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*Improving Life Through Science and Technology
Lubbock-Pecos-Halfway*

Helm Research Farm
Summary Report
2021

Technical Report
22-3

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
Research Participants

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Irrigation of Replanted Cotton using Subsurface Drip Irrigation (SDI) (Field 2)

Scott Jordan, Casey Hardin, Joe Mustian, and Heath Johnson

Objective: Determine cotton lint yield, cotton fiber quality, and seasonal water productivity of replanted NexGen 3930 B3XF cotton using three irrigation timing treatments.

Methodology: This study was conducted in a 12-acre area irrigated by subsurface drip irrigation with 30-inch dripline spacing. The field was divided into three blocks with three different irrigation zones within each block, and a dryland check zone at the edge of the field. The irrigation treatments were designated as T1, T2, and T3. On June 6th following heavy rainfall cotton was replanted at a rate of 47,000 seeds/ac of NexGen 3930 B3XF. The irrigation amounts, field operations, pesticides, and nutrient applications for 2021 are listed in the appendix.



Figure 2: Harvesting cotton from subsurface drip irrigated treatments at Helms Research Farm, 2021

Results: Annual rainfall for 2021 was 18.65 inches and the combined preplant and seasonal irrigation in the three respective irrigation treatments were 6.07, 6.67, and 7.11 inches. Increasing seasonal irrigation appeared to have little effect on cotton lint yield. Cotton lint yield ranged from 661 lb/ac in the dryland check to 940 lb/ac in the T3 irrigation treatment. Seasonal irrigation water use efficiency (SIWUE) decreased by 52.2% from T1 to T2, and 46.3% from T1 to T3. The cotton lint loan value of T1 was 0.565 \$/lb, while the other two treatments had a lint loan value of 0.537 \$/lb.

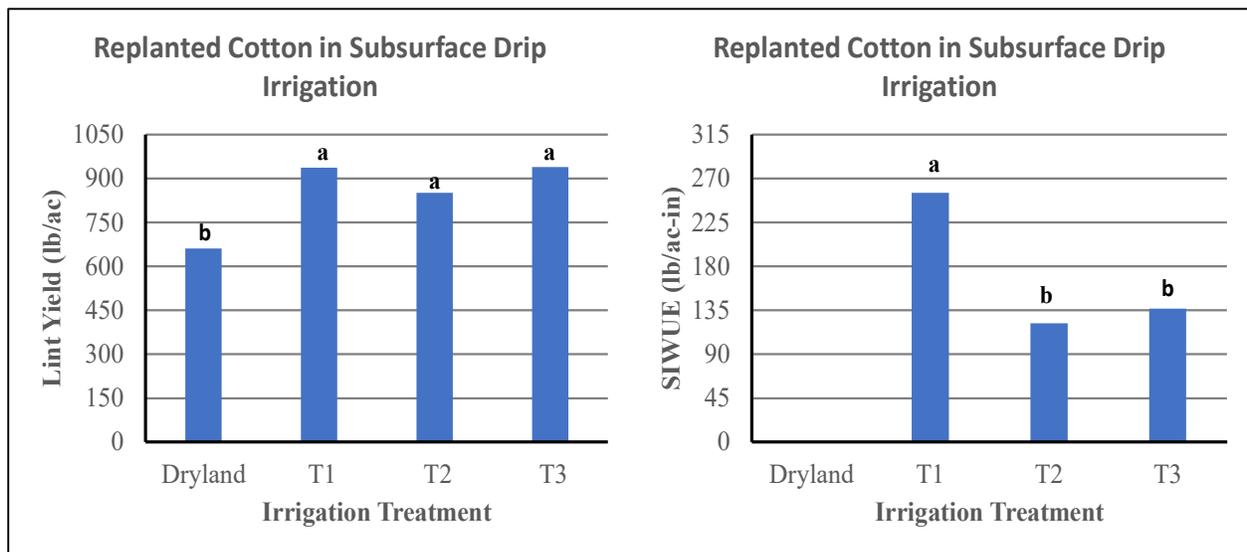


Figure 2. Cotton lint yield and seasonal irrigation water use efficiency (SIWUE) of replanted cotton in subsurface drip irrigation at Helms Research Farm, 2021.

Response of Replanted Cotton to Irrigation Quantities using Subsurface Drip Irrigation (SDI) (Field 3)

Scott Jordan, Casey Hardin, Joe Mustian, and Heath Johnson

Objective: Determine cotton lint yield, fiber quality, and water productivity of replanted NexGen 3406 B3XF using subsurface drip irrigation (SDI).

Methodology: This study was conducted on a 16-acre test area irrigated by subsurface drip irrigation (SDI) with 60-inch dripline spacing. The field was divided 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 2021 are listed in the appendix.

Results: On June 5th, following heavy rainfall in late May, cotton was replanted using NexGen 3406 B3XF at a rate of 47,000 seeds/ac. Annual rainfall through September was 18.65 inches, and the combined preplant and seasonal irrigation quantities ranged from 4.68 to 7.39 inches. Cotton lint yields ranged from 668 to 876 lb/ac (Table 1). As irrigation increased cotton lint yields had a non-significant increase as well. Seasonal irrigation water use efficiency (SIWUE) decreased as irrigation increased across all treatments. Fiber quality, as reflected in the lint loan value, ranged from 0.396 to 0.532 \$/lb (Table 2).

Table 1. Seasonal irrigation amounts, cotton lint yields, and seasonal irrigation water use efficiency of irrigation treatments using subsurface drip at Helms Research Farm, 2021.

Treatment	Seasonal Irrigation (in)	Lint Yield (lb/ac)	SIWUE (lb/ac-in)
Dryland		668	a*
T4	0.67	830	a 241 a
T2	0.74	796	a 174 ab
T5	1.15	826	a 137 b
T3	1.19	822	a 129 b
T1	1.57	862	a 124 b
T6	1.63	876	a 127 b

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

Table 2. Cotton fiber quality characteristics and lint loan values of irrigation treatments using subsurface drip irrigation at Helms Research Farm, 2021.

Treatment	Mic	Length	Unif.	Strength	Elon.	Rd	+b	CGRD	Leaf	Loan Value (¢/lb)
Dryland	4.28	1.08	81.8	30.7	7.6	80.8	8.7	21-1	1.0	53.2
T4	4.00	1.10	82.9	31.8	7.7	81.7	8.5	11-2	2.0	49.0
T2	4.06	1.08	82.7	30.9	7.5	81.0	8.4	21-1	1.0	51.9
T5	4.12	1.08	82.3	30.1	7.8	81.0	8.5	21-1	2.0	44.3
T3	3.92	1.05	81.3	30.2	7.6	80.5	8.3	21-1	2.0	51.4
T1	3.84	1.07	81.9	30.0	7.8	80.9	8.6	21-1	2.0	53.2
T6	3.99	1.07	82.8	29.9	7.8	81.7	8.6	11-2	1.0	39.6

Response of Continuous Cotton to Tillage and Irrigation Level (Field 5a)

Scott Jordan, Casey Hardin, Joe Mustian, and Heath Johnson

Objective: Determine cotton lint yield, fiber quality, and water productivity 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 22-acre test area continuous cotton has been grown since 2014. Each 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.

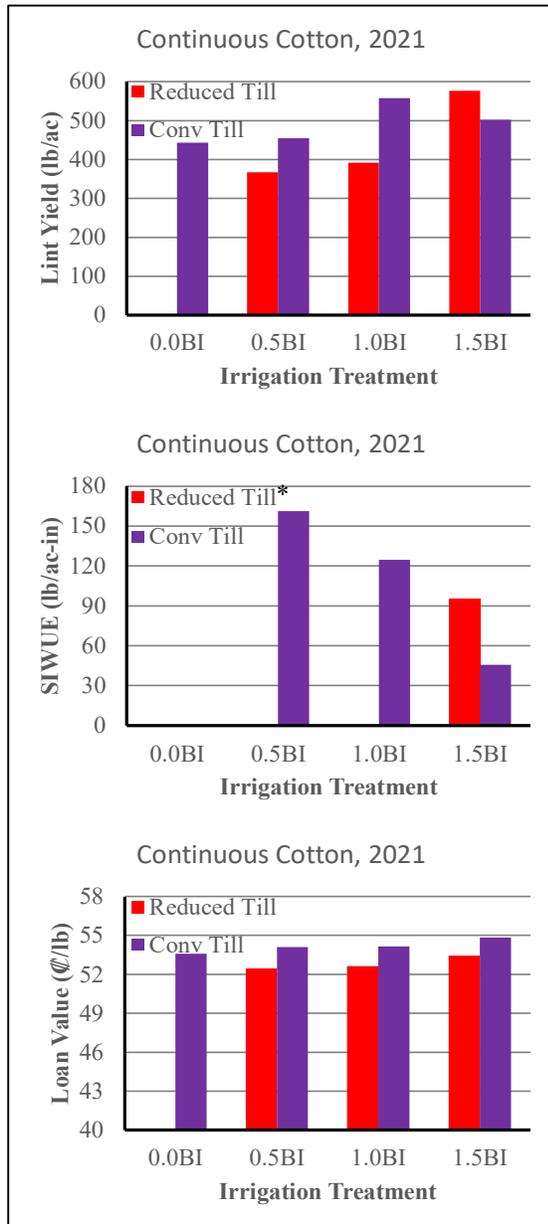


Figure 1. Cotton lint yield, seasonal irrigation water use efficiency (SIWUE), and cotton lint loan value of continuous cotton planted at Helms Research Farm, 2021. (* Only the 1.5 BI treatment in the reduced tillage system resulted in an increase in lint yield over the dryland check.)



Figure 2. Cotton being planted at Helms Research Farm, 2021.

Results: Due to heavy rainfall and hail, the test area was replanted with NexGen 3930 B3XF at a rate of 47,000 seeds/ac on June 12th. Annual rainfall was 18.65 inches and the combined preplant and seasonal irrigation in the three irrigation treatments were 5.29, 5.79, and 6.29 inches. Conventional tillage resulted in 24.0%, and 42.3% increased lint yield in the 0.5 BI and 1.0 BI treatments over the corresponding reduced tillage treatments. However, in the 1.5 BI reduced tillage resulted in 14.9% increased lint yield than the conventionally tilled treatment. As irrigation increased seasonal irrigation water use efficiency (SIWUE) decreased in the conventional tillage treatments. In the reduced tillage system only the 1.5 BI treatment resulted in an increase in lint yield over the dryland check. Conventional tillage cotton resulted in 3%, 3%, and 2.6% higher fiber quality, as reflected in the lint loan value, than the corresponding reduced tilled treatments.

Response of Cotton / Wheat Grain Rotation to Tillage and Irrigation Levels (Field 5c)

Scott Jordan, Casey Hardin, Joe Mustian, and Heath Johnson

Objective: Determine cotton lint yield, fiber quality, and water productivity of cotton following a wheat cover / 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 wheat cover / fallow period in 2020. Two tillage systems, conventional tillage (even 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 quantities 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.

Results: Annual rainfall for 2021 through September was 18.65 inches, and the combined preplant and seasonal irrigation in the three respective irrigation treatments were 6.00, 7.00, and 8.00 inches. In both tillage systems, as the irrigation quantity increased so did the cotton lint yield. Reduced tillage resulted in 1.1%, 22.2%, and 4.2% higher lint yields, than the corresponding conventional tillage treatment. As irrigation quantities increased, the seasonal irrigation water use efficiency (SIWUE) increased for the conventional tillage treatments. However, for the reduced tillage systems, the SIWUE peaked at the 1.0 BI irrigation rate. As reflected in the lint loan value, conventional tillage resulted in 4.2%, 6.7%, and 2.6% higher fiber quality over the corresponding reduced tillage treatments.

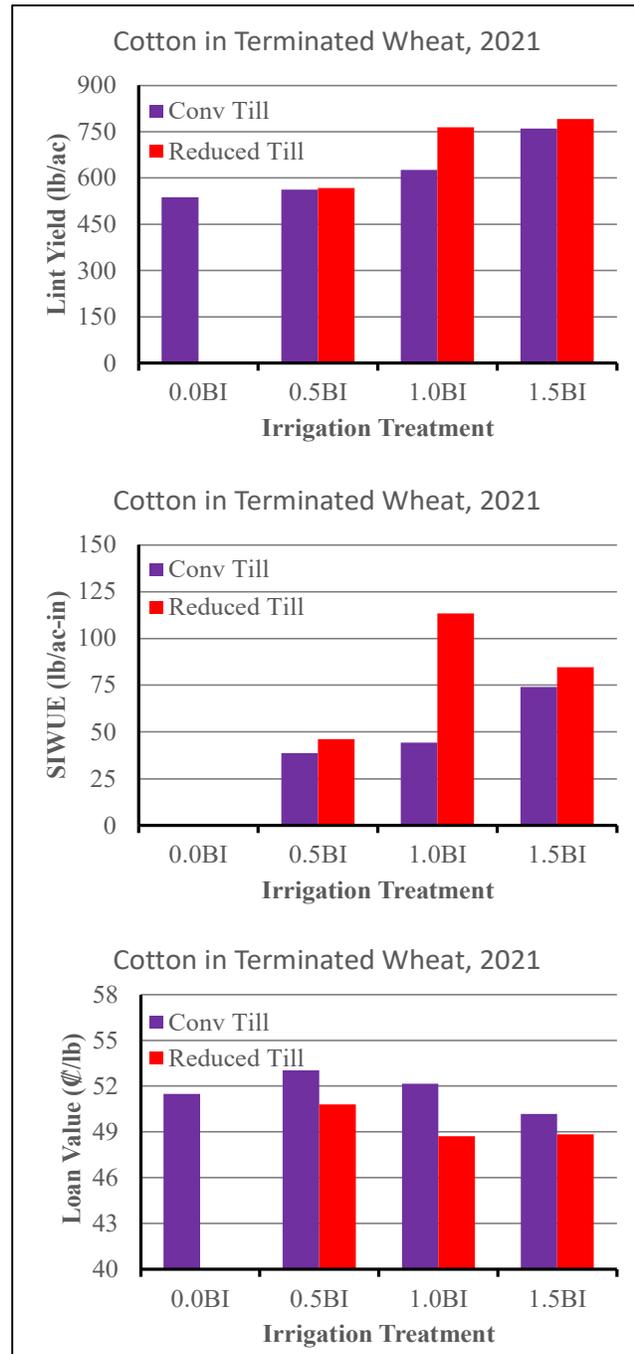


Figure 1. Cotton lint yield, seasonal irrigation water use efficiency (SIWUE), and lint loan value from treatments having two tillage systems and three irrigation levels at Helms Research Farm, 2021.

Response of Cotton in Terminated Wheat to Tillage and Irrigation Levels (Field 5d)

Scott Jordan, Casey Hardin, Joe Mustian, and Heath Johnson

Objective: Determine cotton 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 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 quantities 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 planted into a terminated wheat cover crop, Helms Research Farm, 2021.

Results: Annual rainfall for 2021 through September was 18.65 inches, and the combined preplant and seasonal irrigations in the three respective irrigation treatments were 5.68, 6.68, and 7.68 inches. Reduced tilled cotton increased lint yields by 27.3% and 0.5% in the 0.5 BI and the 1.5 BI treatments respectively, while decreasing lint yield by 10.2% in the 1.0 BI treatment over the corresponding conventional tilled cotton. In the conventional tilled treatments, seasonal irrigation water use efficiency increased as irrigation increased. However, in the reduced tillage treatments increasing water above the 0.5 BI level resulted in decreased water productivity. Fiber quality, as reflected in the lint loan value, decreased as the irrigation applied increased in the conventional tillage treatments. However, in the reduced tillage system fiber quality increased as the irrigation amount increased.

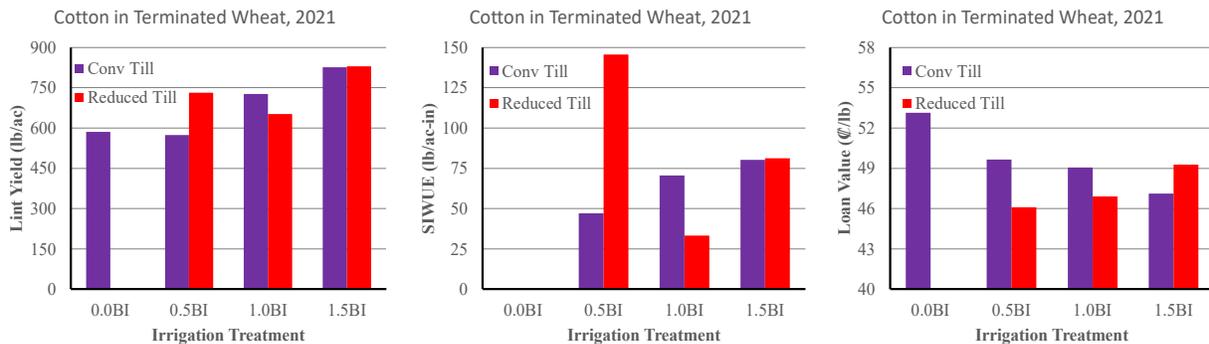


Figure 2. Cotton lint yield, seasonal irrigation water use efficiency (SIWUE), and lint loan values from treatments having two tillage methods and three irrigation levels at Helms Research Farm, 2021.

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

Objective: Determine cotton 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 (even spans) and reduced tillage (odd spans) were used. In addition, each span was broken 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. Cotton harvest at Helms Research Farm, 2021

Results: Due to heavy rainfall, on June 11th the test area was replanted with NexGen 3930 B3XF at a rate of 47,000 seeds/ac. Annual rainfall through September was 18.65 inches and the combined preplant and seasonal irrigation for the three respective irrigation treatments were 5.68, 6.68, and 7.68 inches. Reduced tillage resulted in 28.3% and 18.1% increased lint yield in the 0.5 BI and the 1.0 BI irrigation treatments when compared to the respective conventional tilled treatments but resulted in a decrease in yield by 5.7% in the 1.5 BI treatment. In the conventional tilled treatments, as water increased seasonal irrigation water use efficiency (SIWUE) increased, however SIWUE decreased in the reduced tillage treatments with increased irrigation. Reduced tillage resulted in a 3.4% increase in fiber quality, as reflected in the lint loan value, at the 1.0 BI level over the respective conventional treatment but resulted in a 2.3% decrease at the 1.5 BI level.

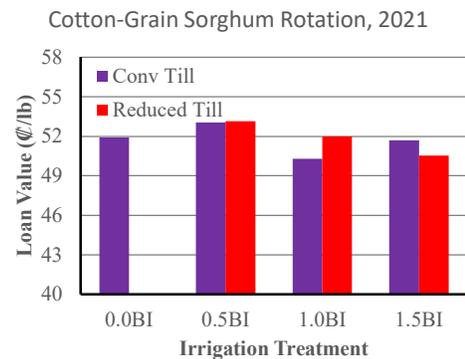
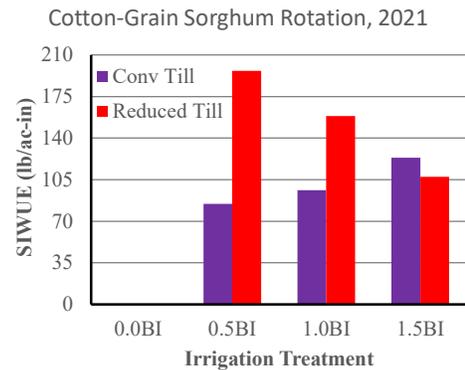
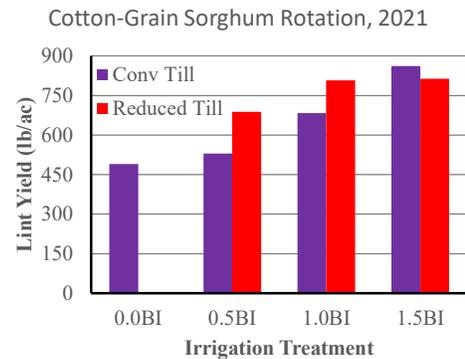


Figure 2. Cotton lint yield, seasonal irrigation water use efficiency (SIWUE), and cotton lint loan value of irrigated cotton treatments following grain sorghum using conventional and reduced tillage systems, Helms Research Farm, 2021

Response of Grain Sorghum / Cotton Rotation to Tillage and Irrigation Levels (Field 5f)

Scott Jordan, Casey Hardin, Joe Mustian, and Heath Johnson

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 (even spans), and reduced tillage (odd spans) were used. In addition, each span was divided into 3 sections with each section delivering different irrigation quantities. The irrigation levels were designated as 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 2. Collecting plot weights of grain sorghum plots at Helms Research Farm, 2021

Results: Annual rainfall through September for 2021 was 18.65 and the combined preplant and seasonal irrigation amounts in the three respective irrigation treatments were 5.10, 6.30 and 7.30 inches. Average grain sorghum yields from 2015 through 2021 are given in Figure 1. Grain sorghum yields increased with an increase in seasonal irrigation. For 2021, Reduced tilled grain sorghum resulted in an 80.7%, 48.4% and 39.4% increase in yield than the corresponding conventional tilled treatments.

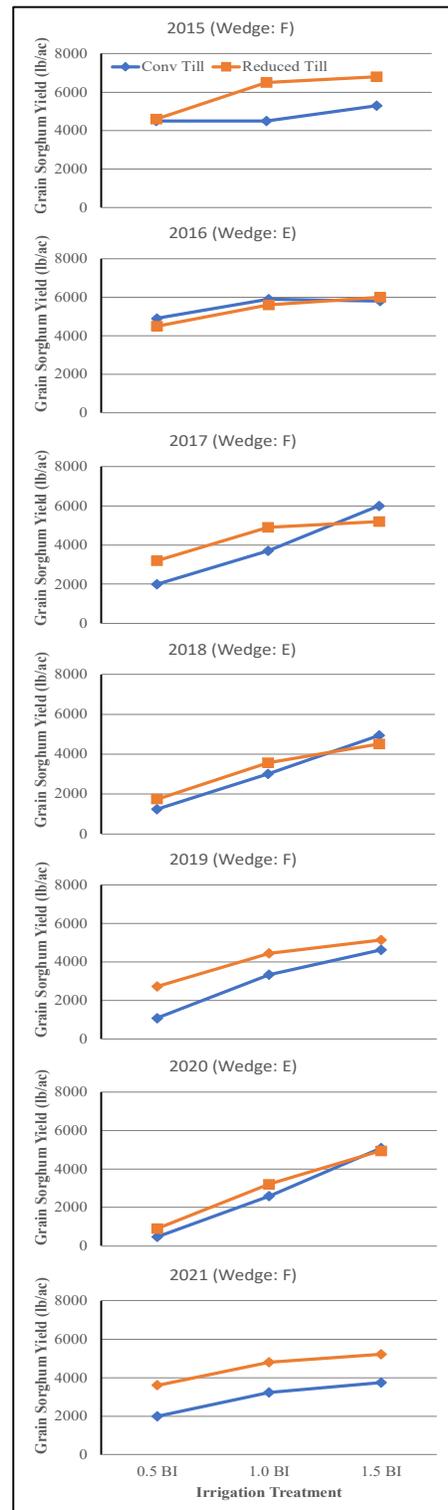


Figure 1. Grain sorghum yields from treatment areas following cotton using conventional and reduced tillage systems at three irrigation levels at Helms Research Farms, 2021

Cotton Variety Trial at Different Irrigation Levels Using SDI (Field 6)

Scott Jordan, Casey Hardin, Joe Mustian, and Heath Johnson

Objective: Determine cotton lint yield, water productivity, and fiber quality 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 20th, at a rate of 47,000 seeds/ac of each variety. 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 appendix.

Table 1. Irrigation quantities for cotton variety trial at Helms Research Farm, 2021.

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: Due to heavy rainfall, the field was replanted on June 10th at a rate of 47,000 seeds/ac for each variety. Total annual rainfall was 18.65 inches, and the total combined preplant and seasonal irrigation quantities ranged from 4.62 to 8.59 inches. Early irrigation (Period 1) was eliminated from the test due to consistent rain in June / early July. Lint yields ranged from 485 to 944 lb/ac (Figure 1), while cotton lint loan values ranged from 0.471 to 0.536 \$/lb. The DeltaPine 1822 XF variety consistently had one of the highest numerical lint yields, water productivities, and fiber quality (data not shown) across the irrigation treatments.

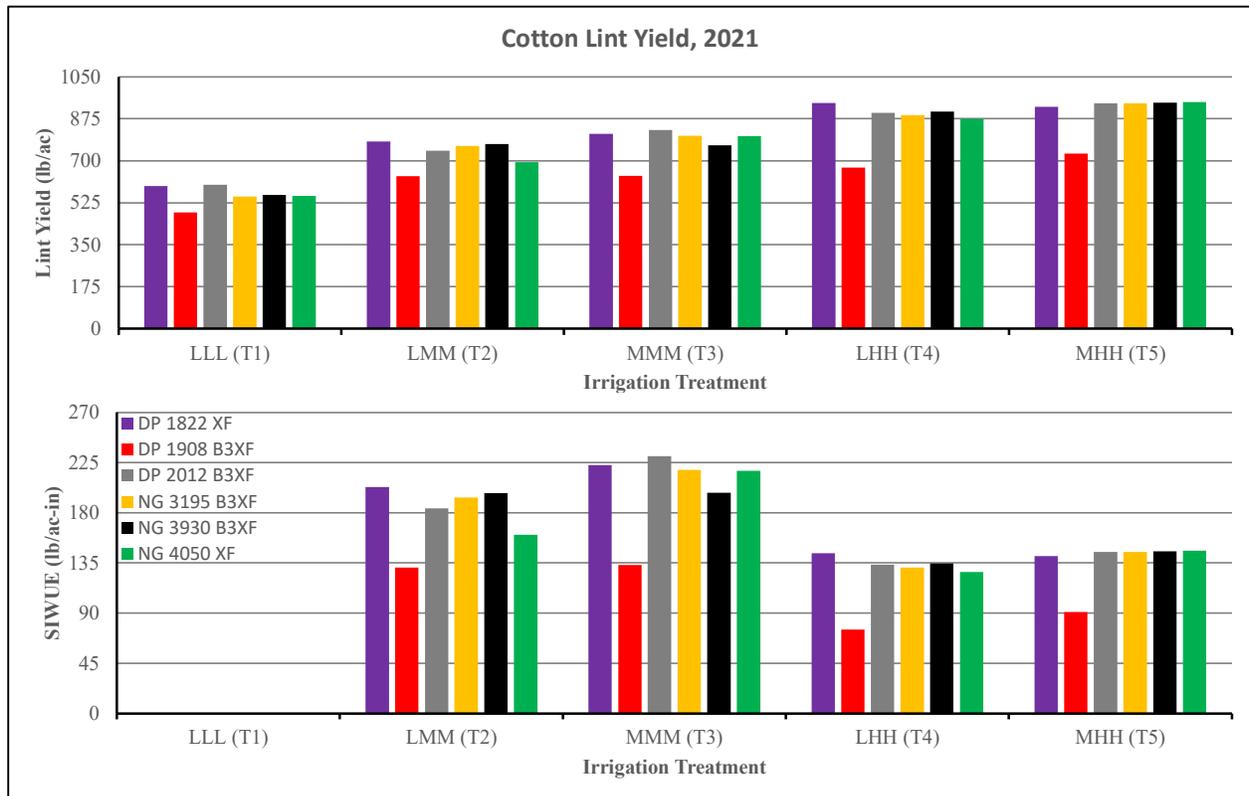


Figure 1. Cotton lint yield and seasonal irrigation water use efficiency (SIWUE) values of six different cotton varieties at five different irrigation levels, Helms Research Farm, 2021.

Performance of NexGen Varieties as Affected by Irrigation Levels, Halfway, TX, 2021.
Wayne Keeling, Ray White, and Justin Spradley

Methodology:

Plot Size:	4 rows by 32 feet, 4 replications			
Planting Date:	May 21			
Varieties:	DP1646B2XF	NG3930B3XF		
	NG3195B3XF	NG4050XF		
	NG3299B3XF	NG4098B3XF		
	NG3406B2XF	NG4190B3XF		
	NG3500XF	NG4545B2XF		
	NG3517B2XF	NG5150B3XF		
Herbicides:	Trifluralin 32 oz/A-field cultivator (PPI)	3/3/21		
	S-metolachlor 1.5 pt/A+paraquat 32 oz/A	5/22/21		
	S-metolachlor 1.5 pt/A	6/22/21		
	Engenia 12.8 oz/A+glyphosate 32 oz/A	7/7/21		
	Outlook 12 oz/A	7/15/21		
	Engenia 12.8 oz/A+glyphosate 32 oz/A	7/29/21		
	Setup 32 oz/A+ETX 1.25 oz/A	10/21/21		
	paraquat 24 oz/A	11/1/21		
Fertilizer:	75-35-0			
Irrigation:	LEPA			
		Low	Base	High
	Preplant	4.4"	4.4"	4.4"
	In Season	<u>1.3"</u>	<u>2.6"</u>	<u>3.9"</u>
	Total	5.7"	7.0"	8.3"
Harvest Date:	November 9			

Results: Eleven NexGen and one competitor varieties were compared under three levels of LEPA irrigation. Heavy rainfall after planting and light hailstorms reduced emergence, stand establishment, and early season growth. The lateness of the crop combined with above average in-season rainfall greatly reduced in-season irrigation resulting in less yield difference below irrigation levels. When averaged across varieties, yield ranged from 489 to 672 lbs lint/A (Table 1). When averaged across irrigation levels, highest yields were produced with NG 4098 B3XF and NG 3299 B3XF. Loan rates increased slightly from low to base irrigation levels; NG 4098 B3XF produced the highest loan value. Highest gross revenue (\$/A) resulted 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).

Variety	In-season Irrigation Levels (inches)			
	Low (1.3)	Base (2.6)	High (3.9)	Average
-----lbs/A-----				
DP1646B2XF	450	499	636	528 BC
NG3195B3XF	519	526	693	579 B
NG3299B3XF	540	561	653	585 AB
NG3406B2XF	487	582	664	578 B
NG3500XF	478	555	649	561 B
NG3517B2XF	514	550	681	581 B
NG3930B3XF	482	510	688	560 B
NG4050XF	485	477	697	553 B
NG4098B3XF	518	570	837	642 A
NG4190B3XF	425	452	551	476 C
NG4545B2XF	495	572	646	571 B
NG5150B3XF	479	486	668	544 B
Average	489 B	528 B	672 A	--
-----¢/lb-----				
DP1646B2XF	54.00	53.90	56.55	54.82 AB
NG3195B3XF	54.00	54.00	54.65	54.22 B
NG3299B3XF	54.00	55.40	53.25	54.22 B
NG3406B2XF	47.25	52.45	54.70	51.47 CD
NG3500XF	53.90	52.45	50.20	52.18 C
NG3517B2XF	49.20	54.00	51.05	51.42 CD
NG3930B3XF	48.75	53.90	51.15	51.27 CD
NG4050XF	53.90	53.90	54.65	54.15 B
NG4098B3XF	55.85	55.95	56.65	56.15 A
NG4190B3XF	55.95	55.50	51.15	54.20 B
NG4545B2XF	50.90	52.45	48.00	50.45 D
NG5150B3XF	54.00	52.35	54.60	53.65 B
Average	52.64 C	53.85 A	53.05 B	--
-----\$/A-----				
DP1646B2XF	243	269	359	290 B
NG3195B3XF	280	284	379	314 B
NG3299B3XF	292	311	348	317 B
NG3406B2XF	230	305	363	300 B
NG3500XF	257	291	326	291 B
NG3517B2XF	253	297	347	299 B
NG3930B3XF	235	275	352	287 B
NG4050XF	262	257	381	300 B
NG4098B3XF	289	319	474	361 A
NG4190B3XF	238	251	282	257 C
NG4545B2XF	252	300	310	287 B
NG5150B3XF	259	254	365	293 B
Average	257 B	284 B	357 A	--

Performance of FiberMax and Stoneville Varieties as Affected by Irrigation Levels, Halfway, TX, 2021.

Wayne Keeling, Ray White, and Justin Spradley

Methodolgy:

Plot Size:	4 rows by 32 feet, 4 replications			
Planting Date:	May 20			
Varieties:	BX 2295 B3XF	FM 2202 GL		
	BX 2296 B3XF	FM 2398 GLTP		
	BX 2297 B3XF	ST 4480 B3XF		
	BX 2298 B3XF	ST 4993 B3XF		
	FM 1621 GL	ST 5600 B2XF		
	FM 1730 GLTP	ST 5707 B2XF		
Herbicides:	Trifluralin 32 oz/A-field cultivator (PPI)	3/3/21		
	S-metolachlor 1.5 pt/A+paraquat 32 oz/A	5/22/21		
	S-metolachlor 1.5 pt/A	6/22/21		
	Liberty 42 oz/A+glyphosate 32 oz/A	7/6/21		
	Outlook 12 oz/A	7/15/21		
	Liberty 42 oz/A+glyphosate 32 oz/A	7/23/21		
	Setup 32 oz/A+ETX 1.25 oz/A	10/21/21		
	paraquat 24 oz/A	11/1/21		
Fertilizer:	75-35-0			
Irrigation:	LEPA			
		Low	Base	High
	Preplant	4.4"	4.4"	4.4"
	In Season	<u>1.3"</u>	<u>2.6"</u>	<u>3.9"</u>
	Total	5.7"	7.0"	8.3"
Harvest Date:	November 11			

Results: Twelve FiberMax and Stoneville varieties, including both commercial and experimental entries, were evaluated under three levels of LEPA irrigation. Heavy rainfall after planting, below-average heat unit accumulation, and hail reduced emergence, stand establishment and delayed squaring and blooming. Due to lateness of the crop and above average in-season rainfall, irrigation inputs were low (1.3" to 3.9" inches applied.)

When averaged across varieties, cotton lint yields ranged from 659 to 803 lbs/A (Table1.) When averaged across irrigation levels, the highest yielding varieties included FM 1621 GL, FM 2202 GL, and FM 2398 GLTP. There was a trend towards reduced loan value at the highest irrigation level, Highest loan values were produced with ST 4993 B3XF, FM2398 GLTP, and FM 1730 GLTP (Table 1.) Greatest gross revenues (\$/A) were produced with FM 2398 GLTP and FM 1621 GL.

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).

Variety	In-season Irrigation Levels (inches)			Average
	Low (1.3)	Base (2.6)	High (3.9)	
	-----lbs/A-----			
BX 2295 B3X	534	723	612	625 EF
BX 2296 B3X	662	707	760	703 DEF
BX 2297 B3X	586	688	528	601 F
BX 2298 B3X	550	695	508	594 F
FM 1621 GL	808	1001	922	910 AB
FM 1730 GLTP	595	717	808	694 DEF
FM 2202 GL	773	964	884	873 ABC
FM 2398 GLTP	896	1098	953	982 A
ST 4480 B3XF	630	663	656	650 EF
ST 4993 B3XF	644	869	752	755 CDE
ST 5600 B2XF	562	631	749	647 EF
ST 5707 B2XF	664	882	1001	849 BCD
Average	659 A	803 A	772 A	--
	-----¢/lb-----			
BX 2295 B3X	54.43	48.88	49.00	50.99 D
BX 2296 B3X	56.05	53.83	50.68	53.88 BC
BX 2297 B3X	54.27	55.85	52.07	54.06 BC
BX 2298 B3X	52.10	52.88	51.38	52.21 CD
FM 1621 GL	53.32	54.30	54.63	54.08 BC
FM 1730 GLTP	56.70	57.15	50.35	55.28 AB
FM 2202 GL	52.68	53.63	50.57	52.29 CD
FM 2398 GLTP	54.65	55.97	56.08	55.57 AB
ST 4480 B3XF	54.35	53.05	55.47	54.29 ABC
ST 4993 B3XF	56.35	56.37	56.77	56.49 A
ST 5600 B2XF	55.20	55.62	50.02	53.61 BC
ST 5707 B2XF	54.67	56.73	53.52	54.97 AB
Average	54.56 A	54.52 A	52.82 B	--
	-----\$/A-----			
BX 2295 B3X	294	351	300	317 DE
BX 2296 B3X	371	379	382	377 CDE
BX 2297 B3X	321	384	277	327 DE
BX 2298 B3X	287	369	256	310 E
FM 1621 GL	431	545	504	493 AB
FM 1730 GLTP	337	410	406	382 CD
FM 2202 GL	407	517	439	454 BC
FM 2398 GLTP	490	614	534	546 A
ST 4480 B3XF	345	351	365	354 DE
ST 4993 B3XF	364	489	428	427 BC
ST 5600 B2XF	310	353	377	347 DE
ST 5707 B2XF	363	501	535	466 B
Average	360 A	439 A	408 A	--

Performance of PhytoGen Varieties as Affected by Irrigation Levels, Halfway, TX, 2021.
Wayne Keeling, Ray White, and Justin Spradley

Methodology:

Plot Size:	4 rows by 32 feet, 4 replications				
Planting Date:	May 20				
Varieties:	PX1122A213-04W3FE	PHY210W3FE			
	PX1122A214-04W3FE	PHY250W3FE			
	PX1140A383-04W3FE	PHY332W3FE			
	PX1140A385-04W3FE	PHY350W3FE			
	DP2044B3XF	PHY394W3FE			
	FM2498GLT	PHY400W3FE			
	NG3930B3XF	PHY411W3FE			
	PHY205W3FE	PHY443W3FE			
Herbicides:	Trifluralin 32 oz/A-field cultivator (PPI)	3/3/21			
	S-metolachlor 1.5 pt/A+paraquat 32 oz/A	5/22/21			
	S-metolachlor 1.5 pt/A	6/22/21			
	Liberty 42 oz/A+glyphosate 32 oz/A	7/6/21			
	Outlook 12 oz/A	7/15/21			
	Liberty 42 oz/A+glyphosate 32 oz/A	7/23/21			
	Setup 32 oz/A+ETX 1.25 oz/A	10/21/21			
	paraquat 24 oz/A	11/1/21			
Fertilizer:	75-35-0				
Irrigation:	LEPA				
		Dry	Low	Base	High
	Preplant	4.4"	4.4"	4.4"	4.4"
	In Season	<u>0.0"</u>	<u>1.3"</u>	<u>2.6"</u>	<u>3.9"</u>
	Total	4.4"	5.7"	7.0"	8.3"
Harvest Date:	November 9				

Results: Thirteen commercial and experimental PhytoGen and three competitor varieties were compared under dryland and three levels of LEDA irrigation. Heavy rainfall after planting, light hailstorms, and below average heat unit accumulation combined to reduce emergence and stand establishment and delay early-season growth. Skippy stands resulted in variable yields for most entries. Due to the lateness of the crop and above average in-season rainfall, irrigation levels applied were low (1.3", 2.6", and 3.9") for the three levels. Lint yields, loan values, and gross revenue (\$/A) are summarized in Tables 1, 2, and 3.

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

Variety	In-season Irrigation Levels (inches)				Average
	Dry (0.0)	Low (1.3)	Base (2.6)	High (3.9)	
	----- lbs/A -----				
PX1122A213	629	613	766	781	720 B
PX1122A214	707	685	837	767	763 B
PX1140A383	546	361	552	329	414 GH
PX1140A385	566	381	388	307	359 H
DP2044B3XF	663	408	578	503	496 EFG
FM2498GLT	689	780	996	908	895 A
NG3930B3XF	656	595	833	790	739 B
PHY205W3FE	652	680	810	782	757 B
PHY210W3FE	624	571	863	713	716 B
PHY250W3FE	657	569	781	730	693 BC
PHY332W3FE	621	430	592	479	500 EF
PHY350W3FE	622	377	573	531	494 EFG
PHY394W3FE	580	567	866	678	704 BC
PHY400W3FE	599	435	442	408	428 FGH
PHY411W3FE	620	449	713	566	576 DE
PHY443W3FE	606	538	720	604	621 CD
Average	627	527 C	707 A	617 B	--

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

Variety	In-season Irrigation Levels (inches)				Average
	Dry (0.0)	Low (1.3)	Base (2.6)	High (3.9)	
	----- ¢/lb -----				
PX1122A213	50.50 d	50.78	47.70	47.08	48.52 B
PX1122A214	48.23 ef	48.00	47.83	48.15	47.99 B
PX1140A383	55.10 ab	52.95	54.68	51.53	53.05 GH
PX1140A385	55.88 a	51.23	48.85	48.93	49.67 H
DP2044B3XF	53.18 bc	48.98	51.35	50.80	50.38 EFG
FM2498GLT	54.53 ab	53.38	55.53	55.48	54.79 A
NG3930B3XF	52.05 cd	51.68	49.50	51.10	50.76 B
PHY205W3FE	46.85 f	50.35	51.38	52.45	51.39 B
PHY210W3FE	50.63 d	53.65	49.78	52.88	52.10 B
PHY250W3FE	50.30 de	47.65	49.75	48.90	48.77 BC
PHY332W3FE	56.35 a	55.60	54.38	54.88	54.95 EF
PHY350W3FE	53.03 bc	54.63	51.23	50.45	52.10 EFG
PHY394W3FE	46.28 f	48.15	49.90	48.90	48.98 BC
PHY400W3FE	54.43 ab	53.68	48.83	50.98	51.16 FGH
PHY411W3FE	52.33 cd	51.58	53.05	53.83	52.82 DE
PHY433W3FE	54.75 ab	52.45	55.78	56.20	54.81 CD
Average	52.15	51.55 A	51.22 A	51.41 A	--

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

Variety	In-season Irrigation Levels (inches)				Average
	Dry (0.0)	Low (1.3)	Base (2.6)	High (3.9)	
		-----\$/A-----			
PX1122A213	318 bcd	312	366	367	348 BCD
PX1122A214	341 abc	328	403	369	367 BC
PX1140A383	301 cd	191	301	169	221 GH
PX1140A385	316 bcd	195	190	150	179 H
DP2044B3XF	352 ab	199	296	256	250 FG
FM2498GLT	375 a	416	553	504	491 A
NG3930B3XF	342 abc	307	412	403	374 BC
PHY205W3FE	306 bcd	343	419	411	391 B
PHY210W3FE	316 bcd	306	430	377	371 BC
PHY250W3FE	331 abc	271	388	357	339 CD
PHY332W3FE	350 abc	239	321	266	275 EF
PHY350W3FE	329 abc	206	293	268	256 FG
PHY394W3FE	268 d	274	434	332	346 BCD
PHY400W3FE	326 abc	233	218	210	220 GH
PHY411W3FE	325 bc	232	379	305	305 DE
PHY433W3FE	332 abc	283	401	340	341 CD
Average	327	271 C	363 A	318 B	--

Performance of Deltapine Varieties as Affected by Irrigation Levels at Halfway, TX, 2021.
 Katie Lewis, Dustin Kelley, Ira Yates, Debrah Dobitz, and Ameer Bumguardner

Methodology:

Plot Size: 4 Rows x 35 feet, 4 replications

Planting Date: May 21

Varieties: 21R543XF DP 2143NR B3XF
 20R739B3XF DP 2123 B3XF
 20R727B3XF DP 2020 B3XF
 20R744B3XF DP 2012 B3XF
 20R732B3XF DP 1822 XF
 20R722NRB3XF DP 1820 B3XF

Herbicides: Trifluralin 4 ec 32 oz - 03/03/2021
 Clethodim 2E 16 oz – 05/13/2020
 Me Too Lachlor 1.5 pt, Solera 32 oz – 05/22/2021
 Me Too Lachlor 1.5 pt, - 6/22/2021
 Engenia 12.8 oz, Honcho K6 32 oz – 06/26/2021
 Clethodim 2E 16 oz – 07/09/2021
 Outlook 12 oz – 07/15/2021
 Mepaquat 12 oz – 07/21/2021
 Engenia 12.8 oz, Honcho K6 32 oz – 07/29/2021
 Mep Star 16 oz – 08/16/2021
 Setup 32 oz, ETX 1.25 oz – 10/21/2021
 Solera 24 oz – 11/01/2021

Fertilizer: Dryland: 57 lbs N/acre
 Irrigated: 60 lbs N/acre, 107 lbs P205/acre

Irrigation: LEPA

	Dry	Low	Base	High
Pre-plant	4.35"	4.35"	4.35"	4.35"
In-season	1.30"	2.60"	3.90"	5.20"
Total	5.65"	6.95"	8.25"	9.55"

Harvest Date: November 10

Results: Deltapine varieties were compared under three irrigation levels and dryland (preplant irrigation only) conditions. Lint yield differences were observed across, as well as within the water levels. Averaged across varieties, yields increased from dryland to the high irrigation level. In the dryland regime, 21R543XF outyielded DP 2143NR B3XF and the other varieties that yielded under 579 lbs/ac of lint. Under low water irrigation 21R543XF produced greater yield than 20R722NRB3XF and six other varieties. Under base water levels, 21R543XF once again lead the way and outyielded all other varieties except for 20R744B3XF which itself produced

greater lint yield than 20R732B3XF and eight other varieties. The highest irrigation level showed the smallest separation of yields with 20R727B3XF and 20R744B3XF having greater lint yield than DP 2143 B3XF, DP 2020 B3XF, and DP 1820 B3XF. These results are promising in that there are varieties soon to be available with greater yield potential than what are currently available.

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

Varieties	Lint Yield (lbs/ac)				
	Dry	Low	Base	High	Average
20R722NRB3XF	598	903	1207	1345	1013
20R727B3XF	524	866	1168	1396	989
20R732B3XF	548	932	1245	1263	997
20R739B3XF	609	864	1149	1263	971
20R744B3XF	615	930	1325	1380	1062
21R543XF	683	1033	1389	1348	1113
DP 1820 B3XF	579	876	1158	1179	948
DP 1822 XF	629	862	1285	1291	1017
DP 2012 B3XF	563	863	1232	1325	996
DP 2020 B3XF	513	928	1078	1185	926
DP 2123 B3XF	532	978	1244	1292	1012
DP 2143NR B3XF	579	857	1175	1208	955
Average	581	908	1221	1290	1000
<i>P-value</i>	0.121	0.257	<.0001	0.363	0.185

Effects of Irrigation Rate, Tillage System, and Nitrogen Application on Verticillium Wilt and Cotton Yield.

Terry Wheeler, Katie Lewis, Wayne Keeling, Will Keeling, and Donna McCallister.

Methodology: The Helm farm has four rotation systems that began in 2014. In the north (A) and south (D) wedges, continuous cotton is grown (Fig. 1). In wedge A, there is no terminated cover crop, and in wedge D, there is a terminated cover crop. The eastern wedges (B and C) are in a winter wheat/summer fallow/cotton rotation. The western wedges (E and F) are in a cotton/sorghum rotation. In each span, there is a base irrigation rate, and then a low (50% below the base rate) and high (50% above the base rate) irrigation rate. In 2021, the low, medium and high seasonal irrigation rates for the A wedge was 0.5, 1.0, and 1.5 inches, respectively. In the other three wedges planted in cotton (C, D, and E in 2021), the low, medium, and high seasonal irrigation amounts were 1.0, 2.0, and 3.0 inches respectively. The field was replanted in mid-June, and between the lateness of the crop and some rain events, the cotton was irrigated sparingly. Nitrogen was applied 32-0-0 at 35.5, 79.5, and 106.5 lbs/acre for low, base, and high irrigation rates, in late March. Also, 10-34-0 was applied in late March, at 26 lbs/acre for low irrigation rate, and 60 lbs/acre for the base and high irrigation rates. An additional nitrogen application (30 lbs of N, with UAN) was applied on August 4th, to 8 rows within the high irrigation rate in the C and E wedge. All treatments were monitored for Verticillium wilt incidence.

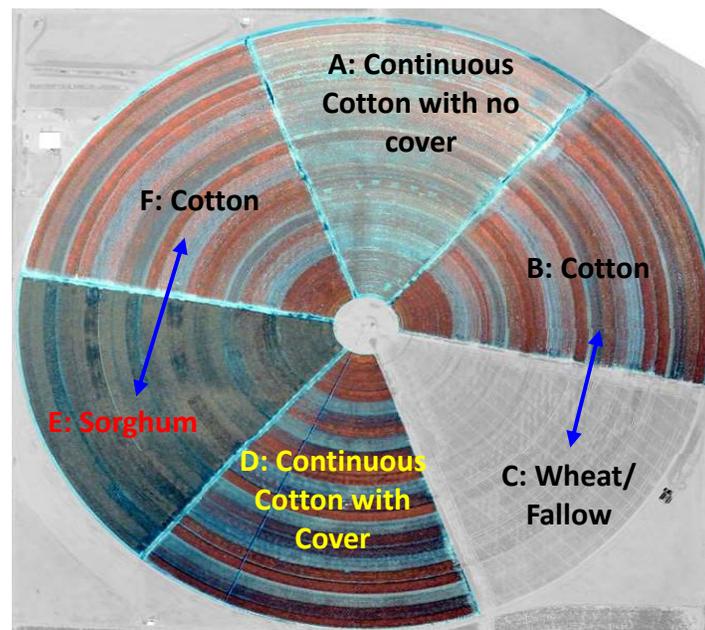


Figure 1. Field layout at the Helm farm with cropping system. Spans 3, 5, and 7 were in minimal tillage, while spans 4, 6, and 8 were in conventional tillage. Within each span was a low, base, and high irrigation rate.

Results: Irrigation water applied was the most critical factor affecting yield in 2021. Verticillium wilt was higher on the conventional tillage (13%) than the reduced tillage (9%), but these differences should not have led to much impact on yield. Irrigation rate and tillage affected

Verticillium wilt incidence. The high, base, and low irrigation rates averaged 15, 11, and 7% wilt, but within the high rate, conventional tillage averaged 19% wilt incidence while reduced tillage averaged 11% wilt incidence. However, these levels of wilt are low for August 27th. Defoliation occurred in September, but it appeared to be due to drought stress rather than Verticillium wilt. Nitrogen (UAN) applied in early August had no impact on Verticillium wilt or lint yield. Overall, yield was a product of irrigation rate, with 138 lbs of lint on average being produced for each inch of irrigation water (Fig. 2).

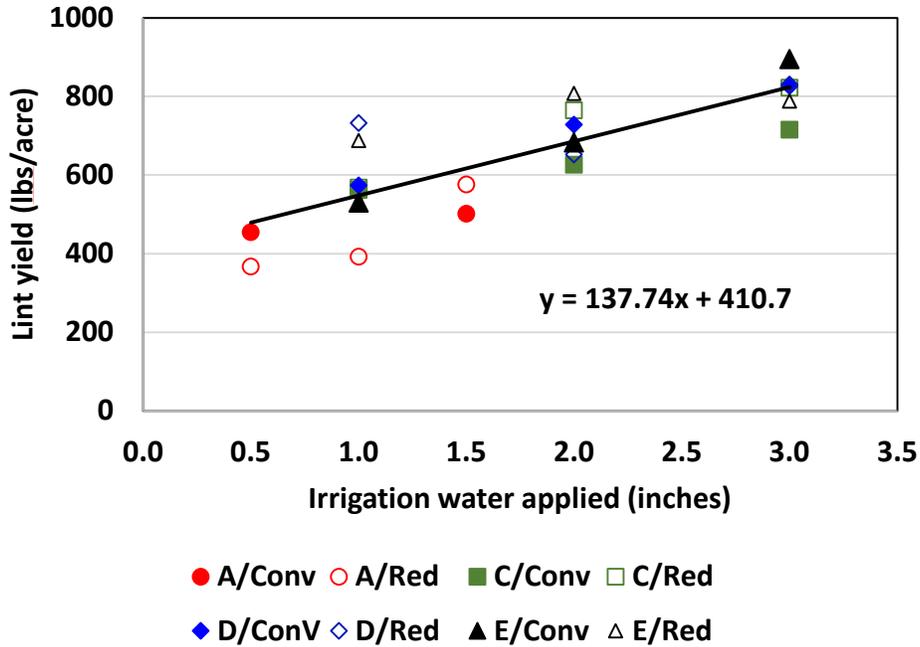


Figure 2. Effect of irrigation applied to cotton lint yield across wedges A, C, D, and E, and conventional (Conv) and reduced (Red) tillage systems.

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 @ Building	Helms @ Well 1	Crop: Cotton										Crop: Cotton							Crop: Cotton				
6	16	2021																								
6	25	2021	0.05																						1.04	
6	26	2021	2.26	2.57																						
6	27	2021	0.34	0.94																						
6	28	2021	0.08																							
6	29	2021	1.01	0.51																						
6	30	2021	0.03																							
7	2	2021	0.09																							
7	4	2021	0.32	0.33																						
7	11	2021	0.64	0.41																						
7	16	2021	0.33	0.16																						
7	17	2021	0.77																							
7	18	2021	1.09	1.78																						
7	25	2021	0.52																							
8	1	2021	0.66	0.49																						
8	9	2021			0.30	0.42	0.53	0.65	0.49	0.37	0.62	0.32	0.47		0.37	0.22	0.59	0.20	0.54	0.46						
8	10	2021				0.32									0.28				0.10	0.38		0.30	0.30	0.28		0.07
8	11	2021																				0.26	0.24	0.24		0.18
8	12	2021	0.10	0.15																						
8	13	2021	0.28																							
8	14	2021	0.45	1.08																						
8	16	2021	0.50	0.48																						
8	25	2021			0.29	0.66	0.51	0.66	0.18			0.15	0.47		0.45	0.27	0.29	0.18	0.18	0.37		0.58	0.56	0.56		0.37
8	26	2021						0.31	0.37	0.64	0.08											0.27	0.30	0.30		0.45
8	30	2021																								
8	31	2021				0.34	0.52	0.66				0.09			0.09	0.21	0.29	0.26	0.22	0.01		0.28	0.28	0.28		0.24
9	1	2021						0.48	0.35	0.51					0.36				0.08	0.38		0.27	0.28	0.28		0.09
9	2	2021			0.38	0.30			0.05		0.20	0.41	0.55		0.02	0.04	0.02	0.03	0.03	0.03	0.04	0.28	0.30	0.30		0.23
9	5	2021	0.16																							
9	7	2021			0.04	0.04	0.04	0.05	0.04	0.04	0.04	0.04	0.04									0.04	0.03			
9	8	2021																						0.03	0.05	0.07
9	10	2021																						0.23	0.26	
9	27	2021	0.60	0.33																						
9	30	2021	1.44	0.60																						
Pre & At Plant			9.70	8.82			4.92	5.01	5.16	5.20	5.06	5.07	5.00	5.10	5.38			5.82	5.98	5.66	5.78	5.78	5.76	4.64		5.16
Seasonal			11.67	9.83			1.01	2.08	1.60	2.02	1.55	1.13	2.01	1.09	1.53	0.04		1.57	0.74	1.19	0.67	1.15	1.63	0.04		1.96
Totals			21.37	18.65			5.93	7.09	6.76	7.22	6.61	6.20	7.01	6.09	6.63	5.42		7.39	6.72	6.85	6.45	6.93	7.39	4.68		7.12

2021 Rain and Irrigation Amounts At Helms Research Farm, Halfway, TX

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

Mo	Da	Year	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: Cotton]				Field: 5 Wedge: F [Crop: Sorghum]											
					Irrigation Level		System	Irrigation Level		System	Irrigation Level		System	Irrigation Level		System	Irrigation Level		System	Irrigation Level		System	Irrigation Level		System	Irrigation Level		System												
					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		Span 2	Span 3 - Span 8		Span 2	Span 3 - Span 8	Span 2	Span 3 - Span 8	Span 2	Span 3 - Span 8						
			Halfway @ Building	Helms @ Well 1	Base	Base	Base - 50%	Base + 50%		Base	Base	Base - 50%	Base + 50%		Base	Base	Base - 50%	Base + 50%		Base	Base	Base - 50%	Base + 50%		Base	Base	Base - 50%	Base + 50%		Base	Base	Base - 50%	Base + 50%		Base	Base	Base - 50%	Base + 50%		
1	16	2021	0.12	0.18																																				
1	17	2021	0.74	1.29																																				
1	21	2021	0.01																																					
2	17	2021	0.05	0.03																																				
3	12	2021	0.08																																					
3	13	2021	0.10	0.17																																				
3	22	2021	0.05	0.08																																				
4	15	2021	0.25																																					
4	16	2021	0.05	0.21																																				
4	17	2021													0.50	0.50	0.50	0.50	S																					
4	18	2021																																						
4	19	2021			0.50	0.50	0.50	0.50	S						0.20	0.20	0.20	0.20	S																					
4	20	2021			0.20	0.20	0.20	0.20	S																															
4	21	2021								0.20	0.20	0.20	0.20	S	0.20	0.20	0.20	0.20	S																					
4	22	2021			0.20	0.20	0.20	0.20	S	0.10	0.10	0.10	0.10	S																										
4	23	2021													0.20	0.20	0.20	0.20	S																					
4	24	2021			0.20	0.20	0.20	0.20	S	0.10	0.10	0.10	0.10	S																										
4	27	2021													0.20	0.20	0.20	0.20	S																					
4	28	2021	0.01		0.20	0.20	0.20	0.20	S	0.10	0.10	0.10	0.10	S																										
4	29	2021													0.20	0.20	0.20	0.20	S																					
4	30	2021			0.20	0.20	0.20	0.20	S	0.10	0.10	0.10	0.10	S	0.20	0.20	0.20	0.20	S																					
5	1	2021			0.20	0.20	0.20	0.20	S	0.10	0.10	0.10	0.10	S																										
5	2	2021													0.20	0.20	0.20	0.20	S																					
5	3	2021	0.38	0.28	0.20	0.20	0.20	0.20	S						0.20	0.20	0.20	0.20	S																					
5	4	2021								0.10	0.10	0.10	0.10	S	0.20	0.20	0.20	0.20	S																					
5	5	2021			0.20	0.20	0.20	0.20	S	0.10	0.10	0.10	0.10	S																										
5	6	2021													0.20	0.20	0.20	0.20	S																					
5	7	2021	0.06	0.20	0.20	0.20	0.20	S	0.10	0.10	0.10	0.10	S																											
5	8	2021													0.20	0.20	0.20	0.20	S																					
5	9	2021	0.01		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	10	2021			0.20	0.20	0.20	0.20	S																															
5	11	2021	0.06							0.05	0.05	0.05	0.05	S	0.20	0.20	0.20	0.20	S																					
5	12	2021			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	14	2021	0.35	0.10																																				
5	15	2021	0.29	0.18																																				
5	17	2021	0.10																																					
5	18	2021	0.12																																					
5	19	2021	0.02																																					
5	22	2021																																						
5	23	2021	0.02																																					
5	24	2021	0.22																																					
5	25	2021	0.13	0.48	0.50	0.50	0.50	0.50	S																															
5	26	2021	3.2	2.08																																				
5	28	2021	0.04																																					
5	30	2021	0.34	0.68																																				
5	31	2021	0.83	0.58																																				
6	1	2021	0.70</																																					

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

Helms Irrigation Amounts (in)

Date			Rainfall (in)		Field 6 Irrigation (Drip)																				
					Zones (Treatment)																				
Mo	Da	Year	Halfway @ Building	Helms @ Well 1	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)	
Crop:																									
Cotton																									
1	16	2021	0.12	0.18																					
1	17	2021	0.74	1.29																					
1	21	2021	0.01																						
2	17	2021	0.05	0.03																					
3	12	2021	0.08																						
3	13	2021	0.10	0.17																					
3	22	2021	0.05	0.08																					
4	7	2021			1.51	1.44	1.50	1.47																	
4	8	2021							1.40	1.51	1.46	1.52													
4	9	2021											1.49	1.52	1.52	1.48									
4	10	2021															1.45	1.53	1.60	1.40					
4	11	2021																			1.46	1.49	1.49	1.47	
4	15	2021	0.25																						
4	16	2021	0.05	0.21																					
4	26	2021			1.03	1.02	1.04	0.49																	
4	27	2021					0.48	0.88	0.95	0.95	0.99	1.11	0.98	0.98	0.47										
4	28	2021	0.01													0.45	0.93	0.97	1.03	0.42					
4	29	2021																	0.47	0.95	0.94	0.97	0.95		
5	3	2021	0.38	0.28																					
5	4	2021			0.09	0.21	0.13	0.24	0.32	0.19	0.29	0.18	0.07	0.21	0.14	0.29	0.32	0.20	0.07	0.41	0.30	0.27	0.24	0.27	
5	7	2021	0.06	0.20																					
5	9	2021	0.01																						
5	10	2021			0.47	0.45	0.48	0.49	0.61	0.52	0.50	0.51	0.46	0.51	0.50										
5	11	2021	0.06													0.51	0.51	0.51	0.51	0.52	0.51	0.53	0.51	0.52	
5	14	2021	0.35	0.10																					
5	15	2021	0.29	0.18																					
5	17	2021	0.10																						
5	18	2021	0.12																						
5	19	2021	0.02																						
5	22	2021			0.47	0.45	0.48	0.50	0.52	0.51	0.51	0.51	0.49	0.49	0.50	0.26									
5	23	2021	0.02													0.25	0.50	0.50	0.50	0.51	0.50	0.51	0.49	0.49	
5	24	2021	0.22																						
5	25	2021	0.13	0.48																					
5	26	2021	3.2	2.08																					
5	28	2021	0.04																						
5	30	2021	0.34	0.68																					
5	31	2021	0.83	0.58																					
6	1	2021	0.70																						
6	2	2021	0.65	1.32																					
6	6	2021	0.67	0.96																					
6	15	2021			0.47	0.45	0.47	0.48	0.50	0.50	0.50	0.50	0.49	0.49	0.48										
6	16	2021														0.48	0.49	0.49	0.49	0.49	0.50	0.51	0.50	0.49	
6	17	2021			0.47	0.45	0.46	0.48	0.51	0.50	0.50	0.50	0.50	0.49	0.48										
6	18	2021														0.48	0.90	0.48	0.49	0.49	0.49	0.50	0.49	0.50	
6	25	2021	0.05																						
6	26	2021	2.26	2.57																					

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

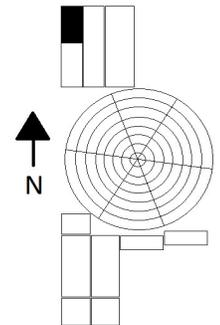
Helms Irrigation Amounts (in)

Date			Rainfall (in)		Field 6 Irrigation (Drip)																				
					Zones (Treatment)																				
Mo	Da	Year	Halfway @ Building	Helms @ Well 1	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)	
Crop:																									
Cotton																									
6	27	2021	0.34	0.94																					
6	28	2021	0.08																						
6	29	2021	1.01	0.51																					
6	30	2021	0.03																						
7	2	2021	0.09																						
7	4	2021	0.32	0.33																					
7	11	2021	0.64	0.41																					
7	16	2021	0.33	0.16																					
7	17	2021	0.77																						
7	18	2021	1.09	1.78																					
7	25	2021	0.52																						
7	29	2021			0.50		0.25	0.49	0.24		0.25	0.50	0.49	0.24		0.50	0.27	0.26	0.51	0.27		0.51	0.50	0.25	
8	1	2021	0.66	0.49																					
8	5	2021			0.42		0.25	0.49	0.24		0.25	0.50	0.49	0.24		0.49	0.25	0.25	0.49	0.24		0.49	0.48	0.24	
8	11	2021			0.57		0.25	0.48	0.25		0.25	0.49	0.48	0.24		0.48	0.24	0.24	0.49	0.25		0.50	0.49	0.29	
8	12	2021	0.10	0.15	0.49		0.24	0.49	0.24		0.25	0.49	0.48	0.24		0.48	0.24	0.25	0.48	0.24		0.50	0.49	0.25	
8	13	2021	0.28																						
8	14	2021	0.45	1.08																					
8	16	2021	0.50	0.48																					
8	23	2021																							
8	24	2021			0.49		0.25	0.49	0.24		0.25	0.50	0.49	0.24		0.49	0.25	0.25	0.48	0.25		0.50	0.49	0.25	
8	25	2021			0.49		0.25	0.48	0.24		0.25	0.49	0.48	0.23		0.47	0.25	0.24	0.49	0.25		0.49	0.49	0.24	
8	26	2021																							
8	30	2021			0.49		0.22	0.49	0.24		0.25	0.49	0.48	0.24		0.48	0.25	0.24	0.48	0.24		0.50	0.49	0.24	
8	31	2021			0.49		0.27	0.48	0.25		0.25	0.48	0.48	0.24		0.49	0.24	0.24	0.48	0.24		0.48	0.48	0.24	
9	5	2021	0.16																						
9	27	2021	0.60	0.33																					
9	30	2021	1.44	0.60																					
Pre & At Plant			9.70	8.82	4.51	4.47	4.56	4.63	4.74	4.68	4.71	4.71	4.61	4.69	4.60	4.67	5.10	4.68	4.69	4.71	4.71	4.75	4.69	4.69	
Seasonal			11.67	9.83	3.94		1.98	3.89	1.94		2.00	3.94	3.87	1.91		3.88	1.99	1.97	3.90	1.98		3.97	3.91	2.00	
Totals			21.37	18.65	8.45	4.47	6.54	8.52	6.68	4.68	6.71	8.65	8.48	6.60	4.60	8.55	7.09	6.65	8.59	6.69	4.71	8.72	8.60	6.69	

Operations Summary

Year	2021
Farm	Helm
Field ID	Field 1 North
Exp. Design	Corn
Soil Type	Pullman Clay Loam

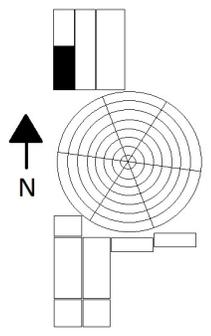
Field Operations	Date	Activity
Tillage	12/7/2020	Shred
	2/9/2021	Disk
	3/2/2021	Disk
	3/8/2021	Field Cultivator
	3/8/2021	List
	3/29/2021	Bed Conditioner
	6/14/2021	Cultivate
Fertility	3/24/2021	Liquid 32-0-0 25lbs/ac
	3/24/2021	Liquid 10-34-0 80lbs/ac
	3/25/2021	Liquid 32-0-0 100lbs/ac
	6/14/2021	Liquid 32-0-0 175lbs/ac
Planting / Harvest	5/10/2021	Planted Various Corn Plots
	10/12/2021	Harvested all corn test
Herbicide / Growth Regulator	5/10/2021	Mee-Too-Lachlor 1.5pt/ac, Clash 8oz/ac
	6/16/2021	Laudis 3oz/ac, Air Force 1.5qt/100gal, Liquid AMS 1%
Insecticide	4/8/2021	Atrazine 1qt/ac
Harvest aid		
Irrigation Amt.		
PrePlant & Planting		
Seasonal		
Rainfall		
PrePlant & Planting	1/1 - 6-25	8.82
Seasonal	6/26 - 9/30	9.83



Operations Summary

Year	2021
Farm	Helm
Field ID	Field 1 South
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

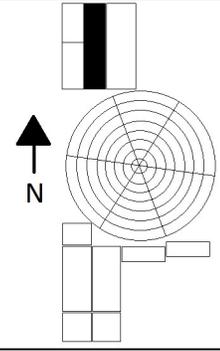
Field Operations	Date	Activity
Tillage		
Fertility		
	Planting / Harvest	10/16/2021
6/10/2021		Planted NexGen 3930 B2XF 47,000seed/ac
10/29/2021		Harvested all cotton
Herbicide / Growth Regulator	3/31/2021	Valor 2oz/ac, Clash 10oz/ac, Showdown 48oz/ac
	6/9/2021	Solera 32oz/ac, Induce 0.50%
	6/22/2021	Mee-Too-Lachlor 1.5pt/ac
	6/26/2021	Engenia 12.8oz/ac, Honcho K6 32oz/ac, Verified 20oz/ac, Smoke 1qt/100gal, Justified 3oz/ac
	7/15/2021	Outlook 12oz/ac
	7/21/2021	Mep Star 10oz/ac
	7/28/2021	Engenia 12.8oz/ac, Honcho K6 32oz/ac, Verified 20oz/ac, Smoke 1qt/100gal, Justified 3oz/ac
	8/16/2021	Mep Star 16oz/ac
Insecticide		
Harvest aid	10/11/2021	Setup 32oz/ac, ETX 1.25oz/ac, Dyne-Amic 1%
	10/25/2021	Solera 24oz/ac, Induce 0.50%
Irrigation Amt.		
PrePlant & Planting		
Seasonal		
Rainfall		
PrePlant & Planting	1/1 - 6-25	8.82
Seasonal	6/26 - 9/30	9.83



Operations Summary

Year	2021
Farm	Helm
Field ID	Field 2
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

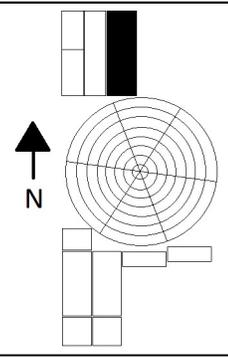
Field Operations	Date	Activity
Tillage	11/5/2020	List
	3/24/2021	Bed Conditioner
	5/19/2021	Bed Packer
	6/6/2021	Bed Packer
	6/8/2021	Rotary Hoe
Fertility	3/25/2021	Liquid 32-0-0 60lbs/ac
	4/1/2021	Liquid 32-0-0 18lbs/ac
	4/1/2021	Liquid 10-34-0 62lbs/ac
Planting / Harvest	11/16/2020	Planted Drifter 45lbs/ac (cover crop)
	5/19/2021	Planted NexGen 3930 B3XF 47,000seed/ac
	10/30/2021	Harvested all cotton
Herbicide / Growth Regulator	4/7/2021	Valor 2oz/ac, Clash 10oz/ac
	4/21/2021	Showdown 42oz/ac
	5/19/2021	Mee-Too-Lachlor 1.5pt/ac
	6/22/2021	Mee-Too-Lachlor 1.5pt/ac
	7/6/2021	Engenia 12.8oz/ac, Honcho K6 32oz/ac, Verified 20oz/ac, Smoke 1qt/100gal, Justified 3oz/ac
	7/15/2021	Outlook 12oz/ac
	7/21/2021	Mep Star 10oz/ac
	7/28/2021	Engenia 12.8oz/ac, Honcho K6 32oz/ac, Verified 20oz/ac, Smoke 1qt/100gal, Justified 3oz/ac
	8/16/2021	Mep Star 16oz/ac
Insecticide		
Harvest aid	10/11/2021	Setup 32oz/ac, ETX 1.25oz/ac, Dyne-Amic 1%
	10/25/2021	Solera 24oz/ac, Induce 0.50%
Irrigation Amt.		
PrePlant & Planting	1/1 - 6/25	1 = 4.92in, 2 = 5.01in, 3 = 5.16in, 4 = 5.20in, 5 = 5.06in, 6 = 5.07in, 7 = 5.00in, 8 = 5.00in, 9 = 5.10in, 10 = 5.38in
Seasonal	6/26 - 9/30	1 = 1.01in, 2 = 2.08in, 3 = 1.60in, 4 = 2.02in, 5 = 1.55in, 6 = 1.13in, 7 = 2.01in, 8 = 1.09in, 9 = 1.53in, 10 = 0.04in
Rainfall		
PrePlant & Planting	1/1 - 6/25	8.82
Seasonal	6/26 - 9/30	9.83



Operations Summary

Year	2021
Farm	Helm
Field ID	Field 3
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

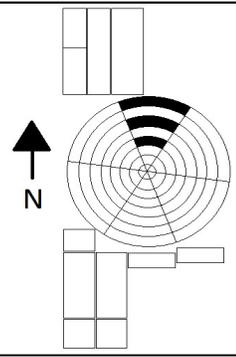
Field Operations	Date	Activity
Tillage	11/9/2020	List
	3/24/2021	Bed Conditioner
	5/19/2021	Bed Packer
	6/5/2021	Bed Packer
	6/8/2021	Rotary Hoe
	7/12/2021	Cultivate
Fertility	3/26/2021	Liquid 32-0-0 59lbs/ac
	4/2/2021	Liquiid 32-0-0 18lbs/ac
	4/2/2021	Liquid 10-34-0 63lbs/ac
Planting / Harvest	11/9/2020	Planted Drifter 45lbs/ac (cover crop)
	5/19/2021	Planted NexGen 3930 B3XF 47,000seed/ac
	10/29/2021	Harvested all cotton
Herbicide / Growth Regulator	4/7/2021	Valor 2oz/ac, Clash 10oz/ac
	4/21/2021	Showdown 42oz/ac
	5/19/2021	Mee-Too-Lachlor 1.5pt/ac
	6/22/2021	Mee-Too-Lachlor 1.5pt/ac
	7/6/2021	Engenia 12.8oz/ac, Honcho K6 32oz/ac, Verified 20oz/ac, Smoke 1qt/100gal, Justified 3oz/ac
	7/15/2021	Outlook 12oz/ac
	7/21/2021	Mep Star 10oz/ac
	7/28/2021	Engenia 12.8oz/ac, Honcho K6 32oz/ac, Verified 20oz/ac, Smoke 1qt/100gal, Justified 3oz/ac
	8/16/2021	Mep Star 16oz/ac
Insecticide		
Harvest aid	10/11/2021	Setup 32oz/ac, ETX 1.25oz/ac, Dyne-Amic 1%
	10/25/2021	Solera 24oz/ac, Induce 0.50%
Irrigation Amt.		
PrePlant & Planting	1/1 - 6/25	1 = 5.82in, 2= 5.98in, 3 = 5.66in, 4 = 5.78in, 5 = 5.78in, 6 = 5.76in, 7 = 4.64in
Seasonal	6/26 - 9/30	1 = 1.57in, 2 = 0.74in, 3 = 1.19in, 4 = 0.67in, 5 = 1.15in, 6 = 1.63in, 7 = 0.04in
Rainfall		
PrePlant & Planting	1/1 - 6/25	8.82
Seasonal	6/26 - 9/30	9.83



Operations Summary

Year	2021
Farm	Helm
Field ID	Field 5A (Even Spans)
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

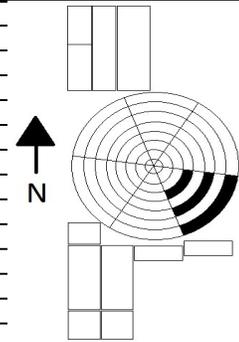
Field Operations	Date	Activity
Tillage	12/8/2020	Shred
	2/9/2021	Disk
	3/1/2021	Disk
	3/2/2021	Chisel
	3/11/2021	Field Cultivator
	3/11/2021	List
	3/12/2021	Rip Soft Middles
	3/26/2021	Bed Conditioners
	4/1/2021	Dike
	4/5/2021	Bed Conditioners
	6/5/2021	Rotary Hoe
	6/8/2021	Rotary Hoe
	6/9/2021	List
	6/12/2021	Cultivate and Dike
	7/7/2021	Rotary Hoe
7/15/2021	Cultivate and Dike	
Fertility	3/26/2021	Liquid 32-0-0 28lbs/ac (low water)
	3/30/2021	Liquid 32-0-0 89lbs/ac (high water)
	3/30/2021	Liquid 32-0-0 7.5lbs/ac (low water)
	3/30/2021	Liquid 10-34-0 26lbs/ac (low water)
	3/30/2021	Liquid 32-0-0 17.5lbs/ac (base and high water)
	3/30/2021	Liquid 10-34-0 60lbs/ac
Planting / Harvest	5/22/2021	Planted NexGen 3500XF 47,000seed/ac
	6/12/2021	Planted NexGen 3930 B3XF 47,000seed/ac (replant)
	11/5/2021	Harvested all cotton
Herbicide / Growth Regulator	3/11/2021	Trifurallin 4EC 32oz/ac
	5/22/2021	Mee-Too-Lachlor 1.5pt/ac, Solera 32oz/ac, Induce 0.50%
	6/22/2021	Mee-Too-Lachlor 1.5pt/ac
	7/7/2021	Engenia 12.8oz/ac, Honcho K6 32oz/ac, Verified 20oz/ac, Smoke 1qt/100gal, Justified 3oz/ac
	7/15/2021	Outlook 12oz/ac
	7/27/2021	Engenia 12.8oz/ac, Honcho K6 32oz/ac, Verified 20oz/ac, Smoke 1qt/100gal, Justified 3oz/ac
	8/16/2021	Mep Star 16oz/ac
Insecticide		
Harvest aid	10/14/2021	Setup 32oz/ac, ETX 1.25oz/ac, Dyne-Amic 1%
	10/29/2021	Solera 24oz/ac, Induce 0.50%
Irrigation Amt.		
PrePlant & Planting	1/1 - 6/25	Base = 4.79in, Base - 50% = 4.79in, Base + 50% = 4.79in
Seasonal	6/26 - 9/30	Base = 1.00in, Base - 50% = 0.50in, Base + 50% = 1.50in
Rainfall		
PrePlant & Planting	1/1 - 6/25	8.82
Seasonal	6/26 - 9/30	9.83



Operations Summary

Year	2021
Farm	Helm
Field ID	Field 5C (Even Spans)
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

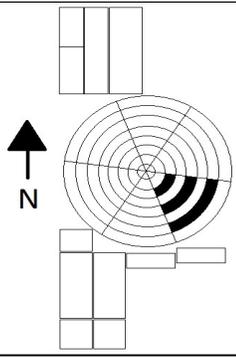
Field Operations	Date	Activity
Tillage	12/9/2020	Shred
	12/10/2020	Disk (overhang)
	12/11/2020	List (overhang)
	3/2/2021	Disk
	3/3/2021	Chisel
	3/11/2021	Field Cultivator
	3/11/2021	List
	3/12/2021	Rip Soft Middles
	4/1/2021	Dike
	4/2/2021	Bed Conditioners
	6/5/2021	Rotary Hoe
	6/8/2021	Rotary Hoe
	6/9/2021	List
	6/11/2021	Cultivate and Dike
	7/7/2021	Rotary Hoe
	7/14/2021	Cultivate and Dike
Fertility	3/26/2021	Liquid 32-0-0 28lbs/ac (low water)
	3/30/2021	Liquid 32-0-0 89lbs/ac (high water)
	3/30/2021	Liquid 32-0-0 62lbs/ac (base water)
	3/30/2021	Liquid 32-0-0 7.5lbs/ac (low water)
	3/30/2021	Liquid 10-34-0 26lbs/ac (low water)
	3/30/2021	Liquid 32-0-0 17.5lbs/ac (base and high water)
	3/30/2021	Liquid 10-34-0 60lbs/ac
Planting / Harvest	12/14/2020	Planted Drifter 45lbs/ac (overhang, cover crop)
	5/21/2021	Planted NexGen 3500XF 47,000seed/ac
	6/11/2021	Planted NexGen 3930 B3XF 47,000seed/ac (replant)
	11/5/2021	Harvested all cotton
Herbicide / Growth Regulator	3/11/2021	Trifluralin 32oz/ac
	5/22/2021	Mee-Too-Lachlor 1.5pt/ac, Solera 32oz/ac, Induce 0.50%
	6/22/2021	Mee-Too-Lachlor 1.5pt/ac
	7/7/2021	Engenia 12.8oz/ac, Honcho K6 32oz/ac, Verified 20oz/ac, Smoke 1qt/100gal, Justified 3oz/ac
	7/15/2021	Outlook 12oz/ac
	7/21/2021	Mep Star 10oz/ac
	7/27/2021	Engenia 12.8oz/ac, Honcho K6 32oz/ac, Verified 20oz/ac, Smoke 1qt/100gal, Justified 3oz/ac
	8/16/2021	Mep Star 16oz/ac
Insecticide		
Harvest aid	10/14/2021	Setup 32oz/ac, ETX 1.25oz/ac, Dyne-Amic 1%
	10/29/2021	Solera 24oz/ac, Induce 0.50%
Irrigation Amt.		
PrePlant & Planting	1/1 - 6/25	Base = 4.99in, Base - 50% = 4.99in, Base + 50% = 4.99in
Seasonal	6/26 - 9/30	Base = 2.00in, Base - 50% = 1.00in, Base + 50% = 3.00in
Rainfall		
PrePlant & Planting	1/1 - 6/25	8.82
Seasonal	6/26 - 9/30	9.83



Operations Summary

Year	2021
Farm	Helm
Field ID	Field 5C (Odd Spans)
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

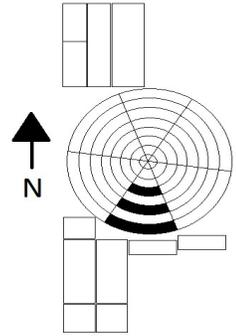
Field Operations	Date	Activity
Tillage		
Fertility	3/26/2021	Liquid 32-0-0 28lbs/ac (low water)
	3/30/2021	Liquid 32-0-0 89lbs/ac (high water)
	3/30/2021	Liquid 32-0-0 62lbs/ac (base water)
	3/30/2021	Liquid 32-0-0 7.5lbs/ac (low water)
	3/30/2021	Liquid 10-34-0 26lbs/ac (low water)
	3/30/2021	Liquid 32-0-0 17.5lbs/ac (base and high water)
	3/30/2021	Liquid 10-34-0 60lbs/ac
Planting / Harvest	5/21/2021	Planted NexGen 3500XF 47,000seed/ac
	6/11/2021	Planted NexGen 3930 B3XF 47,000seed/ac (replant)
	11/5/2021	Harvested all cotton
Herbicide / Growth Regulator	3/31/2021	Valor 2oz/ac, Clash 10oz/ac
	4/23/2021	Showdown 42oz/ac
	5/22/2021	Mee-Too-Lachlor 1.5pt/ac, Solera 32oz/ac, Induce 0.50%
	6/9/2021	Solera 32oz/ac, Induce 0.50%
	6/22/2021	Mee-Too-Lachlor 1.5pt/ac
	7/7/2021	Engenia 12.8oz/ac, Honcho K6 32oz/ac, Verified 20oz/ac, Smoke 1qt/100gal, Justified 3oz/ac
	7/15/2021	Outlook 12oz/ac
	7/27/2021	Engenia 12.8oz/ac, Honcho K6 32oz/ac, Verified 20oz/ac, Smoke 1qt/100gal, Justified 3oz/ac
	8/16/2021	Mep Star 16oz/ac
Insecticide		
Harvest aid	10/14/2021	Setup 32oz/ac, ETX 1.25oz/ac, Dyne-Amic 1%
	10/29/2021	Solera 24oz/ac, Induce 0.50%
Irrigation Amt.		
PrePlant & Planting	1/1 - 6/25	Base = 4.99in, Base - 50% = 4.99in, Base + 50% = 4.99in
Seasonal	6/26 - 9/30	Base = 2.00in, Base - 50% = 1.00in, Base + 50% = 3.00in
Rainfall		
PrePlant & Planting	1/1 - 6/25	8.82
Seasonal	6/26 - 9/30	9.83



Operations Summary

Year	2021
Farm	Helm
Field ID	Field 5D (Even Spans)
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

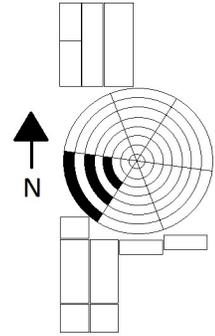
Field Operations	Date	Activity
Tillage	3/26/2021	Bed Conditioner
	7/14/2021	Cultivate and Dike
Fertility	3/26/2021	Liquid 32-0-0 28lbs/ac (low water)
	3/30/2021	Liquid 32-0-0 89lbs/ac (high water)
	3/30/2021	Liquid 32-0-0 7.5lbs/ac (low water)
	3/30/2021	Liquid 10-34-0 26lbs/ac (low water)
	3/30/2021	Liquid 32-0-0 17.5lbs/ac (base and high water)
	3/30/2021	Liquid 10-34-0 60lbs/ac
Planting / Harvest	10/16/2020	Planted VNS 60lbs/ac (cover crop)
	5/21/2021	Planted NexGen 3500XF 47,000seed/ac
	6/11/2021	Planted NexGen 3930 B3XF 47,000seed/ac (replant)
	11/6/2021	Harvested all cotton
Herbicide / Growth Regulator	3/31/2021	Valor 2oz/ac, Clash 10oz/ac
	4/22/2021	Showdown 42oz/ac
	5/22/2021	Mee-Too-Lachlor 1.5pt/ac, Solera 32oz/ac, Induce 0.50%
	7/7/2021	Engenia 12.8oz/ac, Honcho K6 32oz/ac, Verified 20oz/ac, Smoke 1qt/100gal, Justified 3oz/ac
	7/15/2021	Outlook 12oz/ac
	7/21/2021	Mep Star 10oz/ac
	7/27/2021	Engenia 12.8oz/ac, Honcho K6 32oz/ac, Verified 20oz/ac, Smoke 1qt/100gal, Justified 3oz/ac
	8/16/2021	Mep Star 16oz/ac
Insecticide		
Harvest aid	10/14/2021	Setup 32oz/ac, ETX 1.25oz/ac, Dyne-Amic 1%
	10/29/2021	Solera 24oz/ac, Induce 0.50%
Irrigation Amt.		
PrePlant & Planting	1/1 - 6/25	Base = 4.68in, Base - 50% = 4.68in, Base + 50% = 4.68in
Seasonal	6/26 - 9/30	Base = 2.00in, Base - 50% = 1.00in, Base + 50% = 3.00in
Rainfall		
PrePlant & Planting	1/1 - 6/25	8.82
Seasonal	6/26 - 9/30	9.83



Operations Summary

Year	2021
Farm	Helm
Field ID	Field 5E (Even Spans)
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

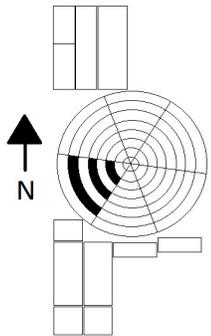
Field Operations	Date	Activity
Tillage	12/8/2020	Shred
	12/10/2020	Disk (overhang)
	12/11/2020	List (overhang)
	2/9/2021	Disk
	3/1/2021	Disk
	3/3/2021	Chisel
	3/11/2021	Field Cultivator
	3/11/2021	List
	3/13/2021	Rip Soft Middles
	4/1/2021	Dike
	4/5/2021	Bed Conditioner
	6/6/2021	Rotary Hoe
	6/8/2021	Rotary Hoe
	6/10/2021	List
	6/11/2021	Cultivate and Dike
	7/7/2021	Rotary Hoe
7/14/2021	Cultivate and Dike	
Fertility	3/26/2021	Liquid 32-0-0 28lbs/ac (low water)
	3/30/2021	Liquid 32-0-0 89lbs/ac (high water)
	3/30/2021	Liquid 32-0-0 7.5lbs/ac (low water)
	3/30/2021	Liquid 10-34-0 26lbs/ac (low water)
	3/30/2021	Liquid 32-0-0 17.5lbs/ac (base and high water)
	3/30/2021	Liquid 10-34-0 60lbs/ac
Planting / Harvest	12/14/2020	Planted Drifter 45lbs/ac (overhang, cover crop)
	5/22/2021	Planted NexGen 3500XF 47,000seed/ac
	6/11/2021	Planted NexGen 3930 B3XF 47,000seed/ac (replant)
	11/6/2021	Harvested all cotton
Herbicide / Growth Regulator	3/11/2021	Trifluralin 32oz/ac
	5/22/2021	Mee-Too-Lachlor 1.5pt/ac, Solera 32oz/ac, Induce 0.50%
	6/22/2021	Mee-Too-Lachlor 1.5pt/ac
	7/7/2021	Engenia 12.8oz/ac, Honcho K6 32oz/ac, Verified 20oz/ac, Smoke 1qt/100gal, Justified 3oz/ac
	7/15/2021	Outlook 12oz/ac
	7/21/2021	Mep Star 10oz/ac
	7/27/2021	Engenia 12.8oz/ac, Honcho K6 32oz/ac, Verified 20oz/ac, Smoke 1qt/100gal, Justified 3oz/ac
	8/16/2021	Mep Star 16oz/ac
Insecticide		
Harvest aid	10/14/2021	Setup 32oz/ac, ETX 1.25oz/ac, Dyne-Amic 1%
	10/29/2021	Solera 24oz/ac, Induce 0.50%
Irrigation Amt.		
PrePlant & Planting	1/1 - 6/25	Base = 4.68in, Base - 50% = 4.68in, Base + 50% = 4.68in
Seasonal	6/26 - 9/30	Base = 2.00in, Base - 50% = 1.00in, Base + 50% = 3.00in
Rainfall		
PrePlant & Planting	1/1 - 6/25	8.82
Seasonal	6/26 - 9/30	9.83



Operations Summary

Year	2021
Farm	Helm
Field ID	Field 5E (Odd Spans)
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

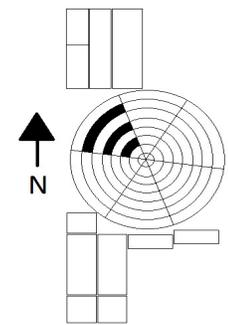
Field Operations	Date	Activity
Tillage		
Fertility	3/26/2021	Liquid 32-0-0 28lbs/ac (low water)
	3/30/2021	Liquid 32-0-0 89lbs/ac (high water)
	3/30/2021	Liquid 32-0-0 62lbs/ac (base water)
	3/30/2021	Liquid 32-0-0 7.5lbs/ac (low water)
	3/30/2021	Liquid 10-34-0 26lbs/ac (low water)
	3/30/2021	Liquid 32-0-0 17.5lbs/ac (base and high water)
	3/30/2021	Liquid 10-34-0 60lbs/ac
Planting / Harvest	5/22/2021	Planted NexGen 3500XF 47,000seed/ac
	6/11/2021	Planted NexGen 3930 B3XF 47,000seed/ac (replant)
	11/6/2021	Harvested all cotton
Herbicide / Growth Regulator	3/31/2021	Valor 2oz/ac, Clash 10oz/ac
	4/23/2021	Showdown 42oz/ac
	5/22/2021	Mee-Too-Lachlor 1.5pt/ac, Solera 32oz/ac, Induce 0.50%
	6/9/2021	Solera 32oz/ac, Induce 0.50%
	6/22/2021	Mee-Too-Lachlor 1.5pt/ac
	7/7/2021	Engenia 12.8oz/ac, Honcho K6 32oz/ac, Verified 20oz/ac, Smoke 1qt/100gal, Justified 3oz/ac
	7/15/2021	Outlook 12oz/ac
	7/27/2021	Engenia 12.8oz/ac, Honcho K6 32oz/ac, Verified 20oz/ac, Smoke 1qt/100gal, Justified 3oz/ac
	8/16/2021	Mep Star 16oz/ac
Insecticide		
Harvest aid	10/14/2021	Setup 32oz/ac, ETX 1.25oz/ac, Dyne-Amic 1%
	10/29/2021	Solera 24oz/ac, Induce 0.50%
Irrigation Amt.		
PrePlant & Planting	1/1 - 6/25	Base = 4.68in, Base - 50% = 4.68in, Base + 50% = 4.68in
Seasonal	6/26 - 9/30	Base = 2.00in, Base - 50% = 1.00in, Base + 50% = 3.00in
Rainfall		
PrePlant & Planting	1/1 - 6/25	8.82
Seasonal	6/26 - 9/30	9.83



Operations Summary

Year	2021
Farm	Helm
Field ID	Field 5F (Odd Spans)
Exp. Design	Grain Sorghum
Soil Type	Pullman Clay Loam

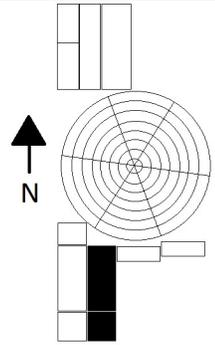
Field Operations	Date	Activity
Tillage		
Fertility	3/26/2021	Liquid 32-0-0 28lbs/ac (low water)
	3/30/2021	Liquid 32-0-0 89lbs/ac (high water)
	3/30/2021	Liquid 32-0-0 62lbs/ac (base water)
	3/30/2021	Liquid 32-0-0 7.5lbs/ac (low water)
	3/30/2021	Liquid 10-34-0 26lbs/ac (low water)
	3/30/2021	Liquid 32-0-0 17.5lbs/ac (base and high water)
	3/30/2021	Liquid 10-34-0 60lbs/ac
Planting / Harvest	5/26/2021	Planted Frontier Hybrid 305C 40,000seed/ac, 50,000seed/ac, 70,000seed/ac
	9/22/2021	Harvested all sorghum
Herbicide / Growth Regulator	4/22/2021	Showdown 42oz/ac
	5/26/2021	Mee-Too-Lachlor 1.5pt/ac, Solera 32oz/ac, Induce 0.50%
	6/22/2021	Mee-Too-Lachlor 1.5pt/ac
	6/26/2021	Clash 6oz/ac
Insecticide	4/8/2021	Atrazine 1qt/ac
Harvest aid	9/10/2021	Buccaneer 48oz/ac, Dyne-Amic 1%
Irrigation Amt.		
PrePlant & Planting	1/1 - 6/25	Base = 4.10in, Base - 50% = 4.10in, Base + 50% = 4.10in
Seasonal	6/26 - 9/30	Base = 2.20in, Base - 50% = 1.00in, Base + 50% = 3.20in
Rainfall		
PrePlant & Planting	1/1 - 6/25	8.82
Seasonal	6/26 - 9/30	9.83



Operations Summary

Year	2021
Farm	Helm
Field ID	Field 7
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

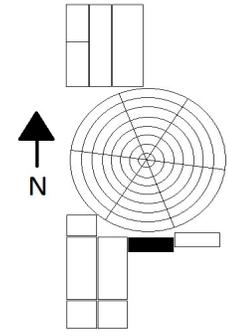
Field Operations	Date	Activity
Tillage	11/10/2020	List
	3/24/2021	Bed Conditioner
	5/18/2021	Bed Packer
	6/8/2021	Rotary Hoe
	7/8/2021	Cultivate
Fertility	3/25/2021	Liquid 32-0--0 57lbs/ac
	4/5/2021	Liquid 32-0-0 18lbs/ac
	4/5/2021	Liquid 10-34-0 60lbs/ac
Planting / Harvest	11/10/2020	Planted Drifter 45lbs/ac (cover crop)
	5/18/2021	Planted Nex Gen 3406 B2XF 47,000seed/ac
	6/6/2021	Planted Nex Gen 3406 B2XF 47,000seed/ac (Replant)
	10/29/2021	Harvested all cotton
Herbicide / Growth Regulator	4/7/2021	Valor 2oz/ac, Clash 10oz/ac
	4/21/2021	Showdown 42oz/ac
	5/18/2021	Mee-Too-Lachlor 1.5pt/ac
	6/22/2021	Mee-Too-Lachlor 1.5pt/ac
	7/7/2021	Engenia 12.8oz/ac, Honcho K6 32oz/ac, Verified 20oz/ac, Smoke 1qt/100gal, Justified 3oz/ac
	7/15/2021	Outlook 12oz/ac
	7/21/2021	Mep Star 10oz/ac
	7/29/2021	Engenia 12.8oz/ac, Honcho K6 32oz/ac, Verified 20oz/ac, Smoke 1qt/100gal, Justified 3oz/ac
	8/16/2021	Mep Star 16oz/ac
Insecticide		
Harvest aid	10/11/2021	Setup 32oz/ac, ETX 1.25oz/ac, Dyne-Amic 1%
	10/25/2021	Solera 24oz/ac, Induce 0.50%
Irrigation Amt.		
PrePlant & Planting	1/1 - 6/25	D = 7.43in, E = 6.80in, F = 6.57in
Seasonal	6/26 - 9/30	D = 2.28in, E = 2.29in, F = 2.27in
Rainfall		
PrePlant & Planting	1/1 - 6/25	8.82
Seasonal	6/26 - 9/30	9.83



Operations Summary

Year	2021
Farm	Helm
Field ID	Field 8
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

Field Operations	Date	Activity
Tillage	12/7/2020	Shred
	2/8/2021	Disk
	2/10/2021	Disk
	3/3/2021	Field Cultivator
	3/8/2021	Field Cultivator
	3/8/2021	List
	5/19/2021	Bed Packer
	6/4/2021	Rotary Hoe
	6/8/2021	Rotary Hoe
	6/10/2021	List
	6/10/2021	Cultivate and Dike
	7/6/2021	Rotary Hoe
	7/9/2021	Field Cultivator
	8/24/2021	Disk
	8/24/2021	Field Cultivator
	8/26/2021	Float
	8/26/2021	Field Cultivator
8/27/2021	List	
Fertility		
Planting / Harvest	5/19/2021	Planted NexGen 2930 B3XF 47,000seed/ac
	6/10/2021	Planated NexGen 2930 B3XF 47,000seed/ac (Replant)
Herbicide / Growth Regulator	3/3/2021	Trifuralin 4EC 32oz/ac
	5/19/2021	Mee-Too-Lachlor 1.5pt/ac
	6/22/2021	Mee-Too-Lachlor 1.5pt/ac
	7/15/2021	Outlook 12oz/ac
Insecticide		
Harvest aid		
Irrigation Amt.		
	PrePlant & Planting	1/1 - 6/25 8.06
Seasonal	6/26 - 9/30 0.28	
Rainfall		
	PrePlant & Planting	1/1 - 6/25 8.82
Seasonal	6/26 - 9/30 9.83	



Operations Summary

Year	2021
Farm	Helm
Field ID	Field 9
Exp. Design	Cotton
Soil Type	Pullman Clay Loam

Field Operations	Date	Activity
Tillage	10/2/2020	Field Cultivator
	10/2/2020	List
	2/9/2021	Disk
Fertility		
Planting / Harvest	10/16/2020	Planted VNS60lb/ac (cover crop)
	6/11/2021	Planted cotton
	11/8/2021	Harvested all cotton
Herbicide / Growth Regulator	3/31/2021	Valor 2oz/ac, Clash 10oz/ac, Showdown 48oz/ac
	5/24/2021	Mee-Too-Lachlor 1.5pt/ac
	6/22/2021	Mee-Too-Lachlor 1.5pt/ac
	6/26/2021	Engenia 12.8oz/ac, Honcho K6 32oz/ac, Verified 20oz/ac, Smoke 1qt/100gal, Justified 3oz/ac
	7/15/2021	Outlook 12oz/ac
	7/21/2021	Mep Star 10oz/ac
	7/28/2021	Engenia 12.8oz/ac, Honcho K6 32oz/ac, Verified 20oz/ac, Smoke 1qt/100gal, Justified 3oz/ac
	8/16/2021	Mep Star 16oz/ac
Insecticide		
Harvest aid	10/11/2021	Setup 32oz/ac, ETX 1.25oz/ac, Dyne-Amic 1%
	10/25/2021	Solera 24oz/ac, Induce 0.50%
Irrigation Amt.		
PrePlant & Planting	1/1 - 6/25	5.16
Seasonal	6/26 - 9/30	1.96
Rainfall		
PrePlant & Planting	1/1 - 6/25	8.82
Seasonal	6/26 - 9/30	9.83

