Irrigation Scheduling and Planter Considerations for Cotton Production

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Irrigation Scheduling (2023)

- **A technique that involves:**
  - Determining how much water is needed
  - When to apply it to the field to meet crop demands.

Irrigation Scheduling Method	Entire US (%)	AL (%)	FL (%)	GA (%)	SC (%)	MS (%)
Visible Stress	78	87	80	80	81	83
Feel of Soil	40	39	44	37	52	39
Soil Moisture Sensor	13	14	16	16	11	30
Scheduling Service	8	1	5	11	2	6.5
Weather Report	7	2	6	7	2.5	4
Calendar Schedule	21	15	23	23	27	15
When Neighbor Irrigates	5	2	1	3	2	3

Irrigation Information

- **Where do farmer's get their info from??**

Irrigation Scheduling Method	Entire US (%)	AL (%)	FL (%)	GA (%)	SC (%)	MS (%)
University Extension	46	56	78	74	74	58
Private Consultant	57	50	58	46	29	65
Irrigation Equipment Dealer	33	51	33	17	47	26
Irrigation District	14	4	40	1	0	1

Barriers to Improvements in Water Conservation

1. Investing in improvements is not a priority (40%)
2. Cannot afford improvements (22%)
3. Improvements won't reduce costs enough to cover new costs (24%)
4. Risk of reduced yield (15%)
5. Uncertainty about future water availability (13%)
6. Improvements will increase management time or cost (13%)
7. Won't be farming long enough to justify improvements (6%)
8. Landlord will not share in cost (9%)
9. Physical Field/Crop Limits Improvements (10%)

Cost of Pumping Irrigation

- Average Irrigation cost ~ $12.00/ac-in applied:
  - ~$8/ac-in for electric
  - ~$16/ac-in for diesel
- Thus, for 500 acres of irrigated land @ 10 inches of irrigation:
  - $60,000
- https://agecon.uga.edu/extension/budgets.html

Level 0: ~~Valid~~ Irrigation Scheduling Tools

- Irrigating when you see crop stress or just a set number of times per week:
  - Easy to do, doesn't take a lot of planning or scientific consideration of the crop
  - In almost all cases it does not maximize crop yield or IWUE
  - Generally default to this method when we are behind or have had equipment issues.

Level I: Valid Irrigation Scheduling Tools

- Checkbook Methods- Corn, Cotton, Peanut, Soybean:
  - Published in each production guide, Free, requires minimal input from user, is very conservative, meaning they tend to over-irrigate in wet years, and can under-irrigate in dry years.
  - I would not consider these to be very advanced, this is just one step above irrigating a set amount a set number of times per week.
  - The checkbook methods are all developed based on a historical average crop water use and evapotranspiration (ET).

Level II: Valid Irrigation Scheduling Tools

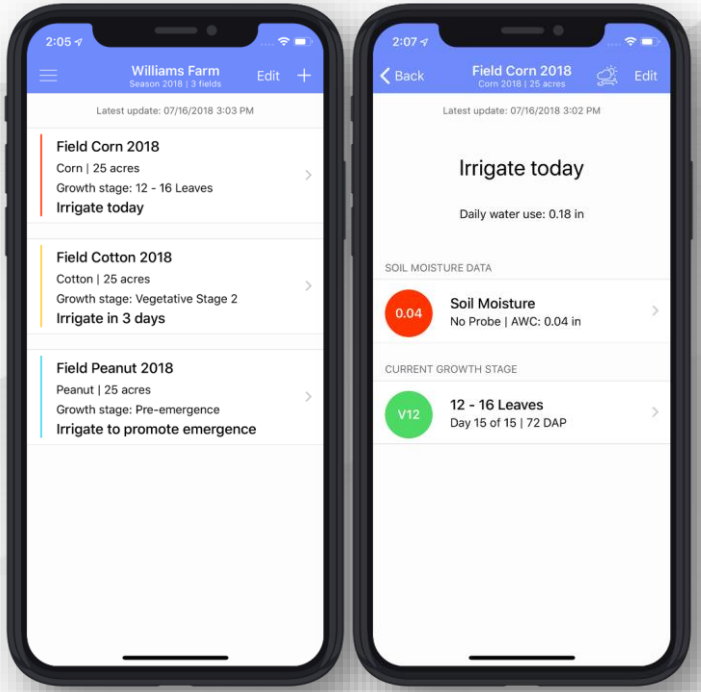
- Computer Models:
  - *SmartIrrigation Apps/PeanutFARM/IrrigatorPro*
  - Free, requires minimal input from user, uses real time daily data.
  - These use the checkbook as a backbone, but rely on daily real time data to make decisions. These methods also take soil type into consideration.
  - A localized computer model can be a very good option for a producer new to scheduling irrigation. It can help them keep a track of how much irrigation they need, and when to apply it based on current climatic conditions.

Level II: Valid Irrigation Scheduling Tools

- Apps I recommend:

IrrigatorPro

https://irrigatorpro.org/



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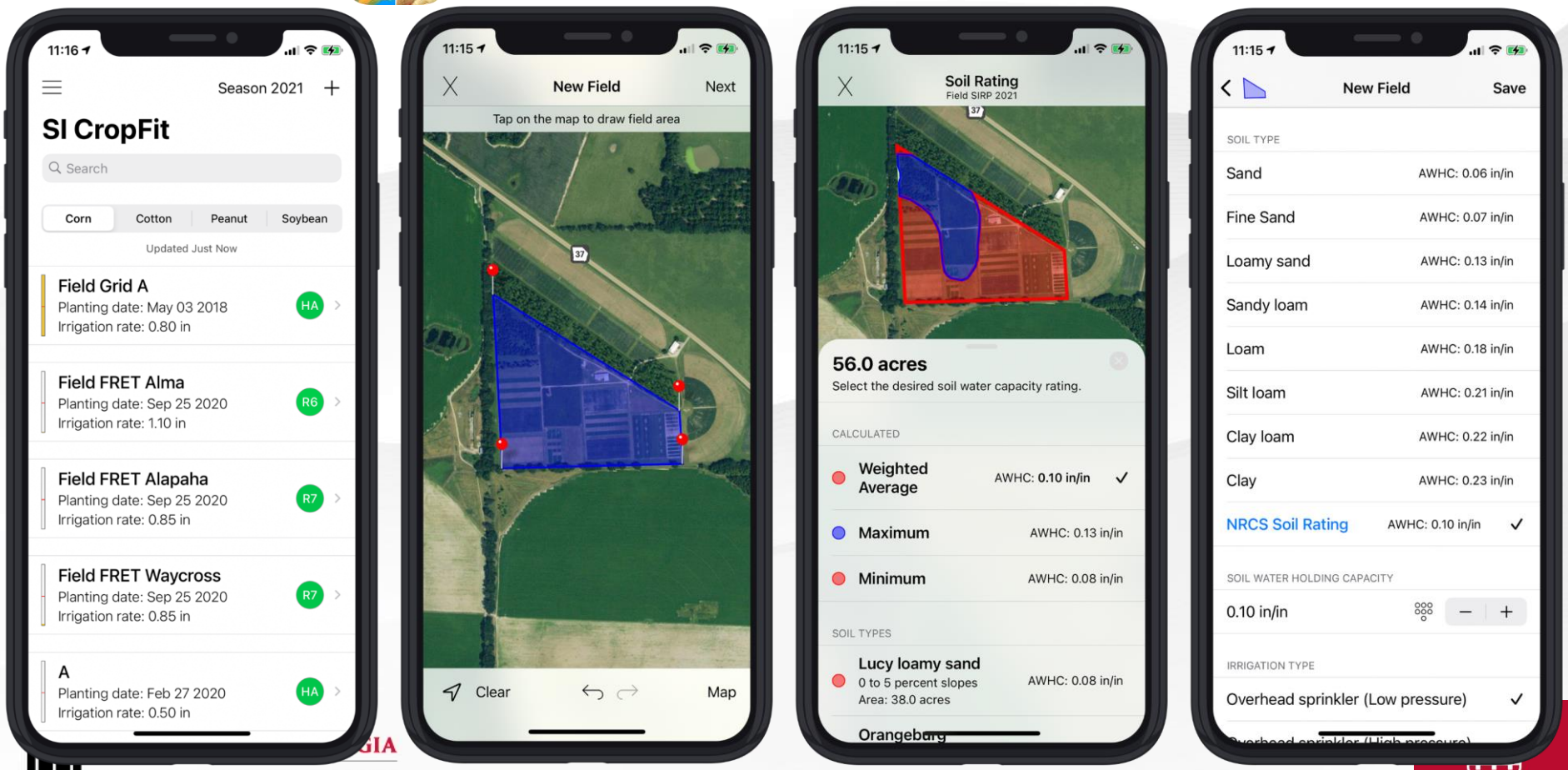
Level II: Valid Irrigation Scheduling Tools

- Officially released 2/19/23, SI CropFit



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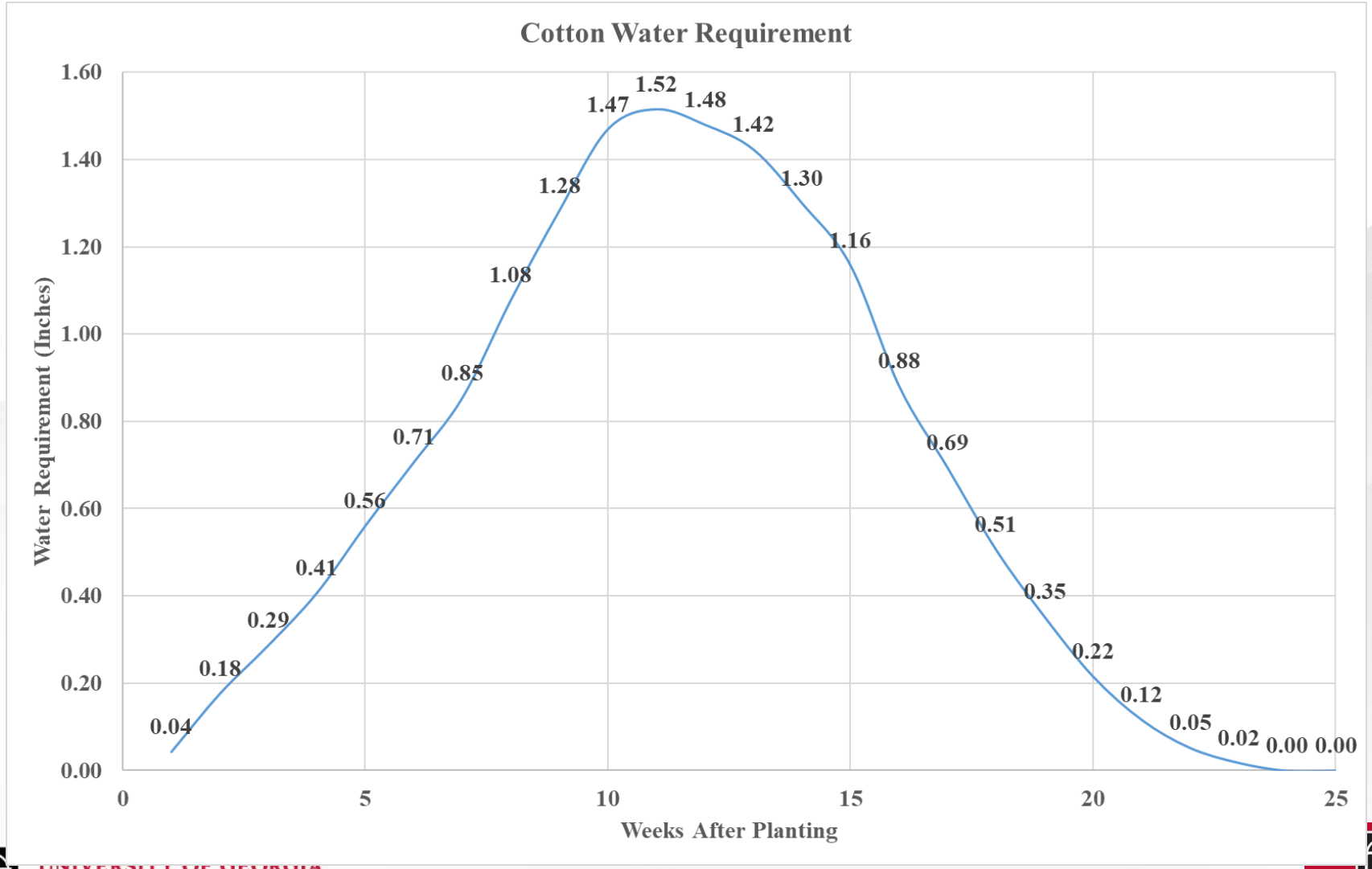
Level III: Valid Irrigation Scheduling Tools

- Soil Moisture Sensors:
  - The are probably the most accurate way of scheduling irrigation currently available.
  - There are many types of soil moisture sensors on the market.
  - Range of costs from ~$500 up to ~2,500 per site, requires user input and utilization of data, are very accurate.
  - Provide current (usually hourly) data which can be used to make hourly to daily irrigation decisions.
  - The data can be difficult to interpret or make accurate decisions from.

Level IV: Valid Irrigation Scheduling Tools

- Hybrid Systems:
  - Since soil moisture sensor data can be difficult to utilize there are some systems that incorporate plant physiological data and soil moisture information.
  - Crop X, IrrigatorPro, and Valley Scheduling are all examples of these systems, and can be used in multiple ways.
  - It can be used a soil water balance such as the computer models, it has an option where soil temperature and/or soil matric potential data can be manually entered, or it has an option where certain data from specific companies will automatically populate into the model.
  - The software then provides an irrigation recommendation for the end user.

Water Requirements: Cotton



Water Requirements: Cotton

Growth Stage	DAP	Weeks after Planting	Inches/Week	Inches/Day
Emergence	1 - 7	1	0.04	0.01
Emergence to First Square	8 - 14	2	0.18	0.03
	15 - 21	3	0.29	0.04
	22 - 28	4	0.41	0.06
	29 - 35	5	0.56	0.08
First Square to First Flower	36 - 42	6	0.71	0.10
	43 - 49	7	0.85	0.12
	50 - 56	8	1.08	0.15
First Flower to First Open Boll	57 - 63	9	1.28	0.18
	64 - 70	10	1.47	0.21
	71 - 77	11	1.52	0.22
	78 - 84	12	1.48	0.21
	85 - 91	13	1.42	0.20
	92 - 98	14	1.30	0.19
	99 - 105	15	1.08	0.15
	106 - 112	16	0.88	0.13
	113 - 119	17	0.69	0.10
First open boll to >60% Open Bolls	120 - 126	18	0.51	0.07
	127 - 133	19	0.35	0.05
	134 - 140	20	0.20	0.03
	141 - 147	21	0.12	0.02
	148 - 154	22	0.05	0.01
	155 - 161	23	0.02	0.00
Harvest	162 - 168	24	0.00	0.00
	169 - 175	25	0.00	0.00

Peak Water Use

Water Use Declines

Irrigation Termination is Strongly Advised

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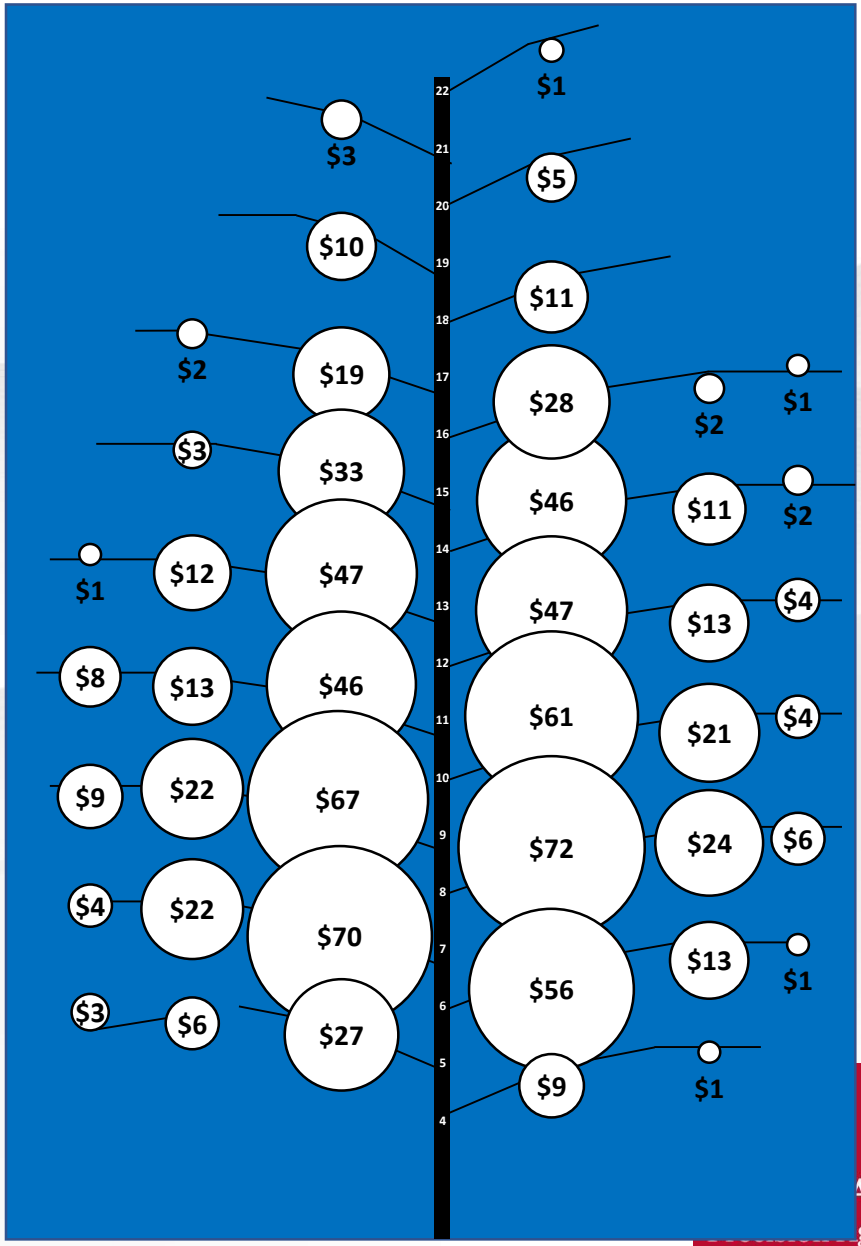
Fruiting Position Value

Georgia 2019 (3 location average)

Fruiting Location	Value
1st Positions	72%
2nd Positions	18%
3rd Positions	5%
Vegetative	5%
Nodes ≤10	60%
Nodes 11-15	31%
Nodes ≥ 16	9%



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2020 Results

Treatment	Irrigation (in)	Total Water (in)	Lint Yield (lb/ac)	IWUE (lb/in)	Profit for $7/ac-in @ $0.79 Cotton	Profit for $12/ac-in @ $0.79 Cotton
Rainfed	1.0	22.4	795	N/A	621	616
45 kPa	5.5	26.9	1304	237	992	964
20 kPa	7.75	29.1	1293	167	967	928
75 kPa	3.25	24.6	1129	347	869	853
Irrigator Pro	5.5	26.9	1245	226	945	918
CropX	4.0	25.4	1113	278	851	831
Valley Scheduler	8.5	29.9	1240	147	920	878
SI Cotton App	6.25	27.6	1270	203	960	928
Checkbook	11.0	32.4	1196	109	868	813

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Planted: May 9, 2020
Picked: October 26, 2020
2020 Rainfall = 21.36 in

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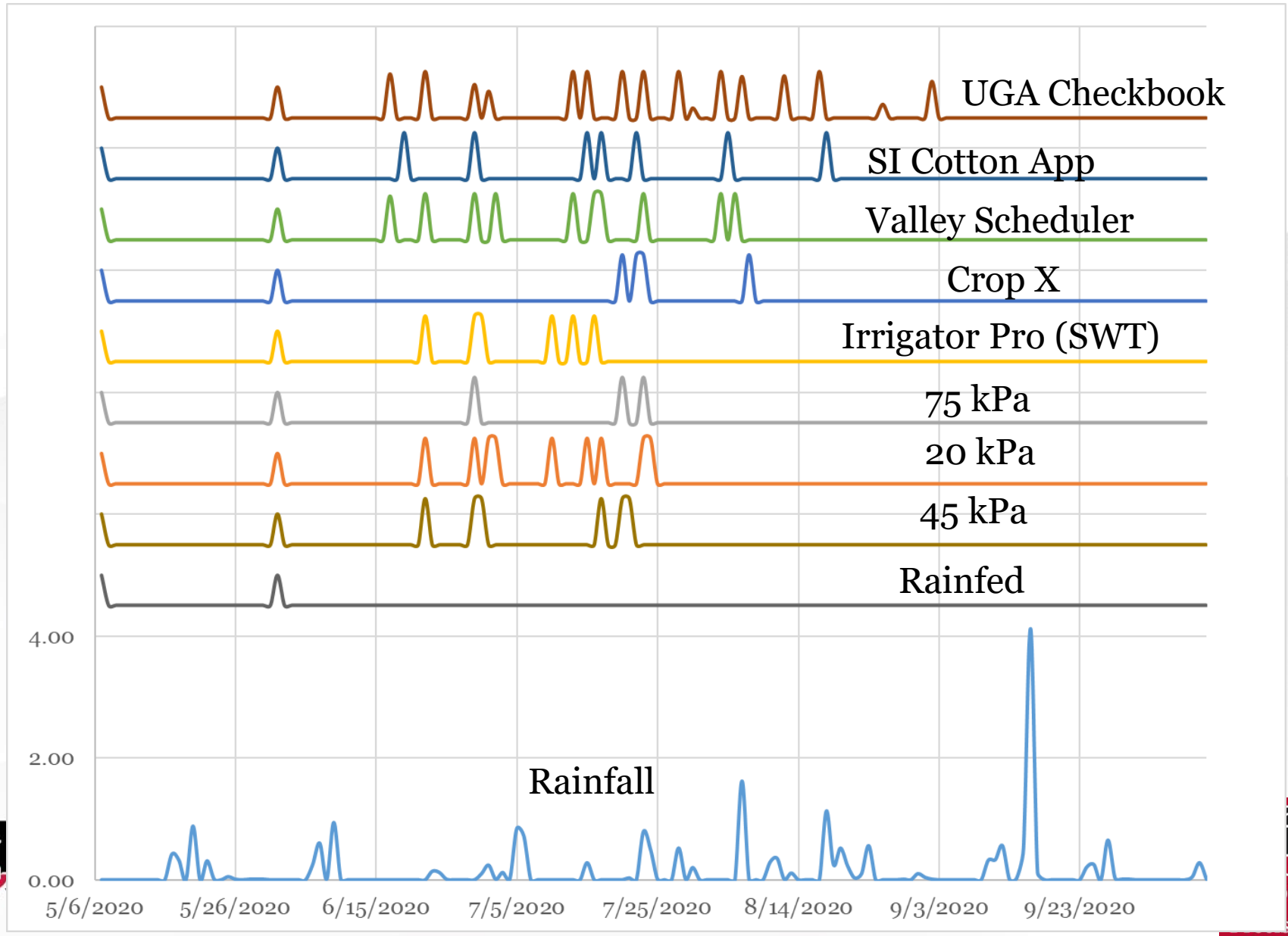
2020 Results



2021 Results

Treatment	Irrigation (in)	Total Water (in)	Lint Yield (lb/ac)	IWUE (lb/in)	Profit for $7/ac-in @ $1.00 Cotton	Profit for $12/ac-in @ $1.00 Cotton
Rainfed	1.0	30.66	1119	N/A	1112	1107
45 kPa	2.36	32.1	1191	505	1175	1162
20 kPa	3.86	33.6	1197	310	1170	1151
Irrigator Pro	2.36	32.1	1175	498	1159	1147
Valley Scheduler	2.36	32.1	1148	486	1131	1120
SI Cotton App	2.36	32.1	1164	493	1148	1136
Checkbook	7.26	37.0	1177	162	1126	1090

Planted: May 7, 2021
Picked: October 20, 2021
2021 Rainfall = 29.66 in

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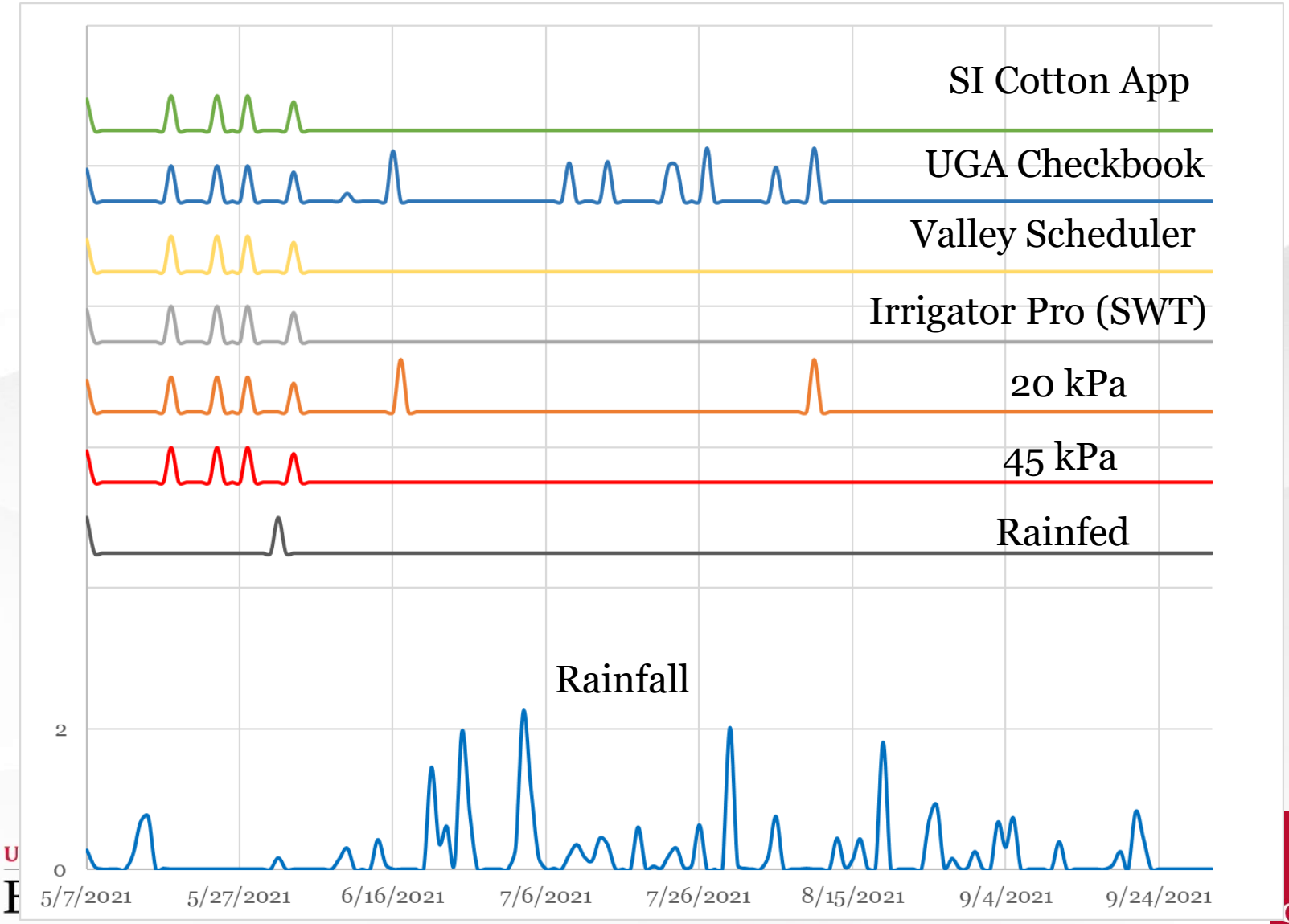
2021 Irrigation Timing Results



2022 Results

Treatment	Irrigation (in)	Total Water (in)	Lint Yield (lb/ac)	IWUE (lb/in)	Boll Rot Rating (% of rotted bolls)	Profit for $7/ac-in @ $0.90 Cotton	Profit for $20/ac-in @ $0.90 Cotton
Rainfed	1.0	22.3	1431	N/A	13	1281	1268
45 kPa	6.25	27.6	1256	201	18	1086	1005
20 kPa	11.5	32.8	1099	95	23	908	759
SI Cotton App	5.5	26.8	1200	218	24	1042	970
Limited Water	3.5	24.8	1265	361	19	1114	1069
Checkbook	10.6	31.9	1219	115	18	1022	884

Planted: April 25, 2022
Picked: October 24, 2022
2022 Rainfall = 21.31 in

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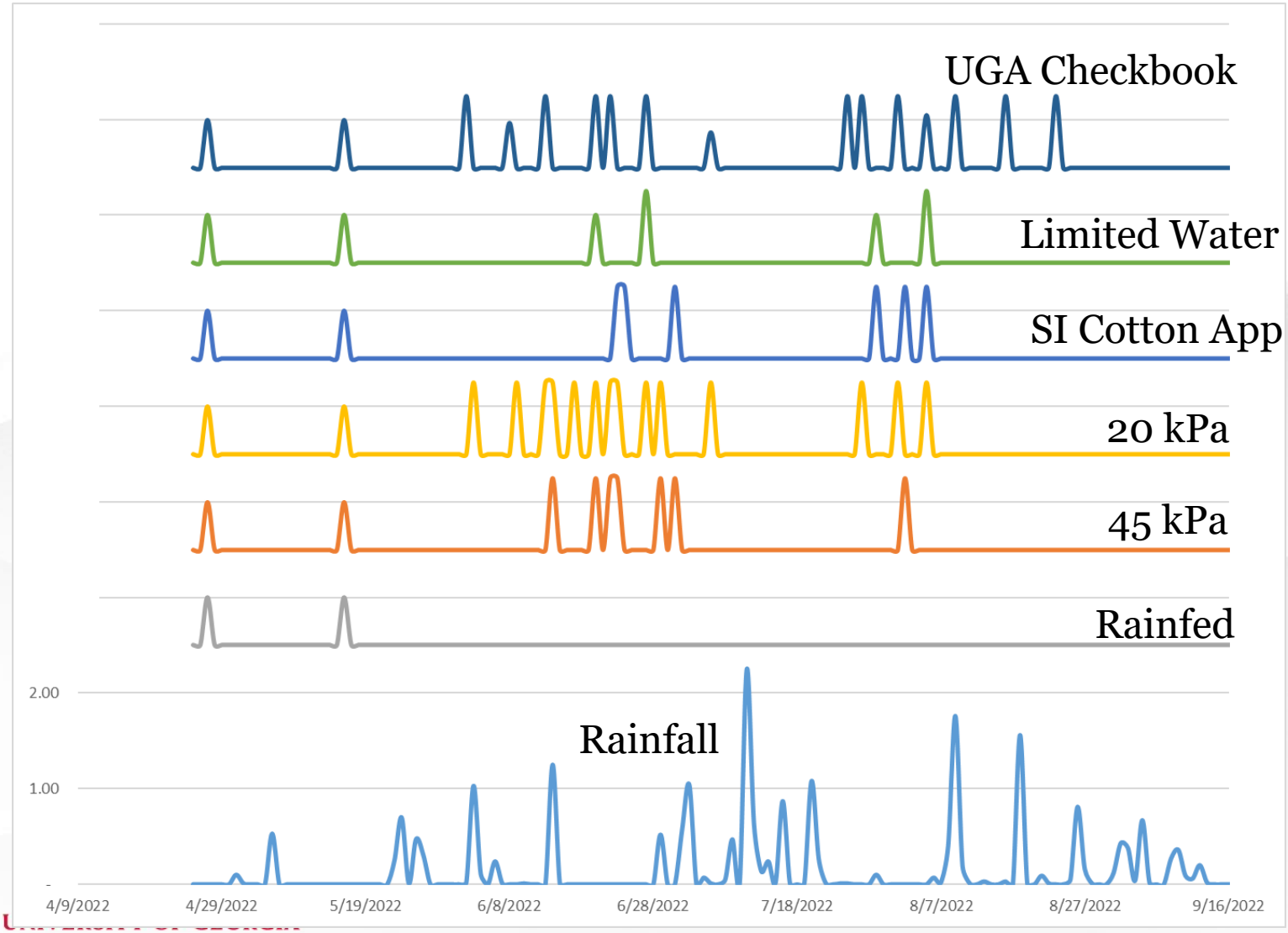
2022 Irrigation Timing Results



2023 Results

Treatment	Irrigation (in)	Total Water (in)	Lint Yield (lb/ac)	IWUE (lb/in)	Profit for $7/ac-in @ $0.84 Cotton	Profit for $20/ac-in @ $0.84 Cotton
Rainfed 27,500	0.5	22.7	1187.0	-	902.5	896.0
Rainfed 20,000	0.5	22.7	1256.1	-	985.4	978.9
Rainfed 12,500	0.5	22.7	1071.7	-	855.3	848.8
45kPA 27,500	5.0	27.2	1613.3	85.3	1229.1	1164.1
45kPA 20,000	5.8	28.0	1705.5	78.2	1326.2	1251.4
45kPA 12,500	6.5	28.7	1521.1	69.1	1190.9	1106.4
SI App 27,500	7.3	29.5	1688.2	66.0	1284.6	1190.3
SI App 20,000	7.3	29.5	1745.9	67.6	1349.5	1255.3
SI App 12,500	7.3	29.5	1711.3	88.2	1345.3	1251.1

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Planted: May 5, 2023
Picked: October 25, 2023
2023 Rainfall = 22.2 in

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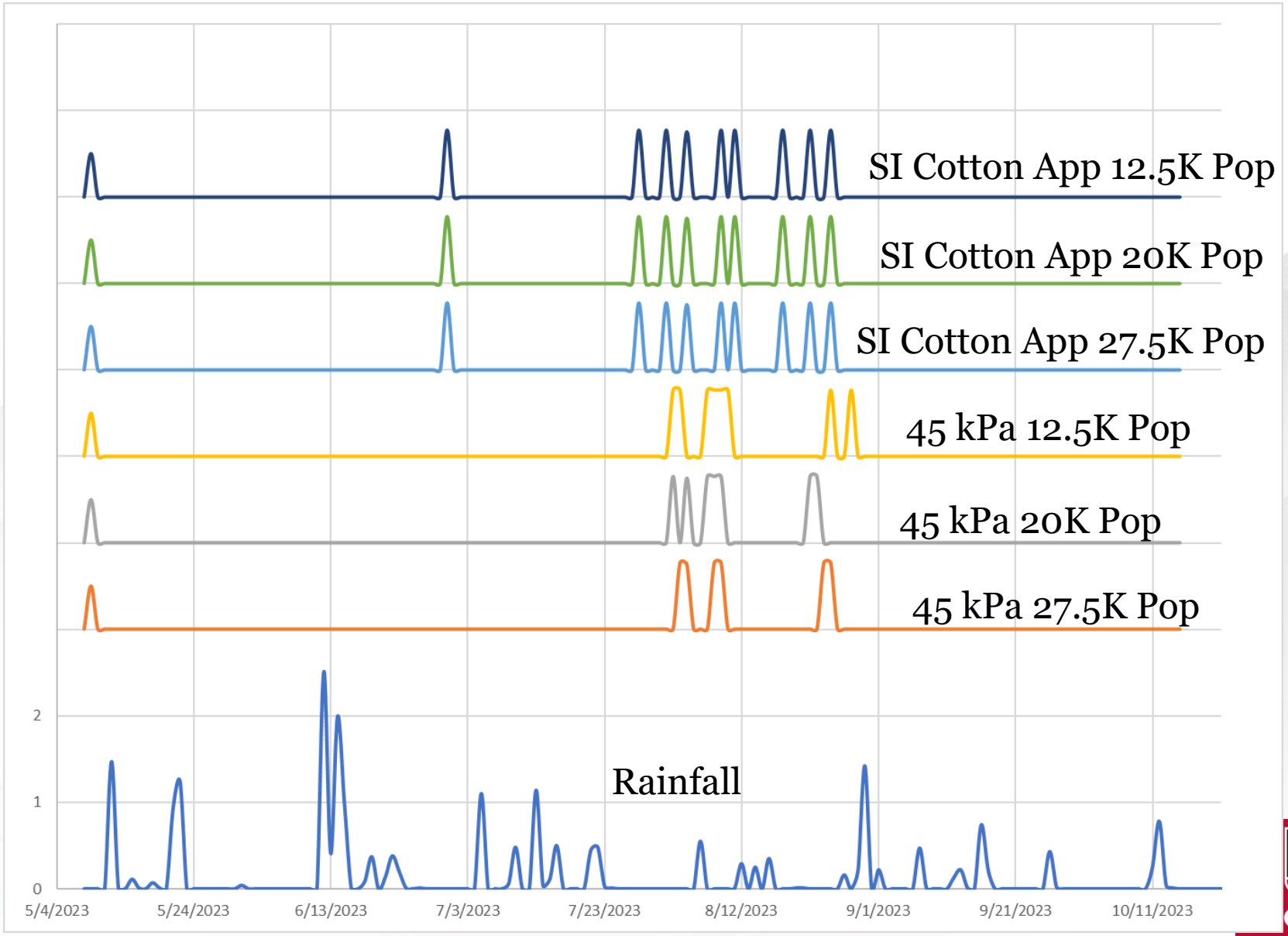
2023 Irrigation Timing Results



2024 Results

Treatment	Irrigation (in)	Total Water (in)	Lint Yield (lb/ac)	IWUE (lb/in)	Profit for $8/ac-in @ $0.69 Cotton	Profit for $16/ac-in @ $0.69 Cotton
Rainfed 27,500	0.5	30.75	1065	-	725.82	722.32
Rainfed 20,000	0.5	30.75	1187	-	840.18	836.68
Rainfed 12,500	0.5	30.75	1083	-	782.89	779.39
45kPA 27,500	3.5	33.75	1125	3.7	744.37	719.87
45kPA 20,000	4.25	34.5	1111	-0.2	748.63	718.88
45kPA 12,500	4.25	34.5	1035	-18.1	712.35	682.60
SI App 27,500	5.0	35.25	1166	10.9	762.39	727.39
SI App 20,000	5.0	35.25	1129	3.5	755.89	720.89
SI App 12,500	5.0	35.25	1026	-17.2	698.60	663.60

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Planted: April 29, 2024
Picked: October 4, 2024
2024 Rainfall = 30.25 in

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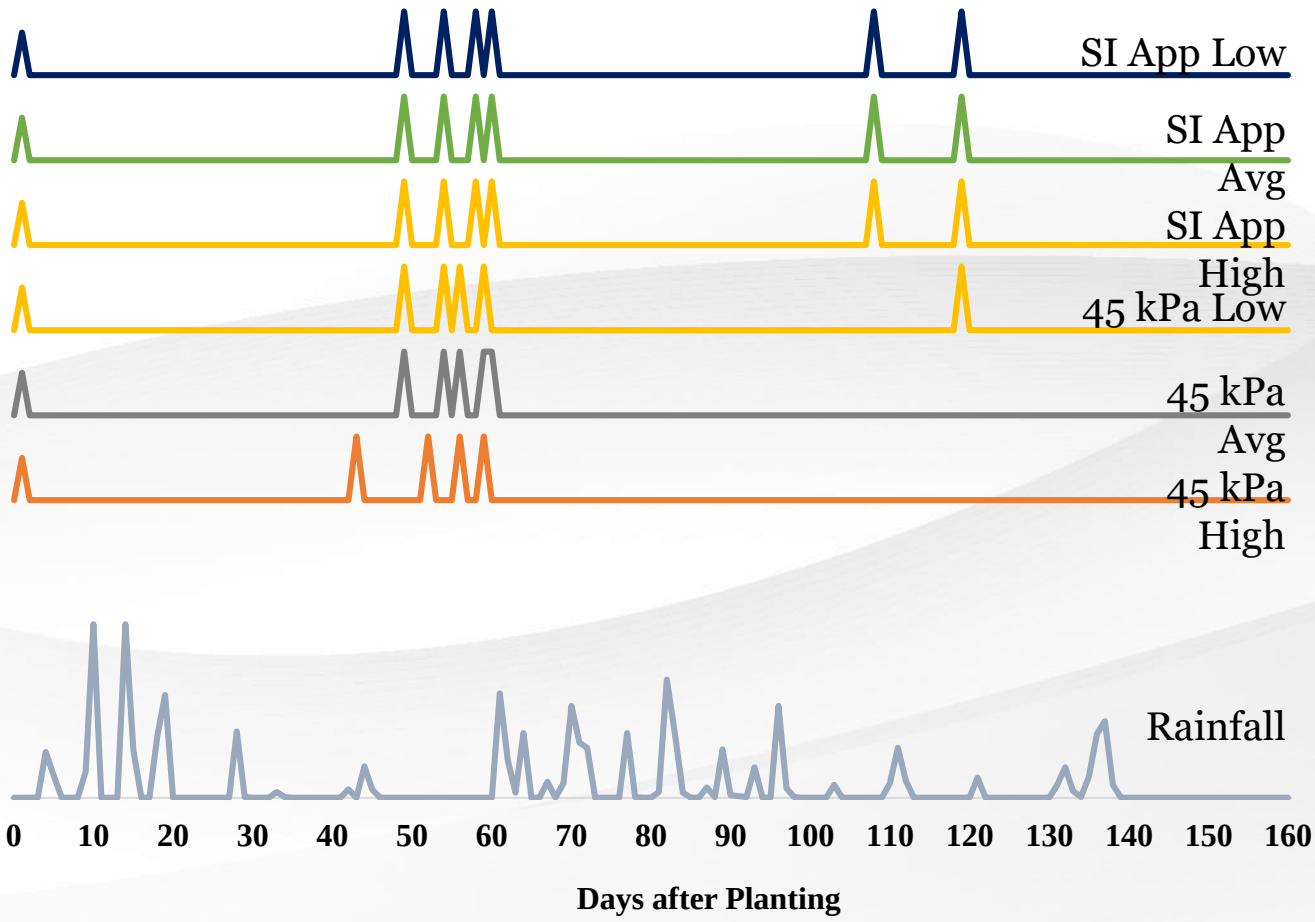
2024 Irrigation Timing Results



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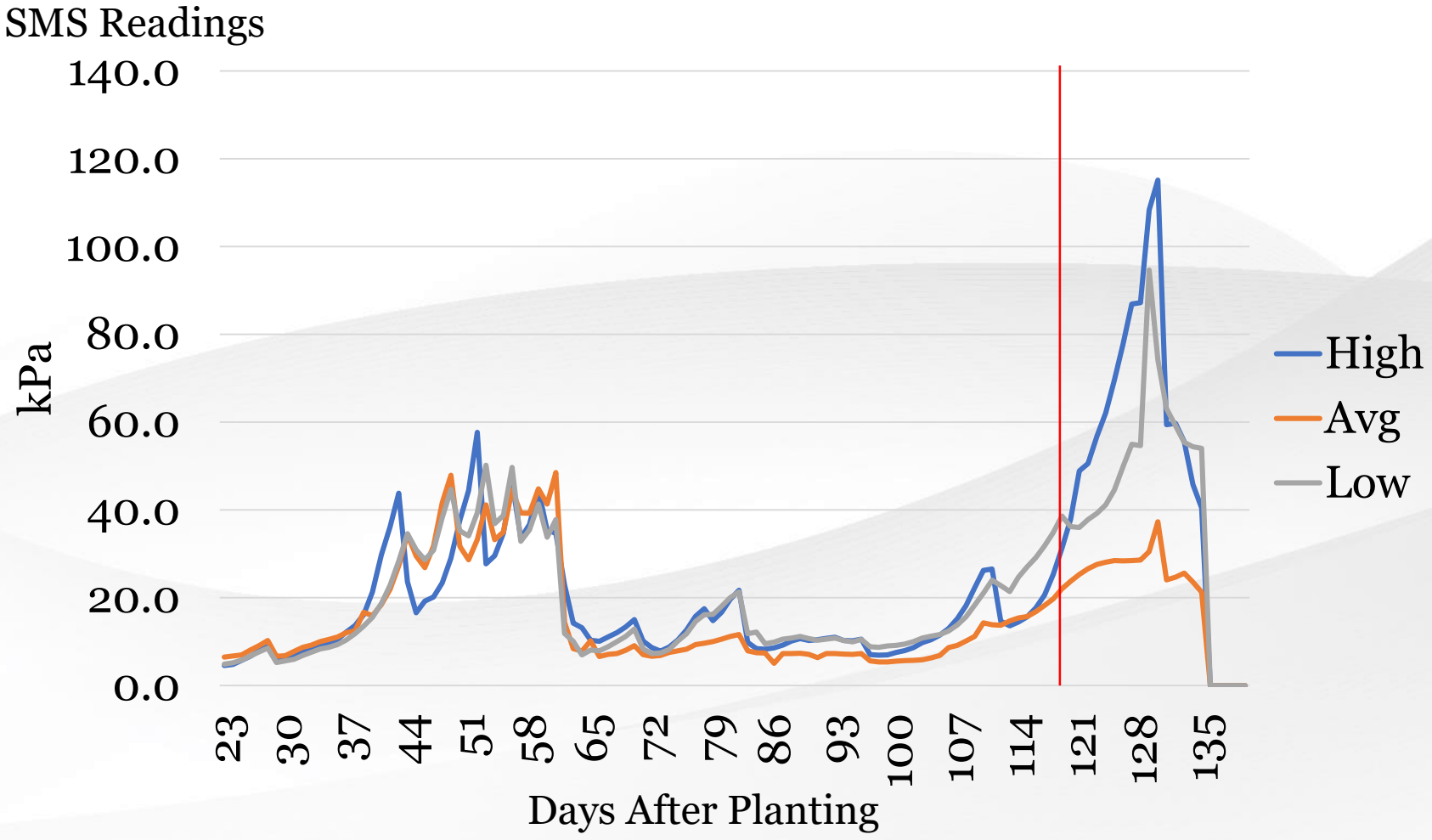
2024 Soil Water Tension Levels



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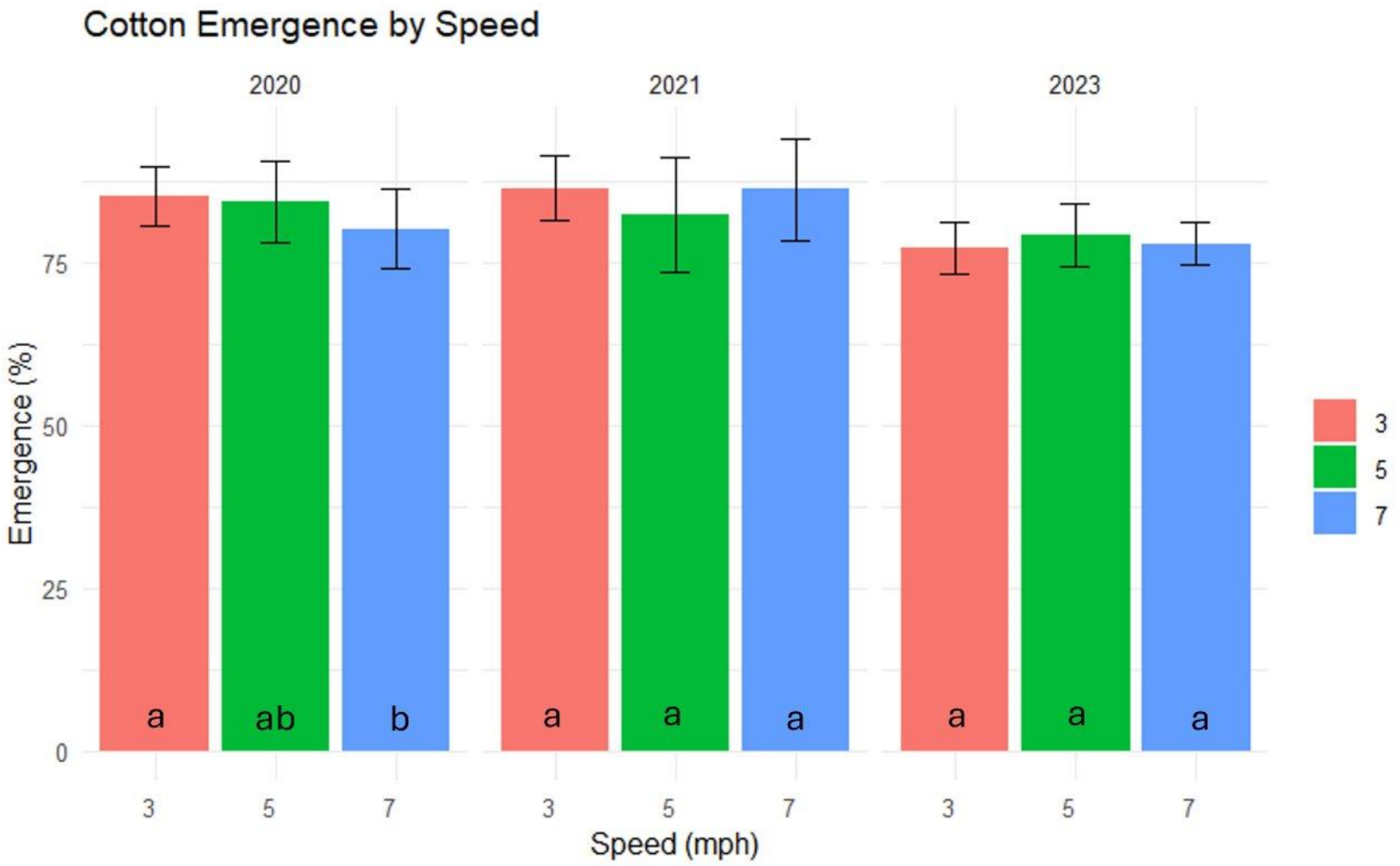
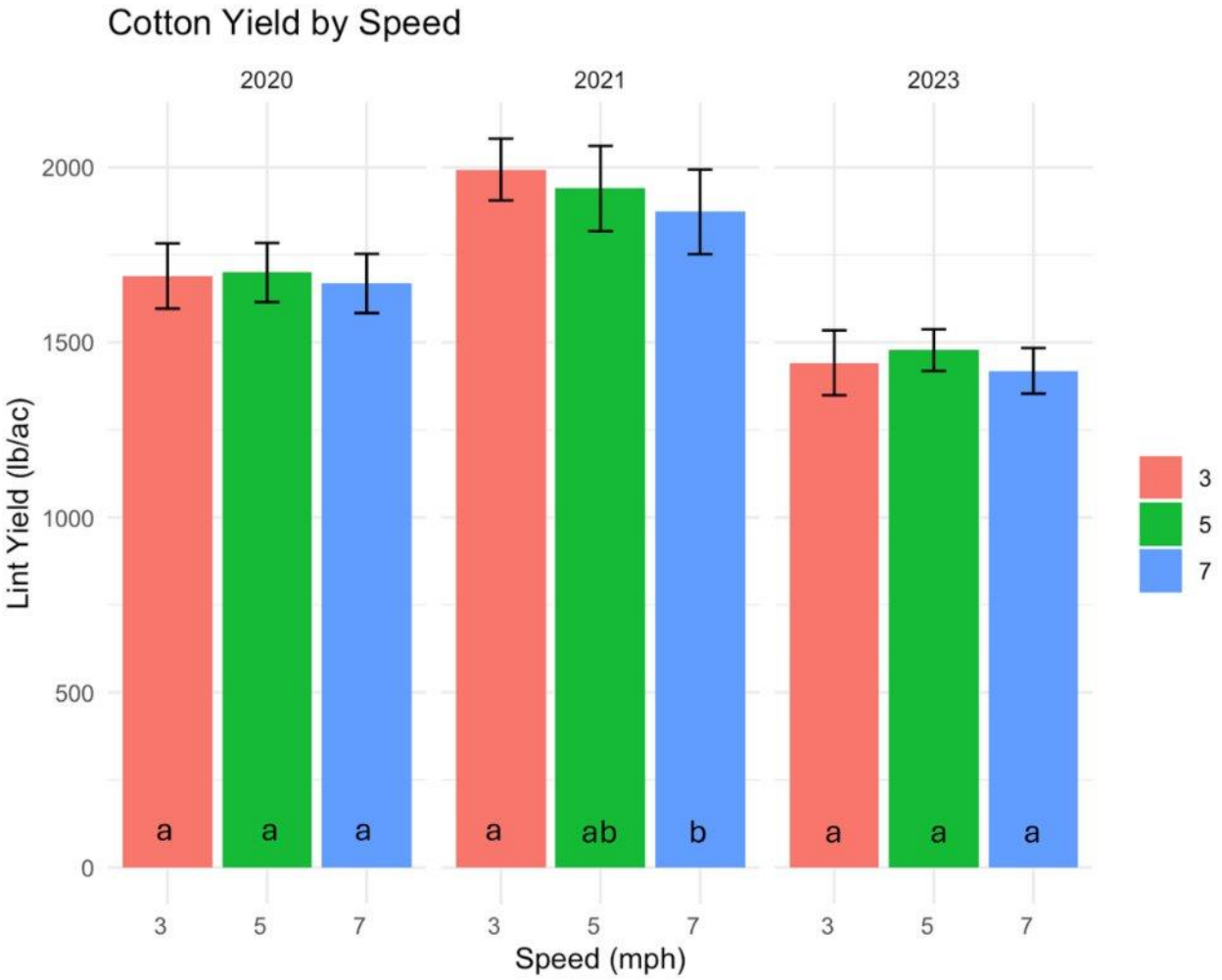
Cotton Planter Performance

Key findings:
Cotton can be planted at 7 mph without affecting emergence (statement based on 2 out of 3 years)



Cotton Planter Performance

Key findings:
Cotton can be planted at 7 mph without affecting yield (statement based on 2 out of 3 years)



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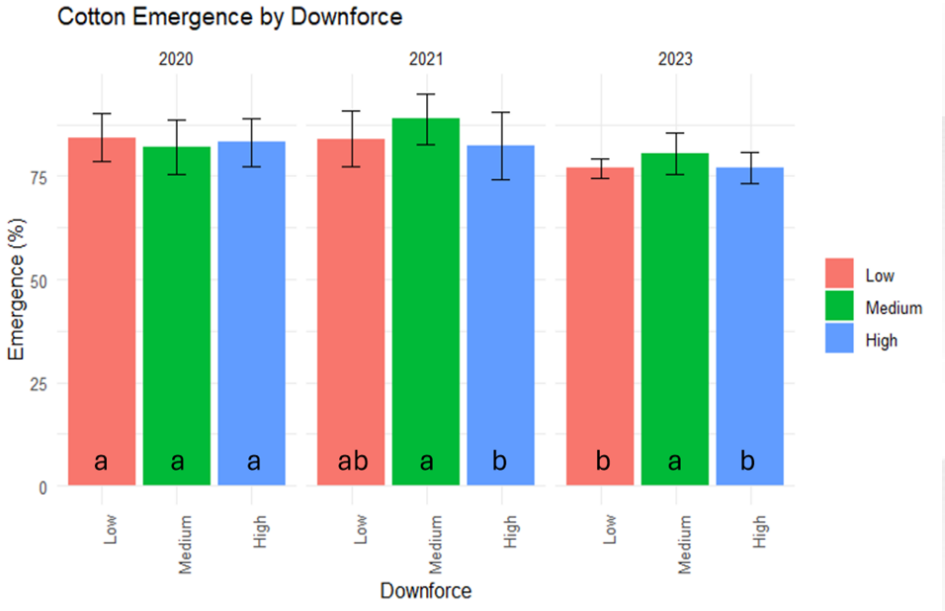
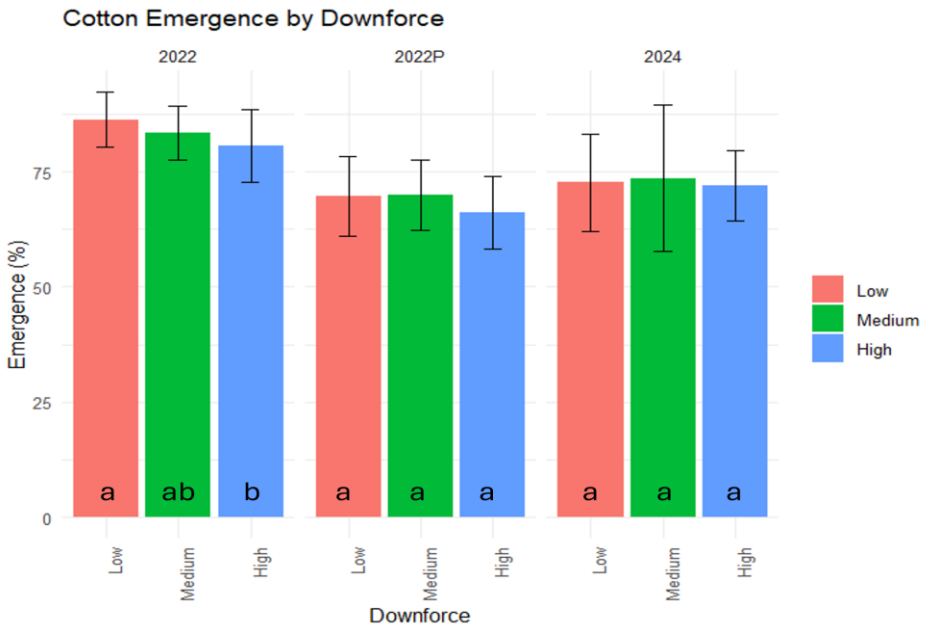
Cotton Planter Performance





Key findings:
High Downforce can decrease cotton emergence (statement based on 4 out of 6 years)

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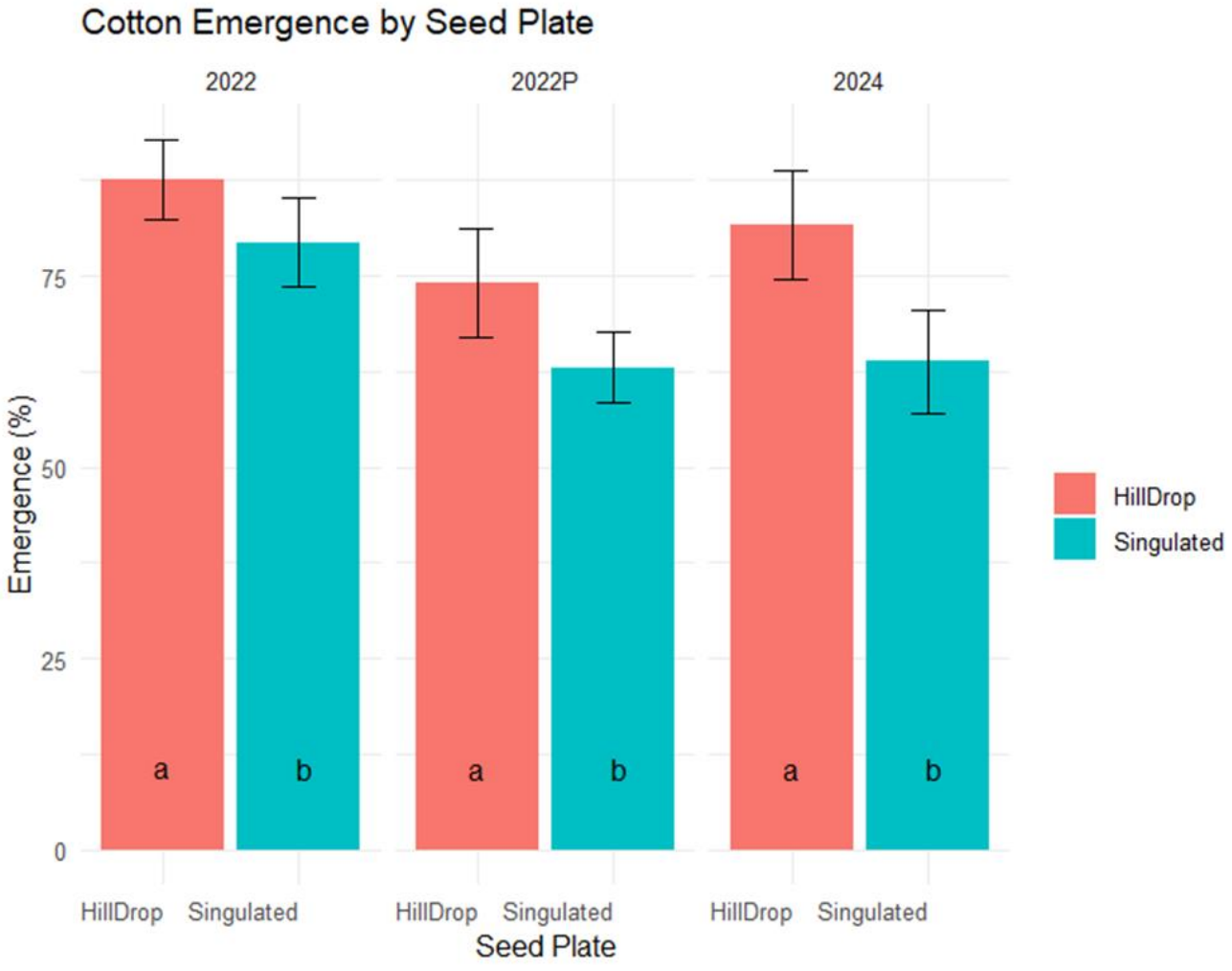
Cotton Planter Performance

Key findings:
Hill Drop Seed Plates improved emergence across all years



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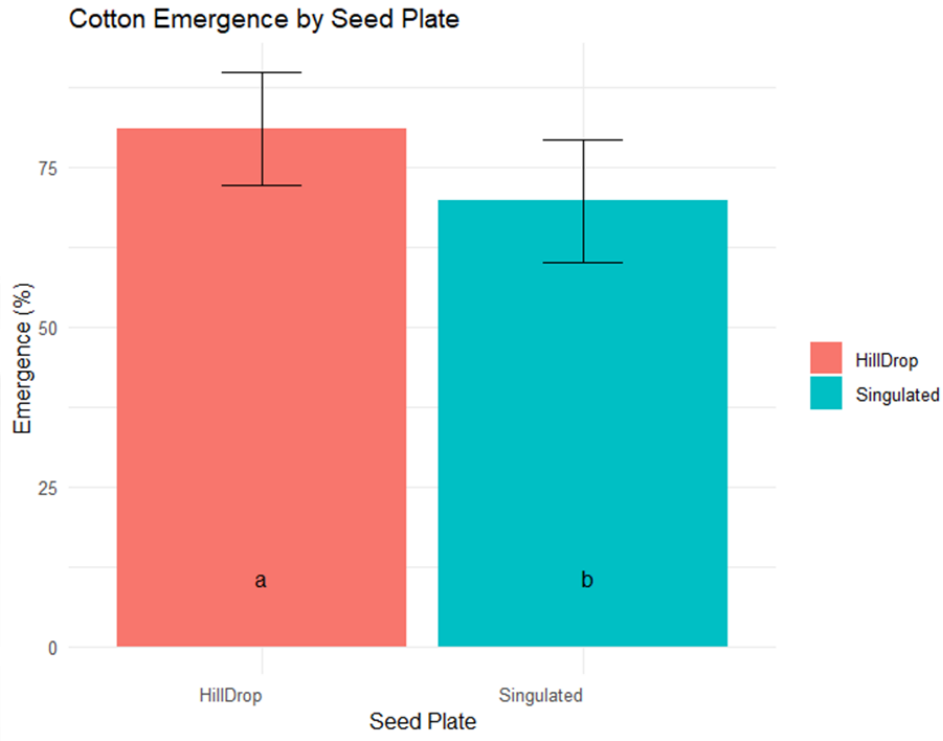
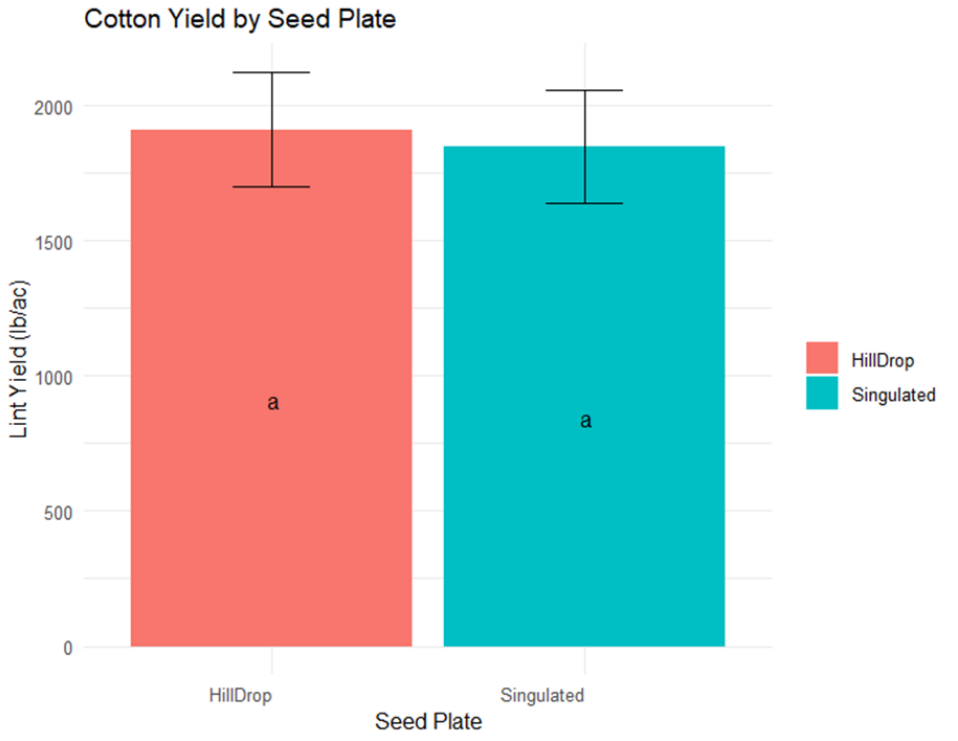
Cotton Planter Performance





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