

2013 Safflower Irrigation Research Results

Presentation by

L. Niel Allen
Extension Irrigation Specialist

Earl Creech, Clark Israelsen, Mike Pace
Students Holly Kent and Phillip Castro

Logan, Utah
February 21, 2014



Irrigated Safflower

- Adequate water is important to the production of high safflower yields.
- Excess irrigation can reduce yields, increase late weed growth, and create an environment where safflower is more susceptible to *Alternaria* leaf spot.
- *Alternaria* leaf spot is caused by fungi that grow on leaves of safflower and can decrease yield and is expensive to control. Disease occurs when spores land on leaves or stems, germinate in the presence of free moisture, and directly penetrate and infect the plant.

Introduction

Questions Investigated:

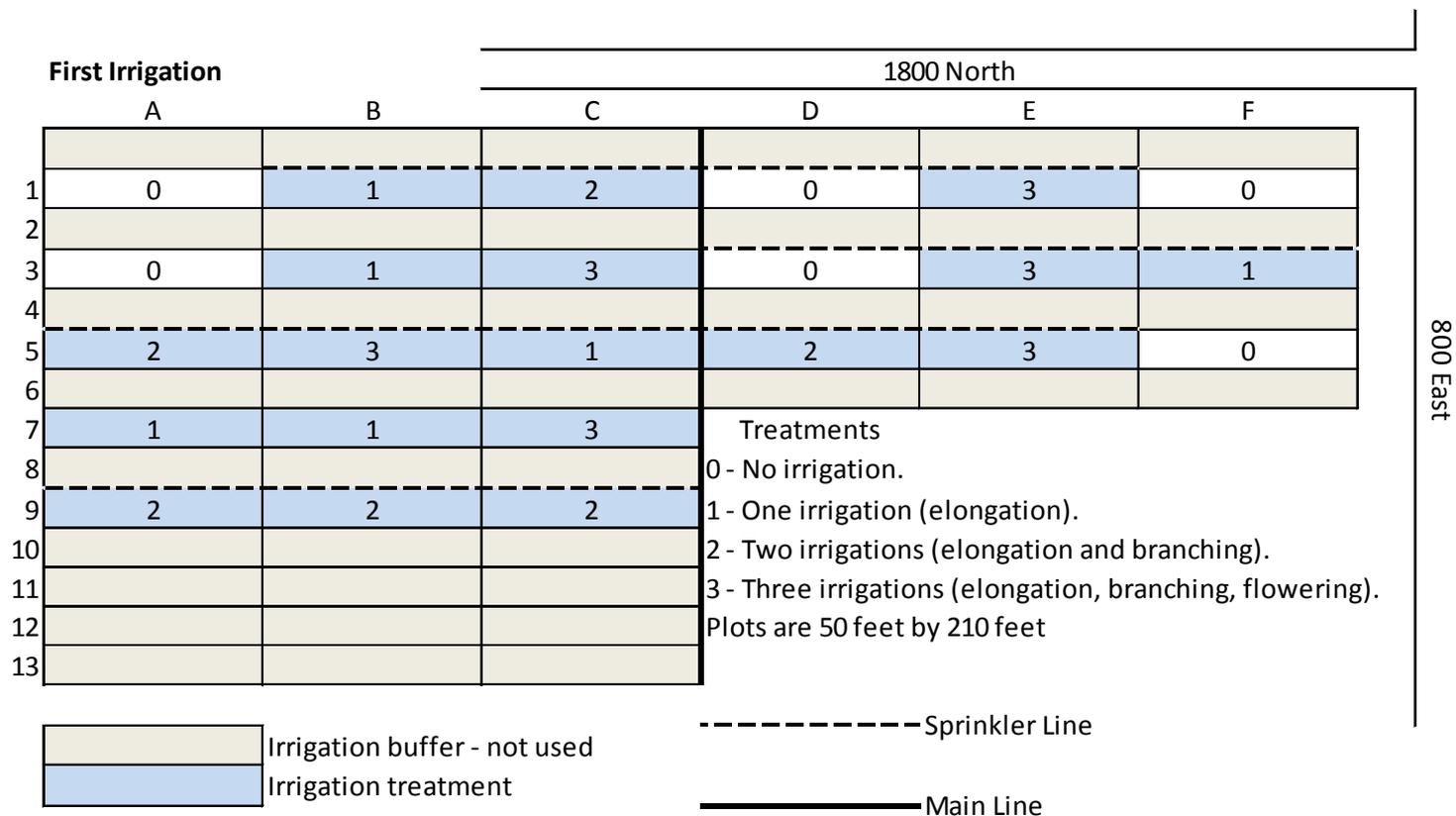
1. When and how often should safflower be irrigated?
2. At what growth stage should irrigation be terminated? and
3. How does irrigation impact *Alternaria* leaf spot?

Greenville Utah Agriculture Experiment Farm, North Logan, Utah (field in 2011)



Irrigation Plot Layout

Safflower Irrigation Research (2013) Greenville Farm



2013 Cropping Information

- Pre-plant fertilizer application of 70 lbs N per acre
- **April 22:** Treated with Sonalan for weed control (2 pints per acre)
- **April 25:** planted
 - Seeding rate of 20 lbs per acre
 - Variety is #208
- **May 7:** cotyledon leaf stage
- **June 11-14 :** 1st irrigation (2.96 inches net avg.)
- **June 28 – July 2:** 2nd irrigation (3.27 inches net avg.)
- **July 18-19:** 3rd irrigation (3.27 inches net avg.)

Cropping Information

- **August 3:** Obtained imagery of field.
- **August 9:** Fungicide application on half of each plot (Quadris Flowable) at 12 oz. per acre and (Exit Activator Adjuvant) at about 6 oz. per acre.
- **Oct 9:** Harvested 9 of 48 sub-plots (a portion of the east side) Combine broke and then it rained.
- **Oct 21:** Harvested remainder of plots
- Total yield of field (all buffers and plots) was 38,000 lbs or about 2,990 lbs. per acre

Data Collected

- Weather data from USU Greenville Farm station
- Initial soil moisture samples taken at 3 locations on May 10.
- Soil moisture samples taken every two weeks at 6 locations June 7 through September 3.
- Yield data for plots
- Oil content, bushel weight, moisture percent
- Seed Color Score – color scale, dark ends, papus, immature seeds, slight yellowing, sprouting



May 7



May 21



May 29



June 7



June 17 (first Irrigation June 11)



June 24



July 9 (2nd Irrigation on June 28)



July 9 (two irrigations)



July 9 (no irrigations)



July 9 (two irrigations, slight Alternaria leaf spot)



July 15

Differences in maturity, branching, and number of seed heads



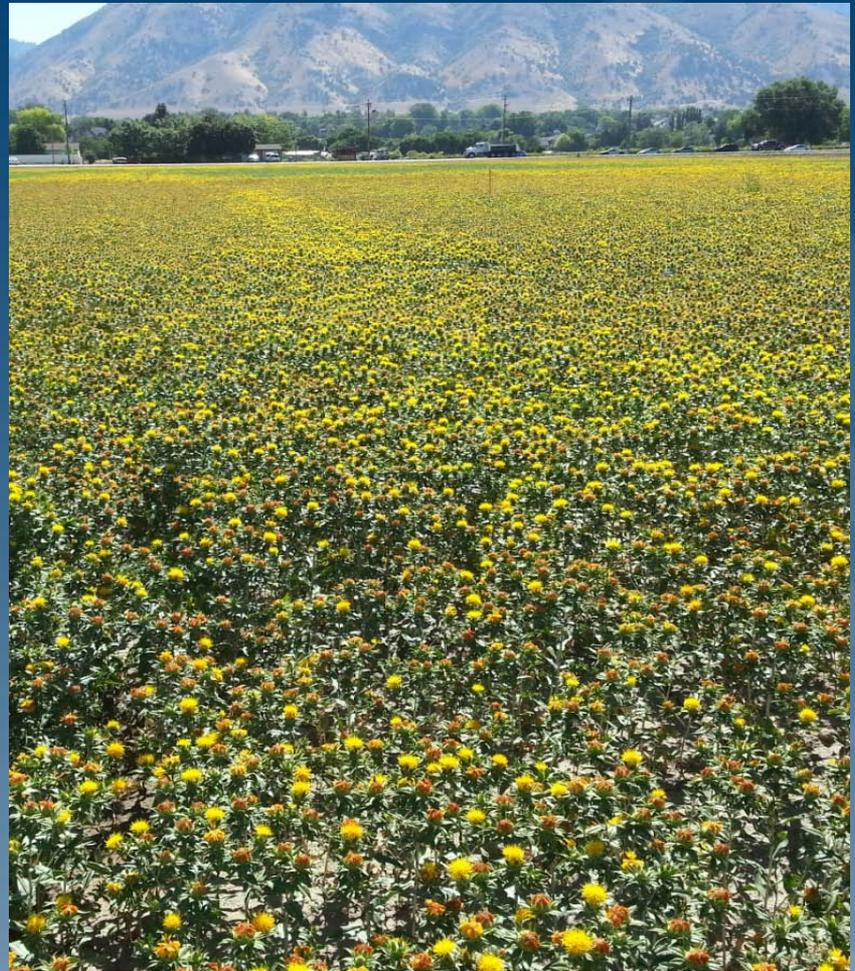
July 15 (2 irrigations, 1 irrigation, and no irrigation)



July 18 (third and last irrigation)



July 22 (3 irrigations)



July 22 (no irrigations)



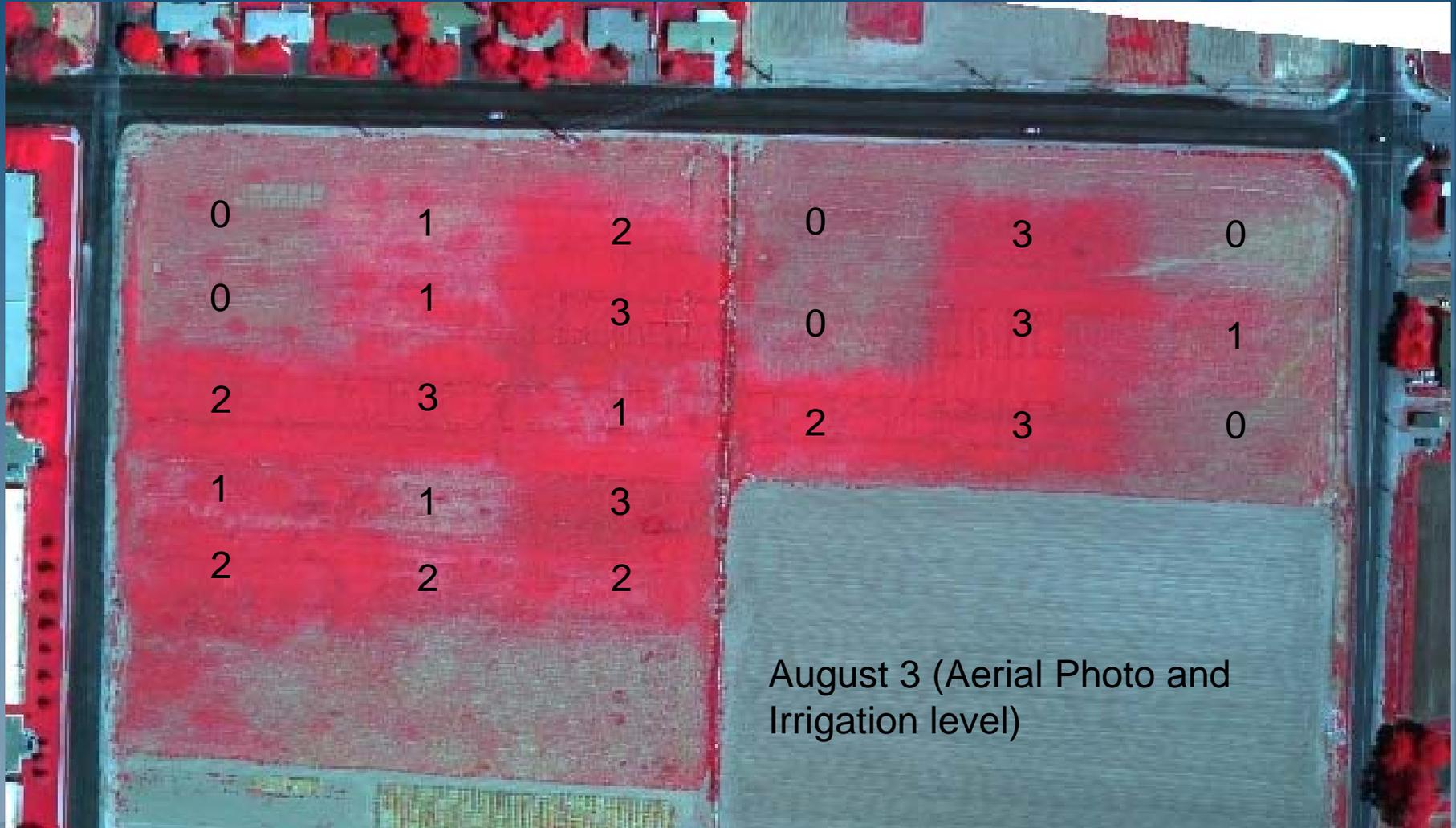
July 30 (3 irrigations, Fungicide was applied August 9)



July 30 (no irrigation
east side)

No signs of
Alternaria

False Color Image (red is well irrigated)



Difference between area treated with and without fungicide



September 19



September 19 (fungicide treated)



September 19 (untreated)



October 18 (harvest)

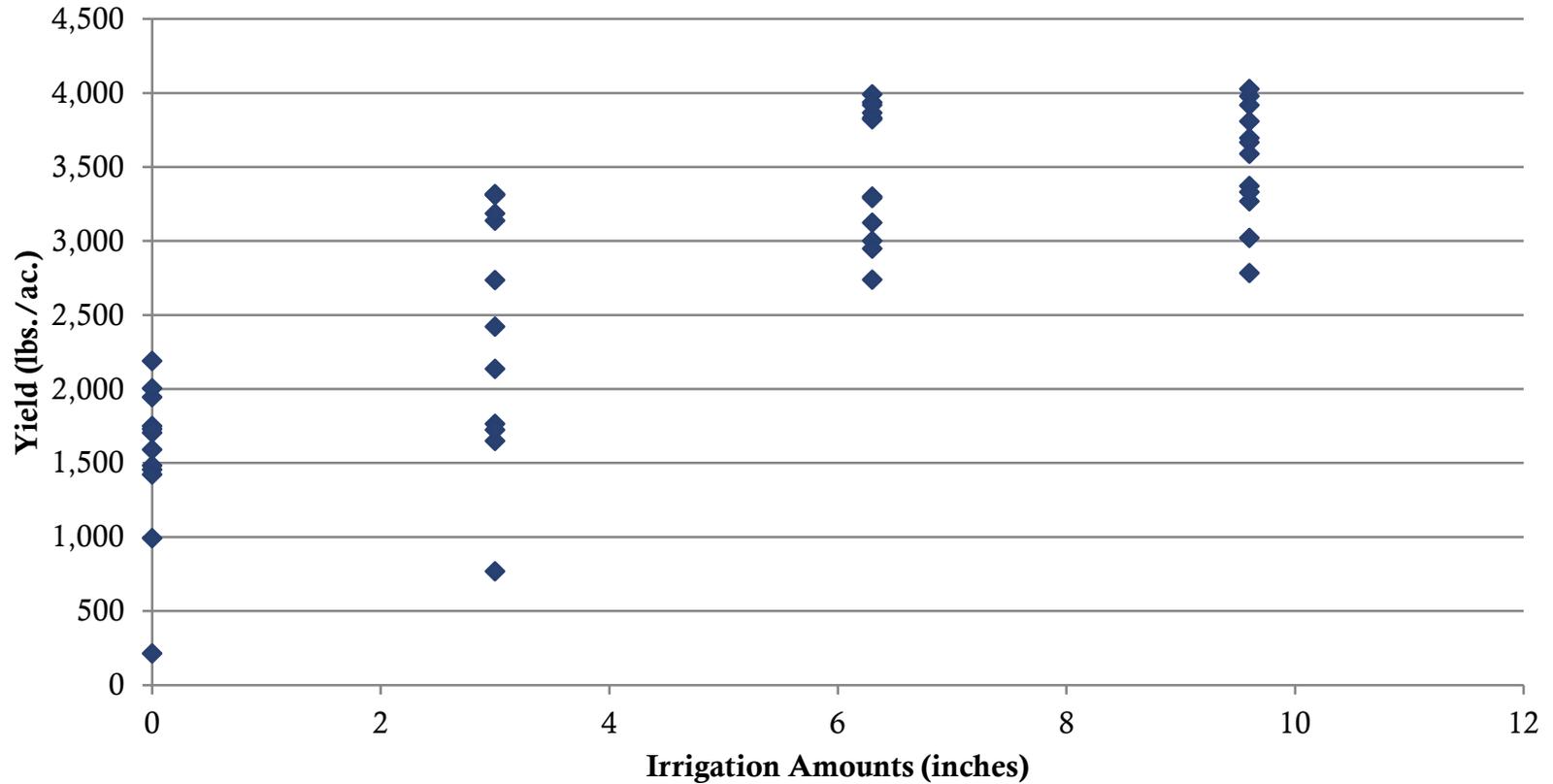
Summary of Yields

		East Side		Column (North Edge, 1800 N)						
Field Center (mainline)	field		D		E		F		800 East	
		FRS	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6		
	1	Range 3		I-0	FT I-0	I-3	FT I-3	I-0		FT I-0
				1455.3	1422.9	3268.2	3020.9	1749.7		213.7
	3	Range 2		I-0	FT I-0	I-3	FT I-3	I-1		FT I-1
				1704.8	1729.9	3695.7	2783.8	1723.8		768.7
5	Range 1		I-2	FT I-2	I-3	FT I-3	I-0	FT I-0		
			3831.9	3865.5	3978.4	3330.8	1483.3	992.4		

		West Side		Column (North Edge, 1800 N)						
600 East	Field		A		B		C		Field Center (mainline)	
		FRS	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6		
	1	Range 5		I-0	FT I-0	I-1	FT I-1	I-2		FT I-2
				1945.2	1590.8	1649.3	2136.3	3300.2		3123.8
	3	Range 4		I-0	FT I-0	I-1	FT I-1	I-3		FT I-3
				2189.8	2004.8	2735.9	3309.9	3918.0		3808.6
5	Range 3		I-2	FT I-2	I-3	FT I-3	I-1	FT I-1		
			3936.7	3919.4	3666.6	4027.0	3316.7	3185.9		
7	Range 2		I-1	I-1	I-1	I-1	I-3	I-3		
			3313.3	3137.6	2421.6	1764.8	3588.9	3371.6		
9	Range 1		I-2	I-2	I-2	I-2	I-2	I-2		
			3822.4	3991.0	3290.5	2738.6	2948.5	3000.9		

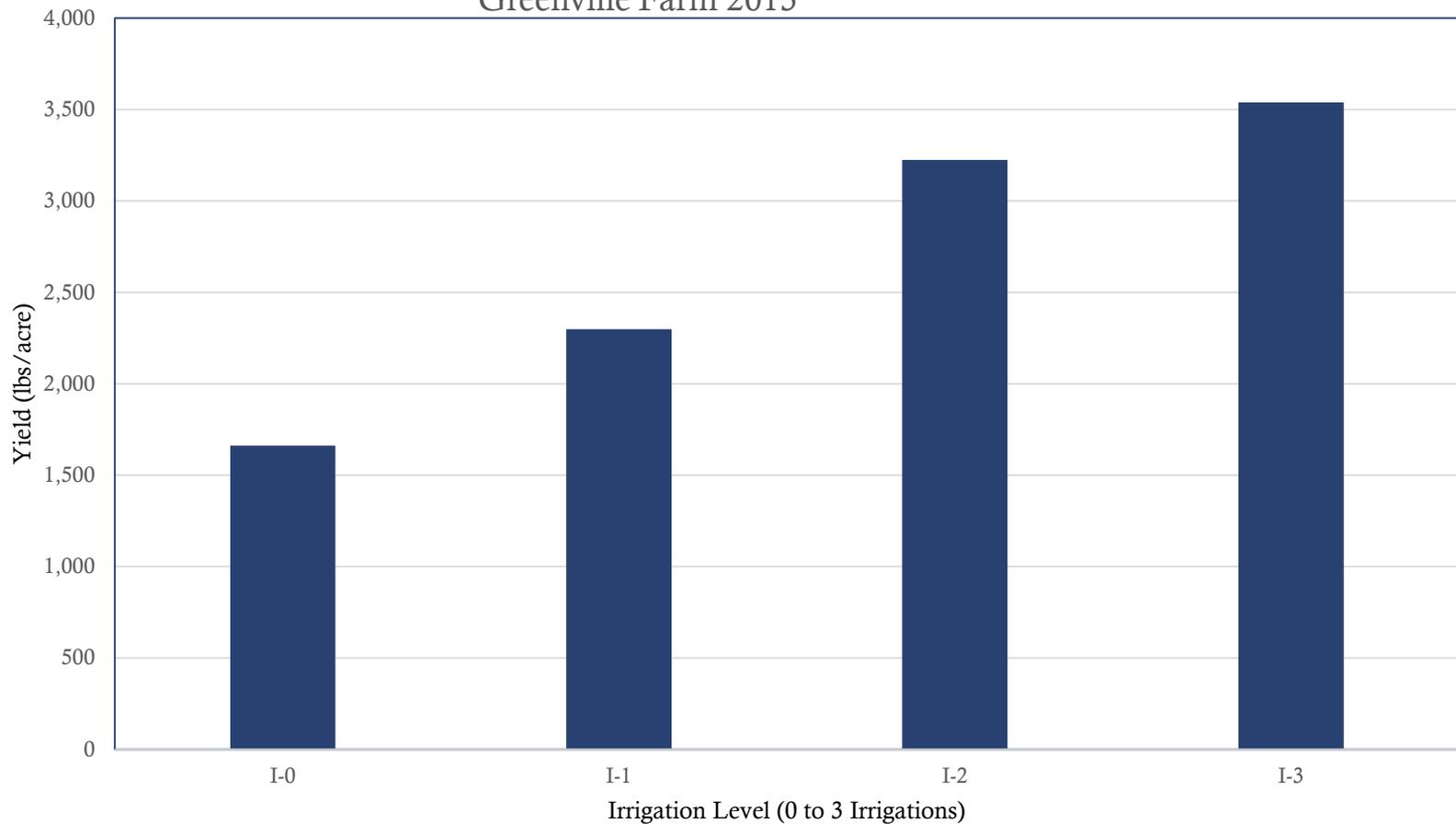
Safflower Yields

Safflower Yield for Irrigation Levels

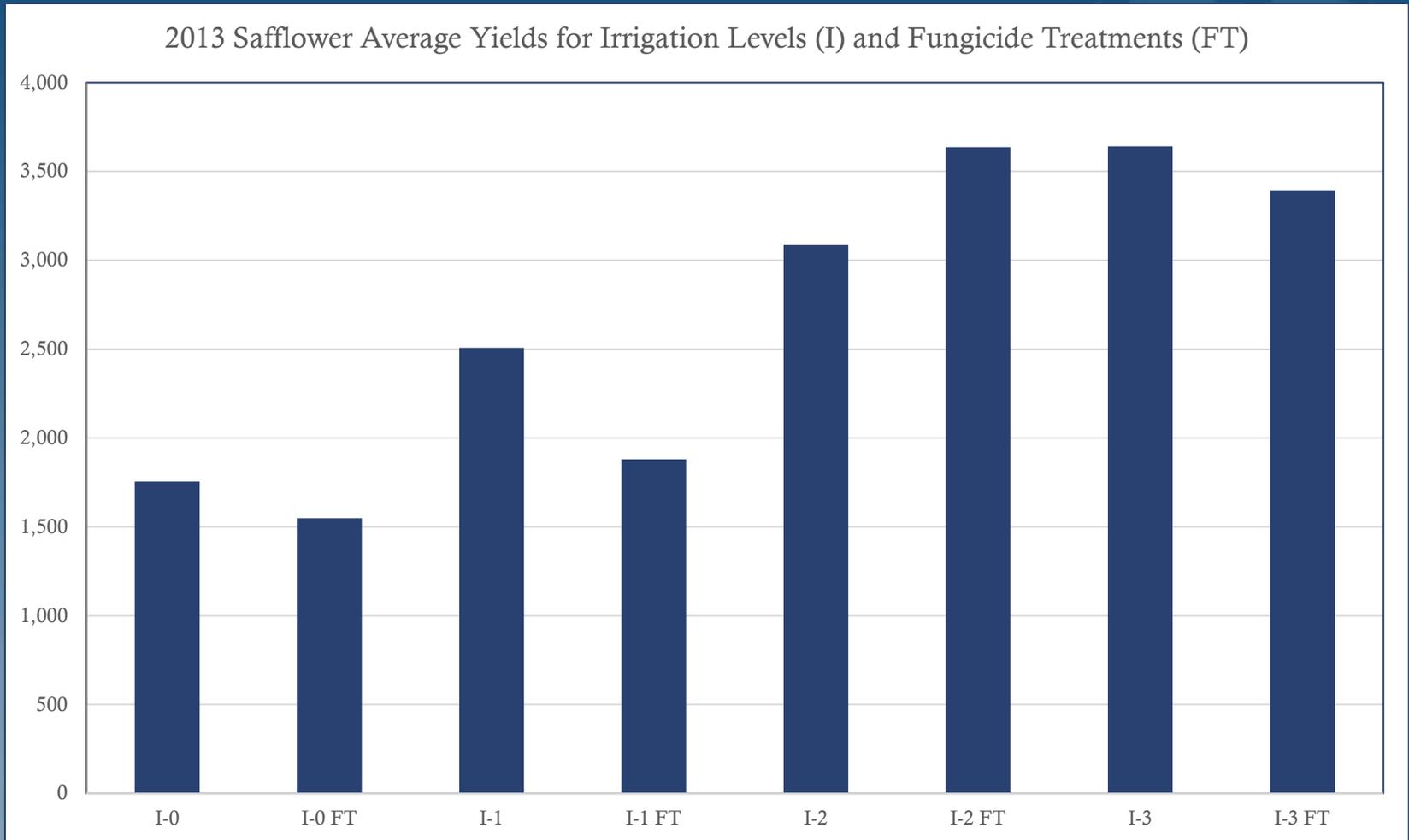


Average Yields for by Irrigation Levels

Safflower Yields v Number of Irrigations
Greenville Farm 2013



Yields for Irrigation Levels and Fungicide Treatments

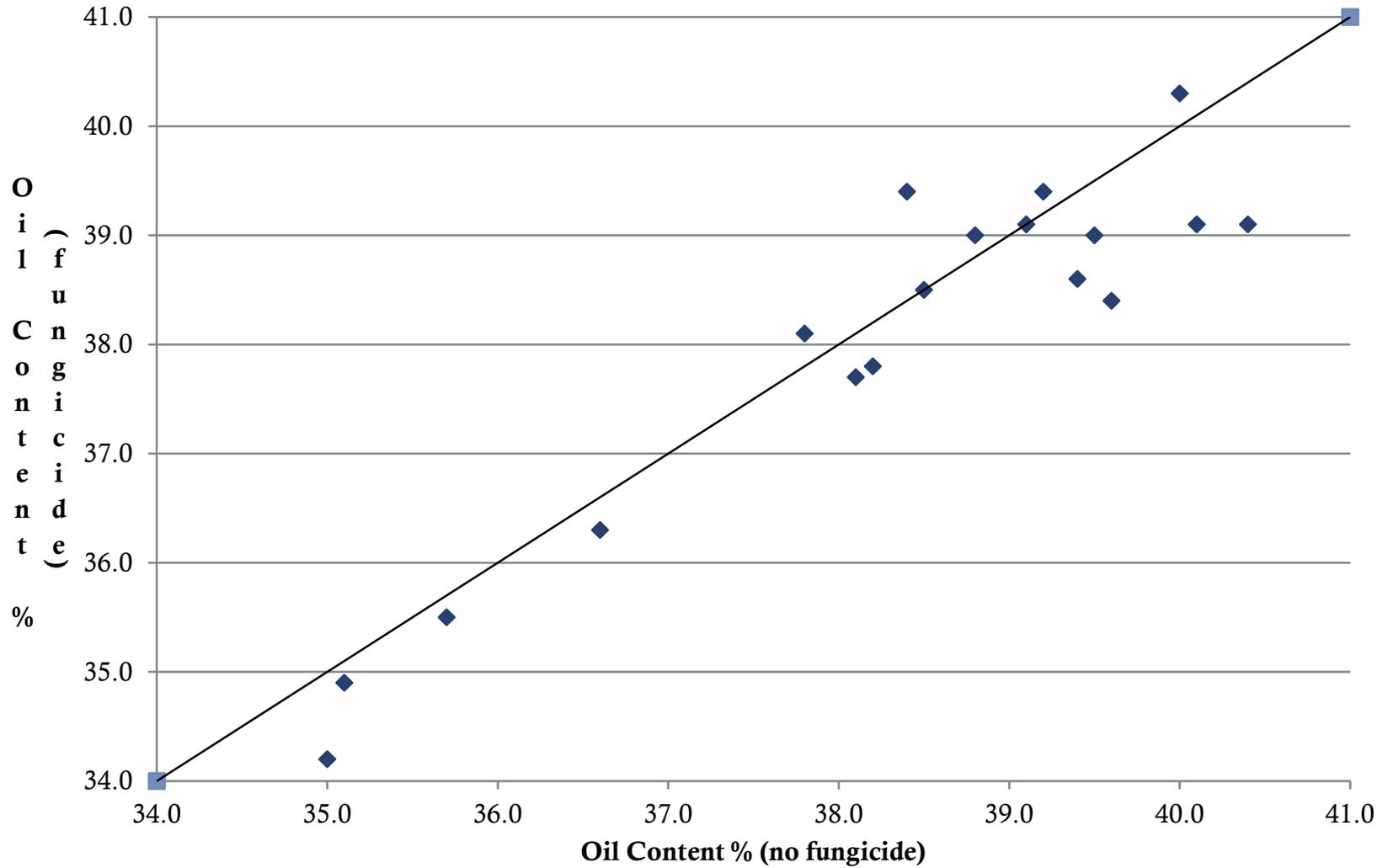


Oil Content by Irrigation Level and Fungicide Treatment

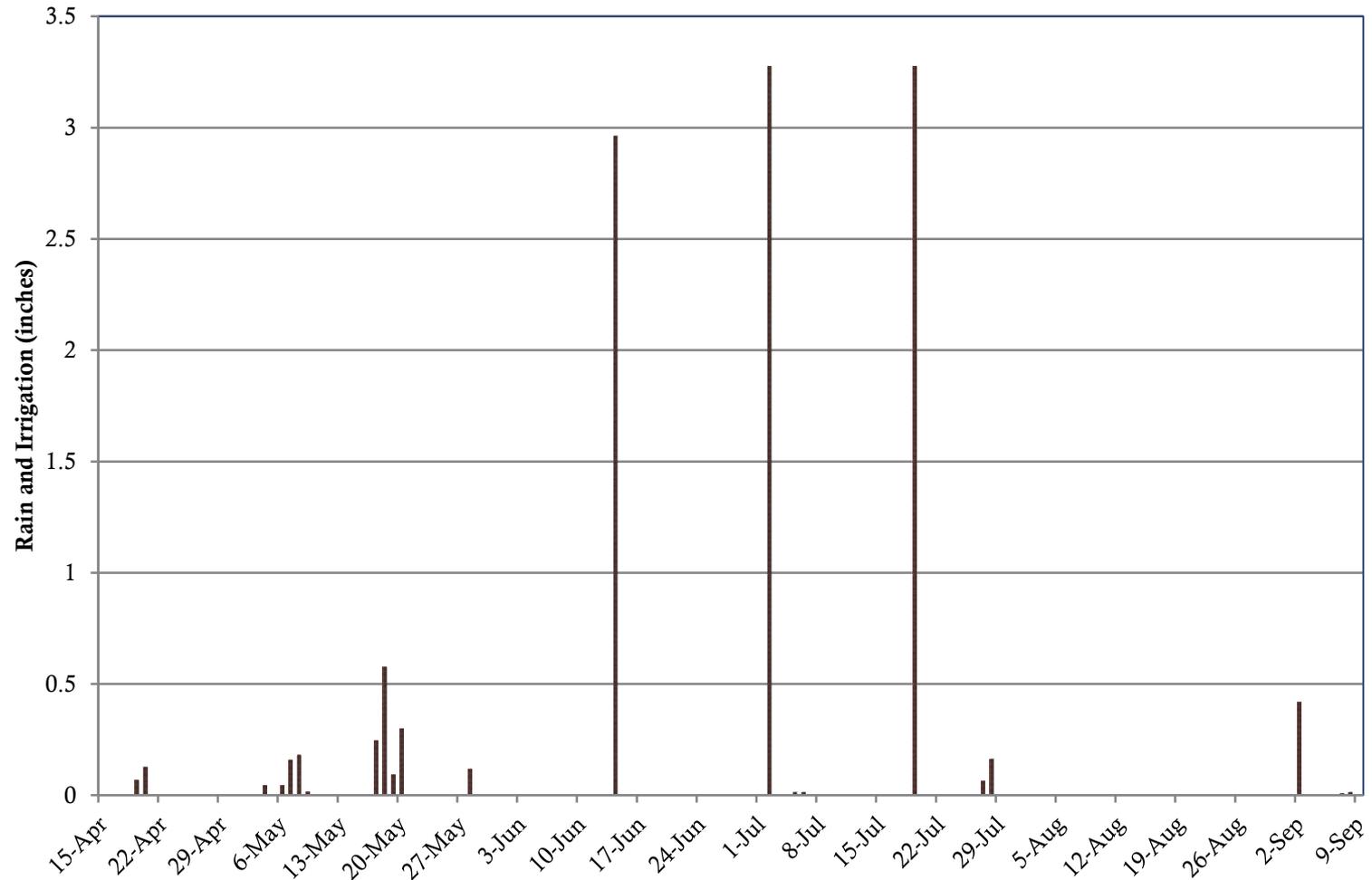
Irrigation Level	Oil Content %	Std. Dev. Oil Content
I-0	38.8	1.6
I-1	36.6	2.4
I-2	35.6	2.6
I-3	36.9	2.5

Fungicide Treatment	Oil Content %	Std. Dev. Oil Content
Treated	38.0	1.70
No Treatment	38.3	1.68

2013 Safflower Oil Content No Fungicide v Fungicide



2013 Greenville Farm Safflower Study (Rain and Irrigation)



Safflower Seasonal Soil Water Depletion in top 5 feet (2013)

Location	No. Irrigations	Soil Water Depletion (in.)	ET (in.)
1 - E	3	6.27	18.68
2 - E	1	7.89	12.94
3 - E	0	6.65	8.68
4 - W	2	9.71	17.97
5 - W	1	8.85	15.01
6 - W	2	9.79	18.96

E is located on East side of mainline

W is located on West side of mainline

Precipitation May 1 - August 31 (2.02 inches)

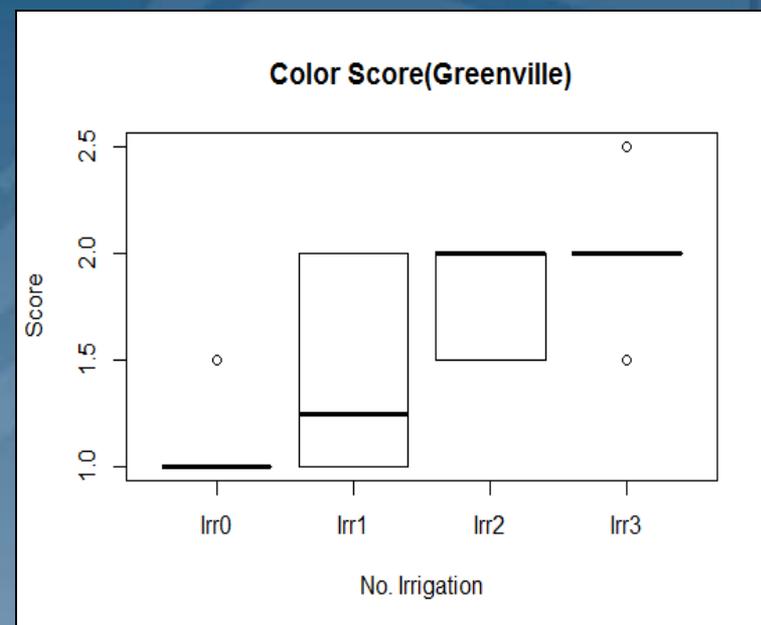
Precipitation May 1 - May31 (1.77 inches)

Evaluation of Color Scores

Treatment	Average	Std. Dev.
I-0	1.08	0.20
FT I-0	1.00	0.00
I-1	1.44	0.42
FT I-1	1.50	0.41
I-2	1.78	0.26
FT I-2	1.67	0.58
I-3	2.00	0.29
FT I-3	2.00	0.61

Treatment	Average	Std. Dev.
Treated	1.53	0.57
No Treatment	1.55	0.44

Significance:
Higher for irrigated



Evaluation of Color Scores

Table of converting the color quality to its quantity

Type	Quantity								
Non	0								
SY-	1	P-	1	IS-	1	S-	1	DE-	1
SY	2	P	2	IS	2	S	2	DE	2
SY+	3	P+	3	IS+	3	S+	3	DE+	3

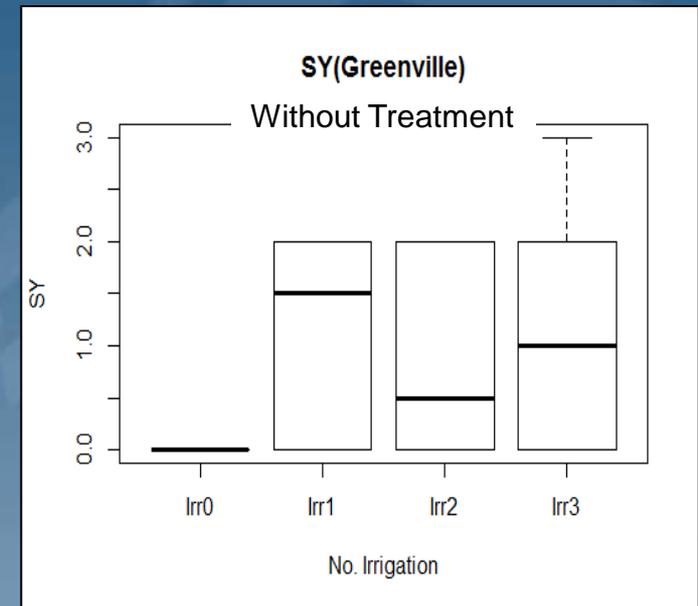
- SY – Slight yellowing
- P – Papus
- IS – Immature seed
- S – Sprouting
- DE – Dark ends

Evaluation of Slight Yellowing

Treatment	Average	Std. Dev.
I-0	0.00	0.00
FT I-0	0.00	0.00
I-1	1.00	0.93
FT I-1	0.50	0.58
I-2	0.78	0.97
FT I-2	0.67	1.15
I-3	1.29	1.25
FT I-3	2.00	0.71

Treatment	Average	Std. Dev.
Treated	0.82	1.01
No Treatment	0.77	1.00

Significance:
More yellowing for
irrigated

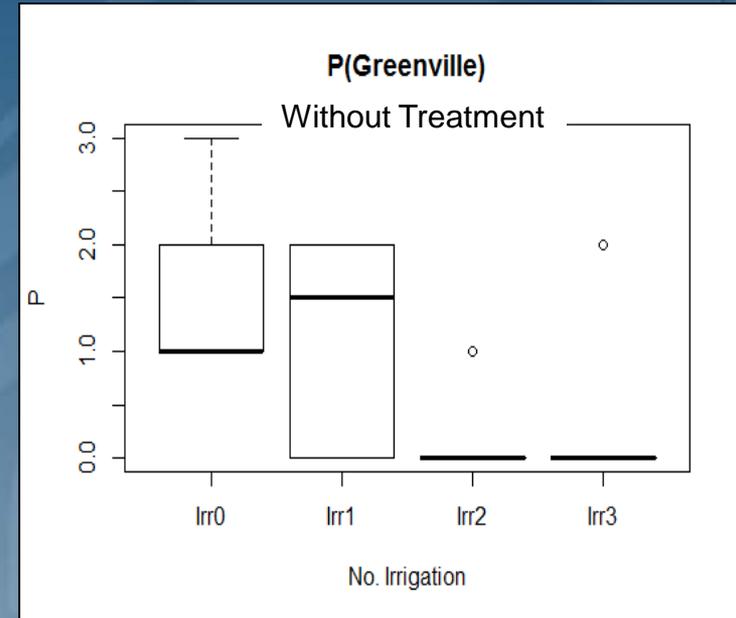


Evaluation of Papus

Treatment	Average	Std. Dev.
I-0	1.50	0.84
FT I-0	1.60	0.89
I-1	0.88	0.99
FT I-1	0.25	0.50
I-2	0.11	0.33
FT I-2	0.67	1.15
I-3	0.29	0.76
FT I-3	0.40	0.89

Treatment	Average	Std. Dev.
Treated	0.76	0.97
No Treatment	0.61	0.89

Significance:
Highest for
non-irrigated.



Evaluation of Immature Seeds

Treatment	Average	Std. Dev.
I-0	0.00	0.00
FT I-0	0.00	0.00
I-1	0.00	0.00
FT I-1	0.00	0.00
I-2	0.33	0.71
FT I-2	1.33	1.15
I-3	0.57	0.98
FT I-3	0.40	0.89

No significant Differences. Although more immature seeds at irrigation levels 2 and 3.

Treatment	Average	Std. Dev.
Treated	0.35	0.79
No Treatment	0.23	0.63

Evaluation of Sprouting

Treatment	Average	Std. Dev.
I-0	0.00	0.00
FT I-0	0.00	0.00
I-1	0.00	0.00
FT I-1	0.75	0.96
I-2	0.56	0.73
FT I-2	0.00	0.00
I-3	0.43	0.79
FT I-3	0.80	1.30

No significant Differences.
Although more sprouting
in irrigated.

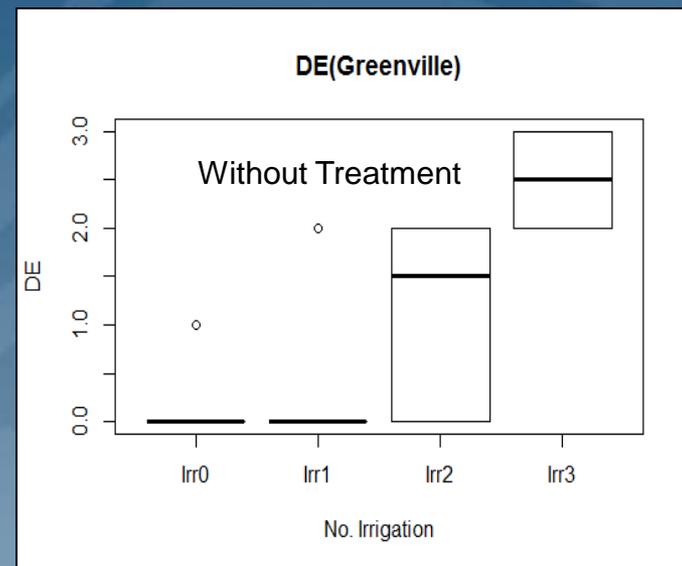
Treatment	Average	Std. Dev.
Treated	0.41	0.87
No Treatment	0.26	0.58

Evaluation of Dark Ends

Treatment	Average	Std. Dev.
I-0	0.17	0.41
FT I-0	0.00	0.00
I-1	0.50	1.07
FT I-1	0.00	0.00
I-2	1.22	0.83
FT I-2	0.67	1.15
I-3	2.43	0.53
FT I-3	1.00	1.41

Treatment	Average	Std. Dev.
Treated	0.41	0.94
No Treatment	1.06	1.12

Significance:
More Dark Ends for
Non-treated and increases
with number of irrigations



Summary

- ∞ The number of irrigations made effected the yields with a high significance level. There was the least difference in yield moving from 2 to 3 irrigations.
- ∞ The alternaria leaf spot disease was not a significant factor in the yield.
- ∞ The fungicide treatment resulted in improvement of slight yellowing and dark ends.
- ∞ In 2013 there was very little rain in June, July, and August while the was maturing. The results could change during a year with higher precipitation.