Cotton Physiology

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GEORGIA COTTON COMMISSION

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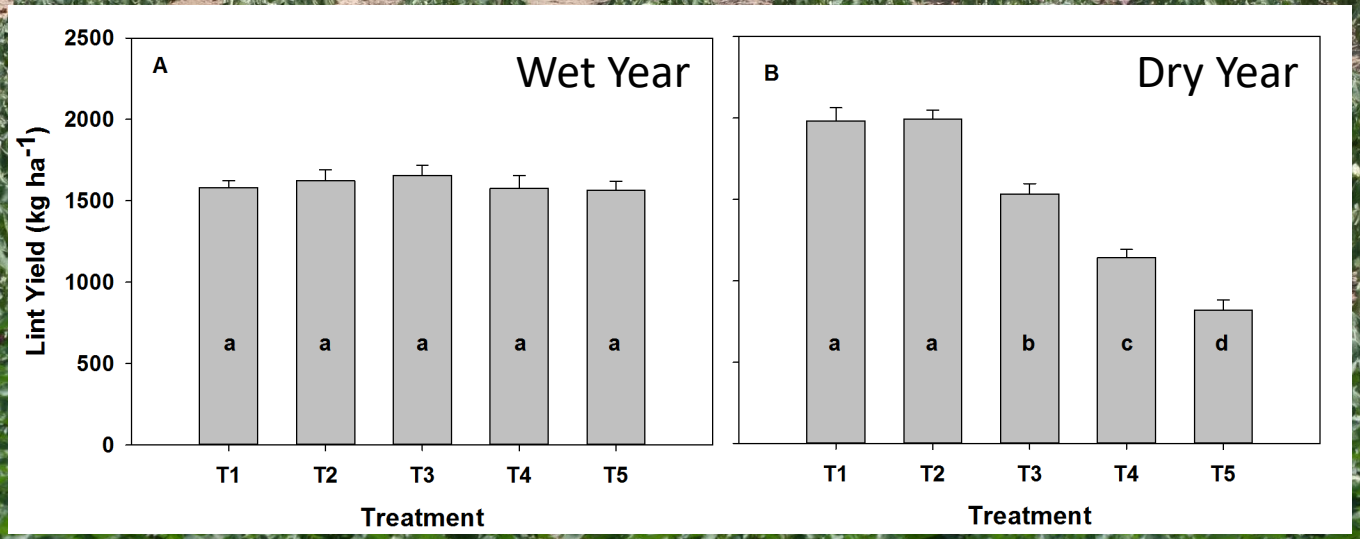
Drought

1. Decreases leaf area expansion, plant height, fruiting sites, etc.
2. Decreases light interception and canopy photosynthetic rates.
3. Hastens maturity, decreases boll numbers and (sometimes) boll mass.
4. Reduces yield.

Drought



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2. Decreases light interception and canopy photosynthetic rates.
3. Hastens maturity, decreases boll numbers and (sometimes) boll mass.
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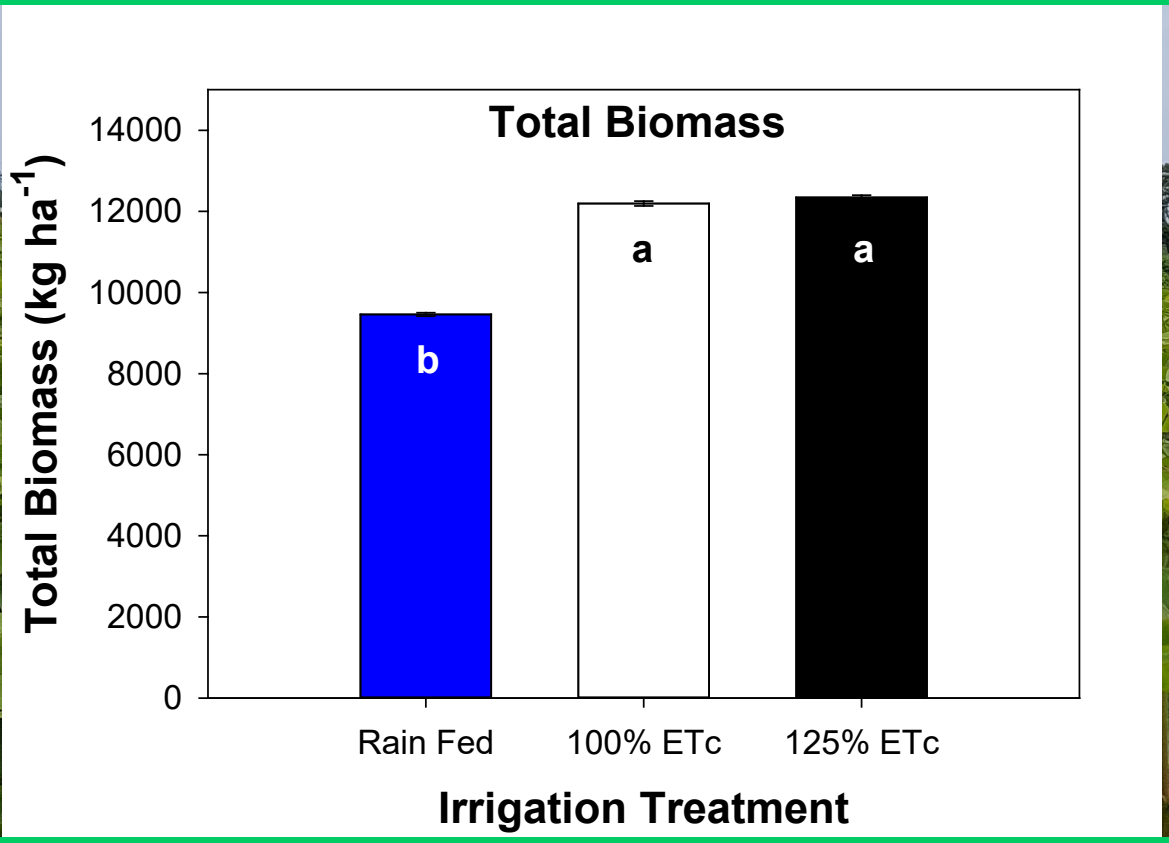
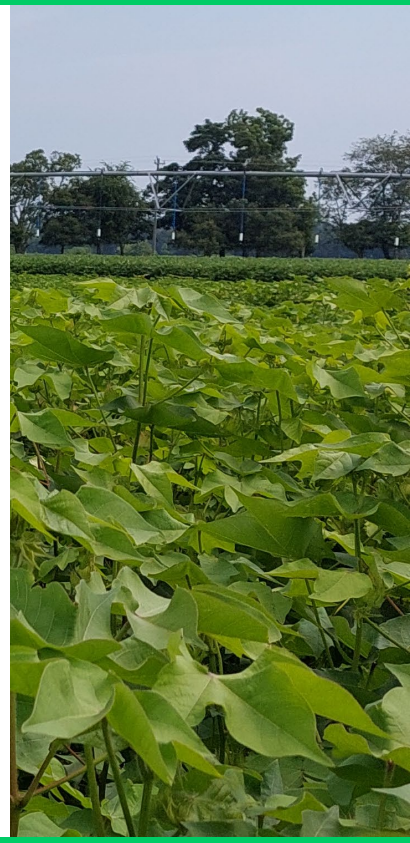
Water Excess

1. Can produce rank growth.
2. Decreases light interception and fruit retention at lower nodes.
3. Can delay maturity and (sometimes) decrease yield.

Water Excess





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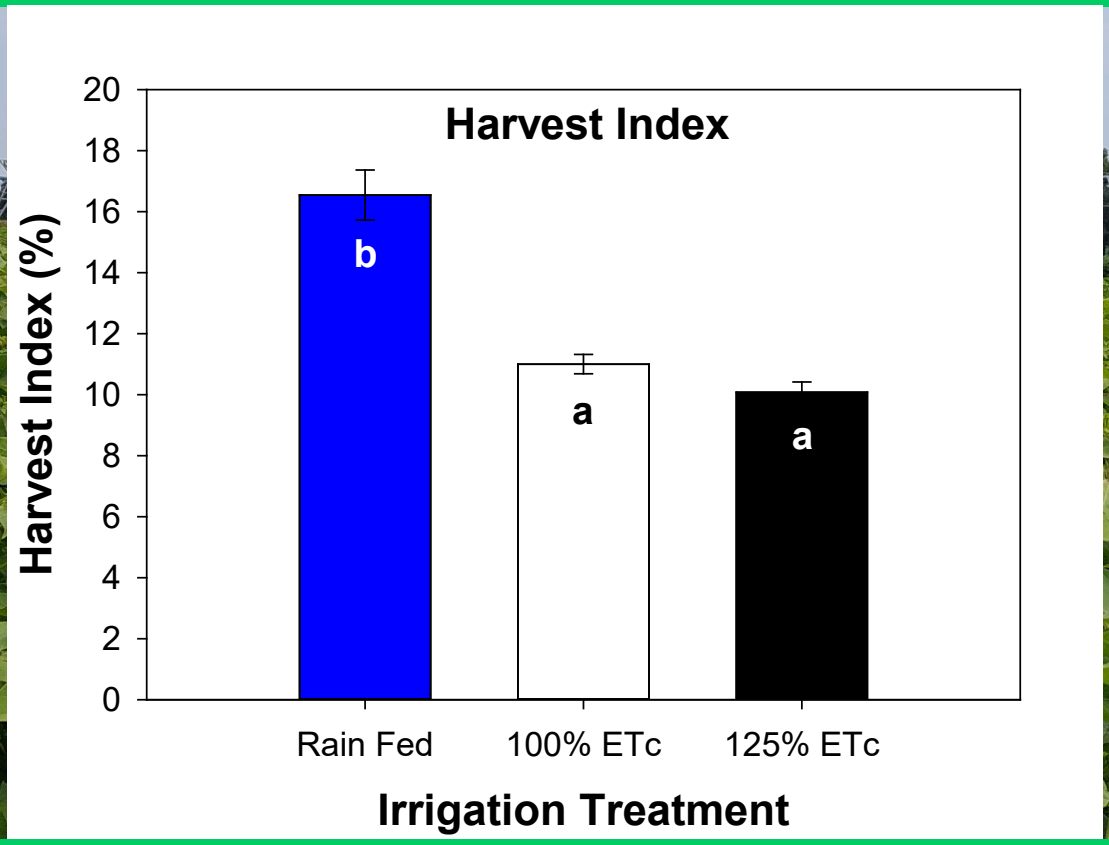

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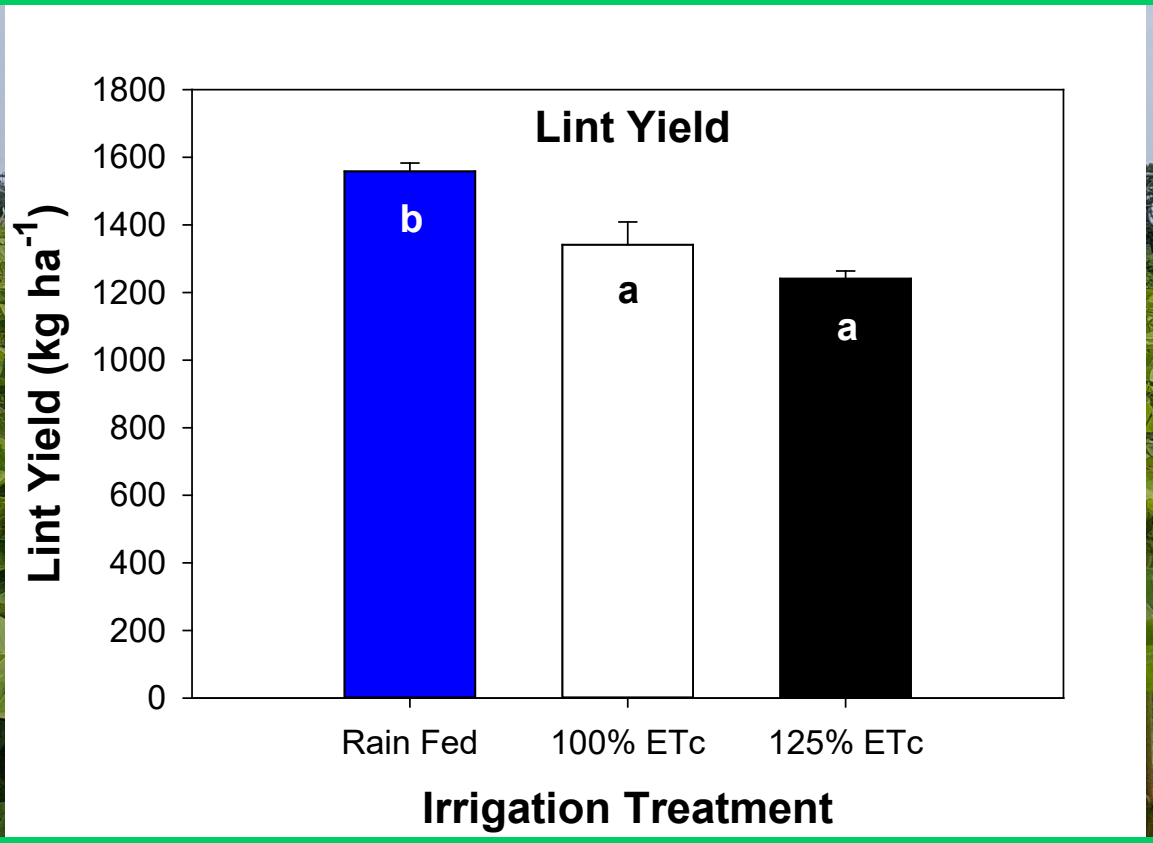

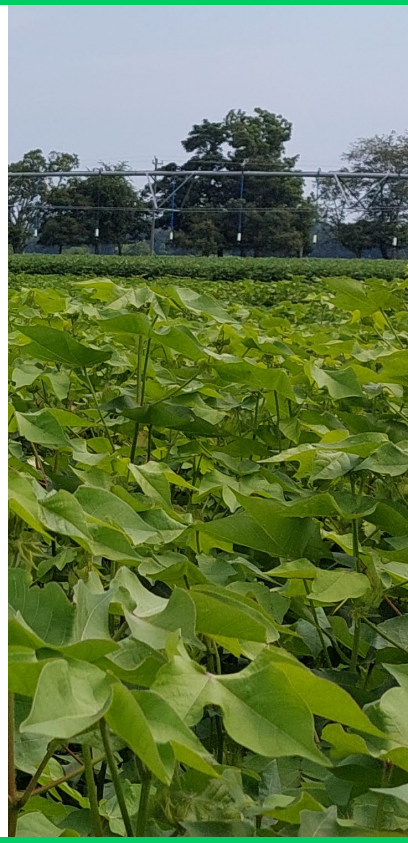

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PGR Effects

PGR Application

- Produces shorter plants by reducing internode elongation.
- Positively affects fruit retention on lower nodes.
- Can accelerate maturity due to effects on vegetative growth and fruit retention.
- Can we offset negative impacts of excessive irrigation by more aggressively managing PGRs in modern cultivars?

2020 & 2021 Objective

To quantify the effect of irrigation, PGR management, and cultivar on plant growth, maturity, and yield.

Experimental Details

Irrigation Treatments:

1 → 100% ETc

1.25 → 125% ETc

Dryland → No supplemental irrigation after stand establishment

PGR Treatments:

1 → Untreated control

2 → Moderate treatment (12 oz/acre Pix at FF; 16 oz/acre Pix two weeks later)

3 → Aggressive (10 oz/acre at 8 leaf stage + two applications noted above).

Cultivars:

- DP 1646
- DG 3615
- DG 3799

Replications: 3

Design: Split-split plot

Location: Stripling Irrigation Research Park, Camilla, GA.

Experimental Details

In-Season Measurements:

- NAWF
- Use linear regression to determine days to cutout (NAWF = 3) for each plot.

End of season measurements:

- Plant Height
- Yield and Fiber Quality

Experimental Details

2001				2019		2028				2046		2055				2073							
2002				2020		2029				2047		2056				2074							
2003				2021		2030				2048		2057				2075							
2004				2022		2031				2049		2058				2076							
2005		2010		2023		2032		2037		2050		2059		2064		2077							
2006		2011		2024		2033		2038		2051		2060		2065		2078							
2007		2012		2025		2034		2039		2052		2061		2066		2079							
2008		2013		2026		2035		2040		2053		2062		2067		2080							
2009		2014		2027		2036		2041		2054		2063		2068		2081							
Dryland		2015		125% Etc		Dryland		2042		125% Etc		Dryland		2069		125% Etc							
		2016						2043						2070									
		2017						2044						2071									
		2018						2045						2072									
		100% Etc						100% Etc						100% Etc									
Pivot 1						Pivot 2						Pivot 3											
Highway																							
PGR 1																							
PGR 2																							
PGR 3																							

Experimental Details

2001				2019	2028			2046	2055				2073				
2002				2020	2029			2047	2056				2074				
2003				2021	2030			2048	2057				2075				
2004				2022	2031			2049	2058				2076				
2005		2010		2023	2032		2037	2050	2059		2064		2077				
2006		2011		2024	2033		2038	2051	2060		2065		2078				
2007		2012		2025	2034		2039	2052	2061		2066		2079				
2008		2013		2026	2035		2040	2053	2062		2067		2080				
2009		2014		2027	2036		2041	2054	2063		2068		2081				
Dryland		2015		125% Etc	Dryland		2042	125% Etc	Dryland		2069		125% Etc				
		2016					2043				2070						
		2017					2044				2071						
		2018					2045				2072						
		100% Etc					100% Etc				100% Etc						
Pivot 1					Pivot 2				Pivot 3								
Highway																	

Cultivar 1	DP 1646
Cultivar 2	DG 3615
Cultivar 3	DG 3799

Results

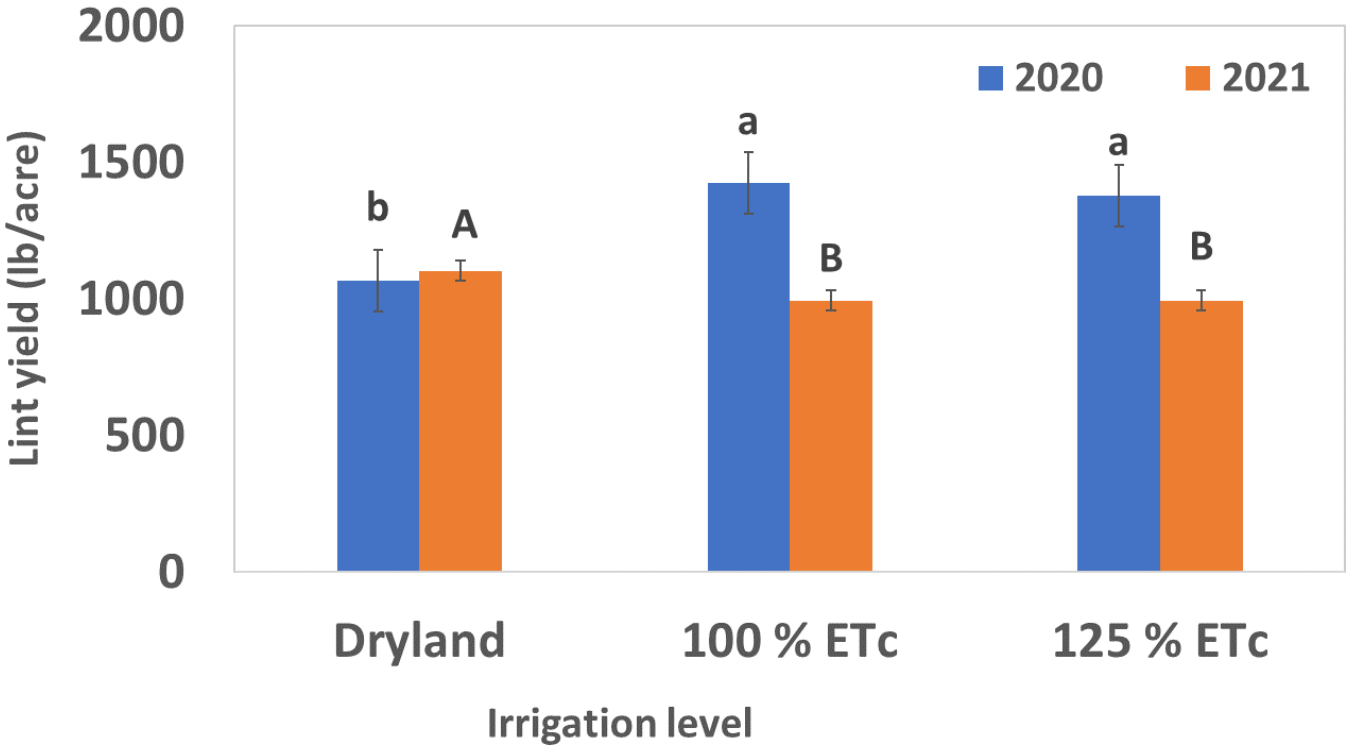
Significant Effects

Source	P value					
	Plant Height		Cutout date		Lint yield	
	2020	2021	2020	2021	2020	2021
Variety	0.0377	0.0019	0.1727	0.6173	0.0938	0.0001
Irrigation	0.0001	0.0001	0.0001	0.2013	0.0001	0.0003
PGR	0.0001	0.0001	0.0001	0.0001	0.0774	0.0928
Variety*Irrigation	0.2896	0.1848	0.8386	0.9319	0.1907	0.1698
Variety*PGR	0.2719	0.5781	0.9331	0.6383	0.7367	0.1771
Irrigation*PGR	0.0001	0.0472	0.0017	0.4004	0.1872	0.1254
Variety*Irrigation*PGR	0.7765	0.7637	0.9287	0.984	0.8998	0.2927

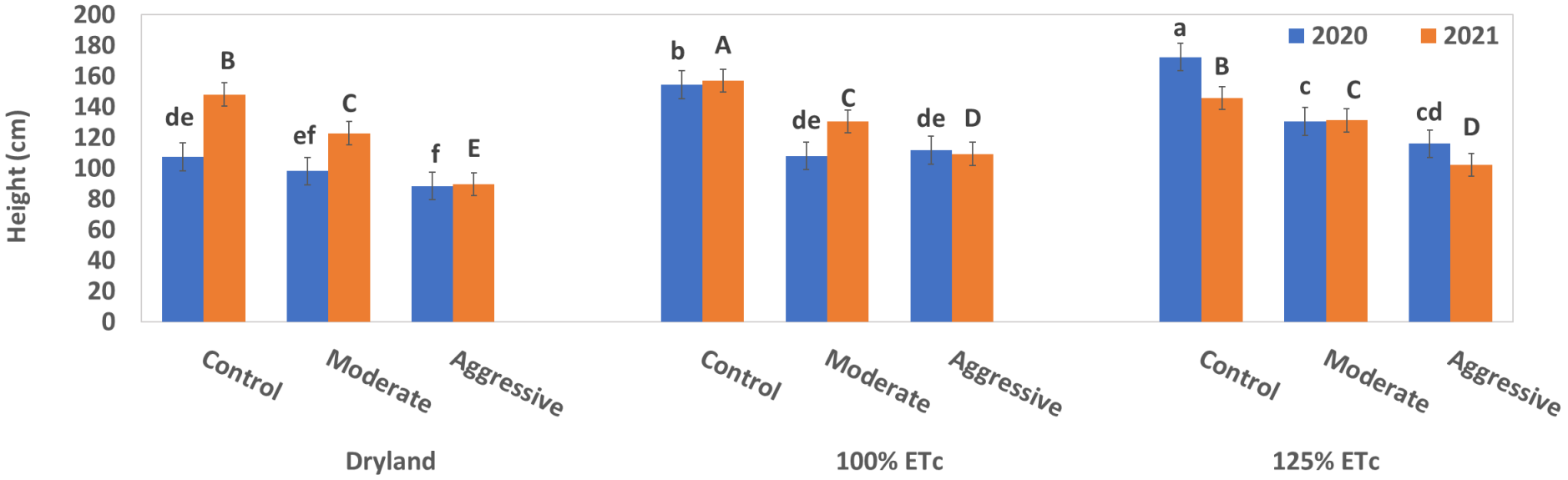
Water

Year	Treatment	Irrigation (cm)	Rainfall (cm)	Total water (cm)
2020	Dryland	3.6	34.7	38.3
	100% ETc	25.6	34.7	60.3
	125% ETc	29	34.7	63.7
2021	Dryland	5.1	73.5	78.6
	100% ETc	16.5	73.5	90.0
	125% ETc	22.3	73.5	95.8

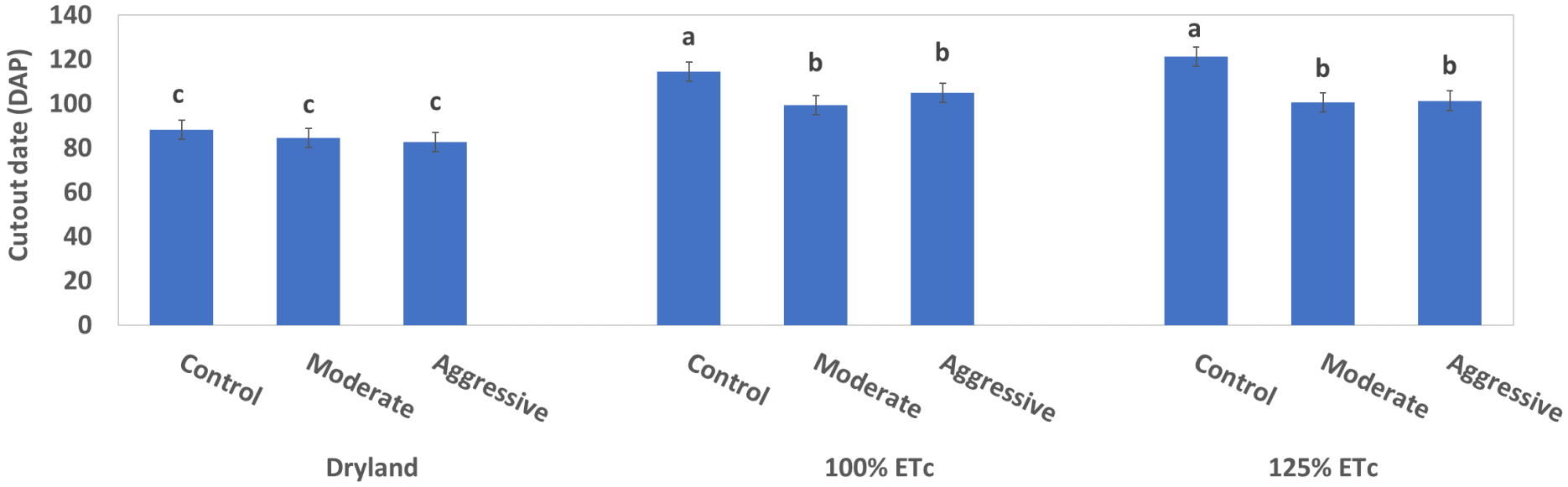
Lint Yield


2000
1500
1000
500
0
Lint yield (lb/acre)
2020
2021
b
A
a
B
a
B
Dryland
100 % ETc
125 % ETc
Irrigation level

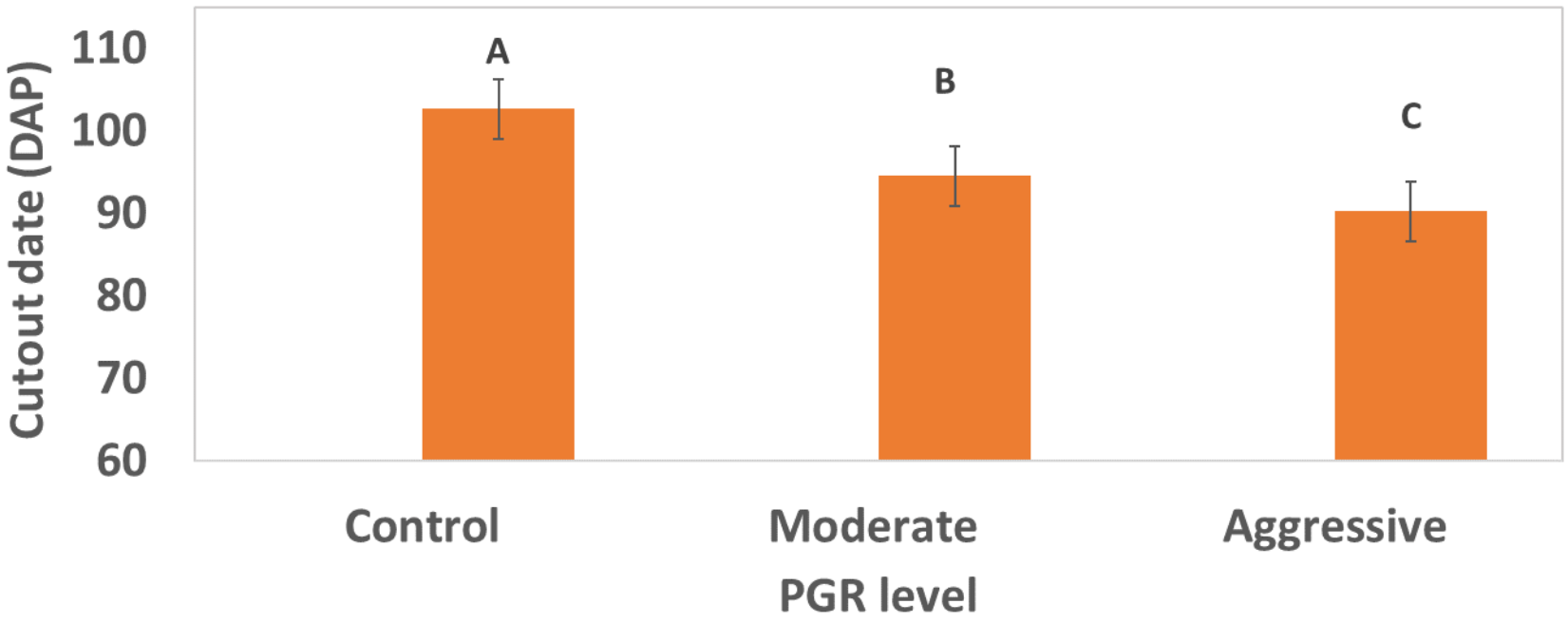
Height


Height (cm)
200
180
160
140
120
100
80
60
40
20
0
2020
2021
de
B
ef
C
f
E
b
A
de
C
de
D
a
B
c
C
cd
D
Control
Moderate
Aggressive
Control
Moderate
Aggressive
Control
Moderate
Aggressive
Dryland
100% ETc
125% ETc

Cutout Date (2020)



Cutout Date (2021)



Conclusions

- ✓ **2020 was a dry year and yields responded positively to irrigation and 2021 was a wet year and yield responded negatively to irrigation.**
- ✓ **There was no effect of PGR treatment or an interaction between PGR and any other effect for lint yield.**
- ✓ **For height, a PGR x Irrigation interaction was observed in both years, with the shortest plants observed in aggressively treated plots under dryland conditions.**
- ✓ **In 2020, PGR treatment hastened cutout by 2-3 weeks in irrigated plots, but had no effect on maturity in dryland plots. Only PGR treatment affected cutout date in 2021.**

PGR Management and Drought Susceptibility

Tifton-Bowen Farm 2021

Treatments:

Irrigation: supplied via subsurface drip

1. Well watered all season according to UGA Checkbook method
2. Drought stressed imposed after third PGR application for 3 weeks, then returned to well-watered

PGR: 4.2% solution of mepiquat chloride (MC).

1. Aggressive: 10 oz. at 8 leaf, 12 oz. at first flower, and 16 oz. at first flower + 2 weeks
2. No PGR application

Layout

Field 6712

2 Row x 15 ft. Plots
5 ft. alleys
Planted at 3 seed per ft.

Untreated Control
Aggressive Treatment

15 ft. From Edge

2 row buffer	Well Watered	2 row buffer	Drought Stressed	2 row buffer
	307		308	
	305		306	
	303		304	
	301		302	

15 ft. From Edge

N
W E
S

Field 6713

15 ft. From Edge

2 row buffer	Well Watered	2 row buffer	Drought Stressed	2 row buffer
	323		324	
	321		322	
	319		320	
	317		318	

15 ft. From Edge

15 ft. From Edge

2 row buffer	Drought Stressed	2 row buffer	Well Watered	2 row buffer
	315		316	
	313		314	
	311		312	
	309		310	

15 ft. From Edge

Data Collection

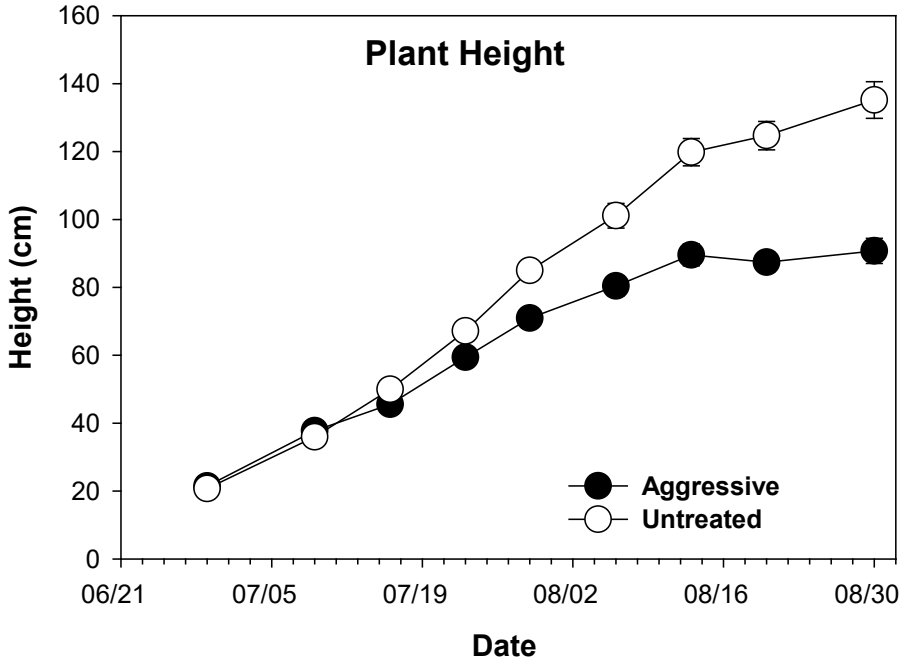
Weekly measurements:

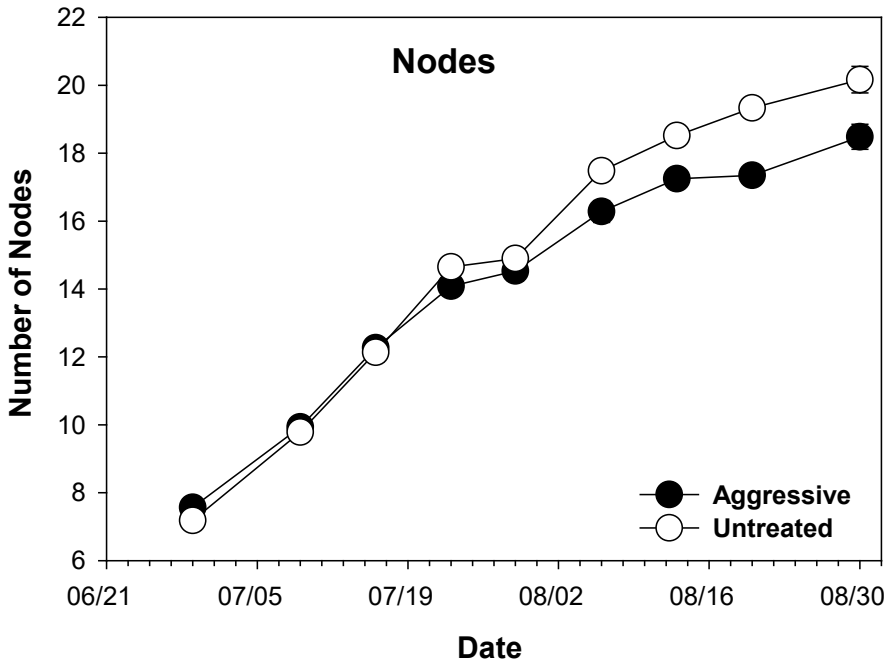
- ✓ Height (cm)
- ✓ Number of mainstem nodes
- ✓ 4th internode length (cm)
- ✓ Soil Moisture content
- ✓ Nodes above white flower

End of Season Measurements:

- ✓ Lint Yield
- ✓ Fiber Quality
- ✓ Total fruiting sites and bolls per plant
- ✓ HVI Analysis

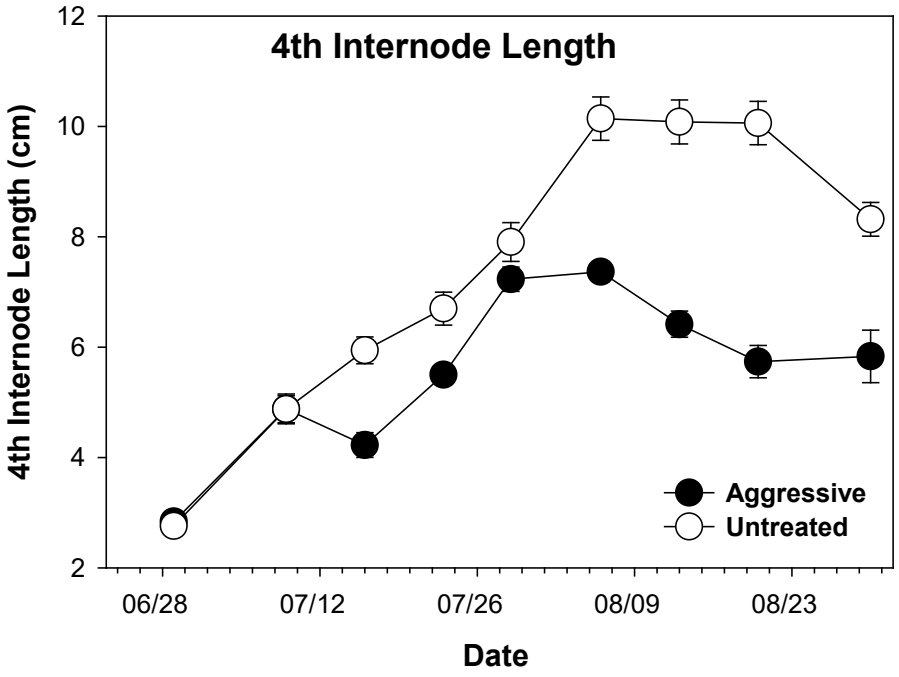
Height and Nodes

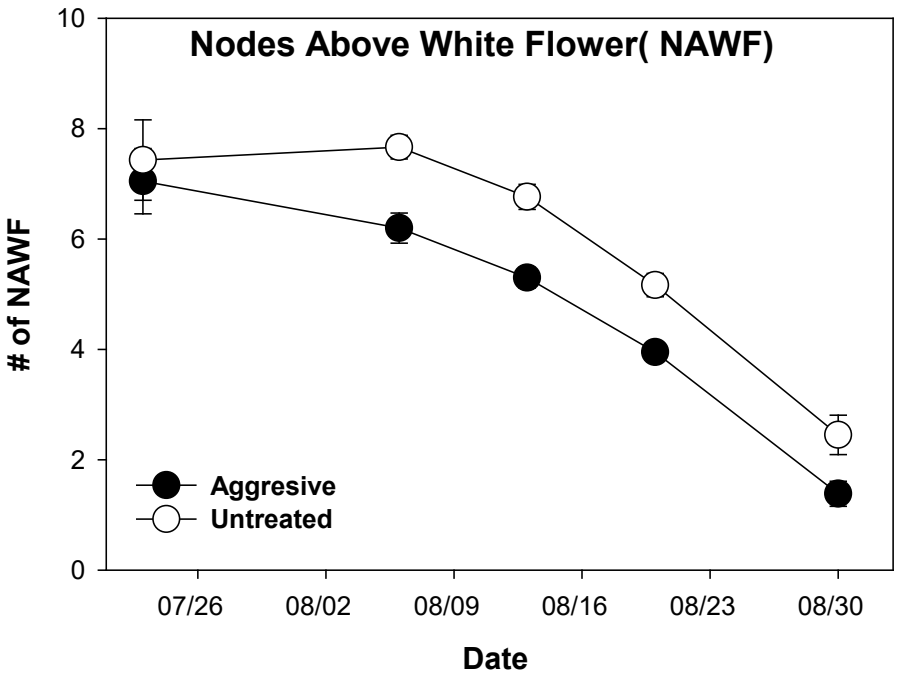




Only a PGR effect.

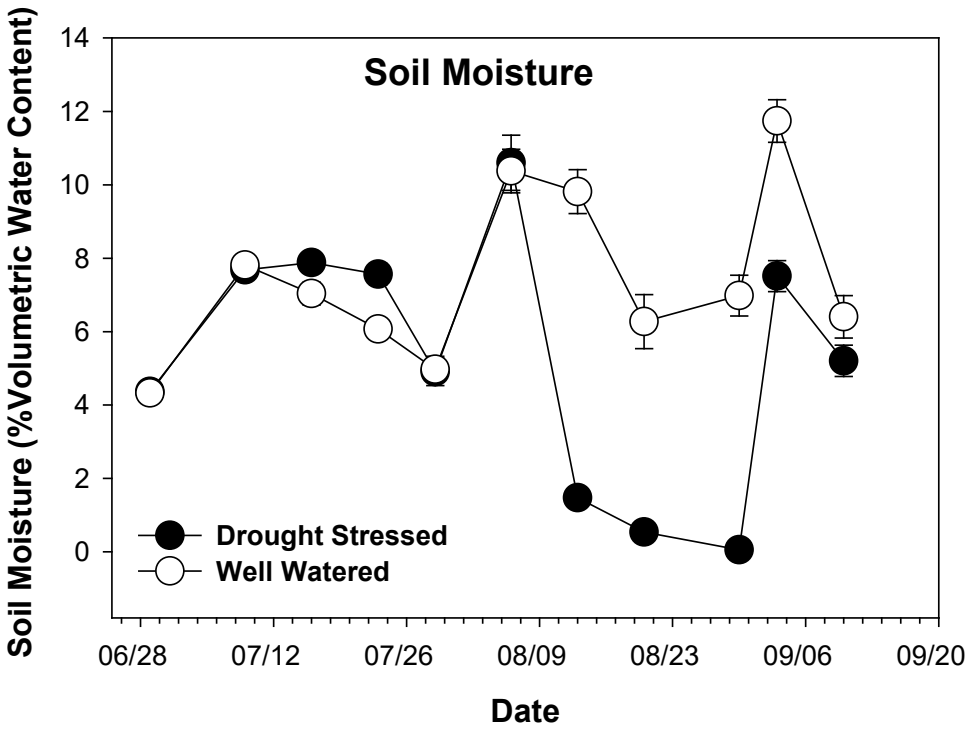
Conclusions





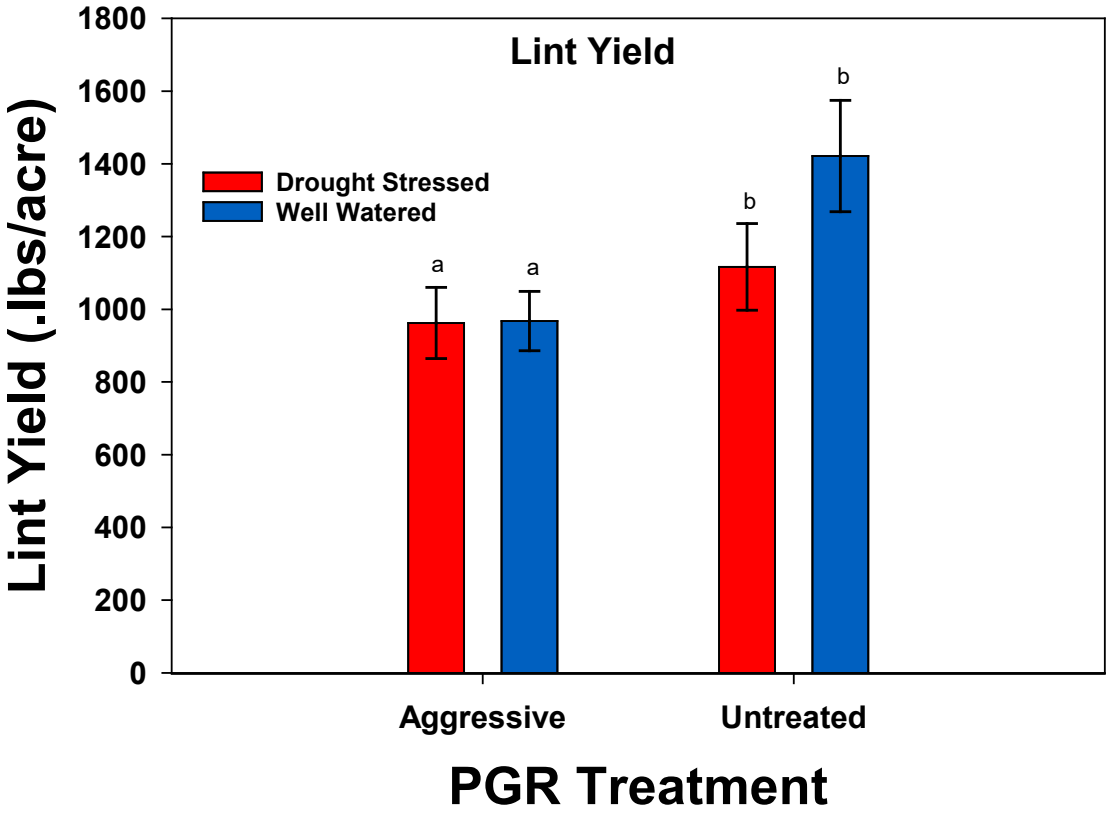
Only a PGR effect.

Soil Moisture

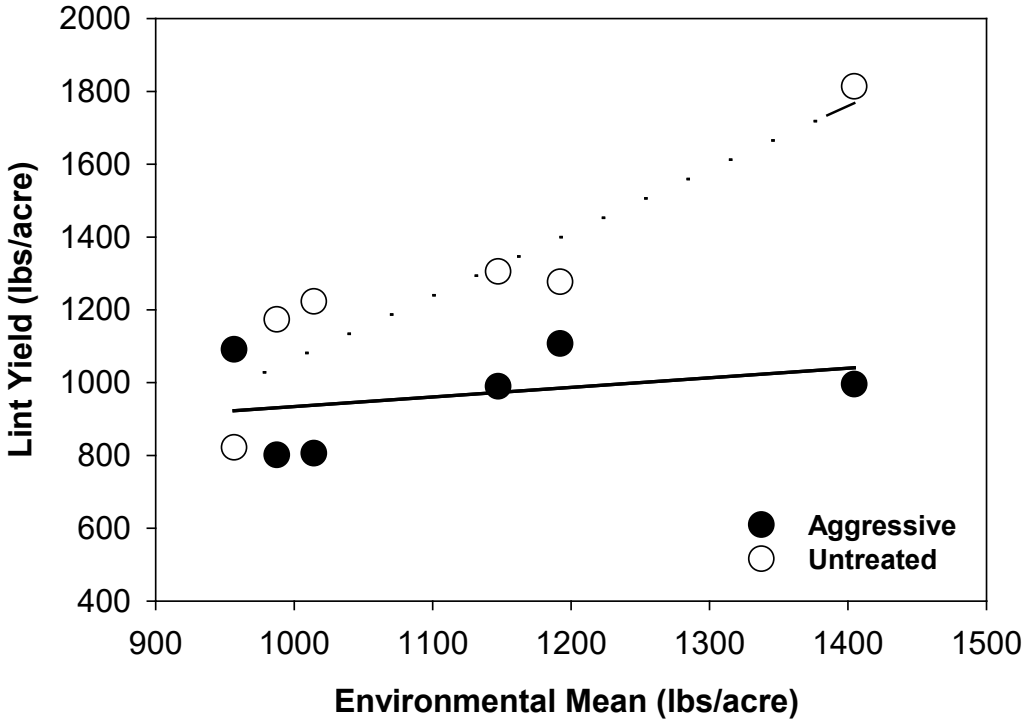


Only an irrigation effect.

Yield


Lint Yield
Lint Yield (.lbs/acre)
1800
1600
1400
1200
1000
800
600
400
200
0
Drought Stressed
Well Watered
a
a
b
b
Aggressive
Untreated
PGR Treatment

Yield Stability



Conclusions

- ✓ **PGR treatment significantly impacted growth parameters (height, nodes, 4th internode length).**
- ✓ **PGR treatment hastened cutout and significantly decreased lint yield compared to untreated plots.**
- ✓ **Irrigation and PGR x irrigation did not or rarely impacted growth parameters and yield.**
- ✓ **Drought stress affected soil moisture measurements but stress severity differed substantially depending on shelter.**
- ✓ **PGR treated plots were more yield stable but did not achieve the same yields as untreated plants in a high yield situation.**

QUESTIONS?