TEXAS A&M AGRILIFE RESEARCH

Improving Life Through Science and Technology

Lubbock-Pecos-Halfway

Helm Research Farm

Summary Report

2020

Technical Report
21-3

Texas AgriLife Research / Dr. Patrick Stover, Director
The Texas A&M University System / College Station, Texas

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Introduction:

The Texas A&M University System purchased 373 acres of farmland from the estate of Ardella Helm in December 1999 for the purpose of conducting large scale research and extension programs to enhance produce profitability and sustainability in an irrigated environment. The farm is located 2 miles south of the Texas A&M AgriLife Research and Extension Center at Halfway in Hale County.

Current projects at the Helm Research Farm involve production options and economics of subsurface drip (SDI) and pivot irrigation. Other research projects include weed and insect control, plant breeding and yield trails for several commodities and production systems projects. During the past year, irrigated experiments were conducted under the 130-acre center pivot and on 86-acres of SDI.

The soils are predominantly deep clay loams and silty clay loams, with 0-1% and 1-3% slopes, moderately to moderately slowly permeable subsoils and high water and fertility holding capacities. Supplemental water for irrigation comes from 6 wells, 320 to 340 feet deep, pumping at rates of 100 to 200 gallons per minute each.

Texas AgriLife Research - Texas AgriLife Extension
Lubbock / Halfway
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Irrigation of Replanted Cotton using Subsurface Drip Irrigation (SDI) (Field 2)
Scott Jordan, Joe Mustian, Heath Johnson and James Bordovsky

Objective: Determine cotton lint yield, fiber quality and water productivity of replanted cotton using three irrigation timing treatments.

Methodology: This study was conducted in a 12-acre area irrigated by SDI with 30-inch dripline spacing. The field was broken up into 3 blocks with three different irrigation zones within each block, and a dryland check zone next to the 3rd block. The irrigation treatments were designated as T1, T2, and T3. On June 11th, following heavy rainfall and damaging hail, cotton was replanted at 47,000 seeds/ac of NexGen 2982 B3XF. The irrigation amounts, field operations, varieties, pesticides, and nutrient applications for 2020 are listed in the appendix.

Figure 1. Harvesting subsurface drip irrigated treatments at Helms Research Farm, 2020.

Results: Annual rainfall for 2020 was 7.9 inches and the combined preplant and seasonal irrigation in the three respective irrigation treatments were 8.77, 9.91, and 10.64 inches. As irrigation increased, cotton lint yields increased across the irrigation treatments. In the T2 and the T3 treatment, cotton lint yields increased by 15.8% and 35.0% respectively over the T1 irrigation treatment. Seasonal irrigation water use efficiency (SIWUE) decreased by 1.5% from T1 to T2 but increased by 10.8% from T1 to T3. Fiber quality, as reflected in the cotton lint loan value, ranged from 0.428 $/lb to 0.498 $/lb among the irrigation treatments.

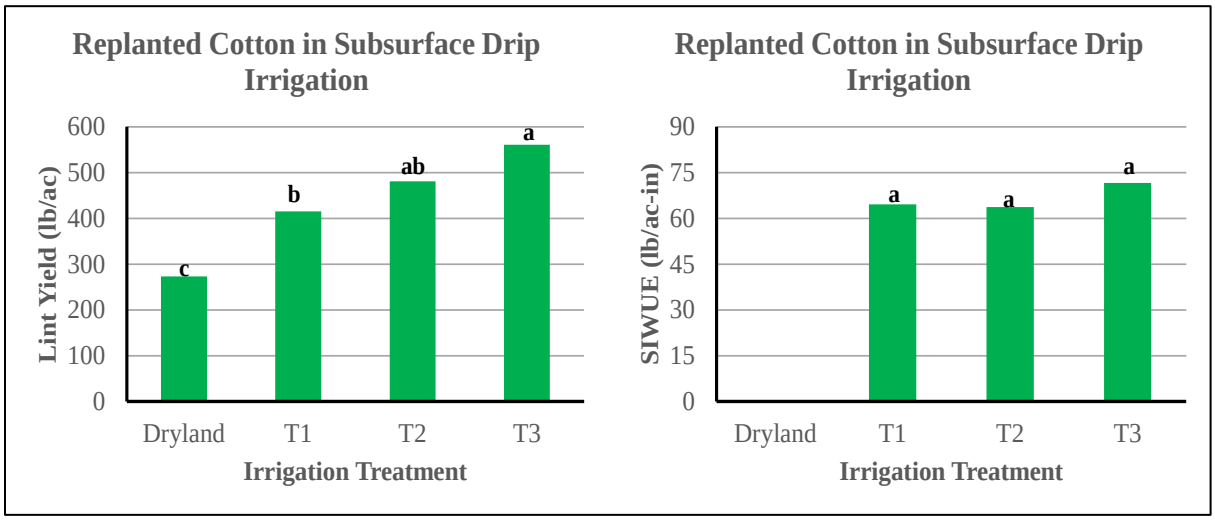


Figure 2. Cotton lint yield and seasonal irrigation water use efficiency (SIWUE) of replanted cotton in sub surface drip irrigation at Helms Research Farm, 2020

Cotton Response to Irrigation Quantities using Subsurface Drip Irrigation (Field 3)
Scott Jordan, Joe Mustian, Heath Johnson and James Bordovsky.

Objective: Determine cotton lint yield, seasonal water use efficiency, and fiber quality of low-population cotton using subsurface drip irrigation (SDI).

Methodology: This study was conducted in a 16-acre test area irrigated by subsurface drip irrigation (SDI) with 60-inch dripline spacing. The field was broken up into three blocks with six different irrigation zones within each block, and two dryland check zones on the outside perimeter of the field. The irrigation zones were designated as T1, T2, T3, T4, T5, and T6. The irrigation amounts, field operations, varieties, pesticides, and nutrient applications for 2020 are listed in the appendix.

Results: Heavy rainfall and damaging hail in early June resulted in a poor stand of cotton in the test area. Due to a well going down in the beginning of July, the test plan for this field was modified. Annual rainfall was 7.9 inches with total preplant and seasonal irrigation quantities ranging from 5.69 to 8.49 inches. Cotton lint yields ranged from 151 to 505 lb/ac. As irrigation increased cotton lint yields increased as well. Seasonal water use efficiency decreased as the seasonal irrigation applied increased over 2 inches. Fiber quality, as reflected in the cotton lint loan value, ranged from 0.468 $/lb to 0.512 $/lb. In years of similar weather challenges, irrigation of low population cotton may be a better alternative than replanting.

Table 1. Seasonal irrigation amounts, cotton lint yields and seasonal water use efficiency of irrigation treatments using SDI at Helms Research Farm, 2020.

Treatment	Seasonal Irrigation (in)	Lint Yield (lb/ac)		SIWUE (lb/ac-in)	
Check		151	e*		
T4	1.93	329	d	92	a
T2	2.24	388	cd	106	a
T5	2.58	413	bc	102	a
T3	2.73	426	bc	101	a
T1	4.09	505	ab	87	a
T6	4.19	492	a	81	a

* Yield and SIWUE means followed by the same letter are not significantly different (p<0.5, Turkey).

Table 2. Cotton fiber quality characteristics and loan values of irrigation treatments using subsurface drip irrigation at Helms Research Farm, 2020.

Treatment	Mic	Length	Unif	Strength	Elon.	Rd	+b	CGRD	Leaf	Loan Value (¢/lb)
Check	3.88	1.04	79.9	26.1	5.9	80.8	9.5	11-1	1.0	51.2
T4	3.27	1.07	80.3	26.6	6.0	82.1	9.2	11-1	1.0	47.9
T2	3.22	1.10	81.0	28.6	6.1	82.7	9.4	11-1	1.0	49.6
T5	2.90	1.10	81.6	28.9	6.3	83.5	9.1	11-1	1.0	46.8
T3	3.04	1.11	80.7	30.0	6.0	82.9	9.1	11-1	1.0	51.0
T1	3.29	1.12	81.4	29.5	6.0	83.1	9.2	11-1	1.0	50.8
T6	2.77	1.14	81.5	30.6	6.2	83.5	9.2	11-1	1.0	48.2

Continuous Cotton Response to Tillage and Irrigation Level (Field 5a)
Scott Jordan, Casey Hardin, Joe Mustian, and James Bordovsky

Objective: Determine yield, fiber quality, and water use efficiency of continuous cotton at three irrigation levels under conventional and reduced tillage.

Methodology: These results are part of a comprehensive crop rotation-tillage-irrigation study conducted on 125 acres irrigated by LEPA. In this 222-acre test area continuous cotton has been grown since 2014. Each pivot span was divided into three sections with each section delivering different irrigation amounts. The irrigation levels were designated as the base irrigation rate (1.0 BI); 50% of base irrigation rate (0.5 BI); and 150% of base irrigation rate (1.5 BI). Field operations, irrigation amounts, pesticides and nutrient applications are listed in the appendix.

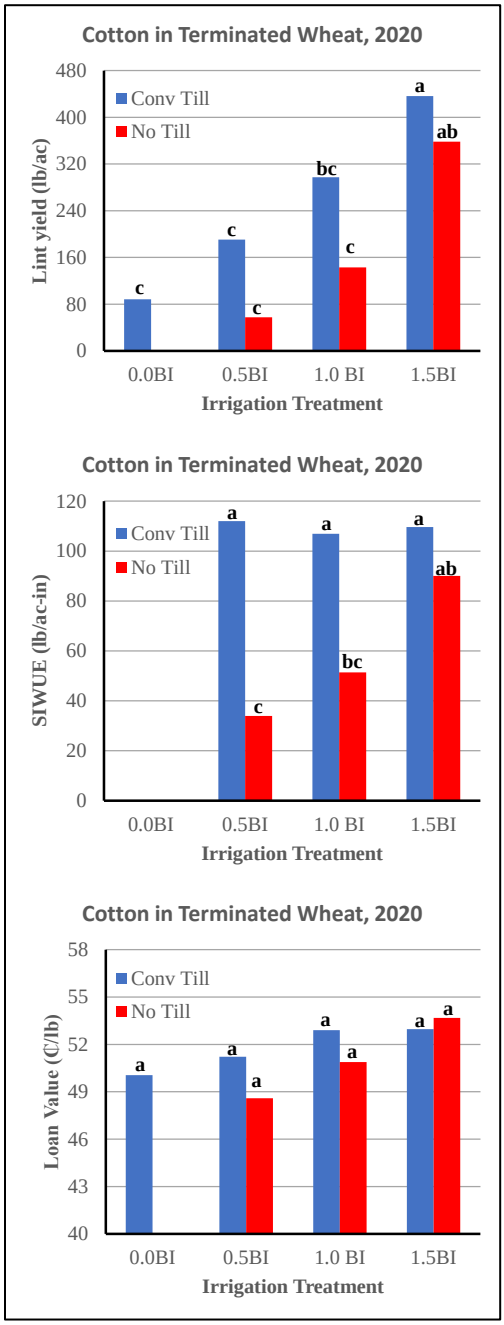


Figure 1. Cotton lint yield, seasonal irrigation water use efficiency, and cotton lint loan value from irrigation levels in two tillage systems at Helms Research Farm, Halfway, TX, 2020.

Results: Heavy rainfall and hail in early June resulted in a poor stand of cotton in the test area. Due to a well going down in the beginning of July, the pivot was set to run at 100% speed through this section of the field for the growing season. Annual rainfall was 7.9 inches and the combined preplant and seasonal irrigations in the three respective irrigation treatments were 5.45, 6.64, and 7.85 inches. Conventional tillage resulted in higher cotton yields and water use efficiency at all irrigation levels than the corresponding no tillage treatments. Fiber quality, as reflected in the loan value, of conventional tillage at the 0.5BI and the 1.0 BI was increased by 5.4% and 4.0% respectively when compared to the no tillage treatments. However, the fiber quality decreased by 1.4% at the 1.5 BI in the conventional tillage areas compared to the no tillage areas.

Figure 2. Low population continuous cotton at Helms Research Farm, 2020.

Cotton / Wheat Grain Rotation Response to Tillage and Irrigation Levels (Field 5b)
Scott Jordan, Casey Hardin, Joe Mustian, and James Bordovsky

Objective: Determine lint yield, fiber quality, and water productivity of cotton following a wheat / fallow period with cotton irrigated at three levels under conventional and reduced tillage systems.

Methodology: These results are part of a comprehensive crop rotation-tillage-irrigation study conducted on 125 acres irrigated by LEPA. In this 22-acre test area, cotton was planted following a fallow period in 2019. Two tillage systems, conventional tillage (even pivot spans) and no tillage (odd spans) were used. In addition, each span was divided into three sections, with each section delivering different quantities of irrigation. The irrigation levels were designated as base irrigation rate (1.0 BI); 50% base irrigation rate (0.5 BI); and 150% base irrigation rate (1.5 BI). Field operations, irrigation amounts, pesticides, and nutrient applications are listed in the appendix.

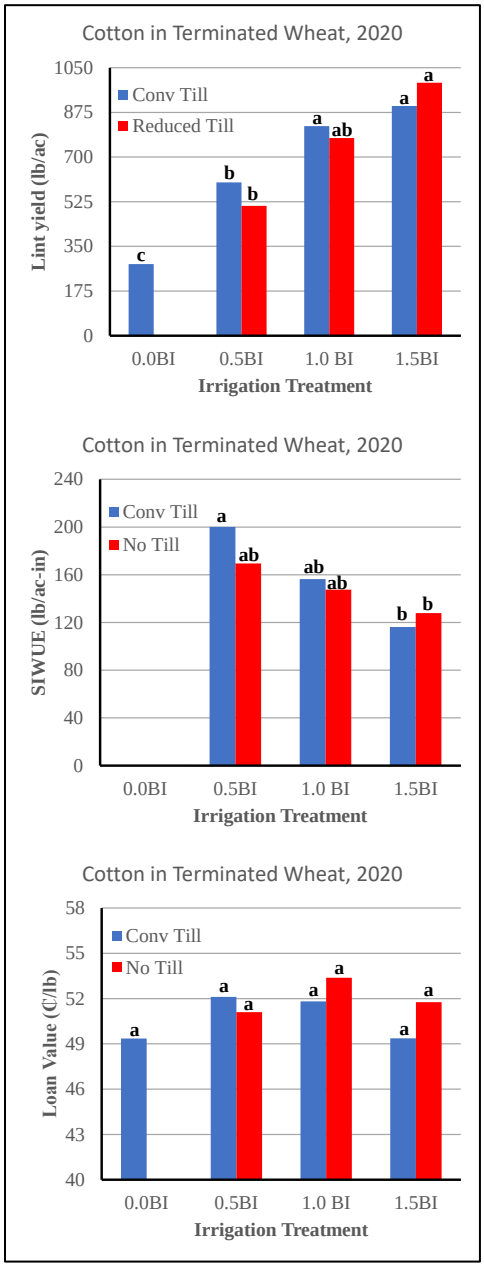


Figure 1. Cotton lint yield, seasonal irrigation water use efficiency (SIWUE), and lint loan values from treatments having two tillage system and three irrigation levels at Hems Research Farm, 2020.

Results: Annual rainfall for 2020 was 7.9 inches, and the combined preplant and seasonal irrigations in the three respective irrigation treatments were 6.70, 9.20, and 11.95 inches. As irrigation quantity increased, cotton lint yield increased in both tillage systems. Under conventional tillage, the 0.5 BI and 1.0 BI treatments resulted in 18.1% and 5.9% higher lint yields, respectively, than the corresponding reduced tillage treatments, while the 1.5 BI resulted in a 10.1% decrease in lint yield compared to the corresponding reduced tillage treatment. As irrigation quantity increased, seasonal irrigation water use efficiency decreased in both tillage systems. Conventional tillage treatments resulted in 1.9% higher fiber quality, as reflected in the lint loan value, at the 0.5 BI level, while resulting in 3.1% and 4.9% reduced fiber quality at the 1.0 BI and 1.5 BI levels, respectively, than the reduced tillage treatments.

Figure 2. Reduced tillage cotton following a wheat / fallow rotation at Helms Research Farm, 2020.

Cotton in Terminated Wheat Response to Tillage and Irrigation Levels (Field 5d)
Scott Jordan, Casey Hardin, Joe Mustian, and James Bordovsky

Objective: Determine lint yield, fiber quality, and water productivity of cotton planted into a terminated wheat cover crop irrigated at three levels under conventional and reduced tillage systems.

Methodology: These results are part of a comprehensive crop rotation-tillage-irrigation study conducted on 125 acres irrigated by LEPA. In this 22-acre test area, cotton was planted into a terminated wheat cover crop. Two tillage systems, conventional tillage (even pivot spans) and reduced tillage (odd spans) were used. In addition, each span was divided into three sections, with each section delivering different irrigation quantities. The irrigation levels were designated as base irrigation rate (1.0 BI); 50% base irrigation rate (0.5 BI); and 150% base irrigation rate (1.5 BI). Field operations, irrigation amounts, pesticides, and nutrient applications are listed in the appendix.

Figure 1. Conventionally tilled cotton two weeks before harvest at Helms Research Farm, 2020

Results: Annual rainfall for 2020 was 7.9 inches, and the combined preplant and seasonal irrigations in the three respective irrigation treatments were 7.50, 10.00, and 12.75 inches. As irrigation increased, cotton lint yields, and fiber quality increased in both tillage systems. Conventionally tilled cotton increased lint yields by 26.7%, 33.6% and 2.8% over the respective irrigation treatments in the reduced tillage treatments. Conventional tillage increased seasonal irrigation water use efficiency (SIWUE) by 26.9%, 33.3%, and 2.7% in each respective irrigation treatment when compared to the reduced tillage plots. In the reduced tillage plots, water productivity increased as the irrigation amount increased; however, in the conventional tillage plots, irrigation at the 1.5 BI level reduced the SIWUE compared to the 1.0 BI level. At each irrigation treatment level, the fiber quality, as reflected in the lint loan values, was similar in both tillage systems.

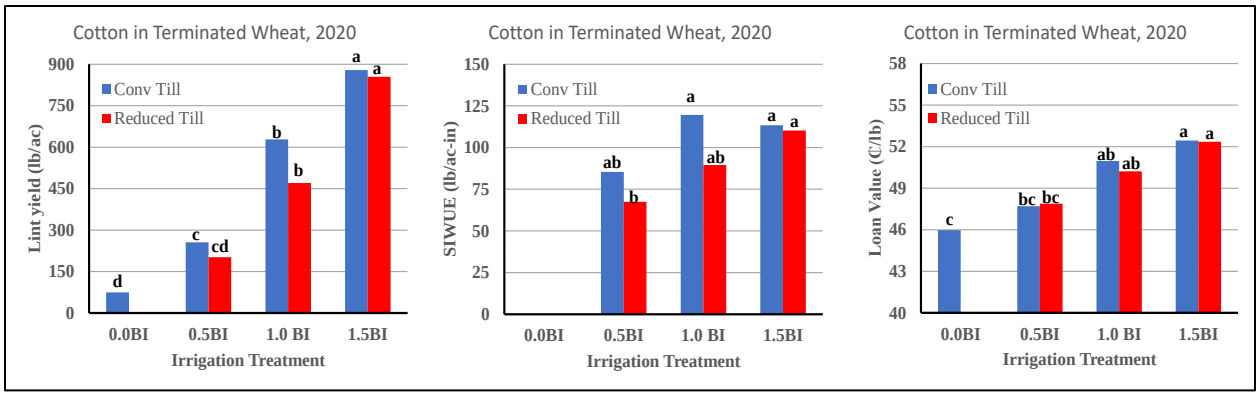


Figure 2. Lint yield, seasonal irrigation water use efficiency (SIWUE), and lint loan values from treatments having two tillage methods and three irrigation levels at Helms Research Farm, 2020. Means with the same letter are not significantly different ($p<0.5$, Tukey).

Grain Sorghum / Cotton Rotation Response to Tillage and Irrigation Levels (Field 5e)
Scott Jordan, Casey Hardin, Joe Mustian, and James Bordovsky

Objective: Determine grain yield, and water productivity of grain sorghum following cotton in a two-year rotation at three levels of irrigation under conventional and reduced tillage systems.

Methodology: These results are part of a comprehensive crop rotation-tillage-irrigation study conducted on 125 acres irrigated by LEPA. In this 22-acre test area, grain sorghum was planted in a two-year rotation with cotton. Two tillage systems, conventional tillage (even pivot spans) and no tillage (odd spans) were used. In addition, each span was divided into three sections, with each section delivering different irrigation quantities. The irrigation levels were designated as base irrigation rate (1.0 BI); 50% base irrigation rate (0.5 BI); and 150% base irrigation rate (1.5 BI). Field operations, irrigation amounts, pesticides, and nutrient applications are listed in the appendix.

Figure 1. Collecting plot weights of grain sorghum plots at Helms Research Farm, 2020.

Results: Annual rainfall for 2020 was 7.9 inches, and the combined preplant and seasonal irrigations in the three respective irrigation treatments were 5.20, 8.20, and 10.95 inches. Average annual grain sorghum yields from 2014 through 2020 are given in Figure 1. In 2020, non-irrigated sorghum yielded no measurable amount of grain due to limited rainfall during the growing season. In the past, grain yields have increased with increased irrigation quantities. Over the last four-year period, reduced tillage treatments have resulted in higher grain yields at the 0.5 BI and 1.0 BI levels, than those in the conventional tillage treatments.

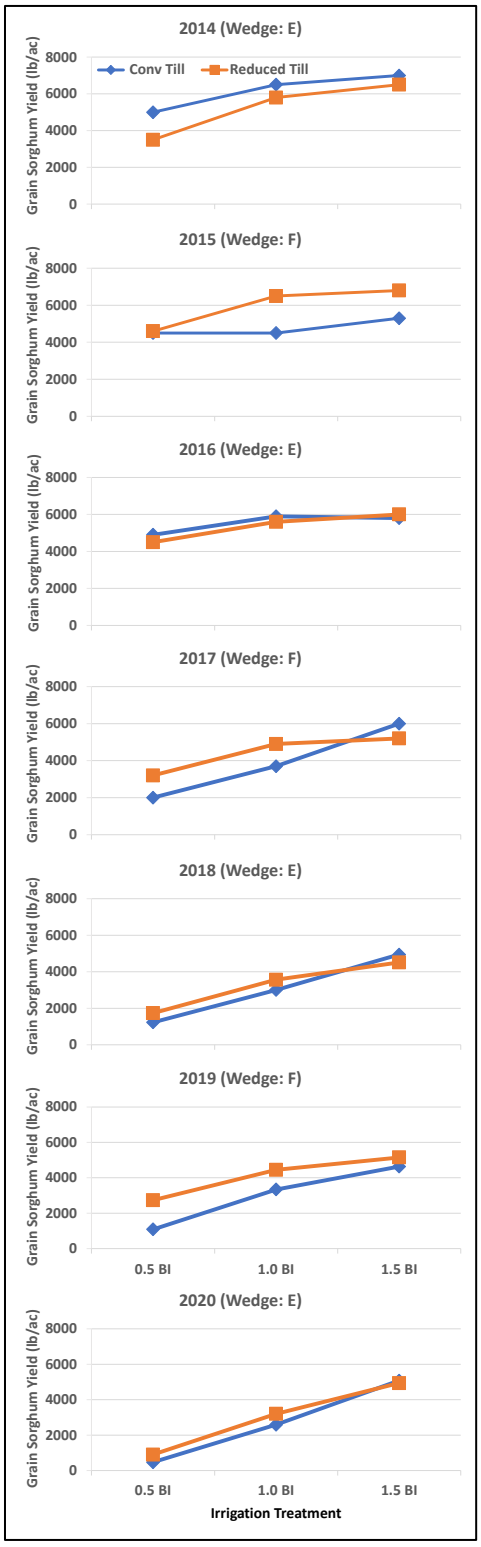


Figure 1. Grain sorghum yields from treatment areas following cotton using conventional and reduced tillage systems at three irrigation levels at the Helms Research Farm, 2014 – 2020.

Cotton / Grain Sorghum Rotation Response to Tillage and Irrigation Levels (Field 5f)
Scott Jordan, Casey Hardin, Joe Mustian, and James Bordovsky

Objective: Determine lint yield, fiber quality, and water productivity of cotton following grain sorghum in a two-year rotation with irrigation at three levels under conventional and reduced tillage systems.

Methodology: These results are part of a comprehensive crop rotation-tillage-irrigation study conducted on 125 acres irrigated by LEPA. In this 22-acre test area, cotton was planted following grain sorghum in a two-year rotation. Two tillage systems, conventional tillage (even pivot spans) and no tillage (odd spans) were used. In addition, each span was divided into three sections, with each section delivering different irrigation quantities. The irrigation levels were designated as base irrigation rate (1.0 BI); 50% base irrigation rate (0.5 BI); and 150% base irrigation rate (1.5 BI). Field operations, irrigation amounts, pesticides, and nutrient applications are listed in the appendix.

Figure 1. Reduced tillage cotton following grain sorghum, Helms Research Farm, 2020.

Results: Heavy rainfall and hail in early June resulted in a poor stand of cotton in the test area. Due to a well going down in the beginning of July, the pivot was set to run at 100% speed through this section of the field during the growing season. Annual rainfall for 2020 was 7.9 inches, and the combined preplant and seasonal irrigations in the three respective irrigation treatments 5.95, 7.14, and 8.47 inches. Increasing the irrigation quantity increased cotton lint yield but reduced seasonal water use efficiency. Reduced tillage resulted in 41.0%, 64.8%, and 46.6% increased lint yields for 0.5 BI, 1.0 BI and 1.5 BI irrigation levels, respectively, when compared to the respective conventional tillage treatments. This resulted in an increase in seasonal irrigation water use efficiency (SIWUE) in the reduced tillage plots compared to the conventional tillage plots. In the conventional tillage plots, increasing the irrigation amount above the 0.5BI level resulted in a decrease in fiber quality, as reflected in the lint loan value. However, in the reduced tillage areas increasing the irrigation amount resulted in an increase in fiber quality.

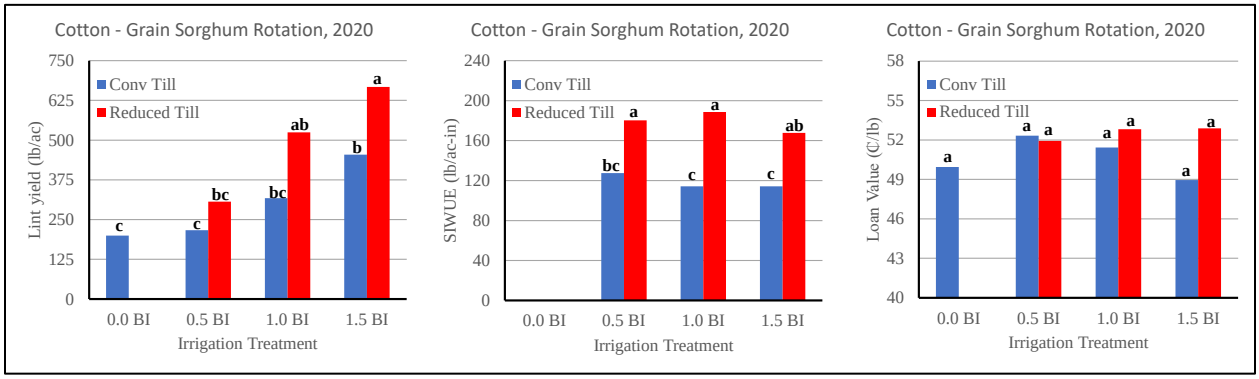


Figure 2. Cotton lint yield, seasonal irrigation water use efficiency (SIWUE), and cotton lint loan value of irrigated cotton treatments following grain sorghum using conventional and reduced tillage systems at three irrigation levels at Helms Research Farm, 2020.

Cotton Variety Trial at Different Irrigation Levels Using SDI (Field 6)
Scott Jordan, Casey Hardin, Joe Mustian, and James Bordovsky

Objective: Determine yield and water productivity of six different cotton varieties irrigated at five different levels using subsurface drip irrigation (SDI).

Methodology: This test was conducted on a 17-acre field irrigated by SDI with 30-inch dripline spacing. The test was planted on May 19th at 47,000 seeds/acre. The field was divided into four blocks, and within each block there were five different irrigation treatments. Irrigation amounts, field operations, pesticides, and nutrient applications are provided in the appendix.

Table 1. Irrigation quantities for cotton variety trial at Helms Research Farm, 2020.

Treatment	Irrigation Quantities (in/day)		
	Period 1	Period 2	Period 3
LLL	0.0	0.0	0.0
LMM	0.0	0.1	0.1
MMM	0.1	0.1	0.1
LHH	0.0	0.2	0.2
MHH	0.1	0.2	0.2

Results: Total annual rainfall was 7.9 inches, and the total seasonal irrigation quantities ranged from 0.0 to 11.60 inches. Lint yields ranged from 325 to 1686 lb/ac (Figure 1), while loan values ranged from 0.421 to 0.566 $/lb. There was a consistent decrease in seasonal irrigation water use efficiency (SIWUE) as irrigation increased across the six varieties. The NexGen 3930 B3XF variety consistently had the highest lint yield, water use efficiency, and fiber quality (data not shown) across the irrigation treatments.

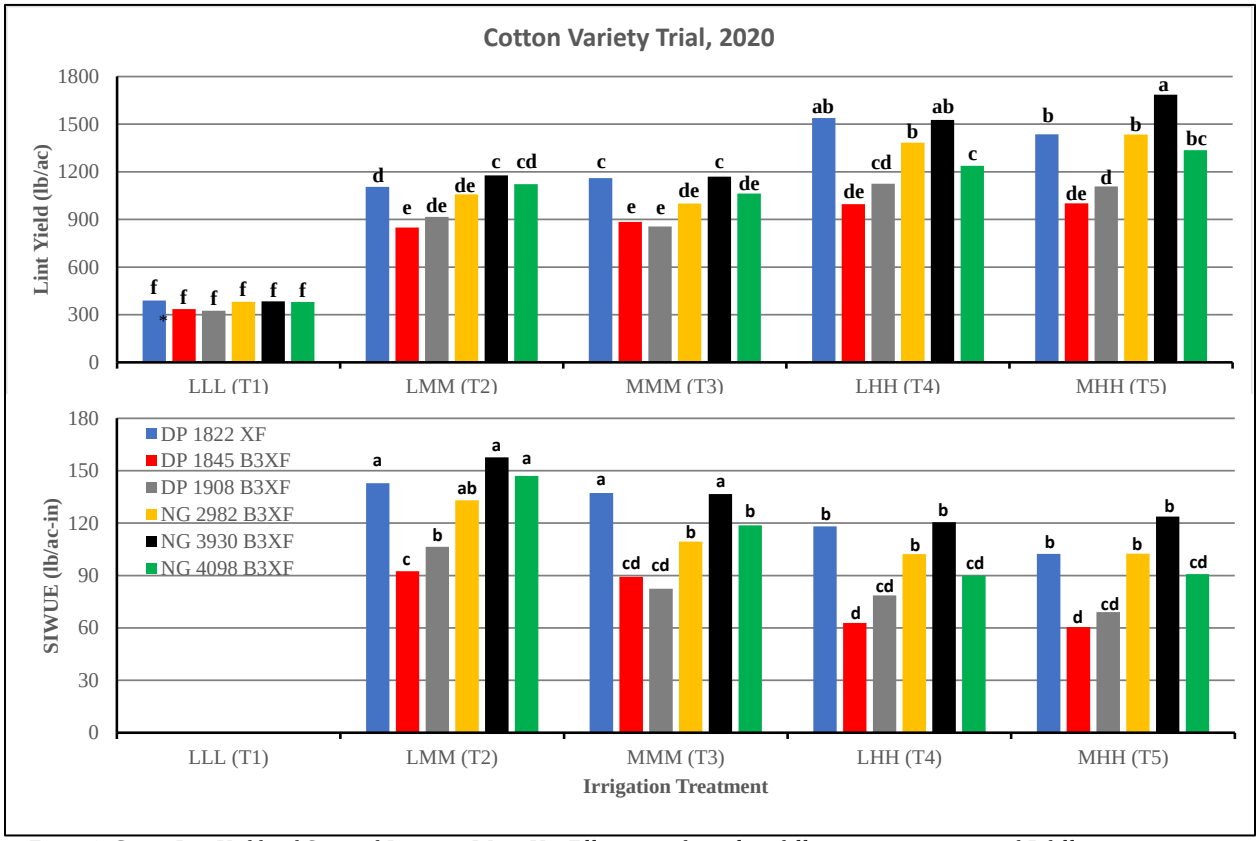


Figure 1: Cotton Lint Yield and Seasonal Irrigation Water Use Efficiency values of six different cotton varieties and 5 different irrigation levels. *Means with the same letter are not significantly different (p<0.5, Tukey)

Performance of NexGen Varieties as Affected by Irrigation Levels, Halfway, TX, 2020.
Wayne Keeling, Justin Spradley, and Ray White

Methodology:

Plot Size: 4 rows by 32 feet, 4 replications

Planting Date: May 19

Varieties:

AMX19A014B3XF	DP 1845 B3XF
AMX19A015B3XF	NG 3406 B2XF
AMX19A016B3XF	NG 3930 B3XF
AMX19A018B3XF	NG 4098 B3XF
NG 3195 B3XF	NG 4936 B3XF
NG 5150 B3XF	NG 5711 B3XF

Herbicides:

Trifluralin 32 oz/A-field cultivator (PPI)		3/5/20
Paraquat 32 oz/A		5/16/20
Me Too Lachlor 1.5 pt/A		5/22/20
Liberty 43 oz/A+glyphosate 32 oz/A		6/10/20
Outlook 12 oz/A		7/1/20
Liberty 43 oz/A+glyphosate 32 oz/A		7/15/20
Diuron 1.5 pt/A	(Hooded)	7/28/20
Glyphosate 32 oz/A		8/10/20

Fertilizer: 87-0-0

Irrigation: LEPA

	Low	Base	High
Preplant	5.0”	5.0”	5.0”
In Season	3.6”	7.2”	10.8”
Total	8.6”	12.2”	15.8”

Harvest Date: November 11

Results: Eleven NexGen commercial and experimental varieties were evaluated under three levels of LEPA irrigation. The test area followed corn production in 2019, which boosted yields compared to continuous cotton trials. When averaged across varieties, cotton lint yields ranged from 389 to 1064 lbs/A as irrigation level increased (Table 1). When averaged across irrigation levels, lint yields ranged from 602 to 848 lbs/A. Highest yields were produced with NG 4098 B3XF and one of the experimental varieties. Loan values increased with greater irrigation levels and varied by variety. Gross revenues ($/A) were highest with NG 4098 B3XF.

Table 1. Effect of NexGen varieties and LEPA irrigation level on cotton lint yield (lbs/A), loan value (¢/lb), and gross revenue ($/A).

	In-season Irrigation Levels (inches)			
Variety	**Low (3.6)**	**Base (7.2)**	**High (10.8)**	**Average**
		lbs/A		
AMX19A014B3XF	400	840	1143	**794 B**
AMX19A015B3XF	405	784	1108	**766 BCD**
AMX19A016B3XF	475	908	1162	**848 A**
AMX19A018B3XF	415	780	1139	**778 BC**
NG 3195 B3XF	354	654	1012	**673 E**
NG 5150 B3XF	299	631	1022	**651 EF**
DP 1845 B3XF	434	759	987	**727 D**
NG 3406 B2XF	383	777	1129	**763 BCD**
NG 3930 B3XF	400	737	1112	**750 CD**
NG 4098 B3XF	436	892	1183	**837 A**
NG 4936 B3XF	327	562	918	**602 G**
NG 5711 B3XF	340	663	859	**621 FG**
Average	**389 C**	**749 B**	**1064 A**	**--**
		¢/A		
AMX19A014B3XF	45.50	49.70	53.90	**49.70 C**
AMX19A015B3XF	49.70	54.30	55.30	**53.10 AB**
AMX19A016B3XF	43.60	45.50	52.50	**47.20 D**
AMX19A018B3XF	50.60	54.60	56.20	**53.80 A**
NG 3195 B3XF	52.40	53.90	55.70	**54.00 A**
NG 5150 B3XF	47.80	52.40	53.70	**51.30 BC**
DP 1845 B3XF	55.90	56.50	50.20	**54.20 A**
NG 3406 B2XF	44.10	52.90	52.90	**49.97 C**
NG 3930 B3XF	52.90	54.30	54.30	**53.83 A**
NG 4098 B3XF	51.80	55.60	56.30	**54.57 A**
NG 4936 B3XF	52.40	53.80	56.10	**54.10 A**
NG 5711 B3XF	53.80	54.40	55.60	**54.60 A**
Average	**50.04 C**	**53.16 B**	**54.39 A**	**--**
		$/A		
AMX19A014B3XF	182	418	616	**405 BCD**
AMX19A015B3XF	202	426	613	**413 BC**
AMX19A016B3XF	207	413	610	**410 BCD**
AMX19A018B3XF	210	426	640	**425 B**
NG 3195 B3XF	186	352	563	**367 E**
NG 5150 B3XF	143	331	549	**341 F**
DP 1845 B3XF	243	429	496	**389 DE**
NG 3406 B2XF	169	411	597	**392 CD**
NG 3930 B3XF	212	400	604	**405 BCD**
NG 4098 B3XF	226	496	666	**463 A**
NG 4936 B3XF	171	302	515	**329 F**
NG 5711 B3XF	183	361	478	**340 F**
Average	**194 C**	**397 B**	**579 A**	**--**

Performance of FiberMax and Stoneville Varieties as Affected by Irrigation Levels, Halfway, TX, 2020.

Wayne Keeling, Justin Spradley, and Ray White

Methodology:

Plot Size: 4 rows by 32 feet, 4 replications

Planting Date: May 19

Varieties:

BX 2192 B3XF	ST 4480 B3XF
BX 2194 B3XF	ST 4990 B3XF
FM 1621 GL	ST 4993 B3XF
FM 1730 GLTP	ST 5091 B3XF
FM 2202 GL	ST 5600 B2XF
FM 2398 GLTP	ST 5707 B2XF

Herbicides:

Trifluralin 32 oz/A-field cultivator (PPI)	3/5/20
Paraquat 32 oz/A	5/16/20
Me Too Lachlor 1.5 pt/A	5/19/20
Liberty 43 oz/A+glyphosate 32 oz/A	6/10/20
Outlook 12 oz/A	7/1/20
Liberty 43 oz/A+glyphosate 32 oz/A	7/9/20
Diuron 1.5 pt/A (Hooded)	7/29/20
Liberty 43 oz/A+glyphosate 32 oz/A	8/6/20

Fertilizer: 87-0-0

Irrigation: LEPA

	Dry	Low	Base	High
Preplant	5.0”	5.0”	5.0”	5.0”
In Season	0.0”	3.6”	7.2”	10.8”
Total	5.0”	8.6”	12.2”	15.8”

Harvest Date: November 12

Results: Twelve commercial and experimental FiberMax and Stoneville varieties were evaluated under three levels of LEPA irrigation and dryland. When averaged across varieties, lint yields ranged from 294 to 795 lbs/A with increased irrigation levels. When averaged across irrigation levels, the highest yielding entries included FM 1621 GL, FM 2202 GL, and FM 2398 GLTP (Table 1). Loan values ranged from 52-53 ¢/lb and were similar across irrigation levels and varied among varieties. Gross revenues ($/A) were highest with FM 1621 GL, FM 2202 GL, and FM 2398 GLTP.

Table 1. Effect of FiberMax and Stoneville varieties and LEPA irrigation level on cotton lint yield (lbs/A), loan value (¢/lb), and gross revenue ($/A).

	In-season Irrigation Levels (inches)				
Variety	**Dry (0.0)**	**Low (3.6)**	**Base (7.2)**	**High (10.8)**	**Average**
		---------- lbs/A----------			
BX 2192 B3XF	249 cde	234	409	592	**412 CD**
BX 2194 B3XF	263 bcde	346	591	776	**571 B**
FM 1621 GL	337 a	322	604	1029	**652 A**
FM 1730 GLTP	253 cde	219	667	742	**543 B**
FM 2202 GL	336 abc	356	626	1008	**663 A**
FM 2398 GLTP	306 abcde	357	646	1039	**681 A**
ST 4480 B3XF	275 e	314	532	728	**525 B**
ST 4990 B3XF	216 ab	263	432	622	**439 C**
ST 4993 B3XF	322 ab	308	616	780	**568 B**
ST 5091 B3XF	221 de	188	352	553	**364 D**
ST 5600 B2XF	276 abcde	303	496	825	**542 B**
ST 5707 B2XF	282 abcd	318	546	843	**569 B**
Average	**278**	**294 C**	**543 B**	**795 A**	--
		----------¢/lb----------			
BX 2192 B3XF	51.67	54.43	55.90	51.03	**53.79 A**
BX 2194 B3XF	52.53	48.98	48.37	45.33	**47.56 C**
FM 1621 GL	52.13	53.37	52.83	55.27	**53.82 A**
FM 1730 GLTP	52.08	53.42	54.15	56.40	**54.66 A**
FM 2202 GL	52.12	51.87	52.78	54.60	**53.08 A**
FM 2398 GLTP	52.20	52.93	55.22	54.13	**54.09 A**
ST 4480 B3XF	52.12	53.90	53.85	54.27	**54.01 A**
ST 4990 B3XF	52.87	54.30	55.62	53.25	**54.39 A**
ST 4993 B3XF	50.88	52.35	54.42	53.68	**53.48 A**
ST 5091 B3XF	51.87	50.90	50.88	49.52	**50.43 B**
ST 5600 B2XF	52.12	52.53	52.82	55.18	**53.51 A**
ST 5707 B2XF	50.62	52.87	54.32	51.98	**53.06 A**
Average	**51.93**	**52.65 A**	**53.43 A**	**52.89 A**	--
		----------$/A----------			
BX 2192 B3XF	129 de	127	229	302	**219 E**
BX 2194 B3XF	139 cde	168	287	351	**269 CD**
FM 1621 GL	175 a	172	319	568	**353 A**
FM 1730 GLTP	131 de	118	361	418	**299 BC**
FM 2202 GL	175 ab	185	331	550	**355 A**
FM 2398 GLTP	160 abcd	188	357	564	**370 A**
ST 4480 B3XF	143 bcde	169	286	397	**284 BC**
ST 4990 B3XF	114 e	142	240	331	**238 DE**
ST 4993 B3XF	164 abc	162	334	419	**305 B**
ST 5091 B3XF	114 e	96	179	275	**183 F**
ST 5600 B2XF	144 abcde	159	262	454	**292 BC**
ST 5707 B2XF	143 cde	168	297	438	**301 BC**
Average	**144**	**154 C**	**290 B**	**422 A**	--

Performance of PhytoGen Varieties as Affected by Irrigation Levels, Halfway, TX, 2020.
Wayne Keeling, Justin Spradley, and Ray White

Methodology:

Plot Size: 4 rows by 32 feet, 4 replications

Planting Date: May 19

Varieties:

FM 2498 GLT	PX 2C14 W3FE
NG 3930 B3XF	PX 2D18 W3FE
PHY 210 W3FE	PX 2E05 W3FE
PHY 250 W3FE	PX 3D32 W3FE
PHY 350 W3FE	PX 3D43 W3FE
PHY 394 W3FE	PX 3E33 W3FE
PHY 400 W3FE	PX 4B08 W3FE
PHY 430 W3FE	

Herbicides:

Trifluralin 32 oz/A-field cultivator (PPI)	3/5/20
Paraquat 32 oz/A	5/16/20
Me Too Lachlor 1.5 pt/A	5/19/20
Liberty 43 oz/A+glyphosate 32 oz/A	6/10/20
Outlook 12 oz/A	7/1/20
Liberty 43 oz/A+glyphosate 32 oz/A	7/9/20
Diuron 1.5 pt/A (Hooded)	7/29/20
Liberty 43 oz/A+glyphosate 32 oz/A	8/6/20

Fertilizer: 87-0-0

Irrigation: LEPA

	Dry	Low	Base	High
Preplant	5.0”	5.0”	5.0”	5.0”
In Season	0.0”	3.6”	7.2”	10.8”
Total	5.0”	8.6”	12.2”	15.8”

Harvest Date: November 12

Results: Thirteen commercial and experimental PhytoGen varieties were compared nder three levels of LEPA irrigation and dryland. When averaged across varieties, lint yields increased with irrigation level, with 904 lbs/A at the high irrigation level (Table 1). When averaged across irrigation levels, highest yields were achieved with PHY 394 W3FE, PHY 250 W3FE, PHY 210 W3FE, and four of the experimentals. Loan values were similar for the base and high irrigation levels and were reduced with the low irrigation level (Table 2). When averaged across irrigation levels, loan values ranged from 48 to 51 ¢/lb. Gross revenues increased with irrigation level and varied among varieties (Table 3).

Table 1. Effect of variety and irrigation level on cotton lint yield (lbs./A).

	In-season Irrigation Levels (inches)				
Variety	**Dry (0.0)**	**Low (3.6)**	**Base (7.2)**	**High (10.8)**	**Average**
		---------- lbs/A----------			
FM 2498 GLT	185 cde	251	621	1025	**632 AB**
NG 3930 B3XF	179 de	217	612	961	**597 ABC**
PHY 210 W3FE	222 abcde	198	694	983	**625 AB**
PHY 250 W3FE	207 abcde	217	669	946	**611 AB**
PHY 350 W3FE	282 a	255	560	924	**580 BC**
PHY 394 W3FE	243 abcd	307	628	991	**642 A**
PHY 400 W3FE	195 bcde	210	483	774	**489 D**
PHY 430 W3FE	275 ab	235	581	815	**543 CD**
PX 2C14 W3FE	249 abcd	213	495	905	**538 CD**
PX 2D18 W3FE	212 abcde	201	523	896	**540 CD**
PX 2E05 W3FE	275 ab	260	547	1053	**620 AB**
PX 3D32 W3FE	257 abcd	228	587	966	**594 ABC**
PX 3D43 W3FE	266 abc	250	598	893	**580 BC**
PX 3E33 W3FE	272 ab	346	603	921	**623 AB**
PX 4B08 W3FE	280 ab	283	728	921	**644 A**
Average	**234**	**236 C**	**589 B**	**904 A**	--

Table 2. Effect of variety and irrigation level on loan value (¢/lb).

	In-season Irrigation Levels (inches)				
Variety	**Dry (0.0)**	**Low (3.6)**	**Base (7.2)**	**High (10.8)**	**Average**
		----------¢/lb----------			
FM 2498 GLT	46.20 fgh	44.00	50.80	54.85	**49.88 BC**
NG 3930 B3XF	48.48 de	47.75	53.43	53.13	**51.43 A**
PHY 210 W3FE	47.70 def	45.73	52.20	54.45	**50.79 A**
PHY 250 W3FE	46.15 fgh	44.73	51.25	53.25	**49.74 CD**
PHY 350 W3FE	48.96 cd	45.95	51.00	50.75	**49.23 CDE**
PHY 394 W3FE	45.73 gh	49.55	50.95	46.58	**49.03 DEF**
PHY 400 W3FE	46.80 efgh	48.53	52.03	53.15	**51.23 A**
PHY 430 W3FE	46.10 fgh	45.48	48.83	47.80	**47.37 G**
PX 2C14 W3FE	47.65 def	46.63	51.05	50.35	**49.34 CDE**
PX 2D18 W3FE	45.10 h	45.63	51.68	47.38	**48.23 F**
PX 2E05 W3FE	46.80 efgh	45.48	48.78	51.80	**48.68 EF**
PX 3D32 W3FE	50.53 bc	46.75	51.93	55.08	**51.25 A**
PX 3D43 W3FE	47.23 defg	47.18	51.23	54.08	**50.83 A**
PX 3E33 W3FE	50.93 b	50.08	52.00	51.63	**51.23 A**
PX 4B08 W3FE	45.45 gh	47.10	49.50	49.38	**48.66 EF**
Average	**47.78**	**47.09 B**	**51.13 A**	**51.32 A**	--

Table 3. Effect of variety and irrigation level on gross revenue ($/A).

	In-season Irrigation Levels (inches)				
Variety	**Dry (0.0)**	**Low (3.6)**	**Base (7.2)**	**High (10.8)**	**Average**
		----------$/A----------			
FM 2498 GLT	86 d	110	315	562	**329 A**
NG 3930 B3XF	87 cd	104	327	509	**313 AB**
PHY 210 W3FE	106 abcd	91	362	535	**329 A**
PHY 250 W3FE	96 bcd	97	343	504	**315 AB**
PHY 350 W3FE	136 a	117	286	469	**291 BC**
PHY 394 W3FE	111 abcd	152	320	463	**312 AB**
PHY 400 W3FE	91 bcd	102	252	411	**255 D**
PHY 430 W3FE	127 ab	107	283	391	**260 CD**
PX 2C14 W3FE	119 abcd	99	253	455	**269 CD**
PX 2D18 W3FE	96 bcd	91	271	424	**262 CD**
PX 2E05 W3FE	129 ab	118	267	545	**310 AB**
PX 3D32 W3FE	130 ab	107	305	532	**315 AB**
PX 3D43 W3FE	125 abc	118	306	483	**302 AB**
PX 3E33 W3FE	139 a	173	314	477	**321 AB**
PX 4B08 W3FE	127 ab	133	360	454	**316 AB**
Average	**112**	**111 C**	**301 B**	**465 A**	--

Effects of Crop Rotation, Tillage, and Irrigation on Soil Organic Carbon and Permanganate Oxidizable Carbon (Field 5abd)

Katie Lewis, Joseph Burke, Chris Cobos, Dustin Kelley, and James Bordovsky

Objective: Evaluate the cumulative effects of crop rotation, tillage, and irrigation level on soil organic carbon and permanganate oxidizable carbon.

Methodology: Soil samples were collected at depth (0-6, 6-12, 12-24, 24-48 inches) in January 2020 from cropping systems (continuous cotton, conventional tillage, CC,CT; cotton-wheat-fallow, C'20-W'21; and continuous cotton, rye cover crop, CC, CC), and varying irrigation (1.5 base irrigation (BI) and 0.5BI). Samples were analyzed for soil organic C (SOC) via combustion and permanganate oxidizable C (POxC) via reduction with dilute permanganate.

Results: Soil organic C and POxC are measures of soil health and are strongly influenced by environment, tillage, and crop selection. Soil organic C was greatest in the cotton-wheat-fallow rotation regardless of irrigation level (Fig. 1). The rye cover crop reduced profile SOC at 0.5BI likely due to limited rye productivity and increased microbial activity which rapidly decomposed biomass. Soil POxC levels were greater following a rye cover crop which indicates rye contributes greater active carbon compared to CC, CT and following harvested wheat (Fig. 2). The rye is likely contributing rhizodeposits which stimulates microbial activity and supplies fresh active C residues to the soil system.

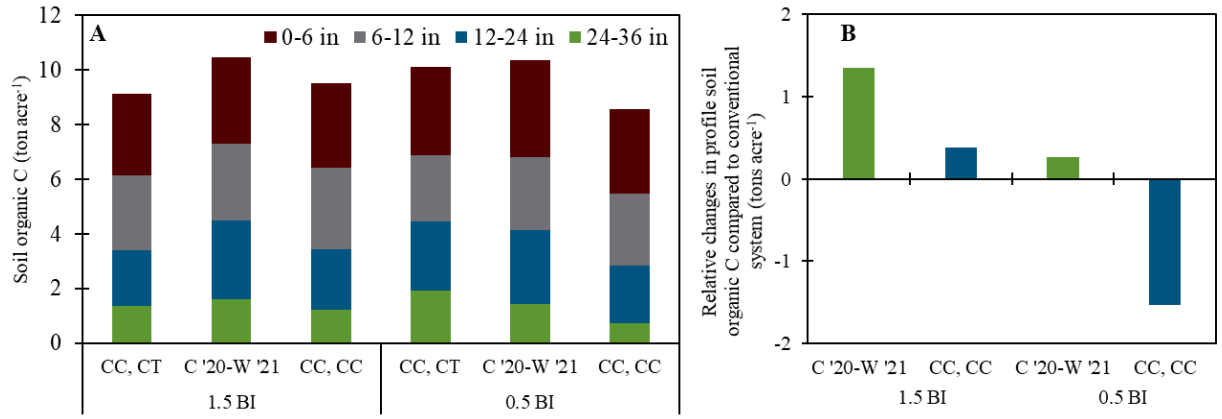


Figure 1. **A)** Soil organic C (SOC) at depth as affected by crop rotation: continuous cotton, conventional tillage (CC,CT); cotton following wheat (C'20-W'21); and continuous cotton, cover crop (CC,CC), at 1.5 BI and 0.5 BI irrigation levels; **B)** The relative changes in SOC in the soil profile comparing C'20-W'21 and CC,CC to CC,CT at 1.5BI and 0.5BI irrigation level.

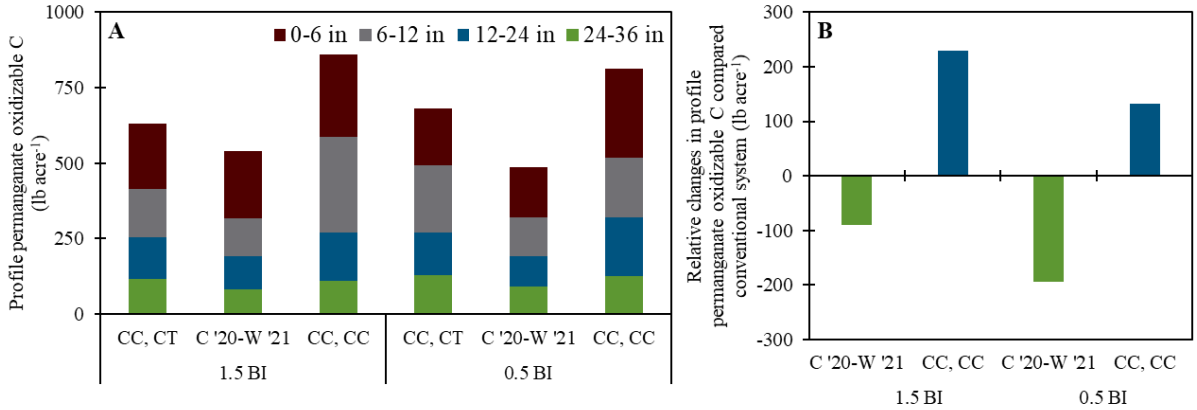


Figure 2. A) Permanganate oxidizable C (POxC) at depth as affected by crop rotation: continuous cotton, conventional tillage (CC,CT); cotton following wheat (C'20-W'21); and continuous cotton, cover crop (CC,CC), at 1.5 BI and 0.5 BI irrigation levels; **B)** The relative changes in POxC in the soil profile comparing C'20-W'21

Performance of Deltapine Varieties as Affected by Irrigation Levels at Halfway, TX, 2020.
Katie Lewis, Dustin Kelley, Ira Yates, Debrah Dobitz, and Amee Bumguardner

Methodology:

Plot Size: 4 Rows x 35 feet, 4 replications

Planting Date: May 22

Varieties:

19R132B3XF	20R713B3XF
19R227B3XF	20R724B3XF
19R228B3XF	DP2012B3XF
19R237B3XF	DP2020B3XF
19R242NRB3XF	DP1908B3XF
20R721NRB3XF	DP1845B3XF

Herbicides:
Trifluralin 32 oz - 03/05/2020
Solera 32 oz – 05/16/2020
Me Too Lachlor 1.5 pt – 05/22/2020
Acephate 3 oz, Liberty 43 oz, Showdown 32 oz – 6/10/2020
Outlook 12 oz – 07/01/2020
Liberty 43 oz, Showdown 32 oz – 07/15/2020
Diuron 1.5 pt – 07/28/2020
Showdown 32 oz – 08/10/2020

Fertilizer:
Dryland: 28 lbs N/acre
Irrigated: 100 lbs N/acre, 40 lbs P205/acre

Irrigation: LEPA

	Dry	Low	Base	High
Pre-plant	3.3”	3.3"	3.3"	3.3"
In-season	1.9”	5.0"	8.5"	12.0"
Total	5.2”	8.3"	11.8"	15.3"

Harvest Date: November 9

Results: Twelve Deltapine varieties were compared under three irrigation levels and dryland (preplant irrigation only) conditions. Averaged across varieties, yields increased from dryland to the high irrigation level. Averaged across the four water regimes, 19R132B3XF and DP 1845 B3XF produced over 500 lb lint/acre (Table 1). Lint yield differences were determined within the low irrigation level, DP 1845 B3XF had the greatest lint yield compared to 19R242NRB3XF and the other varieties that yielded below 253 lb lint/acre. For the base irrigation level, 19R132B3XF had the highest lint yield compared to DP 2020 B3XF. Lint yield of 19R132B3XF was greater than 20R724B3XF, DP 2020 B3XF, 19R242NRB3XF and 19R237B3XF within the high irrigation level (Table 1). Loan value differences were determined within the dryland conditions, DP 1845 B3XF had the greatest loan value compared to 20R713B3XF and 20R724B3XF. Loan values were greater for 19R237B3XF compared to 20R713B3XF, 19R228B3XF, DP 2012 B3XF and

20R724B3XF in the low irrigation level. For the high irrigation level, 19R132B3XF had the greatest loan value compared to 19R237B3XF, DP 1845 B3XF, DP 2012 B3XF, DP 2020 B3XF and 20R724B3XF (Table 2). The variety DP 1845 B3XF decreased in loan value as the irrigation level increased, except for the base irrigation level. The loan value for 19R237B3XF decreased under the high irrigation level. Generally, the base irrigation level had a greater loan value (Table 2).

Table 1. Effect of cotton variety and irrigation on lint yield (lbs/ac).

	Lint Yield (lbs/ac)				
Varieties	**Dry**	**Low**	**Base**	**High**	**Average**
19R132B3XF	313	354	658	953	**569**
19R227B3XF	228	286	437	792	**436**
19R228B3XF	211	248	413	804	**419**
19R237B3XF	211	250	393	624	**369**
19R242NRB3XF	173	253	422	664	**378**
20R713B3XF	196	225	484	912	**454**
20R721NRB3XF	245	249	415	852	**440**
20R724B3XF	172	231	396	698	**374**
DP1845B3XF	308	419	592	875	**548**
DP1908B3XF	236	329	457	820	**460**
DP2012B3XF	168	193	412	807	**395**
DP2020B3XF	176	188	359	685	**352**
Average	**219**	**268**	**453**	**790**	**433**
P-value	**0.068**	**0.001**	**0.033**	**0.000**	**0.025**

Table 2. Effect of cotton variety and irrigation on loan value (cents/lb).

	Loan Value (cents/lb)				
Varieties	**Dry**	**Low**	**Base**	**High**	**Average**
19R132B3XF	52.58	52.58	55.23	56.85	**54.31**
19R227B3XF	52.20	51.98	54.30	52.48	**52.74**
19R228B3XF	53.13	50.58	55.08	56.35	**53.78**
19R237B3XF	56.30	56.33	56.58	51.58	**55.19**
19R242NRB3XF	53.18	54.00	56.35	53.98	**54.38**
20R713B3XF	50.00	51.35	56.35	56.80	**53.63**
20R721NRB3XF	55.18	54.28	56.00	56.83	**55.57**
20R724B3XF	47.23	48.15	52.05	49.28	**49.18**
DP1845B3XF	56.73	55.90	57.20	50.90	**55.18**
DP1908B3XF	51.93	54.63	56.33	54.78	**54.41**
DP2012B3XF	52.70	48.45	55.08	50.75	**51.74**
DP2020B3XF	52.48	52.48	53.75	49.85	**52.14**
Average	**52.80**	**52.56**	**55.36**	**53.37**	**53.52**
P-value	**0.004**	**0.028**	**0.106**	**0.016**	**0.039**

Effect of Nitrogen Fertility on Cotton Crop Reponse to Simulated Cotton Fleahopper and Lygus Damage

M.N. Parajulee, D. P. Dhakal, A. Hakeem, and K.L. Lewis

Objective: The objective was to evaluate the effect of artificial injury to cotton squares mimicking acute cotton fleahopper damage under variable nitrogen application rates on cotton fiber yield and quality.

Methodology: A high-yielding cotton cultivar, NG3930B3XF, was planted at a targeted rate of 54,000 seeds/acre on May 21, 2020. The experiment was laid out in a split-plot randomized block design with five nitrogen fertility rate treatments (0, 50, 100, 150, and 200 lb N/acre) applied for 18 years as main plots (16-row plots) and three fruit loss treatments (artificial cotton square injury treatment mimicking acute cotton fleahopper infestation, 20% boll removal treatment to mimic late-season Lygus infestation, and control) as sub-plots with four replications (total 60 experimental units). Within each of the five main-plot treatments included pre-bloom side-dress applications of N augmentation using a soil applicator injection rig on July 30, 2020. Pre-treatment soil samples (consisting of three 0 to 12 and 12 to 24-inch depth soil cores each) were collected from each of the 20 main-plots on June 12, 2020. Ten leaves per plot were collected twice (August 13 and September 17) for leaf dry weight and nitrogen analysis. Within each main-plot, three 10-ft. sections of uniform cotton were flagged in the middle two rows, each receiving hand removal of 100% cotton squares three weeks into squaring, 20% bolls removed from top canopy of the plants at crop cut-out or control (no square or boll removal). Treatment plots were hand-harvested on October 19 for lint yield and fiber analysis.

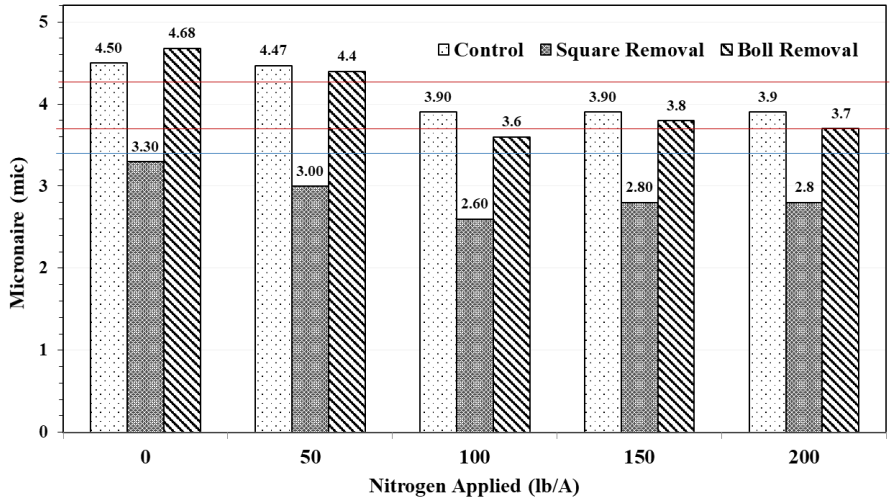


Fig. 1. Lint micronaire values affected by simulated cotton fleahopper and Lygus damage through artificial square and boll removal across variable N rates.

Results: Significantly higher soil residual nitrogen was recorded from plots that received high rates of soil N augmentation in preceding 17 years than control plots. Lint yield did not significantly vary across simulated insect treatments or N augmentation treatments, owing to considerable variation in data due to poor stand establishment and mid-season drought. Nevertheless, the lint quality, measured in terms of micronaire values, was significantly impacted by the simulated cotton fleahopper damage. Early season square removal lowered the micronaire values to a discount range regardless of N level, whereas late season 20% boll removal did not significantly impact the micronaire values (Fig. 1). Micronaire values in both control and boll removal treatments were in the base range at lower N rates and premium range at 100 lb/A and higher N rates.

The effect of tillage system and irrigation rate on Verticillium wilt and cotton lint yield in 2020.

Terry Wheeler, Robert Ballesteros, Daniel Campos, and Jay Hodge

Methodology: The Helm circle contains four wedges in cotton each year, two tillage systems (conventional tillage with beds and LEPA irrigation versus reduced tillage on flat ground and splatter irrigation), and three irrigation rates (0.5B, 1.0B, and 1.5B). In 2020, two of the wedges had really bad stands and were not irrigated normally, so only results from wedge B and D will be presented. Wedge B is cotton rotated with winter wheat and summer fallow, and wedge D is continuous cotton with a terminated wheat cover. Each year wilt incidence is measured in late August, and defoliation is measured (only on the 1.0B and 1.5B irrigation rates) in late September. The weather was warm in 2020 during August and early September, which reduces the damage caused by Verticillium wilt.

Results: Yield was affected primarily by irrigation in 2020, with the highest yields associated with the highest irrigation rate (Table 1). Verticillium wilt incidence was much higher (34%) for the high irrigation rate in wedge B under conventional tillage than for all other irrigation rates or tillage treatments (Table 1). Verticillium wilt was low overall in wedge D. Defoliation was highest with reduced tillage and high irrigation rate in wedge B than for the other treatments in wedge B. In wedge D, defoliation was mainly affected by irrigation rate, with more defoliation associated with higher irrigation rate. In general, Verticillium wilt was more severe with the higher irrigation rate but did not appear to impact yield.

Table 1. Effect of tillage treatment and irrigation rate on Verticillium wilt, defoliation, and cotton lint yield for wedges B and D at Helm farm in 2020.

Irrigation Rate[1]	Tillage	Lint yield (lbs/acre)		% Wilt		% Defoliation	
		B	D	B	D	B	D
0.5B	Conventional	600 c[2]	256 d	1.0 c	0.2 b	---	---
0.5B	Reduced	508 c	202 d	0.7 c	0.0 b	---	---
1.0B	Conventional	821 b	628 b	7.7 bc	0.2 b	42.0 ab	22.2 b
1.0B	Reduced	774 b	470 c	0.2 c	0.0 b	28.3 b	25.9 b
1.5B	Conventional	900 ab	879 a	33.8 a	5.2 a	39.2 ab	46.0 a
1.5B	Reduced	992 a	854 a	12.6 b	6.5 a	52.5 a	44.6 a

[1]Irrigation for the 0.5B was 2.75-inches in wedge B and 2.5-inches in wedge D. Irrigation for 1.0B was 5.25-inches for both wedges, and irrigation for 1.5B was 8.0 inches and 7.75 inches in wedges B and D. There was 4.1 inches of rain at the field from May through August in 2020.
[2]Means within a wedge followed by different letters are significantly different at P=0.05.

Appendix

2020 Rain and Irrigation Amounts At Helms Research Farm, Halfway, TX

Helms Irrigation Amounts (in)

Date			Rainfall (in)		Field 2 Irrigation (Drip)										Field 3 Irrigation (Drip)							Field 7 Irrigation (Drip)				
					Zones (Treatment)										Zones							Zones				
					1 (T1)	2 (T3)	3 (T2)	4 (T3)	5 (T2)	6 (T1)	7 (T3)	8 (T1)	9 (T2)	10 (Dry)	1	2	3	4	5	6	7	D	E	F	G	H
Mo	Da	Year	Halfway @ Buildling	Helms @ Well 1	Crop: Cotton										Crop: Cotton							Crop: Cotton				
1	16	2020	0.06																							
1	17	2020	0.29																							
1	21	2020	0.11	0.35																						
2	10	2020	0.08																							
2	12	2020	0.24	0.26																						
3	3	2020	0.14	0.20																						
3	8	2020	0.51	0.43																						
3	13	2020	0.40																							
3	15	2020	0.20	0.30																						
3	17	2020	0.95	0.70																						
3	18	2020	0.33	0.30																						
4	15	2020			0.14	0.20	0.20	0.20	0.31	0.01	0.39	0.19	0.19	0.13	0.11	0.12	0.11	0.09	0.08	0.09	0.11	0.50	0.22	0.17	0.13	0.11
4	17	2020																				0.32	0.05	0.21	0.08	0.14
4	23	2020			0.14	0.15	0.16	0.12		0.31	0.02	0.16	0.15	0.15	0.12	0.12	0.12	0.12	0.07		0.05	0.32	0.20	0.30	0.07	0.15
4	24	2020			0.17	0.16	0.16	0.16	0.15	0.16	0.15	0.16	0.15	0.16	0.12	0.12	0.12	0.12	0.13	0.13	0.09	0.32	0.28	0.27	0.07	0.13
4	25	2020			0.14	0.16	0.16	0.19	0.19	0.16	0.15	0.16	0.15	0.16	0.12	0.12	0.12	0.13	0.15	0.13	0.09	0.32	0.31	0.27	0.08	0.12
4	26	2020			0.10	0.11	0.11	0.11	0.21	0.20	0.15	0.15	0.13	0.12	0.09	0.11	0.09	0.06	0.10	0.16	0.09	0.22	0.28	0.26	0.06	0.09
4	29	2020			0.14	0.16	0.15	0.10	0.13	0.16	0.15	0.16	0.15	0.16	0.12	0.12	0.12	0.05	0.03	0.13	0.09	0.32	0.22	0.27	0.07	0.13
4	30	2020			0.14	0.16	0.17	0.21	0.26	0.16	0.15	0.16	0.15	0.16	0.12	0.12	0.12	0.12	0.12	0.02		0.28	0.39	0.28	0.11	0.16
5	1	2020			0.12	0.13	0.12	0.12	0.09	0.16	0.15	0.15	0.15	0.14	0.10	0.12	0.11	0.10	0.09	0.11	0.09	0.22	0.18	0.27	0.11	0.15
5	2	2020			0.11	0.11	0.11	0.10	0.09	0.16	0.15	0.14	0.12	0.12	0.09	0.10	0.07	0.09	0.06	0.12	0.09	0.18	0.18	0.25	0.12	0.15
5	6	2020			0.14	0.16	0.16	0.16	0.15	0.13	0.12	0.16	0.15	0.16	0.12	0.12	0.11	0.12	0.12	0.11	0.08	0.26	0.26	0.22	0.14	0.20
5	7	2020			0.14	0.15	0.17	0.25	0.00	0.03	0.15	0.15	0.15	0.15	0.12	0.12	0.11	0.12	0.15	0.02	0.09	0.26	0.22	0.21	0.16	0.19
5	8	2020			0.13	0.14	0.14	0.03	0.13	0.16	0.15	0.15	0.15	0.16	0.12	0.12	0.12	0.11	0.05	0.13	0.09	0.17	0.16	0.12	0.15	0.28
5	9	2020			0.14	0.15	0.15	0.20	0.15	0.16	0.15	0.16	0.15	0.16	0.12	0.12	0.12	0.12	0.14	0.13	0.09	0.18	0.15	0.20	0.27	0.28
5	11	2020	0.23	0.25																						
5	12	2020			0.12	0.12	0.12	0.03	0.15	0.16	0.15	0.16	0.15	0.14	0.10	0.12	0.11	0.09	0.04	0.13	0.09	0.15	0.12	0.05	0.25	0.28
5	14	2020			0.28	0.31	0.34	0.35	0.25	0.25	0.31	0.31	0.30	0.32	0.25	0.26	0.25	0.25	0.27	0.20	0.18					
5	15	2020			0.14	0.16	0.12	0.10	0.15	0.17	0.15	0.15	0.15	0.16	0.13	0.14	0.12	0.13	0.08	0.12	0.04					
5	18	2020			0.42	0.47	0.50	0.46	0.46	0.51	0.46	0.46	0.45	0.48	0.38	0.41	0.37	0.38	0.39	0.41	0.28					
5	19	2020	0.66	0.63	0.14	0.15	0.23	0.15	0.15	0.17	0.15	0.15	0.15	0.16	0.13	0.13	0.12	0.12	0.13	0.14	0.09					
5	20	2020			0.14	0.15	0.17	0.17	0.00	0.16	0.15	0.15	0.15	0.16	0.12	0.13	0.12	0.12	0.13	0.05	0.09				0.57	0.83
5	21	2020													0.12	0.13	0.12	0.12	0.02		0.08				0.55	
5	22	2020			0.14	0.15	0.15	0.02			0.02	0.15	0.15	0.16	0.12	0.13	0.12	0.12	0.16	0.08	0.03	0.28	0.15	0.15	0.49	0.26
5	25	2020	0.09																							
5	26	2020			0.40	0.45	0.47	0.44	0.45	0.50	0.45	0.45	0.45	0.47	0.50	0.51	0.48	0.49	0.59	0.63	1.34	0.75	1.19	1.30	0.35	1.12
5	27	2020																	0.65	0.70	0.02			0.83		
5	28	2020															0.24	0.26	0.57	0.59		0.07			0.00	0.62
5	29	2020													0.60	0.60	0.17	0.17								
6	2	2020													0.09	0.09	0.14	0.15			0.51					
6	3	2020																				0.19				
6	4	2020	1.37	0.68																						
6	9	2020																				0.95	0.86			
6	10	2020			0.44	0.15	0.53	0.50	0.14	0.53	0.48	0.14	0.46	0.50								0.02	0.02	0.77		
6	11	2020			0.43	0.55	0.52	0.49	0.54	0.53	0.47	0.54	0.46	0.51									0.61			
6	12	2020			0.43	0.49	0.53	0.49	0.49	0.55	0.48	0.48	0.47	0.52									0.29			
6	15	2020			1.28	1.39	1.60	1.48	1.38	1.58	1.44	1.36	1.38	1.55												
6	17	2020	1.08	1.42																						
6	19	2020	0.35	0.36																						

2020 Rain and Irrigation Amounts At Helms Research Farm, Halfway, TX

Helms Irrigation Amounts (in)

Date			Rainfall (in)		Field 2 Irrigation (Drip)										Field 3 Irrigation (Drip)							Field 7 Irrigation (Drip)				
					Zones (Treatment)										Zones							Zones				
					1 (T1)	2 (T3)	3 (T2)	4 (T3)	5 (T2)	6 (T1)	7 (T3)	8 (T1)	9 (T2)	10 (Dry)	1	2	3	4	5	6	7	D	E	F	G	H
Mo	Da	Year	Halfway @ Buildling	Helms @ Well 1	Crop: Cotton										Crop: Cotton							Crop: Cotton	Cotton	Fallow	Cotton	Cotton
6	23	2020	0.08	0.11																						
7	4	2020																							0.65	
7	5	2020	0.35	0.43																						1.13
7	6	2020	0.08																							
7	8	2020																						1.45		
7	9	2020															0.08	0.08		0.02		0.28	0.20	0.16	0.00	
7	10	2020													0.28	0.04			0.02	0.30		0.24	0.26	0.32		
7	11	2020														0.10	0.10						0.11	0.11		
7	13	2020																							2.39	
7	17	2020							0.23	0.40	0.58	0.09	0.05		0.33					0.29						
7	20	2020	0.05		0.29	0.63	0.50	0.67	0.48		0.06	0.32	0.47		0.36	0.35	0.34	0.18	0.26	0.36						
7	22	2020	0.24																							
7	24	2020																				0.70		0.92		
7	28	2020	0.20	0.13												0.16	0.27	0.18	0.21			0.24	0.27	0.33	0.00	
7	29	2020													0.35				0.08	0.40		0.24	0.28	0.32		
7	30	2020													0.01	0.19	0.27	0.18	0.18	0.00						
7	31	2020													0.36	0.16			0.12	0.40						
8	2	2020	0.10																							
8	3	2020	0.10																							
8	4	2020							0.46	0.37	0.53															
8	5	2020			0.30	0.23					0.11	0.33	0.48													
8	6	2020				0.44	0.56	0.57																		
8	7	2020													0.01	0.21	0.29	0.18	0.29	0.20						
8	9	2020	0.10																							
8	11	2020	0.11																							
8	12	2020													0.33					0.28						
8	13	2020						0.15	0.48	0.36	0.57															
8	14	2020			0.29	0.27					0.06	0.33	0.47													
8	17	2020				0.39	0.58	0.63																		
8	18	2020													0.33				0.11	0.40						
8	19	2020													0.04	0.19	0.27	0.18	0.18							
8	20	2020			0.30	0.23					0.00	0.33	0.48													
8	21	2020			0.02	0.42	0.58	0.63	0.02	0.03	0.03	0.02	0.02		0.02	0.02	0.02	0.01	0.02	0.01						
8	24	2020			0.29	0.66	0.53	0.68	0.49	0.37	0.63	0.32	0.47		0.40	0.19	0.27	0.18	0.28	0.38						
8	25	2020						0.03	0.49	0.37	0.54															
8	26	2020													0.02	0.19	0.27	0.18	0.22							
8	27	2020													0.34				0.07	0.41						
8	28	2020			0.12	0.13	0.10	0.13	0.10	0.06	0.09	0.07	0.10		0.16	0.08	0.11	0.07	0.10	0.13						
8	29	2020	0.14	0.04																						
8	31	2020			0.45	0.41	0.32	0.41	0.31	0.24	0.68	0.22	0.60		0.58	0.23	0.32	0.36	0.31	0.42						
9	4	2020			0.07	0.14	0.11	0.14	0.11	0.08	0.07	0.07	0.10		0.14	0.08	0.11	0.10	0.11	0.14						
9	9	2020	0.21	0.14																						
9	15	2020			0.04	0.04	0.04	0.04	0.04	0.03	0.04	0.03	0.03	0.03												
9	16	2020													0.04	0.05	0.04	0.05	0.05	0.05	0.03					
Pre & At Plant			4.20	3.42	2.83	3.13	3.26	3.04	3.03	3.23	3.26	3.28	3.14	3.18	2.46	2.63	2.42	2.32	2.20	2.25	1.74	4.03	3.22	3.36	1.89	2.56
Seasonal			4.65	3.31	5.42	7.33	7.28	7.68	6.21	6.15	7.47	5.41	6.80	3.90	5.66	3.82	4.13	3.37	4.70	6.24	2.10	3.96	4.23	6.65	5.01	3.97
Totals			8.85	6.73	8.25	10.46	10.54	10.73	9.24	9.37	10.73	8.69	9.94	7.08	8.11	6.45	6.54	5.69	6.91	8.49	3.84	7.99	7.44	10.01	6.89	6.53

2020 Rain and Irrigation Amounts At Helms Research Farm, Halfway, TX

Helms Irrigation Amounts (in) L = LEPA Irrigation S = Spray Irrigation

Date			Rainfall (in)		Field: 5 Wedge: A [Crop: Cotton]					Field: 5 Wedge: B [Crop: Cotton]					Field: 5 Wedge: C [Crop: Wheat]					Field: 5 Wedge: D (East) [Crop: Cotton]					Field: 5 Wedge: D (West) [Crop: Cotton]					Field: 5 Wedge: E [Crop: Sorghum]					Field: 5 Wedge: F [Crop: Cotton]				
					Irrigation Level					Irrigation Level					Irrigation Level					Irrigation Level					Irrigation Level					Irrigation Level					Irrigation Level				
					Span 2	Span 3 - Span 8				Span 2	Span 3 - Span 8				Span 2	Span 3 - Span 8				Span 2	Span 3 - Span 8				Span 2	Span 3 - Span 8				Span 2	Span 3 - Span 8				Span 2	Span 3 - Span 8			
Mo	Da	Year	Halfway @ Buildling	Helms @ Well 1	Base	Base	Base - 50%	Base + 50%	System	Base	Base	Base - 50%	Base + 50%	System	Base	Base	Base - 50%	Base + 50%	System	Base	Base	Base - 50%	Base + 50%	System	Base	Base	Base - 50%	Base + 50%	System	Base	Base	Base - 50%	Base + 50%	System	Base	Base	Base - 50%	Base + 50%	System
1	16	2020	0.06																																			
1	17	2020	0.29																																			
1	21	2020	0.11	0.35																																		
2	10	2020	0.08																																			
2	12	2020	0.24	0.26																																		
3	3	2020	0.14	0.20																																		
3	8	2020	0.51	0.43																																		
3	13	2020	0.40																																			
3	15	2020	0.20	0.30																																		
3	17	2020	0.95	0.70																																		
3	18	2020	0.33	0.30																																		
4	22	2020													1.00	1.00	1.00	1.00	S																			
4	24	2020																		1.00	1.00	1.00	1.00	S	1.00	1.00	1.00	1.00	S									
4	26	2020																												1.00	1.00	1.00	1.00	S					
4	27	2020																																1.00	1.00	1.00	1.00	S
4	29	2020			1.00	1.00	1.00	1.00	S																													
5	1	2020								1.00	1.00	1.00	1.00	S	0.25	0.25	0.25	0.25	S																			
5	5	2020																		0.40	0.40	0.40	0.40	S	0.40	0.40	0.40	0.40	S	0.40	0.40	0.40	0.40	S					
5	6	2020			0.40	0.40	0.40	0.40	S																									0.40	0.40	0.40	0.40	S
5	7	2020								0.40	0.40	0.40	0.40	S																								
5	9	2020													0.07	0.07	0.07	0.07	S	0.40	0.40	0.40	0.40	S	0.40	0.40	0.40	0.40	S									
5	10	2020																												0.40	0.40	0.40	0.40	S	0.40	0.40	0.40	0.40	S
5	11	2020	0.23	0.25	0.40	0.40	0.40	0.40	S	0.40	0.40	0.40	0.40	S																								
5	12	2020													0.07	0.07	0.07	0.07	S	0.40	0.40	0.40	0.40	S	0.40	0.40	0.40	0.40	S									
5	13	2020																												0.40	0.40	0.40	0.40	S	0.40	0.40	0.40	0.40	S
5	14	2020			0.40	0.40	0.40	0.40	S	0.40	0.40	0.40	0.40	S																								
5	15	2020													0.07	0.07	0.07	0.07	S	0.40	0.40	0.40	0.40	S	0.40	0.40	0.40	0.40	S									
5	16	2020																												0.40	0.40	0.40	0.40	S	0.40	0.40	0.40	0.40	S
5	17	2020			0.40	0.40	0.40	0.40	S																													
5	18	2020								0.40	0.40	0.40	0.40	S	0.07	0.07	0.07	0.07	S	0.75	0.75	0.75	0.75	S	0.75	0.75	0.75	0.75	S									
5	19	2020	0.66	0.63																										0.05	0.05	0.05	0.05	S					
5	20	2020																																0.50	0.50	0.50	0.50	S
5	23	2020																		0.50	0.50	0.50	0.50	S	0.50	0.50	0.50	0.50	S	0.05	0.05	0.05	0.05	S					
5	24	2020																																0.50	0.50	0.50	0.50	S
5	25	2020	0.09																																			
5	26	2020			0.50	0.50	0.50	0.50	S																													
5	27	2020								0.45	0.45	0.45	0.45	S																								
5	29	2020																		0.20	0.20	0.20	0.20	S	0.20	0.20	0.20	0.20	S	0.05	0.05	0.05	0.05	S	0.20	0.20	0.20	0.20	S
5	30	2020			0.20	0.20	0.20	0.20	S	0.20	0.20	0.20	0.20	S																								
5	31	2020													0.05	0.05	0.05	0.05	S	0.20	0.20	0.20	0.20	S	0.20	0.20	0.20	0.20	S	0.20	0.20	0.20	0.20	S	0.20	0.20	0.20	0.20	S
6	1	2020			0.20	0.20	0.20	0.20	S	0.20	0.20	0.20	0.20	S																								
6	4	2020	1.37	0.68																																		
6	17	2020	1.08	1.42																																		
6	19	2020	0.35	0.36																																		
6	23	2020	0.06	0.11																																		
7	2	2020																		0.50	0.50	0.50	0.50	S	0.50	0.50	0.50	0.50	S									
7	3	2020																												0.50	0.50	0.50	0.50	S					
7	4	2020																																0.50	0.50	0.50	0.50	S
7	5	2020	0.35	0.43	0.50	0.50	0.50	0.50	S																													
7	6	2020	0.08							0.50	0.50	0.50	0.50	S																								
7	10	2020																		0.25		0.25	0.25	L	0.25		0.25	0.25	L	0.25		0.25	0.25	L					
7	11	2020			0.12		0.12	0.12	L	0.25		0.25	0.25	L	0.08		0.08	0.08	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.12		0.12	0.12	L
7	12	2020			0.12	0.12		0.12	L	0.25	0.25		0.25	L	0.08	0.08		0.08	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L						0.12	0.12		0.12	L

2020 Rain and Irrigation Amounts At Helms Research Farm, Halfway, TX

Helms Irrigation Amounts (in) L = LEPA Irrigation S = Spray Irrigation

Date			Rainfall (in)		Field: 5 Wedge: A [Crop: Cotton]					Field: 5 Wedge: B [Crop: Cotton]					Field: 5 Wedge: C [Crop: Wheat]					Field: 5 Wedge: D (East) [Crop: Cotton]					Field: 5 Wedge: D (West) [Crop: Cotton]					Field: 5 Wedge: E [Crop: Sorghum]					Field: 5 Wedge: F [Crop: Cotton]				
					Irrigation Level					Irrigation Level					Irrigation Level					Irrigation Level					Irrigation Level					Irrigation Level					Irrigation Level				
					Span 2	Span 3 - Span 8				Span 2	Span 3 - Span 8				Span 2	Span 3 - Span 8				Span 2	Span 3 - Span 8				Span 2	Span 3 - Span 8				Span 2	Span 3 - Span 8				Span 2	Span 3 - Span 8			
Mo	Da	Year	Halfway @ Buildling	Helms @ Well 1	Base	Base	Base - 50%	Base + 50%	System	Base	Base	Base - 50%	Base + 50%	System	Base	Base	Base - 50%	Base + 50%	System	Base	Base	Base - 50%	Base + 50%	System	Base	Base	Base - 50%	Base + 50%	System	Base	Base	Base - 50%	Base + 50%	System	Base	Base	Base - 50%	Base + 50%	System
7	13	2020			0.12	0.12		0.12	L	0.25	0.25		0.25	L															0.25	0.25		0.25	L	0.12	0.12		0.12	L
7	16	2020																		0.25		0.25	0.25	L	0.25		0.25	0.25	L	0.25		0.25	0.25	L					
7	17	2020			0.12		0.12	0.12	L	0.25		0.25	0.25	L	0.08		0.08	0.08	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L						0.12		0.12	0.12	L
7	18	2020			0.12	0.12		0.12	L	0.25	0.25		0.25	L	0.08	0.08		0.08	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.12	0.12		0.12	L
7	19	2020			0.12	0.12		0.12	L	0.25	0.25		0.25	L	0.08	0.08		0.08	L	0.25		0.25	0.25	L	0.25		0.25	0.25	L	0.25	0.25		0.25	L	0.12	0.12		0.12	L
7	20	2020	0.05		0.12		0.12	0.12	L	0.25		0.25	0.25	L	0.08		0.08	0.08	L	0.25	0.25		0.25	L						0.25		0.25	0.25	L	0.12		0.12	0.12	L
7	21	2020			0.12	0.12		0.12	L	0.25	0.25		0.25	L	0.08	0.08		0.08	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.12	0.12		0.12	L
7	22	2020	0.24	0.00	0.12	0.12		0.12	L	0.25	0.25		0.25	L											0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.12	0.12		0.12	L
7	27	2020			0.12	0.12	0.12	0.12	L											0.25		0.25	0.25	L	0.25		0.25	0.25	L	0.25		0.25	0.25	L	0.12	0.12	0.12	0.12	L
7	28	2020	0.20	0.13						0.25		0.25	0.25	L	0.08		0.08	0.08	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.12	0.12		0.12	L
7	29	2020			0.12	0.12		0.12	L	0.25	0.25		0.25	L	0.08	0.08		0.08	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L					
7	30	2020			0.12	0.12		0.12	L	0.25	0.25		0.25	L	0.08	0.08		0.08	L	0.25		0.25	0.25	L	0.25		0.25	0.25	L	0.25		0.25	0.25	L	0.12	0.12		0.12	L
7	31	2020			0.12		0.12	0.12	L	0.25		0.25	0.25	L																				0.12		0.12	0.12	L
8	2	2020	0.10																																				
8	3	2020	0.10		0.12	0.12		0.12	L											0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.12	0.12		0.12	L
8	4	2020								0.25	0.25		0.25	L	0.08		0.08	0.08	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.12	0.12		0.12	L
8	5	2020			0.12	0.12		0.12	L	0.25	0.25		0.25	L	0.08	0.08		0.08	L	0.25		0.25	0.25	L	0.25		0.25	0.25	L	0.25		0.25	0.25	L					
8	6	2020			0.12		0.12	0.12	L	0.25		0.25	0.25	L	0.08		0.08	0.08	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L						0.12		0.12	0.12	L
8	7	2020			0.12	0.12		0.12	L	0.25	0.25		0.25	L	0.08	0.08		0.08	L											0.25	0.25		0.25	L	0.12	0.12		0.12	L
8	9	2020	0.10																																				
8	10	2020																		0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.12	0.12		0.12	L
8	11	2020	0.11		0.12	0.12		0.12	L	0.25	0.25		0.25	L	0.08	0.08		0.08	L	0.25		0.25	0.25	L	0.25		0.25	0.25	L	0.25		0.25	0.25	L					
8	12	2020			0.25		0.25	0.25	L	0.25		0.25	0.25	L	0.08		0.08	0.08	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L						0.25		0.25	0.25	L
8	13	2020			0.12	0.12		0.12	L	0.25	0.25		0.25	L	0.08	0.08		0.08	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.12	0.12		0.12	L
8	14	2020			0.12	0.12		0.12	L	0.25	0.25		0.25	L	0.08	0.08		0.08	L	0.25		0.25	0.25	L	0.25		0.25	0.25	L	0.25		0.25	0.25	L	0.12	0.12		0.12	L
8	15	2020																											0.25	0.25		0.25	L					
8	17	2020			0.12		0.12	0.12	L	0.25		0.25	0.25	L	0.08		0.08	0.08	L																0.12		0.12	0.12	L
8	18	2020			0.12	0.12		0.12	L	0.25	0.25		0.25	L	0.08	0.08		0.08	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.12	0.12		0.12	L
8	19	2020			0.12	0.12		0.12	L	0.25	0.25		0.25	L						0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.12	0.12		0.12	L
8	20	2020			0.12		0.12	0.12	L	0.25		0.25	0.25	L	0.08	0.08		0.08	L	0.25		0.25	0.25	L	0.25		0.25	0.25	L	0.25		0.25	0.25	L	0.12		0.12	0.12	L
8	21	2020													0.08		0.08	0.08	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L					
8	24	2020			0.12	0.12		0.12	L	0.25	0.25		0.25	L	0.08	0.08		0.08	L	0.25	0.25		0.25	L											0.12	0.12		0.12	L
8	25	2020			0.12	0.12		0.12	L	0.25	0.25		0.25	L	0.08	0.08		0.08	L						0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.12	0.12		0.12	L
8	26	2020			0.12		0.12	0.12	L	0.25		0.25	0.25	L						0.25		0.25	0.25	L	0.25		0.25	0.25	L	0.25		0.25	0.25	L	0.12		0.12	0.12	L
8	27	2020			0.12	0.12		0.12	L						0.08		0.08	0.08	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.12	0.12		0.12	L
8	28	2020								0.25	0.25		0.25	L	0.08	0.08		0.08	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L					
8	29	2020	0.14	0.04																																			
8	31	2020			0.12	0.12		0.12	L	0.25	0.25		0.25	L	0.08	0.08		0.08	L																0.12	0.12		0.12	L
9	1	2020			0.12		0.12			0.25		0.25	0.25	L						0.25		0.25	0.25	L	0.25		0.25	0.25	L	0.25		0.25	0.25	L	0.12		0.12	0.12	L
9	2	2020													0.08		0.08	0.08	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L	0.50	0.50		0.50	L					
9	3	2020			0.12	0.12		0.12	L	0.25	0.25		0.25	L	0.25	0.25		0.25	L											0.25	0.25		0.25	L	0.12	0.12		0.12	L
9	4	2020													0.25	0.25		0.25	L																				
9	9	2020	0.21	0.14																																			
Pre & At Plant			3.84	3.45	2.50	2.50	2.50	2.50		3.45	3.45	3.45	3.45		0.58	0.58	0.58	0.58		3.75	3.75	3.75	3.75		3.75	3.75	3.75	3.75		2.95	2.70	2.70	2.95		3.00	3.00	3.00	3.00	
Seasonal			1.68	0.74	4.47	3.14	1.95	4.35		8.50	5.75	3.25	8.50		2.74	1.86	0.88	2.74		8.00	5.25	2.75	8.00		8.00	5.25	2.75	8.00		8.00	5.50	2.50	8.00		4.47	3.14	1.95	4.47	
Totals			5.52	4.19	6.97	5.64	4.45	6.85		11.95	9.20	6.70	11.95		3.32	2.44	1.46	3.32		11.75	9.00	6.50	11.75		11.75	9.00	6.50	11.75		10.95	8.20	5.20	10.95		7.47	6.14	4.95	7.47	

2020 Rain and Irrigation Amounts At Helms Research Farm, Halfway, TX

Helms Irrigation Amounts (in)

Date			Rainfall (in)		Field 6 Irrigation (Drip)																		
					Zones (Treatment)																		
					1 (T4)	2 (T1)	3 (T2)	4 (T5)	5 (T3)	6 (T1)	7 (T2)	8 (T4)	9 (T5)	10 (T3)	11 (T1)	12 (T4)	13 (T2)	14 (T3	15 (T5)	16 (T2)	17 (T1)	18 (T4)	19 (T5)	20 (T3)
Mo	Da	Year	Halfway @ Buildling	Helms @ Well 1	Crop:																		
					Cotton																		
1	16	2020	0.06																				
1	17	2020	0.29																				
1	21	2020	0.11	0.35																			
2	10	2020	0.08																				
2	12	2020	0.24	0.26																			
2	28	2020			0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
3	2	2020			0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
3	3	2020	0.14	0.20	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
3	8	2020	0.51	0.43	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
3	13	2020	0.40																				
3	15	2020	0.20	0.30																			
3	17	2020	0.95	0.70																			
3	18	2020	0.33	0.30																			
4	2	2020			0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
4	6	2020			0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
4	8	2020			0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
4	9	2020			0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
5	11	2020	0.23	0.25																			
5	14	2020			0.80	0.80	0.80	0.80	0.80														
5	15	2020								0.80	0.80	0.80	0.80	0.80									
5	16	2020													0.80	0.80	0.80	0.80	0.80				
5	17	2020																		0.80	0.80	0.80	0.80	0.80
5	19	2020	0.66	0.63																			
5	25	2020	0.09																				
5	27	2020			0.39	0.39	0.39	0.38	0.36	0.35	0.37	0.37	0.36	0.36	0.36	0.35	0.36	0.35	0.36	0.34	0.36	0.35	0.34	0.31
5	29	2020			0.39	0.39	0.39	0.38	0.36	0.35	0.37	0.37	0.36	0.36	0.36	0.35	0.36	0.35	0.36	0.34	0.36	0.35	0.34	0.31
6	2	2020			0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
6	3	2020			0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
6	4	2020	1.37	0.68																			
6	17	2020	1.08	1.42																			
6	19	2020	0.35	0.36																			
6	23	2020	0.08	0.11																			
7	5	2020	0.35	0.43																			
7	6	2020	0.08					0.30	0.58	0.29			0.68	0.68				0.75	0.80				0.75	0.73
7	7	2020			0.72		0.70	0.66	0.62															
7	14	2020									0.69	0.71	0.66	0.67		0.70	0.66	0.65	0.69	0.63		0.66	0.65	0.62
7	15	2020			0.70			0.65				0.66	0.66			0.66			0.70			0.63	0.65	
7	16	2020			0.64		0.68																	
7	20	2020	0.05					0.66	0.62		0.66	0.67	0.66	0.67										
7	21	2020														0.63	0.63	0.66	0.71					
7	22	2020	0.24		0.68			0.64				0.66	0.67			0.64			0.70	0.59		1.23	1.30	0.62
7	24	2020			1.20		0.60	1.16	0.55															
7	28	2020	0.20	0.13							0.58	1.19	1.18	0.59		0.30	0.57	0.59				0.12		
7	29	2020														0.81			1.24	0.54		0.47		
7	30	2020																				0.55	1.14	0.55
7	31	2020			1.40		0.67	1.31	0.62															

2020 Rain and Irrigation Amounts At Helms Research Farm, Halfway, TX

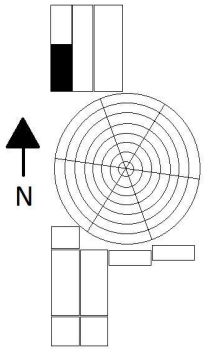
Helms Irrigation Amounts (in)

Date			Rainfall (in)		Field 6 Irrigation (Drip)																			
					Zones (Treatment)																			
					1 (T4)	2 (T1)	3 (T2)	4 (T5)	5 (T3)	6 (T1)	7 (T2)	8 (T4)	9 (T5)	10 (T3)	11 (T1)	12 (T4)	13 (T2)	14 (T3	15 (T5)	16 (T2)	17 (T1)	18 (T4)	19 (T5)	20 (T3)
Mo	Da	Year	Halfway @ Buildling	Helms @ Well 1	Crop:																			
					Cotton																			
8	2	2020	0.10																					
8	3	2020	0.10																					
8	4	2020									0.66	1.33	1.34	0.66										
8	5	2020														1.27	0.64	0.66		0.60				
8	6	2020																	1.39			1.25	1.29	0.62
8	7	2020			1.38		0.73	1.37	0.68															
8	9	2020	0.10																					
8	11	2020	0.11								0.72	1.41	1.40	0.73										
8	12	2020														1.33	0.69	0.81		0.68				
8	13	2020																	1.45			1.34	1.30	0.63
8	17	2020			1.33		0.67	1.30	0.62															
8	18	2020									0.65	1.34	1.34	0.67										
8	19	2020														1.26	0.64	0.66		0.61				
8	20	2020																	1.40			1.26	1.29	0.61
8	21	2020			1.39		0.66	1.33	0.63															
8	25	2020									0.64	1.34	1.32	0.67										
8	26	2020														1.27	0.63	0.66		0.62				
8	27	2020																	1.40			1.27	1.29	0.61
8	28	2020			0.60		0.59	0.58	0.56		0.59	0.61												
8	29	2020	0.14	0.04																				
9	1	2020											0.58	0.60		0.57	0.57	0.58	0.62	0.50		0.52	0.53	
9	2	2020																						0.53
9	3	2020			0.04	0.08	0.04	0.04	0.03	0.06	0.04	0.04	0.04	0.04	0.08	0.04	0.04	0.04	0.04	0.04	0.06	0.04	0.04	0.04
9	9	2020	0.21	0.14																				
Pre & At Plant			3.54	2.79	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65
Seasonal			5.31	3.94	11.25	1.26	6.52	11.15	6.61	1.44	6.34	11.12	11.65	7.08	1.21	10.55	6.19	7.14	12.28	5.87	1.18	10.43	11.31	6.58
Totals			8.85	6.73	12.90	2.91	8.17	12.80	8.26	3.09	7.99	12.77	13.30	8.73	2.86	12.20	7.84	8.79	13.93	7.52	2.83	12.08	12.96	8.23

Operations Summary

Year	2020
Farm	Helm
Field ID	Field 1 South
Exp. Design	Corn
Soil Type	Pullman Clay Loam

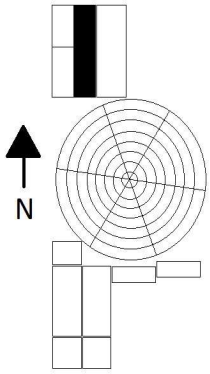
Field Operations	Date	Activity
Tillage	12/3/2019	Shred
	1/9/2020	Disk
	1/10/2020	Disk
	2/25/2020	Field Cultivator
	3/3/2020	List
	5/29/2020	Cultivate
	6/8/2020	Cultivate
	6/17/2020	Cultivate
Fertility	4/3/2020	Liquid 32-0-0 27gal/ac
	4/6/2020	Liquid 10-34-0 20gal/ac
Planting / Harvest	5/6/2020	Various Corn Plots
	10/7/2020	Harvested all test
Herbicide / Growth Regulator		
Insecticide		
Harvest aid		
Irrigation Amt.		
Preplant		
Planting to Harvest		
Rainfall		
PrePlant	1/1 - 5/5	2.5
Planting to Harvest	5/6 - 10/7	3.72



Operations Summary

Year	2020
Farm	Helm
Field ID	Field 2
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

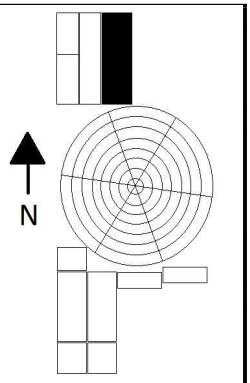
Field Operations	Date	Activity
Tillage	12/3/2019	Shred
	1/9/2020	Disk
	1/10/2020	Disk
	2/25/2020	Cultivate
	3/23/2020	Cultivate
	3/26/2020	List
	4/30/2020	Bed Packer
	6/3/2020	Rotary Hoe
	6/19/2020	Rotary Hoe
	6/21/2020	Rotary Hoe
	6/26/2020	Cultivate (Hard Middles)
Fertility	4/13/2020	Liquid 32-0-0 11.8gal/ac
Planting / Harvest	5/21/2020	Planted NexGin 3930 B3XF 47,000seed/ac
	6/11/2020	Planted Nexgin 2982 B3XF 47,000seed/ac
	10/21/2020	Harvested all test
Herbicide /	3/23/2020	Trifuralin 32oz/ac
Growth Regulator	5/22/2020	Me-Too-Lachlor 1.5pt/ac, Showdown 32oz/ac, Solera 323oz/ac
	6/10/2020	Liberty 43oz/ac, Showdown 32oz/ac
	6/19/2020	Outlook 12oz/ac
	7/15/2020	Liberty 43oz/ac, Showdown 32oz/ac
	7/27/2020	Medal EC 1.3pt/ac
Insecticide	6/10/2020	Acephate 3oz/ac
Harvest aid	9/30/2020	Setup 32oz/ac, ETX 1.25oz/ac, Dyne-Amic 1%
	10/13/2020	Solera 24oz/ac, Induce 0.50%
	10/19/2020	Solera 24oz/ac, Induce 0.50%
Irrigation Amt.		
Preplant	1/1 - 5/19	Trt. 1 = 3.26in, Trt. 2 = 3.25in, Trt. 3 = 3.30in, Dry = 3.34in
Planting to Harvest	5/20 - 9/9	1 = 5.29in, 2 = 7.18in, 3 = 7.11in, 4 = 7.52in, 5 = 6.20in, 6 = 5.98in, 7 = 7.32in, 8 = 5.26in,
		9 = 6.65in, 10 = 3.74in
Rainfall		
Preplant	1/1 - 5/20	2.79
Planting to Harvest	5/21 - 10/21	3.31



Operations Summary

Year	2020
Farm	Helm
Field ID	Field 3
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

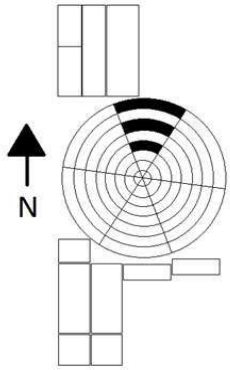
Field Operations	Date	Activity
Tillage	12/3/2019	Shred
	1/9/2020	Disk
	1/10/2020	Disk
	2/25/2020	Cultivate
	3/23/2020	Cultivate
	3/26/2020	List
	4/30/2020	Bed Packer
	6/6/2020	Rotary Hoe
	6/19/2020	Rotary Hoe
	6/21/2020	Rotary Hoe
	6/26/2020	Cultivate (Hard Middles)
Fertility	4/13/2020	Liquid 32-0-0 20gal/ac
	4/16/2020	Liquid 10-34-0gal/ac
Planting / Harvest	5/21/2020	Planted NexGin 3930 B3XF 47,000seed/ac
	10/21/2020	Harvested all test
Herbicide /	3/23/2020	Trifuralin 32oz/ac
Growth Regulator	5/22/2020	Me-Too-Lachlor 1.5pt/ac, Showdown 32oz/ac, Solera 323oz/ac
	6/10/2020	Liberty 43oz/ac, Showdown 32oz/ac
	6/19/2020	Outlook 12oz/ac
	7/15/2020	Liberty 43oz/ac, Showdown 32oz/ac
	7/27/2020	Medal EC 1.3pt/ac
Insecticide	6/10/2020	Acephate 3oz/ac
Harvest aid	9/30/2020	Setup 32oz/ac, ETX 1.25oz/ac, Dyne-Amic 1%
	10/13/2020	Solera 24oz/ac, Induce 0.50%
	10/19/2020	Solera 24oz/ac, Induce 0.50%
Irrigation Amt.		
Preplant	1/1 - 5/20	1 = 2.58in, 2 = 2.76in, 3 = 2.54in, 4 = 2.44in, 5 = 2.33in., 6 = 2.30in, Border = 1.83in
Planting to Harvest	5/21 - 10/21	1 = 5.53in, 2 = 3.69in, 3 = 4.01in, 4 = 3.24in, 5 = 4.58in., 6 = 6.19in, Border = 2.00in
Rainfall		
Preplant	1/1 - 5/20	2.79
Planting to Harvest	5/21 - 10/21	3.31



Operations Summary

Year	2020
Farm	Helm
Field ID	Field 5A (Even Spans)
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

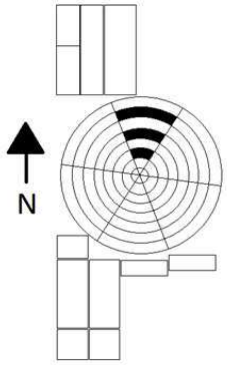
Field Operations	Date	Activity
Tillage	12/4/2019	Shred
	1/27/2020	Disk
	2/3/2020	Disk
	2/6/2020	Chisel
	2/26/2020	Cultivate
	3/24/2020	Cultivate
	3/27/2020	Stalk Puller
	3/27/2020	List
	4/1/2020	Rip Soft Middles
	4/14/2020	Dike
	4/17/2020	Bed Conditioner
	6/6/2020	Rotary Hoe
	6/16/2020	Cultivate and Dike
	6/19/2020	Rotary Hoe
	6/24/2020	Cultivate and Dike
Fertility	4/6/2020	Liquid 32-0-0 33gal/ac (High Water)
	4/6/2020	Liquid 32-0-0 16gal/ac (Low Water)
	4/7/2020	Liquid 32-0-0 4gal/ac (Dryland)
	4/7/2020	Liquid 32-0-0 28gal/ac (Medium Water)
	4/9/2020	Liquid 10-34-0 6gal/ac (High Water)
	4/10/2020	Liquid 10-34-0 3 gal/ac (Medium Water)
Planting / Harvest	5/22/2020	Planted NexGin 3500XF 47,000seed/ac
	10/21/2020	Harvested all test
Herbicide / Growth Regulator	3/23/2020	Trifuralin 32oz/ac
	4/17/2020	Showdown 48oz/ac, DyneAmic 1%
	5/23/2020	Me-Too-Lachlor 1.5pt/ac, Showdown 32oz/ac, Solera 32oz/ac
	6/10/2020	Liberty 43oz/ac, Showdown 32oz/ac
	7/1/2020	Showdown 32oz/ac, Outlook 12oz/ac
	7/15/2020	Liberty 43oz/ac, Showdown 32oz/ac
	7/29/2020	Mepiquat 12oz/ac
	7/30/2020	Diuron 1.5pt/ac
Insecticide	6/10/2020	Acephate 3oz/ac
Harvest aid	9/30/2020	Setup 32oz/ac, ETX 1.25oz/ac, Dyne-Amic 1%
	10/13/2020	Solera 24oz/acm Induce 0.50%
Irrigation Amt.		
Preplant	1/1 - 5/21	Base = 2.60in, Base - 50% = 2.60, Base + 50% = 2.60
Planting to Harvest	5/22 - 10/21	Base = 4.04in, Base - 50% = 2.85, Base + 50% = 5.25
Rainfall		
Preplant	1/1 - 5/21	3.42
Planting to Harvest	5/22 - 10/21	3.31



Operations Summary

Year	2020
Farm	Helm
Field ID	Field 5A (Odd Spans)
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

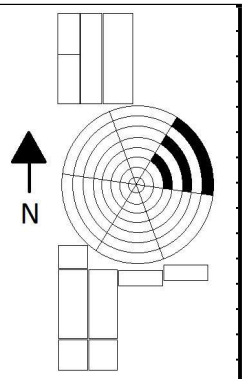
Field Operations	Date	Activity
Tillage	12/4/2019	Shred
	12/11/2019	List
	12/12/2019	Rip Soft Middles
Fertility	4/6/2020	Liquid 32-0-0 33gal/ac (High Water)
	4/6/2020	Liquid 32-0-0 16gal/ac (Low Water)
	4/7/2020	Liquid 32-0-0 4gal/ac (Dryland)
	4/7/2020	Liquid 32-0-0 28gal/ac (Medium Water)
	4/9/2020	Liquid 10-34-0 6gal/ac (High Water)
	4/10/2020	Liquid 10-34-0 3 gal/ac (Medium Water)
Planting / Harvest	5/22/2020	Planted NexGin 3500XF 47,000seed/ac
	10/21/2020	Harvested all test
Herbicide / Growth Regulator	5/23/2020	Me-Too-Lachlor 1.5pt/ac, Showdown 32oz/ac, Solera 32oz/ac
	6/10/2020	Liberty 43oz/ac, Showdown 32oz/ac
	7/1/2020	Showdown 32oz/ac, Outlook 12oz/ac
	7/15/2020	Liberty 43oz/ac, Showdown 32oz/ac
	7/29/2020	Mepiquat 12oz/ac
	7/30/2020	Diuron 1.5pt/ac
Insecticide	6/10/2020	Acephate 3oz/ac
Harvest aid	9/30/2020	Setup 32oz/ac, ETX 1.25oz/ac, Dyne-Amic 1%
	10/13/2020	Solera 24oz/acm Induce 0.50%
Irrigation Amt.		
Preplant	1/1 - 5/21	Base = 2.60in, Base - 50% = 2.60, Base + 50% = 2.60
Planting to Harvest	5/22 - 10/21	Base = 4.04in, Base - 50% = 2.85, Base + 50% = 5.25
Rainfall		
Preplant	1/1 - 5/21	3.42
Planting to Harvest	5/22 - 10/21	3.31



Operations Summary

Year	2020
Farm	Helm
Field ID	Field 5B (Even Spans)
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

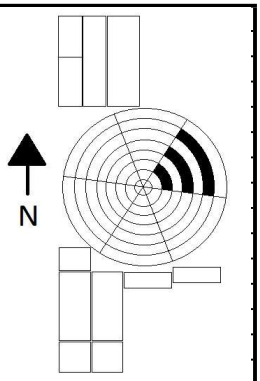
Field Operations	Date	Activity
Tillage	10/7/2019	Chisel
	1/27/2020	Disk
	2/3/2020	Chisel
	2/26/2020	Cultivate
	3/24/2020	Cultivate
	3/27/2020	List
	4/1/2020	Rip Soft Middles
	4/14/2020	Dike
	4/17/2020	Bed Conditioner
	6/6/2020	Rotary Hoe
	6/16/2020	Cultivate and Dike
	6/19/2020	Rotary Hoe
	6/24/2020	Cultivate and Dike
Fertility	4/6/2020	Liquid 32-0-0 33gal/ac (High Water)
	4/6/2020	Liquid 32-0-0 16gal/ac (Low Water)
	4/7/2020	Liquid 32-0-0 4gal/ac (Dryland)
	4/7/2020	Liquid 32-0-0 28gal/ac (Medium Water)
	4/9/2020	Liquid 10-34-0 6gal/ac (High Water)
	4/10/2020	Liquid 10-34-0 3 gal/ac (Medium Water)
Planting / Harvest	5/22/2020	Planted NexGin 3500XF 47,000seed/ac
	10/22/2020	Harvested all test
Herbicide / Growth Regulator	3/23/2020	Trifuralin 32oz/ac
	4/17/2020	Showdown 48oz/ac, DyneAmic 1%
	5/23/2020	Me-Too-Lachlor 1.5pt/ac, Showdown 32oz/ac, Solera 32oz/ac
	6/10/2020	Liberty 43oz/ac, Showdown 32oz/ac
	7/1/2020	Showdown 32oz/ac, Outlook 12oz/ac
	7/15/2020	Liberty 43oz/ac, Showdown 32oz/ac
	8/13/2020	Mepiquat 12oz/ac
	7/29/2020	Diuron 1.5pt/ac
Insecticide	6/10/2020	Acephate 3oz/ac
Harvest aid	9/30/2020	Setup 32oz/ac, ETX 1.25oz/ac, Dyne-Amic 1%
	10/13/2020	Solera 24oz/acm Induce 0.50%
Irrigation Amt.		
Preplant	1/1 - 5/21	Base = 2.60in, Base - 50% = 2.60, Base + 50% = 2.60
Planting to Harvest	5/22 - 10/22	Base = 6.60in, Base - 50% = 4.1in, Base + 50% = 9.35
Rainfall		
Preplant	1/1 - 5/21	3.42
Planting to Harvest	5/22 - 10/22	3.31



Operations Summary

Year	2020
Farm	Helm
Field ID	Field 5B (Odd Spans)
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

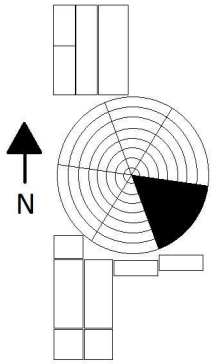
Field Operations	Date	Activity
Tillage		
Fertility	4/6/2020	Liquid 32-0-0 33gal/ac (High Water)
	4/6/2020	Liquid 32-0-0 16gal/ac (Low Water)
	4/7/2020	Liquid 32-0-0 4gal/ac (Dryland)
	4/7/2020	Liquid 32-0-0 28gal/ac (Medium Water)
	4/9/2020	Liquid 10-34-0 6gal/ac (High Water)
	4/10/2020	Liquid 10-34-0 3 gal/ac (Medium Water)
Planting / Harvest	5/22/2020	Planted NexGin 3500XF 47,000seed/ac
	10/22/2020	Harvested all test
Herbicide /	4/17/2020	Showdown 48oz/ac, DyneAmic 1%
Growth Regulator	5/23/2020	Me-Too-Lachlor 1.5pt/ac, Showdown 32oz/ac, Solera 32oz/ac
	6/10/2020	Liberty 43oz/ac, Showdown 32oz/ac
	7/1/2020	Showdown 32oz/ac, Outlook 12oz/ac
	7/15/2020	Liberty 43oz/ac, Showdown 32oz/ac
	7/29/2020	Mepiquat 12oz/ac
	8/13/2020	Diuron 1.5pt/ac
Insecticide	6/10/2020	Acephate 3oz/ac
Harvest aid	9/30/2020	Setup 32oz/ac, ETX 1.25oz/ac, DyneAmic 1%
	10/13/2020	Solera 24oz/acm Induce 0.50%
Irrigation Amt.		
Preplant	1/1 - 5/21	Base = 2.60in, Base - 50% = 2.60, Base + 50% = 2.60
Planting to Harvest	5/22 - 10/22	Base = 6.60in, Base - 50% = 4.1in, Base + 50% = 9.35
Rainfall		
Preplant	1/1 - 5/21	3.42
Planting to Harvest	5/22 - 10/22	3.31



Operations Summary

Year	2020
Farm	Helm
Field ID	Field 5C (All Spans)
Exp. Design	Wheat
Soil Type	Pullman Clay Loam

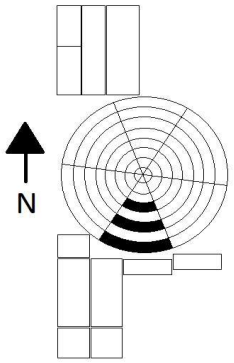
Field Operations	Date	Activity
Tillage	11/26/2019	Shred
Fertility	4/6/2020	Liquid 32-0-0 33gal/ac (High Water)
	4/6/2020	Liquid 32-0-0 16gal/ac (Low Water)
	4/7/2020	Liquid 32-0-0 4gal/ac (Dryland)
	4/7/2020	Liquid 32-0-0 28gal/ac (Medium Water)
	4/9/2020	Liquid 10-34-0 6gal/ac (High Water)
	4/10/2020	Liquid 10-34-0 3 gal/ac (Medium Water)
Planting / Harvest	12/12/2019	Planted VNS 70lbs/ac (Yield)
Herbicide /	3/29/2020	Clash 10oz/ac
Growth Regulator	7/16/2020	Clash 16oz/ac, Showdown 32oz/ac
	9/23/2020	Medal EC1.3pt/ac, Clash 12oz/ac, Showdown 32oz/ac
Insecticide		
Harvest aid		
Irrigation Amt.		
Preplant	1/1 - 5/21	Base = 1.53in, Base - 50% = 1.53, Base + 50% = 1.53
Planting to Harvest	5/22 - 10/22	Base = 1.91in, Base - 50% = 0.93in, Base + 50% = 2.79
Rainfall		
Preplant	1/1 - 5/21	3.42
Planting to Harvest	5/22 - 10/22	3.31



Operations Summary

Year	2020
Farm	Helm
Field ID	Field 5D (Even Spans)
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

Field Operations	Date	Activity
Tillage	11/27/2019	Shred
	12/2/2019	Rip Soft Middles
	3/27/2020	Stalk Puller
	6/17/2020	Cultivate and Dike
	6/23/2020	Cultivate and Dike
Fertility	4/6/2020	Liquid 32-0-0 33gal/ac (High Water)
	4/6/2020	Liquid 32-0-0 16gal/ac (Low Water)
	4/7/2020	Liquid 32-0-0 4gal/ac (Dryland)
	4/7/2020	Liquid 32-0-0 28gal/ac (Medium Water)
	4/9/2020	Liquid 10-34-0 6gal/ac (High Water)
	4/10/2020	Liquid 10-34-0 3 gal/ac (Medium Water)
Planting / Harvest	5/23/2020	Planted NexGin 3500XF 47,000seed/ac
	10/22/2020	Harvested all Test
Herbicide / Growth Regulator	5/23/2020	Me-Too-Lachlor 1.5pt/ac, Showdown 32oz/ac, Solera 32oz/ac
	6/10/2020	Liberty 43oz/ac, Showdown 32oz/ac
	7/1/2020	Showdown 32oz/ac, Outlook 12oz/ac
	7/15/2020	Liberty 43oz/ac, Showdown 32oz/ac
	7/29/20202	Mepiquat 12oz/ac
	7/30/2020	Diuron 1.5pt/ac
Insecticide	6/10/2020	Acephate 3oz/ac
Harvest aid	9/21/2020	Setup 32oz/ac, ETX 1.25oz/ac, DyneAmic 1%
	10/5/2020	Solera 24oz/acm Induce 0.50%
	10/13/2020	Solera 24oz/acm Induce 0.50%
Irrigation Amt.		
PrePlant & Planting	1/1 - 5/22	Base = 3.35in, Base - 50% = 3.35in, Base + 50% = 3.35in
Seasonal	5/23 - 10/22	Base = 6.65in, Base - 50% = 4.15in, Base + 50% = 9.40in
Rainfall		
PrePlant & Planting	1/1 - 5/22	3.42
Seasonal	5/23 - 10/22	3.31



Operations Summary

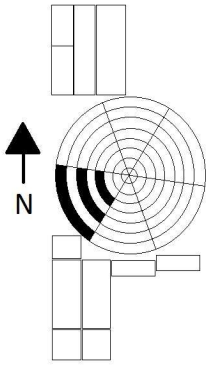
Year	2020
Farm	Helm
Field ID	Field 5D (Odd Spans)
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

Field Operations	Date	Activity
Tillage		
Fertility	4/6/2020	Liquid 32-0-0 33gal/ac (High Water)
	4/6/2020	Liquid 32-0-0 16gal/ac (Low Water)
	4/7/2020	Liquid 32-0-0 4gal/ac (Dryland)
	4/7/2020	Liquid 32-0-0 28gal/ac (Medium Water)
	4/9/2020	Liquid 10-34-0 6gal/ac (High Water)
	4/10/2020	Liquid 10-34-0 3 gal/ac (Medium Water)
Planting / Harvest	5/23/2020	Planted NexGin 3500XF 47,000seed/ac
	10/22/2020	Harvested all test
Herbicide /	5/23/2020	Me-Too-Lachlor 1.5pt/ac, Showdown 32oz/ac, Solera 32oz/ac
Growth Regulator	6/10/2020	Liberty 43oz/ac, Showdown 32oz/ac
	7/1/2020	Showdown 32oz/ac, Outlook 12oz/ac
	7/15/2020	Liberty 43oz/ac, Showdown 32oz/ac
	7/29/20202	Mepiquat 12oz/ac
	7/30/2020	Diuron 1.5pt/ac
Insecticide	6/10/2020	Acephate 3oz/ac
Harvest aid	9/21/2020	Setup 32oz/ac, ETX 1.25oz/ac, DyneAmic 1%
	10/5/2020	Solera 24oz/acm Induce 0.50%
	10/13/2020	Solera 24oz/acm Induce 0.50%
Irrigation Amt.		
PrePlant & Planting	1/1 - 5/22	Base = 3.35in, Base - 50% = 3.35in, Base + 50% = 3.35in
Seasonal	5/23 - 10/22	Base = 6.65in, Base - 50% = 4.15in, Base + 50% = 9.40in
Rainfall		
PrePlant & Planting	1/1 - 5/22	3.42
Seasonal	5/23 - 10/22	3.31

Operations Summary

Year	2020
Farm	Helm
Field ID	Field 5E (Even Spans)
Exp. Design	Grain Sorghum
Soil Type	Pullman Clay Loam

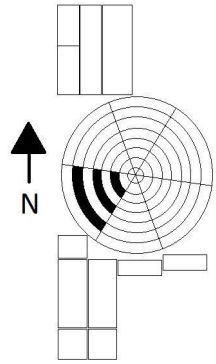
Field Operations	Date	Activity
Tillage	12/14/2019	Shred
	1/31/2020	Disk
	2/3/2020	Disk
	2/6/2020	Chisel
	2/26/2020	Cultivate
	3/27/2020	List
	3/31/2020	Rip Soft Middles
	4/13/2020	Dike
	4/15/2020	Bed Conditioner
	6/6/2020	Rotary Hoe
	7/16/2020	Cultivate and Dike
Fertility	4/6/2020	Liquid 32-0-0 33gal/ac (High Water)
	4/6/2020	Liquid 32-0-0 16gal/ac (Low Water)
	4/7/2020	Liquid 32-0-0 4gal/ac (Dryland)
	4/7/2020	Liquid 32-0-0 28gal/ac (Medium Water)
	4/9/2020	Liquid 10-34-0 6gal/ac (High Water)
	4/10/2020	Liquid 10-34-0 3 gal/ac (Medium Water)
Planting / Harvest	6/12/2020	Planted Frontier Hybrid 40,000seed/ac, 50,000seed/ac, 70,000seed/ac
	10/2/2020	Harvested all test
Herbicide /	6/13/2020	Atrazine 0.5pt/ac, Me-Too-Lachlor 1.3pt/ac, Showdown 48oz/ac
Growth Regulator	7/16/2020	Medal EC 1.3pt/ac, Clash 8oz/ac
	9/21/2020	Showdown 48oz/ac, DyneAmic 1%
Insecticide		
Harvest aid		
Irrigation Amt.		
Preplant	1/1 - 6-11	Base = 2.95in, Base - 50% = 2.95in, Base + 50% = 2.95in
Planting to Harvest	6/12 - 10/2	Base = 6.25in, Base - 50% = 3.25in, Base + 50% = 9.00in
Rainfall		
Preplant	1/1 - 6/11	4.10
Planting to Harvest	6/12 - 10/2	2.63



Operations Summary

Year	2020
Farm	Helm
Field ID	Field 5E (Odd Spans)
Exp. Design	Grain Sorghum
Soil Type	Pullman Clay Loam

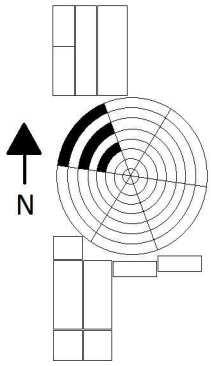
Field Operations	Date	Activity
Tillage		
Fertility	4/6/2020	Liquid 32-0-0 33gal/ac (High Water)
	4/6/2020	Liquid 32-0-0 16gal/ac (Low Water)
	4/7/2020	Liquid 32-0-0 4gal/ac (Dryland)
	4/7/2020	Liquid 32-0-0 28gal/ac (Medium Water)
	4/9/2020	Liquid 10-34-0 6gal/ac (High Water)
	4/10/2020	Liquid 10-34-0 3 gal/ac (Medium Water)
Planting / Harvest	6/12/2020	Planted Frontier Hybrid 40,000seed/ac, 50,000seed/ac, 70,000seed/ac
	10/2/2020	Harvested all test
Herbicide /	3/29/2020	Clash 10oz/ac
Growth Regulator	4/17/2020	Atrazine 1qt/a/c
	6/13/2020	Atrazine 0.5pt/ac, Me-Too-Lachlor 1.3pt/ac, Showdown 48oz/ac
	7/16/2020	Medal EC 1.3pt/ac, Clash 8oz/ac
	9/21/2020	Showdown 48oz/ac, DyneAmic 1%
Insecticide		
Harvest aid		
Irrigation Amt.		
Preplant	1/1 - 6-11	Base = 2.95in, Base - 50% = 2.95in, Base + 50% = 2.95in
Planting to Harvest	6/12 - 10/2	Base = 6.25in, Base - 50% = 3.25in, Base + 50% = 9.00in
Rainfall		
Preplant	1/1 - 6/11	4.10
Planting to Harvest	6/12 - 10/2	2.63



Operations Summary

Year	2020
Farm	Helm
Field ID	Field 5F (Even Spans)
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

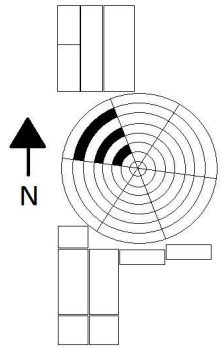
Field Operations	Date	Activity
Tillage	12/4/2020	Shred
	1/31/2020	Disk
	2/3/2020	Disk
	2/6/2020	Chisel
	2/26/2020	Cultivator
	3/24/2020	Cultivator
	3/27/2020	List
	4/1/2020	Rip Soft Middles
	4/14/2020	Dike
	4/17/2020	Bed Conditioner
	6/6/2020	Rotary Hoe
	6/15/2020	Cultivate and Dike
	6/19/2020	Rotary Hoe
	6/25/2020	Cultivate and Dike
Fertility	4/6/2020	Liquid 32-0-0 33gal/ac (High Water)
	4/6/2020	Liquid 32-0-0 16gal/ac (Low Water)
	4/7/2020	Liquid 32-0-0 4gal/ac (Dryland)
	4/7/2020	Liquid 32-0-0 28gal/ac (Medium Water)
	4/9/2020	Liquid 10-34-0 6gal/ac (High Water)
	4/10/2020	Liquid 10-34-0 3 gal/ac (Medium Water)
Planting / Harvest	5/23/2020	Planted NexGin 3500XF 47,000seed/ac
	10/24/2020	Harvested all test
Herbicide /	3/23/2020	Trifuralin 32oz/ac
Growth Regulator	5/23/2020	Me-Too-Lachlor 1.5pt/ac, Showdown 32oz/ac, Solera 32oz/ac
	6/10/2020	Liberty 43oz/ac, Showdown 32oz/ac
	7/1/2020	Showdown 32oz/ac, Outlook 12oz/ac
	7/15/2020	Liberty 43oz/ac, Showdown 32oz/ac
	7/29/2020	Mepiquat 12oz/ac
	7/30/2020	Diuron 1.5pt/ac
Insecticide	6/10/2020	Acephate 3oz/ac
Harvest aid	9/30/2020	Setup 32oz/ac, ETX 1.25oz/ac, DyneAmic 1%
	10/13/2020	Solera 24oz/acm Induce 0.50%
Irrigation Amt.		
Preplant	1/1 - 5/22	Base = 2.60in, Base - 50% = 2.60in, Base + 50% = 2.60in
Planting to Harvest	5/23 - 10/24	Base = 2.35in, Base - 50% = 3.54in, Base + 50% = 4.87in
Rainfall		
Preplant	1/1 - 5/22	3.42
Planting to Harvest	5/23 - 10/24	3.31



Operations Summary

Year	2020
Farm	Helm
Field ID	Field 5F (Odd Spans)
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

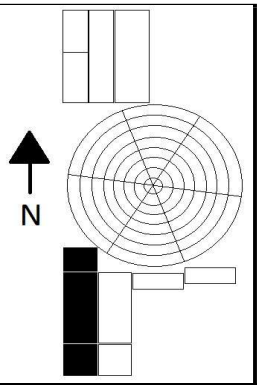
Field Operations	Date	Activity
Tillage		
Fertility	4/6/2020	Liquid 32-0-0 33gal/ac (High Water)
	4/6/2020	Liquid 32-0-0 16gal/ac (Low Water)
	4/7/2020	Liquid 32-0-0 4gal/ac (Dryland)
	4/7/2020	Liquid 32-0-0 28gal/ac (Medium Water)
	4/9/2020	Liquid 10-34-0 6gal/ac (High Water)
	4/10/2020	Liquid 10-34-0 3 gal/ac (Medium Water)
Planting / Harvest	5/23/2020	NexGin 3500XF 47,000seed/ac
	10/24/2020	Harvested all test
Herbicide /	5/23/2020	Me-Too-Lachlor 1.5pt/ac, Showdown 32oz/ac, Solera 32oz/ac
Growth Regulator	6/10/2020	Liberty 43oz/ac, Showdown 32oz/ac
	7/1/2020	Showdown 32oz/ac, Outlook 12oz/ac
	7/15/2020	Liberty 43oz/ac, Showdown 32oz/ac
	7/29/2020	Mepiquat 12oz/ac
	7/30/2020	Diuron 1.5pt/ac
Insecticide	6/10/2020	Acephate 3oz/ac
Harvest aid	9/30/2020	Setup 32oz/ac, ETX 1.25oz/ac, DyneAmic 1%
	10/13/2020	Solera 24oz/acm Induce 0.50%
Irrigation Amt.		
Preplant	1/1 - 5/22	Base = 2.60in, Base - 50% = 2.60in, Base + 50% = 2.60in
Planting to Harvest	5/23 - 10/24	Base = 2.35in, Base - 50% = 3.54in, Base + 50% = 4.87in
Rainfall		
Preplant	1/1 - 5/22	3.42
Planting to Harvest	5/23 - 10/24	3.31



Operations Summary

Year	2020
Farm	Helm
Field ID	Field 6 West
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

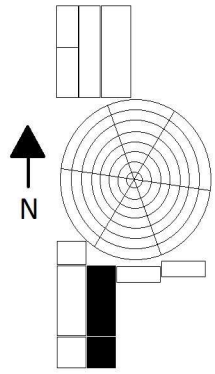
Field Operations	Date	Activity
Tillage	12/3/2019	Cultivate
	12/5/2019	Float
	12/5/2019	Cultivate
	12/10/2019	List
	6/25/2020	Cultivate (Hard Middles)
Fertility	6/4/2020	Liquid 32-0-0 100lbs/ac
	6/4/2020	Liquid 32-0-0 78lbs/ac
Planting / Harvest	12/10/2019	Planted VNS 50lb/ac (Cover Crop)
	5/19/2020	Planted Delta Pine 47,000seed/ac, NexGin 47,000seed/ac
	10/13/2020	Harvested all test (North Block)
	10/22/2020	Harvested all remaining test
Herbicide /	3/29/2020	Clash 12oz/ac, Panther 2oz/ac
Growth Regulator	4/7/2020	Showdown 42oz/ac, DyneAmic 1%
	5/22/2020	Me-Too-Lachlor 1.5pt/ac, Showdown 32oz/ac, Solera 32oz/ac
	6/10/2020	Liberty 43oz/ac, Showdown 32oz/ac
	6/19/2020	Outlook 12oz/ac
	7/28/2020	Mepiquat 16oz/ac
	7/29/2020	Diuron 1.5pt/ac
	8/12/2020	Mepiquat 20oz/ac (High and Base Water)
Insecticide	6/10/2020	Acephate 3oz/ac
Harvest aid	9/21/2020	Setup 32oz/ac, ETX 1.25oz/ac, DyneAmic 1% (North Side)
	9/30/2020	Setup 32oz/ac, ETX 1.25oz/ac, DyneAmic 1%
	10/5/2020	Solera 24oz/ac, Induce 0.50%
	10/13/2020	Solera 24oz/ac, Induce 0.50%
	10/19/2020	Solera 24oz/ac, Induce 0.50%
Irrigation Amt.		
Preplant	1/1 - 5/18	T1 = 1.65in, T2 = 1.65in, T3 = 1.65in, T4 = 1.65in, T5 = 1.65in.
Planting to Harvest	5/19 - 10/22	T1 = 1.27in, T2 = 6.23in, T3 = 6.85in, T4 = 10.84in, T5 = 11.60in.
Rainfall		
Preplant	1/1 - 5/18	2.79
Planting to Harvest	5/19 - 10/22	3.31



Operations Summary

Year	2020
Farm	Helm
Field ID	Field 7
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

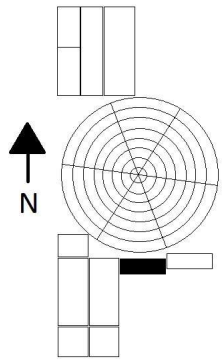
Field Operations	Date	Activity
Tillage	12/3/2019	List
	3/25/2020	Stalk Puller
	3/30/2020	Stalk Puller
	4/30/2020	Bed Packer
	6/25/2020	Cultivate (Hard Middles)
	7/1/2020	Dike (South Side)
Fertility	6/4/2020	Liquid 32-0-0 78lbs/ac
Planting / Harvest	12/22/2019	Planted VNS 50lb/ac (Cover Crop)
	5/21/2020	Planted NexGin 3406 B2XF 47,000seed/ac
	10/13/2020	Harvested all test
Herbicide / Growth Regulator	3/29/2020	Clash 12oz/ac, Panther 2oz/ac
	4/7/2020	Showdown 42oz/ac, DyneAmic 1%
	5/22/2020	Me-Too-Lachlor 1.5pt/ac, Showdown 32oz/ac, Solera 32oz/ac
	6/10/2020	Liberty 43oz/ac, Showdown 32oz/ac
	6/19/2020	Outlook 12oz/ac
	7/28/2020	Mepiquat 12oz/ac
	7/28/2020	Diuron 1.5pt/ac
	8/12/2020	Mepiquat 20oz/ac
Insecticide	6/10/2020	Acephate 3oz/ac
Harvest aid	9/21/2020	Setup 32oz/ac, ETX 1.25oz/ac, Dyne-Amic 1%
	10/5/2020	Solera 24oz/ac, Induce 0.50%
Irrigation Amt.		
PrePlant & Planting	1/1 - 5/20	Zone D = 4.03in, Zone E = 3.22in, Zone F = 3.36in
Seasonal	5/21 - 10/13	Zone D = 3.96in, Zone E 4.23in, Zone F = 6.65in
Rainfall		
PrePlant & Planting	1/1 - 5/20	2.79
Seasonal	5/21 - 10/13	3.31



Operations Summary

Year	2020
Farm	Helm
Field ID	Field 8
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

Field Operations	Date	Activity
Tillage	12/2/2019	Shred
	1/21/2020	Disk
	1/22/2020	Disk
	2/25/2020	Cultivate
	3/23/2020	Cultivate
	3/25/2020	List
	5/1/2020	Bed Packer
	6/6/2020	Rotary Hoe
	6/19/2020	Rotary Hoe
	6/21/2020	Rotary Hoe
	6/30/2020	Cultivate (Hard Middles)
Fertility		
Planting / Harvest	5/20/2020	NexGin 3930 B3XF 47,000seed/ac
	10/21/2020	Harvested all test
Herbicide /	3/23/2020	Trifuralin 32oz/ac
Growth Regulator	7/15/2020	Liberty 43oz/ac, Showdown 32oz/ac
	7/27/2020	Medal EC 1.3pt/ac
	7/28/2020	Mepiquat 16oz/ac
Insecticide		
Harvest aid	9/21/2020	Setup 32oz/ac, ETX 1.25oz/ac, DyneAmic 1%
	10/5/2020	Solera 24oz/ac, Induce 0.50%
Irrigation Amt.		
PrePlant & Planting	1/1 - 5/19	Zone G = 1.89in
Seasonal	5/20 - 9/9	Zone G = 5.01in
Rainfall		
PrePlant & Planting	1/1 - 5/19	2.79
Seasonal	5/20 - 9/9	3.31



Operations Summary

Year	2020
Farm	Helm
Field ID	Field 9
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

Field Operations	Date	Activity
Tillage	12/2/2019	Shred
	2/19/2020	Stalk Puller
	5/1/2020	Bed Packer
	7/8/2020	Shred
	7/8/2020	Disk
Fertility		
Planting / Harvest	5/22/2020	Delta Pine 47,000seed/ac
Herbicide /	3/24/2020	Clash 12oz/ac, Panther 2oz/ac
Growth Regulator	5/23/2020	Me-Too-Lachlor 1.5pt/ac, Showdown 32oz/ac, Solera 32oz/ac
Insecticide	7/1/2020	Coragen 5oz/ac
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	1/1 - 5/19	Zone H = 2.56in
Seasonal	5/20 - 10/20	Zone H = 3.97in
Rainfall		
PrePlant & Planting	1/1 - 5/19	3.42
Seasonal	5/20 - 10/20	3.31