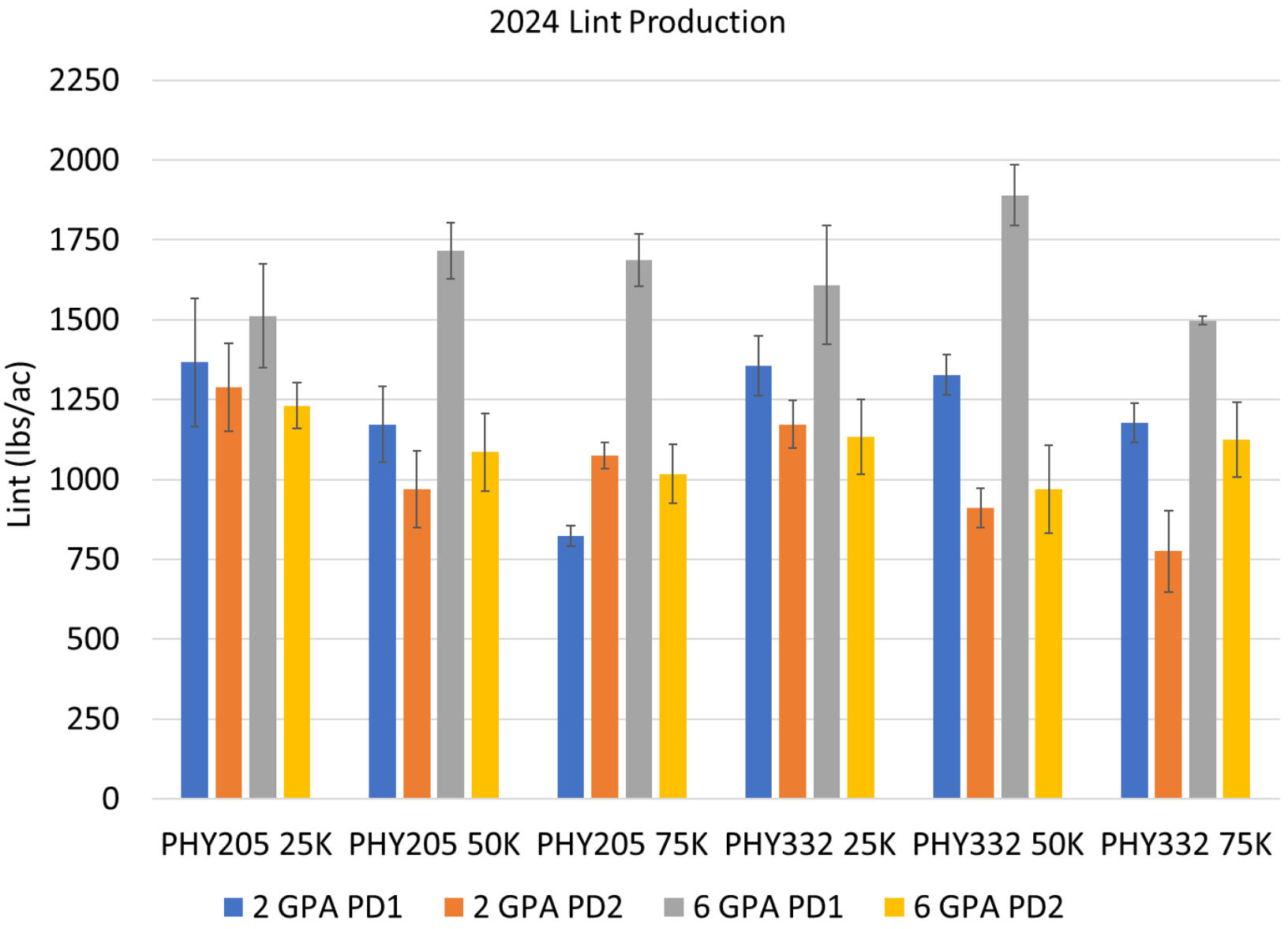
- Planting dates significantly different ($p<0.0001$)
- No significant response to irrigation ($p=0.5057$)
- No varietal difference ($p=0.0491$)
- No difference between seeding rate ($p=0.6576$)



2023

- Planting dates significantly ($p<0.0001$)
- Irrigation significantly different ($p<0.0001$)
- No varietal difference ($p=0.4155$)
- Seeding rates significantly different ($p=0.0068$) for PHY 205

PD	Irrig. GPA	Lint Yield (lbs./ac)
1	2	557
1	6	1196
2	2	413
2	6	639



2024

- Planting dates significantly ($p<0.0001$)
- Irrigation significantly greater PD1 6GPA ($p<0.0001$)
- Seeding rates not signif. ($p=0.2169$) but there is a signif. variety x SR X PD interaction ($p=0.0008$)

4-year Texas Lint Yields

- Planting dates significantly different in 3 of 4 years (2022, 2023, 2024)
  - PD1 outyielded PD2 or yielded the same as PD2
- Varieties alone only different in 1 of 4 years (2021)
- Seeding rates only significantly different in 2 of 4 years (2023 and 2024)
- Irrigation significantly different in 3 of 4 years (2021, 2023, and 2024), but there was a planting date interaction in 2024

Fiber

- Micronaire was significantly impacted irrigation in 3 of 4 years
- Planting date impacted mic in 2 or 4 years – later plating date did not have a premium mic
- Variety only impacted mic in 2 of 4 years
- Seeding Rate/Population only impacted in 1 of 4 years

Interaction	micronaire			
	2021	2022	2023	2024
Irrigation	<.0001	0.0199	0.9224	<.0001
Planting Date (PD)	0.2816	0.3445	<.0001	<.0001
Variety	0.0159	0.1083	0.0005	0.2898
Population	0.7887	0.1359	0.0317	0.3140
Irrig. x PD	0.0038	0.0002	0.0008	0.2976
Irrig. x Variety	0.0433	0.1502	0.1258	0.2159
Irrig. x Pop.	.	0.2338	0.7115	0.7738
PD x Variety	0.6955	0.1197	0.0155	0.0097
Variety x Pop.	0.6219	0.2508	0.5175	0.7925
Irrig x PD x Variety	0.3817	0.0348	0.0470	0.1698

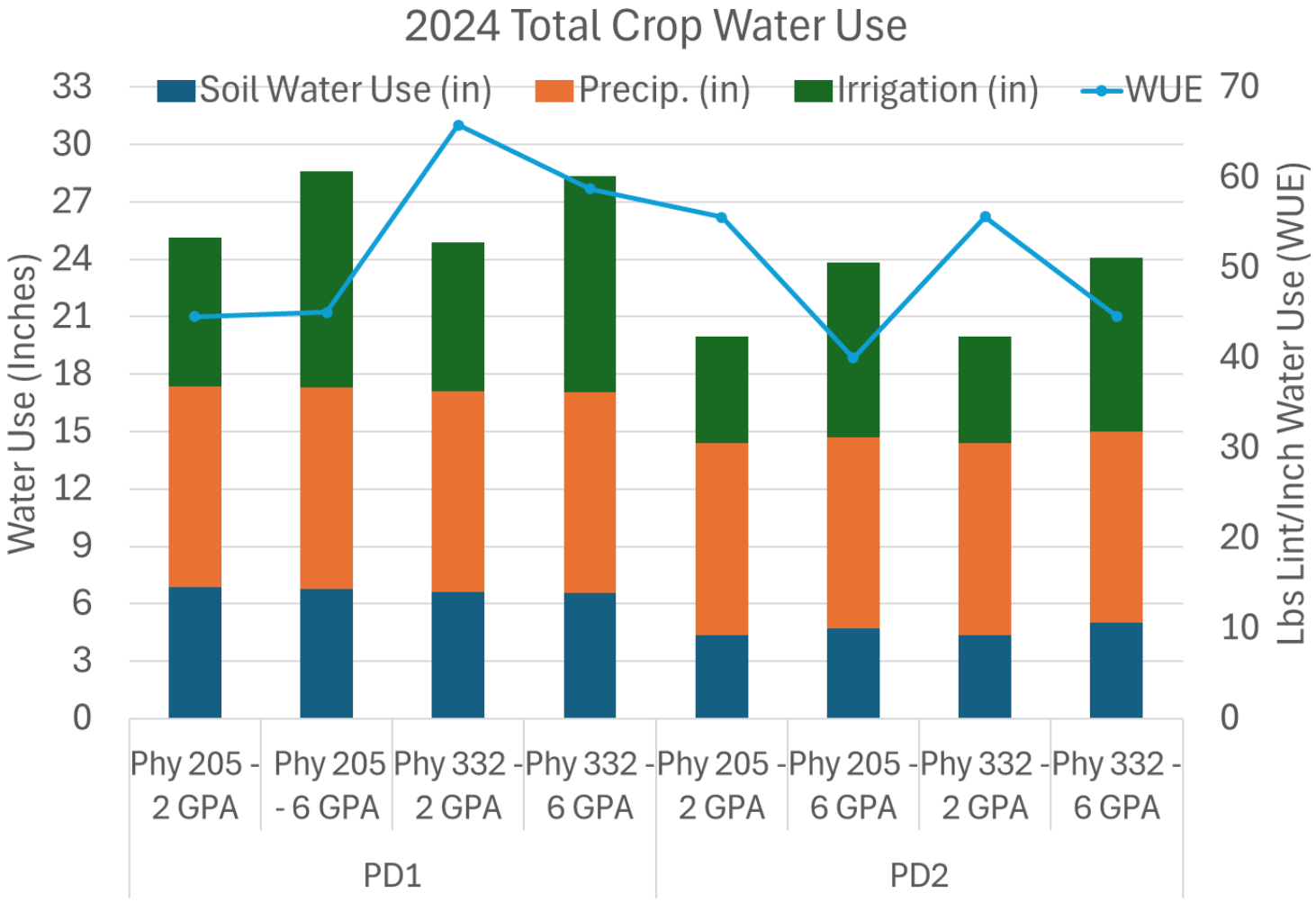
Weather and water availability influenced micronaire in 3 of 4 years.

TEXAS A&M AGRILIFE RESEARCH

TEXAS A&M AGRILIFE EXTENSION

Crop Water Use

- WUE significantly different between evaluated varieties
- Overall WUEs greatest for PD1
  - Water use greater for PD1
- Variety x Irrigation Rate x PD interaction
- Trend for less determinant variety to have greatest WUE at both irrigation levels
  - Early varieties shut down and do not recover
- 4-year data set confirms an inconsistent response to higher irrigation level



Texas 4-year Summary

- 2021 – no yield difference between PD1 and PD2
  - PD1 “hailed” out but retained
  - No benefit to replant
- 2022 – PD1 outyielded PD2
  - PD1 “blown” out but retained
  - Yield loss by replanting
- 2023 – PD1 yield the same or outyielded PD2
  - PD1 sat in water logged soils for ~3 weeks
  - PD2 planted on June 19 did not “fail”
- 2024 - PD1 yielded the same or outyielded PD2
- Is it worth replanting?
  - 4-year data shows either no difference or yield loss
  - time, labor, and seed cost
- Water use not effected by seeding rate/pop or variety.

Questions?

We appreciate ALL the field assistance from Carla Naylor, Kevin Heflin, Jessica Smith and student employees