Lubbock - Pecos - Halfway

Texas A&M Agricultural Research and Extension Center

Helms Research Farm

Summary Report
2006

The Texas Agricultural Experiment Station / Elsa A. Murano, Director
The Texas A&M University System / College Station, Texas

Table of Contents

Texas A & M University System
Texas Agricultural Research and Extension Center
Lubbock/Halfway

Research Participants

Name	Specialty	Association[1]	E-mail Address
Jaroy Moore	Resident Director	TAES	j-moore@tamu.edu
Aaron Alexander		TCE	
Scott Asher	Former Technical Development Rep.	Monsanto	
Craig Bednarz	Plant Physiologist	TAES, TTU	craig.bednarz@ttu.edu
Matt Blackerby	Technician	TAES	mdblackerby@ag.tamu.edu
Randy Boman, Ph.D.	Agronomy - Cotton	TCE	r-boman@tamu.edu
James P. Bordovsky, M.S.	Ag Engineering - Irrigation	TAES	j-bordovsky@tamu.edu
Stanley C. Carroll, M.S.	Entomology - Cotton	TAES	s-carroll2@tamu.edu
Andy Cranmer, M.S.	Irrigation/Entomology	TAES	amcranmer@ag.tamu.edu
Greg Cronholm	Integrated Pest Management	TCE	g-cronholm@tamu.edu
John Everitt, M.S.	Agronomy - Weed Science	TAES	j-everitt@tamu.edu
Wayne Keeling, Ph.D.	Agronomy - Weed Science	TAES	w-keeling@tamu.edu
Mark Kelley, M.S.	Agronomy - Cotton	TCE	m-kelley@tamu.edu
Chance McMillan	Technician	TAES	
Cory Mills	Graduate Research Associate	TAES, TTU	cory.mills@ttu.edu
Joe Mustian, B.S.	Engineering - Irrigation	TAES	jmustian@ag.tamu.edu
Doug Nesmith, M.S.	Research Farm Manager	TAES	d-nesmith@tamu.edu
Megha Parajulee, Ph.D.	Entomology	TAES, TTU	m-parajulee@tamu.edu
Wenwei Xu, Ph.D.	Corn Genetics	TAES, TTU	we-xu@tamu.edu

[1] TAES – Texas Agricultural Experiment Station, TCE – Texas Cooperative Extension, TTU – Texas Tech University

Introduction

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

Current projects at the Helms Research Farm involve production options and economics of subsurface drip irrigation (SDI) and site-specific farming. Other research projects include weed and insect control, plant breeding and yield trials for several commodities and production systems projects. 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 four wells, 320 to 340 feet deep, pumping at rates of 300 to 400 gallons per minute each.





Corn Breeding (Field 1)
Wenwei Xu

Objective: The objectives are to develop multiple stress tolerant corn germplasm (lines and hybrids) by transferring desirable genes from exotic germplasm into temperate lines.

Methodology: Helms Farm is a primary test site for field evaluation of drought tolerance, heat tolerance, insect resistance, yield and other agronomic traits. In 2006, we conducted a series of studies at the Helms Farm:

- Evaluation of 500 experimental hybrids for yield, drought tolerance, and other agronomic traits. They were grown under 100% ET, 50% ET and V-14 drought stress conditions. The plants under 100% ET and 50% ET were watered throughout the growing season. The drought intensity in 50% ET was 40% yield reduction as compared to 100% ET. For V-14 drought stress, irrigation was withheld from V-12 to one-week after flowering.
- Effect of genotypes and irrigation treatments on silage yield and quality.
- Evaluate of the commercial hybrids (including drought tolerant transgenic hybrids) for yield and drought tolerance in collaboration with seed companies.

Results: Several TAES experimental hybrids yield equally or higher than commercial checks. These hybrids include S2B73BC x NC300, LH200 x SPG3, and LH200 x Tx205. These results will be used to write the release proposals of new inbred lines. Drought stress has more negative impact on grain yield than silage yield. On the average, when drought stress reduced grain yield by 17-70%, the dry biomass was declined by 31-45%. Drought stress significantly reduced silage quality. The silage of all eight hybrids from limited irrigation treatment had higher crude protein, lignin, sugar, and neutral detergent fiber contents but lower starch and total digestible nutrient contents than the silage from well watered treatment.

Expectations: New drought and heat tolerant lines and hybrids have been developed and will be released to the seed industry and public sectors. These lines and hybrids can be used for grain and silage corn production. Adoption of new corn germplasm and accompanied strategies for irrigation and crop management can save 5-10% of the irrigation water requirements.

Cotton Irrigation Management with SDI (Field 2)
James P. Bordovsky, Joe Mustian, and Andy Cranmer

Objective: Evaluate cotton production resulting from two management scenarios: 1) *High Input* - applies resources on limited areas to achieve maximum lint yield and 2) *Normal Input* - distributes the same resources over a wider area and is a typical management strategy.

Fig. 1. Dry, *High Input*, and *Normal Input* plots of SDI management study, TAES, Helms-Halfway.

Methodology: Cotton was planted in a field where a ten-zone SDI system was installed. Irrigations were applied in alternate furrows of 30-inch rows with each zone 1300 ft by 16 rows wide and independently controlled and metered. Two cotton management strategies were compared. A *High Input*, high-yield management scenario with the production goal of 3.5 bales per acre and no restriction on input level was replicated in four plots. The *Normal Input* scenario, with an annual yield goal of 2.5 bales per acre, was also replicated four times. In 2006, each zone was planted with two different varieties, FM989B2R, a picker variety that has performed well at this location over a range of irrigation quantities, and DP2280BR, a more determinant stripper variety. Seasonal irrigation in the *Normal* treatment totaled 16.4 inches compared to 20.0 inches in the *High Input* treatments.

Results: Table 1 shows lint yield, loan value, seasonal irrigation water use efficiency, and seasonal irrigation water value of *Normal* and *High Input* treatments. The FM989B2R variety resulted in significantly higher yield, loan values, and water values than did DP2280BR in this long dry growing season. However, different than in past "dry" years, the *Normal* treatment resulted in similar yield and loan values compared to the *High Input* treatment using less water, fertilizer, and growth regulators. This resulted in significantly higher seasonal irrigation water use and irrigation water value for the *Normal* over the *High Input* treatment. For example, an acre-inch of irrigation was worth $60 in the *Normal* treatment planted with FM989 compared to only $35 in the *High Input* treatment planted with DP2280. Economic evaluations using field data from 2001 to 2006 will help determine best management practices with SDI.

Table 1. Yield, loan value, seasonal irrigation water use efficiency, and seasonal irrigation water value of Normal vs. High Input SDI treatments at TAES, Halfway, 2006.

		Treatment			
	Variety	Dry	Normal Input	High Input	Difference
Yield (lb/ac)	FM989B2R	366	2074 a*	1893 a	-181
	DP2280BR	300	1654 a	1630 a	-24
Loan Value ($/lb)	FM989B2R	0.556	0.575 a	0.566 a	-0.009
	DP2280BR	0.471	0.536 a	0.534 a	-0.002
Sea. Irr. WUE (lb/ac-in)	FM989B2R		104.3 a	73.9 b	-30.4
	DP2280BR		81.2 a	65.4 b	-15.8
Sea. Irr. Value ($/ac-in)	FM989B2R		60 a	41.8 b	-18.2
	DP2280BR		43.8 a	35.2 b	-8.6

*Treatment means in the same row followed by the same letter are not signifiantly different (LSD, $p<0.05$).

Effect of SDI Design on Cotton Lint Yield (Field 3)
James P. Bordovsky and Joe Mustian

Objective: Evaluate the effect of water distribution by three SDI designs having flow variations (FV's) of 0.71, 0.85, and 0.94 over 1300-ft. lengths in terms of available soil water, emitter flow rates, and cotton lint yields.

Methodology: SDI designers and irrigators need to know the magnitude of cotton yield losses if average emitter flow variances drop well below current design standards. A SDI system was installed on a 16-acre area with drip lines located in alternate furrows on 30-inch rows. The field was divided into four blocks with six sub-zones per block. Within each block, sub-zones were irrigated by 0.630-in., 0.875-in., or 0.990-in. diameter drip tape, representing poor (**POOR**), very good (**VGOOD**), and acceptable (**ACC**) water distribution designs having estimated field FV's of 0.71, 0.94, and 0.85 at operating pressures of approximately 10, 12, and 6.5 psi, respectively.


Fig. 1. SDI design experiment cotton harvest at TAES, Helms Farm.

Results: Total cotton lint yield within an irrigation level was not affected by water distribution designs having FV's between 0.71 and 0.94. Table 1 compares lint yield, micronaire, and loan values resulting from three designs and two water levels in 2006. Lint yield ranged from 1879 to 1962 lb/ac for VGOOD to POOR SDI designs, respectively, at the 0.6BI irrigation level (14.8 inches of total irrigation). Yields were significantly higher at 1.0BI irrigation level (20.0 inches of total water), but design treatments resulted in no differences in yield. An analysis of cotton lint fiber quality showed no differences in average fiber quality parameters, or, therefore, lint value (loan price) as a result of SDI design. However, micronaire was reduced from premium to the base range with higher irrigation. An economic analysis of six 160-acre SDI installations designed to represent the six treatments of this experiment is currently underway. In some instances, SDI installation costs may be reduced by relaxing design specifications.

Table 1. Comparison of cotton lint yield, micronaire, and loan value resulting from three SDI system designs, TAES, Halfway, 2006.

SDI Design	Irrigation Level	Yield (lb/ac)	Mic (gr/tex)	Loan Value ($/lb)
Poor	0.6BI	1962 bcd*	3.940 a	0.577 a
Vgood	0.6BI	1879 d	3.909 a	0.579 a
Accept	0.6BI	1902 cd	3.926 a	0.576 a
Average		1914 B**	3.925 A	0.577 A
Poor	1.0BI	2027 ab	3.561 b	0.570 a
Vgood	1.0BI	1990 abc	3.618 b	0.570 a
Accept	1.0BI	2056 a	3.571 b	0.570 a
Average		2024 A	3.583 B	0.570 B

*Column means followed by the same lower case letter are not significantly different (P<0.05, LSD).
*Column means followed by the same upper case letter are not significantly different (P<0.05, LSD).

Evaluation of Visual vs. Beat Bucket Sampling for Pests and Beneficials in Cotton (Field 5A)
Greg Cronholm

Objective: To evaluate beat bucket as a sampling tool for cotton IPM compared to the standard visual sampling method for plant bug pests and beneficials.

Methodology: Four varieties were sampled (DP108RR-F, DP117B2RF, ST4664RF, ST4554B2RF) for plant bugs and beneficial arthropods using the visual and beat bucket methods. The beat bucket used for sampling was a 21 quart plastic bucket with a rectangular opening at the top. Plants were sampled on August 29, 2006 at the Helms Farm, Halfway. Plot size was 4 rows x 100 feet. Visual samples were taken on 6 plants per replicate with 4 replicates sampled. Beat bucket samples were taken on 6 plants per replicate for 4 replicates for each variety. No statistical differences were found for varieties, therefore varietal counts were pooled for comparisons.

Results: Table 1 shows a summary of all predators sampled. The beat bucket averaged 31.25 predators per 24 plants sampled, which was significantly higher than the 14.5 predators observed for the visual method. Table 1 also shows a summary of plant bug adults and nymphs observed which were cotton fleahopper and Lygus. The beat bucket samples averaged 39.75 bugs per 24 plant sample versus 9.5 bugs for the visual. The beat bucket was significantly better than the visual method for plant bug detection. Time for sampling was also recorded during the experiment. The visual sampling averaged 2.7 minutes per plant, while the beat bucket averaged 1.6 minutes per plant. The beat bucket method was 4.2 times more efficient than visual for plant bug sampling and 2.2 times more efficient for predator samples. The beat bucket method also took 40% less time than the visual procedure. Based on this data, it will be suggested that IPM programs, independent consultants and area growers consider using the beat bucket as a sampling tool.

Table 1. Summary of predator and plant bugs observed from replicated, 24-plant samples of four cotton varieties by two sampling methods, Helms Farm, 2006.

	All Predators		All Plant Bugs	
	Beat Bucket	Visual	Beat Bucket	Visual
Variety 1	29	12	42	7
Variety 2	28	16	32	13
Variety 3	30	13	46	6
Variety 4	38	17	39	12
Average	31.25b	14.5a	39.75b	9.5a

Replicated Transgenic Cotton Variety Demonstration Under LEPA Irrigation (Field 5A)

Mark Kelley, Aaron Alexander, Randy Boman, Doug Nesmith, and James P. Bordovsky

Objective: The objective of this project was to compare yields, gin turnout, fiber quality and economics of variety and technology selection under LEPA irrigation.

Methodology: Ten varieties were planted on 17-May in 30-inch rows at a rate of 3.2 seed/ row-ft with a John Deere Max Emerge II vacuum planter. A randomized complete block design with three replications was utilized. LEPA irrigation applied 12.47 inches during the growing season. Accumulated rainfall amounts of 2.79 inches prior to planting and 10.93 inches from planting to 30-Sep were recorded. Plots were cultivated on 8-June and furrow diked on 9-June. Fertility management included 65 lb/a P_2O_5 (10-34-0) and 19 lb/a N (32-0-0) applied with coulter rig on 10-Apr, 60 lb/a N (32-0-0) applied with coulter rig on 23-May, and 67 lb/a N (32-0-0) applied through the pivot (fertigation) from 28-Jun to 27-July. Weed management consisted of 22 oz/a Roundup Original Max and 48 oz/a Prowl applied preplant on 25-April and 32 oz/a Glystar applied 5-June. Temik was applied at 3 lb/a infurrow at planting. Harvest aids applied on 24-Oct consisted of 32 oz/a Prep, 1.5 oz/a ET and 1% v/v (1 gal/100 gal spray solution) crop oil concentrate.

Ginning costs were based on $2.45 per cwt of bur cotton and seed value was based on $125/ton. Seed and technology costs were calculated using the appropriate seeding rate (3.2 seed/row-ft) for the 30-inch row spacing and entries using the online Plains Cotton Growers Seed Cost Comparison Worksheet with Monsanto Cap Cost Thresholds available at: http://www.plainscotton.org/Seed/seedindex.html . Net value was determined by subtracting ginning and systems costs from the total value.

Results and Discussion: These results indicate that variety selection can significantly impact final net value/acre (Table 1). Lint turnout ranged from 29.0% for Beltwide Cotton Genetics (BCG) 4630B2F to 33.5% for Stoneville 4554B2RF. Lint yields varied from a low of 1422 lb/acre (BCG 4630B2RF) to a high of 1682 lb/acre (Paymaster 2140B2RF and Stoneville 4554B2RF). Lint loan values ranged from a low of $0.4813/lb to a high of $0.5345/lb for BCG 4630B2RF and AFD 5065B2F, respectively. After adding lint and seed value, total value/acre ranged from a low of $859.59 for BCG 4630B2RF, to a high of $1077.31 for AFD 5065B2F. When subtracting ginning costs and seed and technology fees, the net value/acre among varieties ranged from a high of $891.29 (AFD 5065B2F) to a low of $680.80 (BCG 4630B2RF), a difference of $210.49. These data indicate that substantial differences can be obtained in terms of net value/acre due to variety and technology selection. It should be noted that no inclement weather was encountered at this location to cause preharvest losses of picker-type varieties. Additional multi-site and multi-year applied research is needed to evaluate varieties across a series of environments.

Table 1. Harvest results from the irrigated replicated transgenic cotton variety demonstration, Texas Agricultural Experiment Station, Helms Farm, Halfway, TX, 2006.

Entry	Lint turnout %	Seed turnout %	Bur cotton yield lb/acre	Lint yield lb/acre	Seed yield lb/acre	Lint loan value $/lb	Lint value $/acre	Seed value $/acre	Total value $/acre	Ginning cost $/acre	Seed/ technology cost $/acre	Net value $/acre	
AFD 5065B2F	30.1	56.5	5496	1652	3104	0.5345	883.28	194.03	1077.31	134.64	51.38	891.29	a
Paymaster 2140B2RF	33.1	54.6	5089	1682	2778	0.5223	878.47	173.61	1052.08	124.67	55.15	872.26	ab
Stoneville 4554B2RF	33.5	56.7	5027	1682	2852	0.5157	867.70	178.24	1045.95	123.17	59.64	863.14	ab
FiberMax 9063B2RF	32.3	53.8	4948	1597	2661	0.5282	846.33	166.30	1012.63	121.24	55.48	835.91	abc
Deltapine 117B2RF	32.3	52.4	4892	1582	2563	0.5120	809.61	160.20	969.80	119.86	61.20	788.75	abcd
Americot 1521B2RF	30.0	55.2	5306	1592	2931	0.4963	790.13	183.14	973.27	130.01	56.15	787.11	abcd
All-Tex Apex B2RF	29.7	56.2	5222	1553	2936	0.5048	783.64	183.52	967.17	127.95	59.89	779.33	bcd
BCG 3255B2F	31.1	55.8	5091	1585	2838	0.4938	782.52	177.40	959.91	124.74	58.80	776.38	bcd
PhytoGen 485WRF	30.0	53.9	4816	1445	2597	0.5158	745.66	162.30	907.96	117.99	56.52	733.45	cd
BCG 4630B2F	29.0	56.3	4898	1422	2759	0.4813	687.16	172.44	859.59	119.99	58.80	680.80	d
Test average	31.1	55.1	5079	1579	2802	0.5105	807.45	175.12	982.57	124.43	57.30	800.84	
CV, %	3.7	1.8	5.5	5.5	5.5	4.2	7.7	5.5	7.2	5.5	--	8.1	
OSL	0.0010	0.0006	0.1538	0.0188	0.0107	0.1441	0.0213	0.0108	0.0356	0.1538	--	0.0207	
LSD	2.0	1.7	NS	148	264	NS	107.34	16.50	121.51	NS	--	111.39	

Large-plot Non-replicated Cotton Variety Comparison at Helms Farm (Field 5A)
Wayne Keeling, John Everitt, James P. Bordovsky, Doug Nesmith, and Scott Asher

Methodology:

Plot Size:	4 rows by 1000 feet
Planting Date:	May 10
Seeding Rate:	56,000 sd/A
Fertilizer:	145-65-0
Irrigation	Pre-plant 2.0" Seasonal 12.5"
Herbicides:	Prowl 2 pt/A PPI Roundup WeatherMax 22 oz/A POST
Harvest Date:	November 6

Results:
Sixteen Roundup Ready, Roundup Ready Flex and stacked–gene varieties were compared. Lint yields ranged from 1385 to 1997 lbs lint/A (Table 1). These varieties represent a wide range of maturities, and with a long growing season in 2006, higher yields were produced with the longer maturity varieties. Loan values ranged from 51.1 to 58.10 ¢/A. Gross revenues exceeding 1000 $/A were achieved with ST 4554 B2RF, FM 960 BR, FM 960 B2R, ST 43576 B2RF, and NG 2448 BR. Lint yield, loan values and gross value/A are summarized in Table 1.

Table 1. Cotton lint yields, loan value, and gross value/A for sixteen transgenic varieties at Helms Farm, 2006

Variety	Yield (lbs lint / A)	Loan Value ($)	Gross Value ($/A)
ST4554B2RF	1997	0.577	1,151
FM960BR	1954	0.558	1,090
FM960B2R	1877	0.563	1,056
ST4357B2RF	1771	0.589	1,042
ST5599BR	1826	0.553	1,009
DP444BG/RR	1755	0.560	983
ST4700B2RF	1685	0.577	971
ST5242BR	1679	0.563	945
DP117B2RF	1603	0.585	937
ST5007B2RF	1362	0.561	764
NG 2448R	1816	0.581	1,055
NG 3550RF	1694	0.577	976
NG 3273B2RF	1580	0.544	859
PM 2145RR	1475	0.568	838
NG 1553R	1385	0.560	776
NG 1572RF	1402	0.511	717

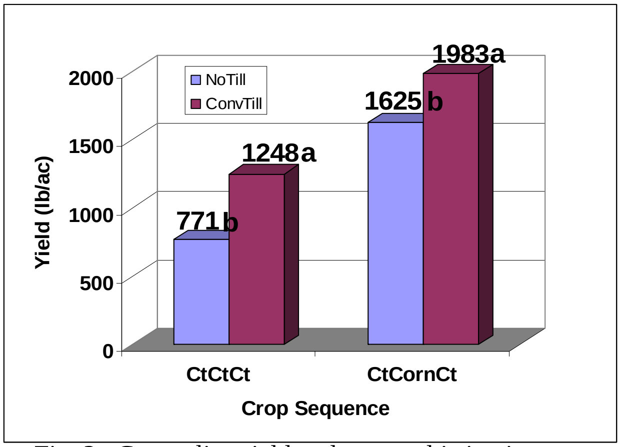
Comparison of Conventional and Conservation Tillage Systems for Cotton (Field 5BCE)
James Bordovsky, Chance McMillan, Doug Nesmith, Wayne Keeling, John Everitt

Objective: The objective was to determine crop response of conservation versus conventional tillage of cotton in a three year rotation with corn.

Methodology: Fibermax 989B2R was planted in two tillage treatments in a three year rotation with corn. The rotation sequence included: Ct-Ct-Cn (cotton-06, cotton-04, and corn-05); Ct-Corn-Ct (cotton-06, corn-04, cotton-05); and Ct-Ct-Ct (continuous cotton). Tillage treatments included conventional tillage (shred, disc, list, rolling cultivator, rod weed, in-season cultivation) alone versus no-till treatments (stalk-puller). Weeds were controlled with 2,4-D preplant for winter weeds in no-till areas. Prowl and Roundup were applied in-season. Approximately 16 inches of irrigation was applied during the 2006 growing season.


Fig. 1. Crop tillage study at the Helms Research Farm, 2006.

Results: Cotton yield from the Ct-Ct-Corn cropping sequence area is not reported due to herbicide damage within treatment areas. Cotton yields and water values were much higher where corn had been grown 2 years prior to the current cotton crop compared to the continuous cotton treatment. Top yields were 1983 and 1248 lb/ac, and top water values at $56 vs $31/ac, respectively, for Ct-Corn-Ct and CtCtCt treatments. Tillage significantly increased yields and seasonal irrigation water value over no-till treatments. This was attributed to better germination due to better seed to soil contact during a weather adverse planting period characterized by high wind speeds, low humidity. Work continues to determine management practices that bring high value to limited water resources.



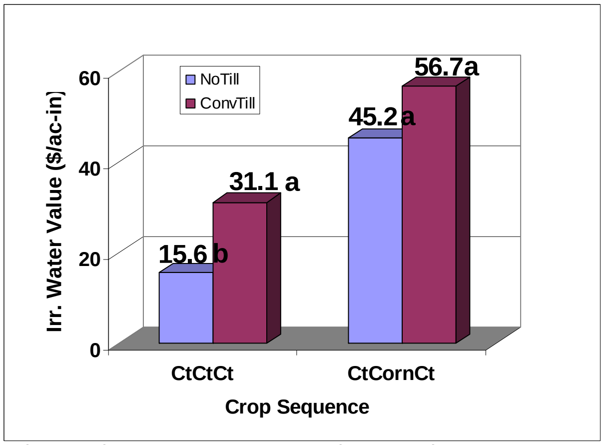


Fig. 2. Cotton lint yield and seasonal irrigation water value from a field experiment with factors of tillage, cropping sequence at the Helms Research Farm, 2006.

Cotton Response to Irrigation Level and Crop History (Field 5BDE)
James P. Bordovsky, Joe Mustian, and Doug Nesmith

Objective: A field experiment was conducted to determine yield and in-season irrigation water value of cotton production as a function of two popular cotton varieties, three irrigation levels, and two crop sequences.

Fig. 1. Large plot cotton harvest at Helms farm.

Methodology: Both cotton varieties were Fibermax – FM989B2R, was a full season variety and has consistently produced high yields at this site over a wide range of moisture conditions, and FM960B2R, shorter season variety and perhaps more tolerant to water stress. The base irrigation level (1.0BI treatment) met approximately 80% of crop water needs using ET scheduling. The two other water levels were ±20% of this amount (0.8BI and 1.2BI). All variety x irrigation treatments were planted at 55,000 ppa in areas of either continuous cotton (Cont. Cot.) or in rotation with corn, with corn planted every three years (Ct-Cu-Ct or Ct-Ct-Cn Treatments). Crop responses were evaluated by harvesting 4 rows x 60^0 pivot arc with a John Deere 4550 stripper, determining burr weight with calibrated trailer scales, and establishing turnout and fiber data from 3-lb sub-samples from each replicate. All treatments were replicated three times.

Results: The crop sequence areas were not replicated, therefore, only general comparisons can be made between these treatments. In general having corn in the rotation with cotton tended to increased cotton yield and lowered fiber quality compared to continuous cotton. Table 1 gives lint yield of the two varieties at the three irrigation levels in the three crop sequence areas. In both the Cont. Cot and the Ct-Ct-Cn areas, FM989 resulted in significantly higher yield than the FM960 (data not shown). Yields increased significantly with the increase in irrigation level from the 0.8BI to the 1.0BI treatment, but yields of the 1.0BI and 1.2BI treatments were not significantly different. Figure 2 shows an increase in water value between the 0.8 and 1.0BI treatments in three of the four treatments, however, this value declines with additional water inputs. These field tests will help evaluate management options that maintain productivity in the short term, while trying to improve the value of our limited water resources for the future.

Table 1. Cotton lint yield of two varieties, three crop sequences at three irrigation levels as TAES, Helms Farm, 2006.

Irrigation Level	Variety	Crop Sequence: Cont. Cot	Crop Sequence: Cot-Cot-Corn	Crop Sequence: Cot-Corn-Cot
0.8BI	FM960B2R	1301.0 c	1447.0 b	1720.0 b
	FM989B2R	1376.0 c	1484.0 b	
	Avg	1338.5 B	1465.5 B	
1.0BI	FM960B2R	1420.0 bc	1720.0 ab	1979.0 a
	FM989B2R	1650.0 ab	1821.0 ab	
	Avg	1535.0 A	1770.5 A	
1.2BI	FM960B2R	1499.0 abc	1537.0 ab	2039.0 a
	FM989B2R	1714.0 a	1614.0 ab	
	Avg	1606.5 A	1575.5 AB	

Column means followed by the same lower case letter are not significantly different (P<0.05, LSD).
Column means followed by the same upper case letter are not significantly different (P<0.05, LSD).

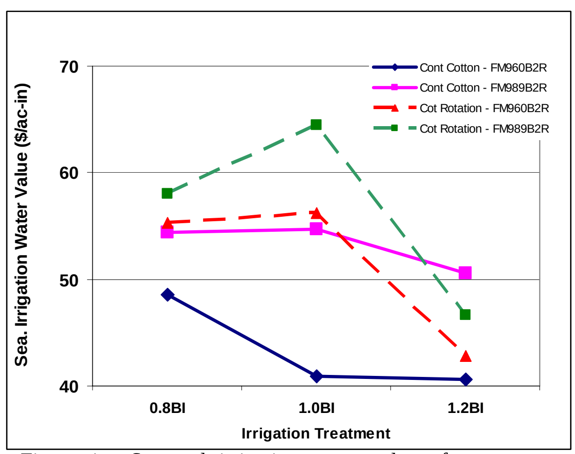


Figure 1. Seasonal irrigation water value of two cotton varieties and two cropping sequences at three irrigation levels, TAES, Halfway, 2006.

Large-plot, Non-replicated Corn Variety Comparison at Helms Farm (Field 5C)
Wayne Keeling, John Everitt, James P. Bordovsky, Doug Nesmith, and Scott Asher

Methodology:

Plot Size:	4 rows by 1000 feet
Planting Date:	April 1, 2006
Planting rate:	32,000 seed/A
Fertilizer:	243-65-0
Irrigation	Pre-plant 2.0” Seasonal 23.76”
Herbicides:	Harness 1.8 qt/A Roundup WeatherMax 22 oz/A PRE
Harvest Date:	September 28

Results:

Sixteen corn hybrids, including commercial and experimental varieties, were planted in a large-plot, non-replicated variety test at Helms Farm in 2006. Yields ranged from 147 to 210 bu/A. Variety, traits, relative maturity, yield, and moisture content at harvest are summarized in Table 1.

Table 1. Corn varieties, traits, yields, and moisture at Helms Farm, 2006.

Brand	Product	Trait(s)	Relative Maturity	Yield (bu / A)	Moisture Content (%)
Dekalb	DKC60-17	RR2	110	159	14.3
Monsanto	ND6025	CONV	110	159	13.7
Monsanto	ND6021	CONV	110	169	14.1
Pioneer	34N43	CONV	110	158	14.8
Monsanto	ND6137EZA1	YGCB	111	163	14.6
Monsanto	ND6019	CONV	110	148	14.1
Dekalb	DKC61-72	RR2	111	159	14.4
Monsanto	ND6139NRR1	RR2	111	133	14.5
Asgrow	RX715RR2/YGCB	RR2/YGCB	111	211	15
Monsanto	ND6129	CONV	111	192	14.5
Pioneer	33B50	CONV	112	203	15.1
Dekalb	DKC61-68	RR2/YGRW	111	189	15.5
Monsanto	ND6232	CONV	112	177	14.8
Monsanto	ND6233	CONV	112	166	14.5
Asgrow	RX752RR2/YGPL	RR2/YGPL	112	201	14.4
Dekalb	DKC66-23	RR2/YGCB	116	193	14.3
	Test Average			174	14.54

Cotton Variety Performance As Affected By Low-Energy Precision Application (LEPA) Irrigation Levels (Field 5F)

Wayne Keeling, James P. Bordovsky, Randy Boman and John Everitt

Methodology:

Plot Size:	4 rows by 1000 feet, 4 replications
Planting Date:	May 8
Varieties:	Stoneville 4554 B2RF
	FiberMax 9063 B2RF
	Stoneville 4700 B2RF
	Delta Pine 117 B2RF
Herbicides:	Prowl 2 qt/A PPI
	Roundup OriginalMax 32 oz/A POST
	Roundup OriginalMax 32 oz/A POST
Fertilizer:	145-24-0
Growth Regulator:	8 oz/A (only on High irrigation treatments)
Irrigation in-season:	Low 11.83", Medium 13.87", High 15.33 "
Harvest Date:	November 9

Results:

Cotton lint yields ranged from 1315 to 1784 lbs lint/A. When averaged across irrigation levels, similar lint yields were produced with ST 4554 B2RF, ST 4700 B2RF, and FM 9063 B2RF. When varieties were averaged within an irrigation level, similar yields were produced with all three irrigation levels (Table 1). When averaged across irrigation levels, highest gross revenues (yield X loan price) were produced with ST 4554 B2RF and FM 9063 B2RF. Similar gross revenues were produced with all three irrigation levels.

Table 1. Effects of RRF/BGII variety and LEPA irrigation levels on cotton lint yields and gross revenues at Helms Farm, Halfway, TX, 2006.

	Variety	Low	Med	High	Avg.
Lint Yield (lb/A)	ST 4554 B2RF	1636	1597	1581	1605 A
	DP 117 B2RF	1315	1360	1363	1346 B
	ST 4700 B2RF	1452	1443	1577	1490 AB
	FM 9063 B2RF	1507	1784	1655	1649 A
		1477 a	1546 a	1544 a	
Gross Revenue ($/A)	ST 4554 B2RF	822	809	870	867 A
	DP 117 B2RF	679	696	631	669 B
	ST 4700 B2RF	782	738	765	761 B
	FM 9063 B2RF	825	990	961	925 A
		802 a	808 a	807 a	

Yield, Quality, Profitability and Drought Avoidance of Cotton Produced at Varying Plant Densities (Field 6A-F)

Craig Bednarz, James P. Bordovsky, Wayne Keeling, Randy Boman, Cory Mills and John Everitt

Objective: The objectives of this work are to determine how lint yield, fiber quality, profitability and drought avoidance are affected by plant density.

Methodology: Studies were conducted using two subsurface irrigation treatments (1.0 base irrigation and 0.6 base irrigation), three plant densities (32,000, 56,000 and 80,000 plants/acre) and two cultivars (ST.4554 BII/RF and FM 9063 BII/RF). Plant density and yield potential interactions are not well understood and the optimum plant density may change with irrigation level. Thus, an irrigation treatment was included in the study. Throughout the growing season, light interception was monitored. With this information, the relationship between season-long cumulative solar radiation and lint yield will be determined. This information is intended to be useful for determining reasonable yield goals under replant decisions (following hail, etc.) or under various deficit irrigation scenarios. Also, the number of nodes above the first square, the number of nodes above white flower and the number of nodes above cracked boll were monitored throughout the growing season to determine crop maturity. Prior to machine harvest, plants from 10 feet of row were removed from the field and will be hand harvested by fruiting position. In this manner, whole plant yield components (bolls per acre, weight per boll, etc.) and within-boll yield components (seed per boll, fiber per seed, etc.) under differing levels of irrigation availability and plant density will be determined.

Results: At this time data collection and analysis are not complete.

Cotton Variety Performance as Affected by Subsurface Drip Irrigation (SDI) Levels at Helms Farm (Field 6A-F)

Wayne Keeling, James P. Bordovsky, Randy Boman, and John Everitt

Methodology:

Plot Size:	4 rows by 1600 feet, 3 replications
Planting Date:	May 8
Varieties:	Stoneville 4554 B2RF FiberMax 9063 B2RF Stoneville 4700B2RF Delta Pine 117 B2RF
Herbicides:	Prowl 2qt/A Roundup WeatherMax 22 oz/A POST
Fertilizer:	Low 146-26-0; High 177-26-0
Growth Regulator:	Pentia 8 oz/A – Only on High Irrigation Treatments
Irrigation – preplant;	4.5 ac-in/ac
Irrigation - in-season:	10.35 ac-in/ac (low volume), 17.0 ac-in/ac (high volume)
Harvest Date:	November 8

Results:

When averaged across SDI irrigation levels, cotton lint yields ranged from 1442 to 1595 lbs lint/A; with no differences between varieties. When varieties were averaged within irrigation levels, similar yields were produced (Table 1). The lack of significant yield variation may partially be due to irregular stand establishment following planting. No differences in gross revenues (yield X loan price) resulted due to variety or irrigation level.

Table 1. Effects of variety and SDI irrigation levels on lint yields and gross revenues at Helms Farm, Halfway, TX, 2006.

	Variety	Low Volume	High Volume	Avg.
Lint yield (lb/A)	ST 4554 B2RF	1594	1597	1595 A
	DP 117 B2RF	1468	1480	1474 A
	ST 4700 B2RF	1427	1465	1446 A
	FM 9063 B2RF	1474	1410	1442 A
		1491 a	1488 a	
Gross revenues ($/A)	ST 4554 B2RF	878	818	848 A
	DP 117 B2RF	724	739	732 A
	ST 4700 B2RF	760	697	729 A
	FM 9063 B2RF	822	712	767 A
		796 a	741 a	

Influence of Soil Nitrogen Level on Seasonal Activity of Cotton Arthropods with Drip Irrigation Systems (Field 6G)

Megha N. Parajulee, Stanley C. Carroll, Douglas M. Nesmith, and James P. Bordovsky

Objective: The objective was to evaluate the effect of nitrogen fertilizer application rates on the population dynamics of cotton arthropods.

Methodology: Experimental plots of FM 960B2R cotton were planted on May 4, 2006 at the Helms research farm located near Halfway, Texas. The experiment was a randomized block design with five treatments and five replications. The five treatments included the application of nitrogen fertilizer at the rate of 0, 50, 100, 150, and 200 lbs/acre. Cotton was planted (approximately 56,000 seeds per acre) in 30-inch rows and was irrigated with a drip irrigation system. We took soil samples from the experimental plots on June 28 for residual nitrogen analysis and monitored crop growth and insect activity throughout the season. Fertility treatments were applied on July 18 with a soil applicator ground rig.

Results: Cotton arthropod populations did not build in 2006. Periodic observations showed only sporadic presence of cotton aphids, but not sufficient in numbers for seasonal monitoring. As a result, no leaf moisture or leaf nitrogen was monitored. Nevertheless, after four years of continuous application of variable rate of nitrogen, residual nitrogen levels varied significantly among the five nitrogen levels. Clearly, the no nitrogen application resulted in significantly lower residual nitrogen compared with that in 100, 150 and 200 lbs/acre treatments (Fig. 1). The 200 lbs/acre treatment had the highest residual nitrogen compared with the other four treatments. The study planned for 2007 should provide ideal treatment plots for variable nitrogen study as there has been additional depletion in the zero nitrogen plots during 2006.

Variation in residual nitrogen levels coupled with variable nitrogen application resulted in phenotypic expression of nitrogen deficiency in cotton across treatment plots, especially between zero-N plots and nitrogen-applied plots. The zero-N plots produced the lowest yield (775 lbs/acre) and the yield increased linearly with each additional 50 lbs of added N (Fig. 2).

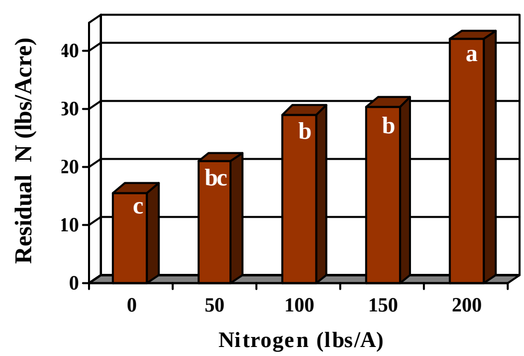


Fig. 1. Effect of nitrogen application rates on residual nitrogen after four years.

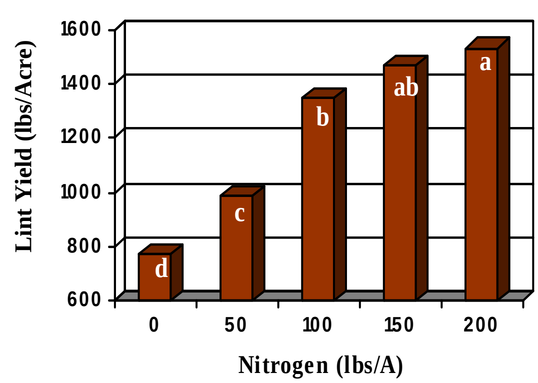


Fig. 2. Effect of nitrogen application rates on lint yields after four years.

Farm Scale Yield Comparisons of Subsurface Drip Irrigation to Center Pivot Irrigation

James P. Bordovsky, Doug Nesmith, Matt Blackerby, and Chance McMillan

Objective: To compare lint yields and irrigation quantities used from farm scale cotton production irrigated by subsurface drip irrigation (SDI) and LEPA.

Methodology: Interest in subsurface drip continues to grow as water availability decreases and opportunities for cost share assistance for water conserving irrigation equipment becomes available. The question of cotton production using SDI verse pivot is often asked. The Helms Research Farm at Halfway provides a unique, controlled environment to answer this question. The problems not normally encountered in small plot research, such as limited irrigation water, inconsistent soils, and/or challenging topography, had to be addressed while irrigating 71 acres with SDI and up to 100 acres with LEPA during the 2002 to 2006 growing seasons. Details of SDI and LEPA irrigated cotton experiments are contained in the previous reports. This report contains average commercial cotton gin yields and irrigation amounts used to achieve those yields with these irrigation systems.

Results: The lack of early season rainfall and the typical high winds and low humidity at planting has caused problems with cotton germination in SDI areas in most years. Excess drip irrigation to achieve germination also resulted in moving planter applied insecticides away from the seed drill resulting in foliar insecticide battles with thrip. In cool years, young cotton plants in all areas struggled resulting in slow early growth. Yields were low in 2003 and 2005 due to cool, wet weather at planting and hail, respectively. Overall cotton yields were high. SDI yields averaged 1264 lb/ac using 15.12 inches of irrigation compared to LEPA yields of 1152 lb/ac using an average of 11.67 inches. Drip yields from various experiments ranged from over 2000 to 0 lb/acre. LEPA yields were within a 600 to 2000 lb/acre range.

Table 1. Area, cotton lint yield (commercial gin yields), and total irrigation water delivered by SDI and LEPA irrigation systems at Helms, 2002-2006. Data from 2004 is estimated due to inadequate module tracking and gin data.

	SDI			LEPA		
	Area (ac)	Tot. Irr. (in)	Yld. (lb/ac)	Area (ac)	Tot. Irr. (in)	Yld. (lb/ac)
2002	71	18.47	1127	84	15.71	1209
2003	71	14.95	1086	103	12.86	1084
2004	71	14.00	1500	103	10.00	1100
2005	53.6	10.86	1041	60	3.05	828
2006	71	17.33	1566	100	16.73	1537
Avg.		15.12	1264		11.67	1152

Evaluation of Soil Amendments to Improve Germination with Subsurface Drip Irrigation.
James Bordovsky, Andy Cranmer, Joe Mustian, and Matt Blackerby

Objective: Germination of seed with SDI in dry periods has been a consistent problem. The objective was to evaluate the placement of soil amendments in the soil profile to determine their effect on cottonseed germination using SDI under a no/reduced rainfall scenario.

Methodology: Four soil amendments and a "check" were placed from near drip laterals to near the soil surface at 20 sites. Soil amendment treatments included two starch-based polymers (Pam and Zeba™ both at 20 lb/ac equivalent), composted cow manure (400 lb/ac), cow manure and gypsum (400 + 400 lb/ac), and an untreated check. TDR sensors in an array above and to each side of the drip lateral were installed and the field where amendments and sensors were located as planted with corn to dry the profile prior to irrigating with SDI. Rainout shelters were constructed and used to prevent rainfall from interfering with soil profile wetting with the drip irrigation system. Wetting of seedbeds in controlled conditions occurred from 31 July through 30 Aug with drip applications of 0.1" applied at 12 hour intervals. Volumetric soil water content was measured twice daily through 12 Aug and daily thereafter by TDR.

Results: The average changes in volumetric water at the uppermost sensor from the initiation of irrigation (day 208) through the 30-day irrigation period; through a "drydown" period where the plots were protected by the shelters; and through to November is shown in Figure 2. The detection of soil water first occurred 11 days following irrigation initiation in the check treatment, followed by the Pam and compost treatments, then the other treatments. The check treatment resulted in the highest TDR readings during irrigation with the lowest in the Zeba™ and compost plus gypsum treatments. These results were somewhat disappointing. On a positive note, some of the treatments reduced the rate of surface soil water change following irrigation termination. Figure 2 also highlights the rate of soil water loss following the termination of SDI irrigation. Zeba™ resulted in the slowest rate of soil water loss with the check treatment resulting in the quickest loss. This work will continue in 2007, sensing differences in undisturbed profiles.

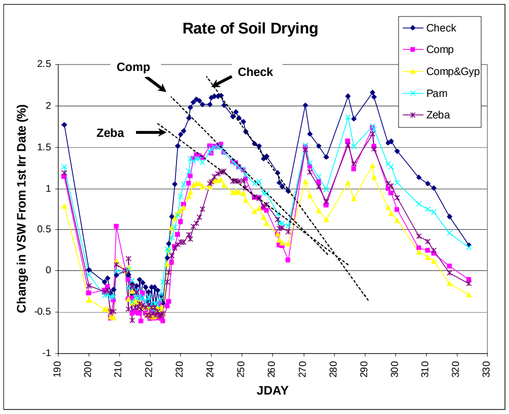


Fig.2. Changes in soil water affected by SDI irrigation measured by the top TDR sensors within soil amendment treatments at TAES, Helms Farm, 2006.

APPENDIX

2006 Rainfall and Irrigation Amounts at Helms and Halfway

Rainfall (inches) Helms Irrigation Amounts (inches) L = LEPA irrigation, S = spray irrigation Helms Irrigation Amount

Date			Halfway @ Building	Helms @ Well 1		Field 2			Field 3		Field 5 - A spans 2-4	Field 5 - A spans 5-8		Field 5 - B spans 2-4	Field 5 - B spans 5-8				Field 5 - C spans 2-4	Field 5 - C spans 5-8	
						Drip			Drip		Pivot	Pivot		Pivot	Pivot				Pivot	Pivot	
						Cotton	Cotton	Cotton	Cotton	Cotton	Cotton	Cotton	system	Cotton	Cotton			system	Corn	Corn	system
Mo	Da	Yr				Hi Input	Normal	Dry	1.0 B.I.	0.6 B.I.					Base	Base+20%	Base-20%				
2	3	2006	0.05	0.04																	
2	18	2006	0.01	0.01																	
2	19	2006	0.01	0.01																	
2	25	2006	0.22	0.20																	
3	18	2006	0.41	0.35																	
3	19	2006	0.59	0.52																	
3	20	2006	0.29	0.25																	
3	22	2006	0.10	0.10																	
3	29	2006	0.10	0.17																	
4	14	2006																	2.00	2.00	S
4	17	2006				0.15	0.15	0.13	0.09	0.13											
4	18	2006				0.21	0.21	0.21	0.19	0.19	0.50	0.50	S	0.50	0.50	0.50	0.50	S			
4	19	2006				0.21	0.21	0.22	0.19	0.19											
4	20	2006	1.09	0.81		0.21	0.21	0.21	0.19	0.19											
4	21	2006				0.21	0.21	0.22	0.19	0.19											
4	22	2006				0.21	0.21	0.22	0.19	0.19											
4	23	2006	0.06	0.06		0.21	0.21	0.22	0.19	0.19											
4	24	2006				0.21	0.21	0.22	0.19	0.18	1.00	1.00	S								
4	25	2006				0.21	0.21	0.21	0.18	0.19											
4	26	2006				0.11	0.11	0.16	0.24	0.19											
4	27	2006							0.15	0.15											
4	28	2006							0.15	0.15				1.00	1.00	1.00	1.00	S			
4	29	2006							0.15	0.15											
4	30	2006							0.15	0.15											
5	1	2006							0.21	0.20											
5	2	2006							0.18	0.19											
5	3	2006				0.06	0.06	0.02	0.17	0.19											
5	4	2006	0.05	0.05		0.20	0.20	0.20	0.29	0.35									0.50	0.50	S
5	5	2006	0.15	0.22																	
5	6	2006																			
5	7	2006				0.14	0.14	0.15													
5	8	2006				0.15	0.15	0.14													
5	9	2006																			
5	12	2006									0.10	0.10	S	0.30	0.30	0.30	0.30	S	0.10	0.10	S
5	13	2006									0.10	0.10	S	0.30	0.30	0.30	0.30	S	0.30	0.30	S
5	17	2006									0.25	0.25	S	0.25	0.25	0.25	0.25	S			
5	18	2006				0.79	0.79				0.25	0.25	S	0.25	0.25	0.25	0.25	S	1.00	1.00	S
5	19	2006				0.44	0.44		0.23	0.05											
5	20	2006				0.22	0.22		0.17	0.18	0.25	0.25	S	0.25	0.25	0.25	0.25	S	2.00	2.00	S
5	21	2006	0.18	0.10		0.22	0.22		0.17	0.18											
5	22	2006				0.20	0.20		0.16	0.24											
5	23	2006				0.23	0.23		0.22	0.14											
5	24	2006				0.20	0.20		0.15	0.25	0.50	0.50	S	0.50	0.50	0.50	0.50	S	1.00	1.00	S
5	25	2006				0.28	0.28		0.30	0.16											
5	26	2006	0.19	0.24		0.16	0.16		0.06	0.22											
5	27	2006				0.27	0.27		0.26	0.14											
5	28	2006				0.22	0.22		0.07	0.29									1.00	1.00	S
5	29	2006				0.16	0.16		0.18	0.06											
5	30	2006																			
5	31	2006	1.20	0.96																	
6	1	2006	0.17	0.17																	
6	5	2006				0.20	0.20		0.01												
6	8	2006												1.50	1.50	1.50	1.50	S	1.50	1.50	S
6	10	2006												1.00	1.00	1.00	1.00	S	1.00	1.00	S
6	12	2006				0.09			0.17	0.12											
6	13	2006					0.41		0.15	0.05											
6	14	2006									0.50	0.50	S	0.50	0.50	0.50	0.50	S	0.50	0.50	S
6	15	2006				0.22	0.17		0.18	0.10											
6	16	2006				0.66			0.24	0.15											
6	17	2006					0.43		0.20	0.10											
6	18	2006				0.45			0.34	0.23	0.50	0.50	S	0.50	0.50	0.50	0.50	S	1.60	1.60	S
6	19	2006					0.42		0.14	0.09											
6	20	2006				0.40			0.24	0.15	0.22	0.18	L	0.22	0.18	0.21	0.15	L	0.22	0.18	L
6	21	2006	0.39	0.22			0.42		0.22	0.13	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
6	22	2006	0.35	0.21		0.36			0.21	0.14	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
6	23	2006					0.41		0.07	0.03									0.32	0.27	L
6	24	2006																	0.32	0.27	L
6	25	2006	0.02	0.02															0.44	0.38	L
6	26	2006	0.11	0.16		0.39			0.21	0.13	0.24	0.20	L	0.24	0.20	0.23	0.16	L			
6	27	2006					0.43		0.23	0.14	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
6	28	2006				0.40			0.23	0.14	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L

2006 Rainfall and Irrigation Amounts at Helms and Halfway

Rainfall (inches) | Helms Irrigation Amounts (inches) L = LEPA irrigation, S = spray irrigation | Helms Irrigation Amount

Date			Halfway @ Building	Helms @ Well 1	Field 2			Field 3		Field 5 - A spans 2-4	Field 5 - A spans 5-8		Field 5 - B spans 2-4	Field 5 - B spans 5-8				Field 5 - C spans 2-4	Field 5 - C spans 5-8	
					Drip			Drip		Pivot	Pivot		Pivot	Pivot				Pivot	Pivot	
					Cotton	Cotton	Cotton	Cotton	Cotton	Cotton	Cotton	system	Cotton	Cotton			system	Corn	Corn	system
Mo	Da	Yr			Hi Input	Normal	Dry	1.0 B.I.	0.6 B.I.					Base	Base+20%	Base-20%				
6	29	2006				0.43		0.22	0.13	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
6	30	2006			0.47			0.27	0.14	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	1	2006				0.24		0.26	0.13									0.44	0.38	L
7	2	2006			0.26			0.05	0.04				0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	3	2006				0.15		0.27	0.13	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	4	2006			0.49			0.27	0.14	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	5	2006				0.23		0.28	0.16	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	6	2006	0.09	0.07	0.44			0.35	0.19	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	7	2006	0.10	0.60		0.25		0.22	0.26											
7	8	2006																		
7	10	2006	0.01	0.06	0.39			0.24	0.14									0.32	0.27	L
7	11	2006				0.43		0.27	0.17									0.44	0.38	L
7	12	2006			0.56			0.26	0.16	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	13	2006				0.43		0.27	0.16	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	14	2006			0.57			0.27	0.18	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	15	2006				0.43		0.27	0.17	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	16	2006			0.56			0.27	0.17	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	17	2006				0.43		0.15	0.16	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	18	2006			0.56			0.19	0.16	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	19	2006				0.43		0.19	0.17	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	20	2006			0.59			0.19	0.16	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	21	2006				0.39		0.20	0.18	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	22	2006	0.08	0.06	0.54			0.20	0.16	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	23	2006				0.39		0.17	0.16	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	24	2006			0.54			0.20	0.17	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	25	2006				0.39		0.21	0.16	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	26	2006			0.67			0.27	0.17	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	27	2006				0.39		0.27	0.17	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	28	2006	0.01	0.25	0.46			0.28	0.17	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	29	2006	0.72	0.88		0.36		0.14	0.09	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	30	2006			0.08					0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
7	31	2006				0.22		0.27	0.17	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
8	1	2006			0.51			0.25	0.15	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
8	2	2006				0.33		0.23	0.13	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
8	3	2006	0.48	0.50	0.68			0.25	0.15	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
8	4	2006	0.06	0.02		0.35		0.29	0.18	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
8	5	2006	0.14	0.01	0.62			0.26	0.15											
8	6	2006				0.28		0.24	0.17											
8	7	2006			0.63			0.24	0.16	0.24	0.20	L	0.24	0.20	0.23	0.16	L			
8	8	2006				0.38		0.26	0.17	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
8	9	2006			0.62			0.25	0.15	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.16	0.14	L
8	10	2006				0.39		0.26	0.16	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.16	0.14	L
8	11	2006			0.65			0.28	0.18	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.16	0.14	L
8	12	2006				0.40		0.25	0.15	0.24	0.20	L	0.24	0.20	0.23	0.16	L	0.32	0.27	L
8	13	2006			0.64			0.25	0.16	0.24	0.20	L	0.48	0.40	0.46	0.32	L	0.16	0.14	L
8	14	2006				0.37		0.25	0.16	0.24	0.20	L								
8	15	2006	0.08	0.15	0.67			0.28	0.18	0.24	0.20	L	0.24	0.20	0.23	0.16	L			
8	16	2006				0.39		0.25	0.16	0.11	0.10	L	0.24	0.23	0.26	0.18	L			
8	17	2006			0.65			0.24	0.15	0.24	0.23	L	0.24	0.23	0.26	0.18	L	0.11	0.10	L
8	18	2006				0.35		0.27	0.17	0.24	0.23	L	0.24	0.23	0.26	0.18	L	0.11	0.10	L
8	19	2006			0.44			0.26	0.18	0.24	0.23	L	0.24	0.23	0.26	0.18	L	0.11	0.10	L
8	20	2006	0.20	0.23		0.30		0.13	0.07	0.24	0.23	L	0.24	0.23	0.26	0.18	L	0.11	0.10	L
8	21	2006	0.76	1.27																
8	23	2006			0.19	0.19														
8	24	2006			0.18	0.19							0.24	0.23	0.26	0.18	L			
8	25	2006			0.19	0.20				0.24	0.23	L								
8	26	2006	0.05	0.05	0.19	0.20				0.24	0.23	L	0.24	0.23	0.26	0.18	L			
8	27	2006			0.12	0.13				0.24	0.23	L	0.24	0.23	0.26	0.18	L			
8	28	2006	0.93	0.64																
9	3	2006	1.16	1.30																
9	4	2006	0.52	0.63																
9	6	2006	0.05	0.05																
9	11	2006	1.01	1.10																
9	12	2006	0.56	0.89																
9	20	2006	0.19	0.15																
9	10	2006																		
9	11	2006																		
9	12	2006																		
9	13	2006																		
9	14	2006																		
9	15	2006																		
9	17	2006																		
Pre & At Plant					5.86	5.86	2.52	5.22	5.26	2.20	2.20		2.60	2.60	2.60	2.60		2.00	2.00	
Seasonal					17.36	12.95	0.00	14.74	9.54	14.24	12.47		17.11	15.30	16.88	13.07		26.10	23.76	
TOTALS			12.94	13.78	23.22	18.81	2.52	19.96	14.80	16.44	14.67		19.71	17.87	19.48	15.67		28.10	25.76	

2006 Rainfall and Irrigation Amounts at Helms and Halfway

Rainfall (inches) | ıts (inches) L = LEPA irrigation, S = spray irrigatic | Helms Irrigation Amounts (inches) L = LEP | Helms Irrigation Amounts (inches) L = LEPA irrigation, S = spray irrigation

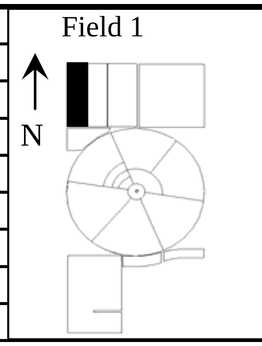
Date Mo	Da	Yr	Halfway @ Building	Helms @ Well 1	Field 5 - D spans 2-4 Pivot Cotton	Field 5 - D spans 5-8 Pivot Cotton Base	Base+20%	Base-20%	system	Field 5 - E spans 2-4 Pivot Cotton	Field 5 - E spans 5-8 Pivot Cotton Base	Base+20%	Base-20%	system	Field 5 - F spans 2-4 Pivot Cotton	Field 5 - F spans 5-8 Pivot Cotton Base	Base+20%	Base-20%	system	Field 6 - A,C,F Drip Cotton 1.0 B.I.	Field 6 - B,D,E 0.6 B.I.	Field 6 - DRY	Field 6 - G Drip Cotton	Field 6 - H Drip Cotton
2	3	2006	0.05	0.04																				
2	18	2006	0.01	0.01																				
2	19	2006	0.01	0.01																				
2	25	2006	0.22	0.20																				
3	18	2006	0.41	0.35																				
3	19	2006	0.59	0.52																				
3	20	2006	0.29	0.25																				
3	22	2006	0.10	0.10																				
3	29	2006	0.10	0.17																				
4	14	2006																						
4	17	2006																						
4	18	2006			0.50	0.50	0.50	0.50	S	0.50	0.50	0.50	0.50	S	0.50	0.50	0.50	0.50	S	0.07	0.07	0.07	0.17	0.25
4	19	2006																		0.14	0.14	0.14	0.15	0.13
4	20	2006	1.09	0.81																0.10	0.10	0.10	0.12	0.13
4	21	2006																		0.12	0.12	0.12	0.12	0.13
4	22	2006																		0.12	0.12	0.12	0.12	0.13
4	23	2006	0.06	0.06																0.12	0.12	0.12	0.12	0.13
4	24	2006			1.00	1.00	1.00	1.00	S	1.00	1.00	1.00	1.00	S	1.00	1.00	1.00	1.00	S	0.10	0.10	0.10	0.12	0.13
4	25	2006																		0.13	0.13	0.13	0.12	0.13
4	26	2006																		0.11	0.11	0.11	0.12	0.13
4	27	2006																		0.08	0.08	0.08	0.12	0.13
4	28	2006																		0.08	0.08	0.08	0.12	0.13
4	29	2006																		0.08	0.08	0.08		0.13
4	30	2006																		0.08	0.08	0.08		0.13
5	1	2006																		0.14	0.14	0.14	0.12	0.12
5	2	2006																		0.09	0.09	0.09	0.12	0.13
5	3	2006																		0.13	0.13	0.13	0.12	0.12
5	4	2006	0.05	0.05																0.18	0.18	0.18	0.11	0.13
5	5	2006	0.15	0.22																			0.11	
5	6	2006																						
5	7	2006																		0.02	0.02	0.02		
5	8	2006																		0.03	0.03	0.03		
5	9	2006																						
5	12	2006			0.30	0.30	0.30	0.30	S	0.30	0.30	0.30	0.30	S	0.30	0.30	0.30	0.30	S					
5	13	2006			0.30	0.30	0.30	0.30	S	0.30	0.30	0.30	0.30	S	0.30	0.30	0.30	0.30	S					
5	17	2006			0.25	0.25	0.25	0.25	S	0.25	0.25	0.25	0.25	S	1.00	1.00	1.00	1.00	S					
5	18	2006																		0.15	0.15	0.15	0.04	0.34
5	19	2006																		0.19	0.19	0.19	0.01	0.01
5	20	2006			0.25	0.25	0.25	0.25	S	0.25	0.25	0.25	0.25	S	2.00	2.00	2.00	2.00	S	0.22	0.22	0.22	0.24	0.25
5	21	2006	0.18	0.10																0.22	0.22	0.22	0.24	0.25
5	22	2006																		0.20	0.20	0.20	0.19	0.20
5	23	2006																		0.24	0.24	0.24	0.24	0.25
5	24	2006																		0.21	0.21	0.21	0.24	0.25
5	25	2006																		0.29	0.29	0.29	0.23	0.25
5	26	2006	0.19	0.24																0.16	0.16	0.16	0.23	0.25
5	27	2006																		0.27	0.27	0.27	0.23	0.25
5	28	2006			1.00	1.00	1.00	1.00	S	1.00	1.00	1.00	1.00	S	0.50	0.50	0.50	0.50	S	0.23	0.23	0.23	0.23	0.25
5	29	2006																		0.17	0.17	0.17	0.23	0.25
5	30	2006																						
5	31	2006	1.20	0.96																				
6	1	2006	0.17	0.17																				
6	5	2006																						
6	8	2006			1.00	1.00	1.00	1.00	S	1.00	1.00	1.00	1.00	S										
6	10	2006			1.00	1.00	1.00	1.00	S	1.00	1.00	1.00	1.00	S										
6	12	2006																		0.31	0.10		0.32	0.04
6	13	2006																		0.21	0.12			0.27
6	14	2006			0.75	0.75	0.75	0.75	S	0.75	0.75	0.75	0.75	S	0.75	0.75	0.75	0.75	S	0.36	0.22		0.30	0.25
6	15	2006																		0.20	0.25		0.33	0.36
6	16	2006																		0.20	0.13			0.30
6	17	2006																						
6	18	2006														0.50	0.50	0.50	0.50	S					
6	19	2006																		0.38	0.20		0.31	0.22
6	20	2006			0.22	0.18	0.21	0.15	L	0.22	0.18	0.21	0.15	L	0.22	0.18	0.21	0.15	L	0.39	0.25		0.33	0.36
6	21	2006	0.39	0.22																0.37	0.22		0.30	0.30
6	22	2006	0.35	0.21																0.05	0.16		0.02	0.22
6	23	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L										
6	24	2006																						
6	25	2006	0.02	0.02																				
6	26	2006	0.11	0.16																0.38	0.23		0.32	0.24
6	27	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.39	0.24		0.32	0.33
6	28	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.38	0.23		0.31	0.32

Rainfall (inches) — ıts (inches) L = LEPA irrigation, S = spray irrigatic — Helms Irrigation Amounts (inches) L = LEP — Helms Irrigation Amounts (inches) L = LEPA irrigation, S = spray irrigation

Date Mo	Da	Yr	Halfway @ Building	Helms @ Well 1	Field 5 - D spans 2-4 Pivot Cotton	Field 5 - D spans 5-8 Pivot Cotton Base	Base+20%	Base-20%	system	Field 5 - E spans 2-4 Pivot Cotton	Field 5 - E spans 5-8 Pivot Cotton Base	Base+20%	Base-20%	system	Field 5 - F spans 2-4 Pivot Cotton	Field 5 - F spans 5-8 Pivot Cotton Base	Base+20%	Base-20%	system	Field 6 - A,C,F Drip Cotton 1.0 B.I.	Field 6 - B,D,E 0.6 B.I.	Field 6 - DRY	Field 6 - G Drip Cotton	Field 6 - H Drip Cotton
6	29	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.38	0.23		0.30	0.33
6	30	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L					
7	1	2006																						
7	2	2006																						
7	3	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.37	0.23		0.30	0.31
7	4	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.39	0.24		0.33	0.33
7	5	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.39	0.25		0.32	0.36
7	6	2006	0.09	0.07	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L					
7	7	2006	0.10	0.60																				
7	8	2006																						
7	10	2006	0.01	0.06																0.37	0.32		0.03	0.33
7	11	2006																		0.36	0.15		0.32	0.33
7	12	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.38	0.20		0.36	0.18
7	13	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.38	0.23		0.30	0.33
7	14	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.38	0.25		0.33	0.36
7	15	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.38	0.24		0.31	0.32
7	16	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.38	0.24		0.31	0.32
7	17	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L					
7	18	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L					
7	19	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L					
7	20	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.38	0.23		0.30	0.33
7	21	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.39	0.25		0.34	0.36
7	22	2006	0.08	0.06	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.39	0.25		0.34	0.36
7	23	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.36	0.21		0.28	0.28
7	24	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.38	0.24		0.32	0.33
7	25	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.37	0.23		0.30	0.32
7	26	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.36	0.18		0.30	0.22
7	27	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.39	0.25		0.33	0.36
7	28	2006	0.01	0.25	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.37	0.23		0.31	0.32
7	29	2006	0.72	0.88	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L					
7	30	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L					
7	31	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.26	0.13		0.19	0.28
8	1	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.32	0.09		0.10	0.02
8	2	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.22	0.16	L	0.32	0.18		0.15	0.32
8	3	2006	0.48	0.50	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.22	0.16	L	0.37	0.23		0.29	0.33
8	4	2006	0.06	0.02	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.22	0.16	L	0.37	0.25		0.34	0.37
8	5	2006	0.14	0.01																				
8	6	2006																						
8	7	2006													0.24	0.20	0.23	0.16	L	0.37	0.22		0.29	0.22
8	8	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.38	0.24		0.33	0.33
8	9	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.37	0.23		0.29	0.33
8	10	2006			0.24	0.20	0.23	0.16	L	0.48	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.37	0.23		0.32	0.33
8	11	2006			0.48	0.40	0.46	0.32	L	0.24	0.40	0.46	0.32	L	0.24	0.40	0.46	0.32	L					
8	12	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L					
8	13	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L					
8	14	2006			0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.38	0.24		0.33	0.34
8	15	2006	0.08	0.15	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.24	0.20	0.23	0.16	L	0.39	0.25		0.33	0.37
8	16	2006								0.24	0.23	0.26	0.18	L	0.11	0.10	0.12	0.08	L	0.37	0.23		0.32	0.30
8	17	2006			0.24	0.23	0.26	0.18	L	0.24	0.23	0.26	0.18	L	0.24	0.23	0.26	0.18	L	0.37	0.23		0.31	0.31
8	18	2006			0.24	0.23	0.26	0.18	L						0.24	0.23	0.26	0.18	L					
8	19	2006			0.24	0.23	0.26	0.18	L	0.49	0.45	0.52	0.36	L	0.24	0.23	0.26	0.18	L					
8	20	2006	0.20	0.23	0.24	0.23	0.26	0.18	L						0.24	0.23	0.26	0.18	L					
8	21	2006	0.76	1.27																				
8	23	2006																		0.22	0.13		0.01	0.24
8	24	2006																		0.21	0.13		0.19	0.19
8	25	2006								0.24	0.23	0.26	0.18	L	0.24	0.23	0.26	0.18	L	0.20	0.13		0.18	0.19
8	26	2006	0.05	0.05	0.49	0.45	0.52	0.36	L	0.24	0.23	0.26	0.18	L	0.24	0.23	0.26	0.18	L	0.20	0.13		0.18	0.19
8	27	2006																		0.15	0.09		0.18	0.18
8	28	2006	0.93	0.64						0.24	0.23	0.26	0.18	L	0.24	0.23	0.26	0.18	L					
9	3	2006	1.16	1.30																				
9	4	2006	0.52	0.63																				
9	6	2006	0.05	0.05																				
9	11	2006	1.01	1.10																				
9	12	2006	0.56	0.89																				
9	20	2006	0.19	0.15																				
9	10	2006																						
9	11	2006																						
9	12	2006																						
9	13	2006																						
9	14	2006																						
9	15	2006																						
9	17	2006																						
Pre & At Plant					2.35	2.35	2.35	2.35		2.35	2.35	2.35	2.35		3.10	3.10	3.10	3.10		4.50	4.50	4.50	4.32	5.09
Seasonal					15.66	13.99	15.43	11.97		15.90	14.22	15.69	12.15		15.52	13.87	15.33	11.83		16.99	10.35	0.00	13.22	14.43
TOTALS			12.94	13.78	18.01	16.34	17.78	14.32		18.25	16.57	18.04	14.50		18.62	17.14	18.48	14.96		21.49	14.85	4.50	17.54	19.52

Operations Summary

Year	2006
Farm	Helm
Field ID	Field 1 Corn Hybrids for Drought Tolerance Xu
Exp. Design	5 zones, 24 rows x 1300' plots, 40" row width
Soil Type	

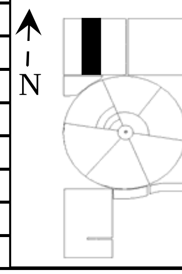


Field Operations	Date	Activity
Tillage	3/2	List
	3/3	Rolling cultivator
Fertility	4/10	applied commercially
Planting		
Herbicide/Growth Regulator	5/1	22 oz/a Roundup
	5/1	48 oz/a Atrazine
Insecticide		
Harvest aid		
Irrigation Amt.		
PrePlant & Planting		
Seasonal		
Rainfall		
PrePlant & Planting		
Seasonal		
Total		

Operations Summary

Year	2006
Farm	Helm
Field ID	Field 2 Drip Cotton Management Bordovsky, Gannaway, Parajulee
Exp. Design	Management (high input vs sustainable); Insect Control; Cotton Varieties, 4 reps, 16 row x 1300' plots
Soil Type	

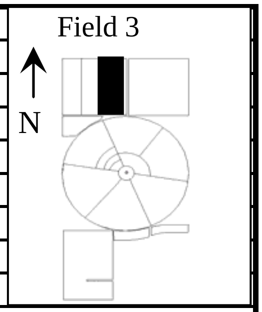
Field 2



Field Operations	Date	Activity
Tillage	3/6	Listed 60" Beds
	5/10	Rotary Hoe
	6/2	Rotary Hoe
	6/14	Furrow Dike
Fertility	4/11	85 lbs/a P2O5 (10-34-0) and 25 lbs/a N (32-0-0) with coulter rig for High, Low and Dry
	5/26	60 lbs/a N (32-0-0) with coulter rig for High, Low and Dry Irr.
	6/5	1.5 lbs/a Zn, 1.5 lbs N, and 0.3 lbs S for High and Low Irr. (Injected into drip lines)
	6/22	1.5 lbs/a Zn, 1.5 lbs N, and 0.3 lbs S for High and Low Irr. (Injected into drip lines)
	6/27-8/3	76 lbs/a N (32-0-0) for Low Irr. (Injected into drip lines)
	6/27-8/6	109 lbs/a N (32-0-0) for High Irr. (Injected into drip lines)
Planting	5/3	989 B2R on East Rows of Each Plot; PM2200 BB on West 8 Rows of Each Plot
	5/11	989 B2R
Herbicide/Growth Regulator	4/27	Roundup 22oz/a
	4/27	Prowl 32oz/a
	5/5	Caporal 32 oz/a
	6/14	Pentia 8oz/a on High Irr. only
	7/11	Pentia 8oz/a on High Irr. only
	7/19	Glystar 32oz/a directed
	7/24	Pentia 8oz/a on High Irr. only
Insecticide	5/3	Temik
Harvest aid	9/18	3oz Ginstar, 3pt Cottonquick on Dryland
	9/29	12oz Gramoxone Max on Dryland
Irrigation Amt.		
PrePlant & Planting	4/17-5/29	Dry 2.52 in. Low 5.86 in. High 5.86 in.
Seasonal	5/30-8/27	Dry 0.0 Low 12.95 in. High 17.36 in.
Rainfall		
PrePlant & Planting	1/1 - 5/3	2.52 in.
Seasonal	5/3 - 9/30	11.20 in.

Operations Summary

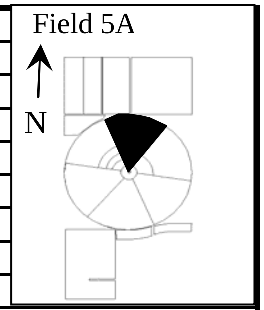
Year	2006
Farm	Helm
Field ID	Field 3 SDI Design Bordovsky
Exp. Design	Drip Irrigation Design(3 levels of drip uniformity) x Irrigation Capacity (2 levels), 4 reps, 16 row x 1300'
Soil Type	



Field Operations	Date	Activity
Tillage		
	3/2	List
	5/10	Rotary Hoe
	6/14	Furrow Dike
Fertility		
	5/26	60 lbs/a N (32-0-0) with coulter rig for High and Low Irr.
	7/7-8/3	76 lbs/a N(32-0-0) for Low Irr. (Injected into drip lines)
	7/6-8/7	109 lbs/a N (32-0-0) for High Irr. (Injected into drip lines)
Planting	5/3	FM 989 B2R 56,000 seed/a
Herbicide/Growth Regulator	4/27	Roundup 22 oz/a
	4/27	Prowl 2qt/a
	5/5	Caporal broadcast 32 oz/a
	7/11	Pentia 8oz/a
	7/19	Glystar 32oz/a directed
Insecticide	5/3	Temik 3 lbs/a
Harvest aid	10/2	21oz Prep, 13oz Def
Irrigation Amt.		
PrePlant & Planting	4/17-5/29	High 5.22 in. Low 5.26in.
Seasonal	6/12-8/20	High 14.74in. Low 9.54in.
Rainfall		
PrePlant & Planting	1/1 - 5/3	2.52 in.
Seasonal	5/3 - 9/30	11.20 in.

Operations Summary

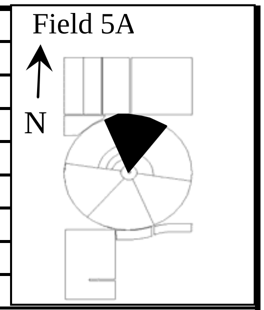
Year	2006
Farm	Helm
Field ID	Field 5a Spans 5-8
Exp. Design	
Soil Type	



Field Operations	Date	Activity
Tillage	3/27	list
	6/8	Cultivated
	6/9	Diked
Fertility	4/7-4/10	65 lbs/a P2O5 (10-34-0) and 19 lbs/a N (32-0-0) with coulter rig
	5/23	60 lbs/a N (32-0-0) with coulter rig
	6/28 - 6/29	15.6 lbs/a of N (32-0-0) through Pivot
	7/12 - 7/14	19.38 lbs/a of N (32-0-0) through Pivot
	7/18 - 7/20	11.19 lbs/a of N (32-0-0) through Pivot
	7/21 - 7/25	17.6 lbs/a of N (32-0-0) through Pivot
	7/27	3.2 lbs/a of N (32-0-0) through Pivot
Planting	5/10	14 Varieties @ 56,000 seed/a (Spans 5-8)
	5/17	Varieties (Spans 2-7)
Herbicide/Growth Regulator	4/25	Roundup 22 oz/a
	4/25	Prowl 48 oz/a
	6/5	Glystar 32 oz/a
Insecticide		
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	4/18-5/18	2.2 in.
Seasonal	5/19-8/27	12.47in.
Rainfall		
PrePlant & Planting	1/1 - 5/17	2.79 in.
Seasonal	5/10 - 9/30	10.93 in.

Operations Summary

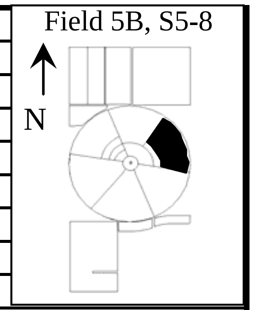
Year	2006
Farm	Helm
Field ID	Field 5a Spans 2-4
Exp. Design	
Soil Type	



Field Operations	Date	Activity
Tillage	3/27	list
	6/8	Cultivated
	6/9	Diked
Fertility	4/7-4/10	65 lbs/a P2O5 (10-34-0) and 19 lbs/a N (32-0-0) with coulter rig
	5/23	60 lbs/a N (32-0-0) with coulter rig
	6/28 - 6/29	18.7 lbs/a of N (32-0-0) through Pivot
	7/12 - 7/14	23.3 lbs/a of N (32-0-0) through Pivot
	7/18 - 7/20	13.4 lbs/a of N (32-0-0) through Pivot
	7/21 - 7/25	21.1 lbs/a of N (32-0-0) through Pivot
	7/27	3.84 lbs/a of N (32-0-0) through Pivot
Planting	5/10	14 Varieties @ 56,000 seed/a (Spans 5-8)
	5/17	Varieties (Spans 2-7)
Herbicide/Growth Regulator	4/25	Roundup 22 oz/a
	4/25	Prowl 48 oz/a
	6/5	Glystar 32 oz/a
Insecticide		
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	4/18-5/18	2.2 in.
Seasonal	5/19-8/27	14.74 in.
Rainfall		
PrePlant & Planting	1/1 - 5/17	2.79 in.
Seasonal	5/10 - 9/30	10.93 in.

Operations Summary

Year	2006
Farm	Helm
Field ID	Field 5b Spans 5-8
Exp. Design	
Soil Type	

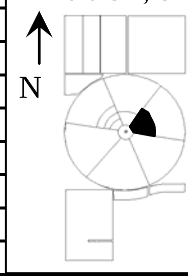


Field Operations	Date	Activity
Tillage	3/27	list
	6/8	Cultivated (Span 8)
	6/9	Diked (Span 8)
Fertility	4/7-4/10	65 lbs/a P2O5 (10-34-0) and 19 lbs/a N (32-0-0) with coulter rig
	5/23	60 lbs/a N (32-0-0) with coulter rig
	6/28 - 6/29	Base=15.6 lbs/a N, +20%=16.34 lbs/a N, -20%=11.38 lbs/a N (32-0-0) through Pivot
	7/12 - 7/14	Base=19.38 lbs/a N, +20%=20.28 lbs/a N, -20%=14.16 lbs/a N (32-0-0) through Pivot
	7/18 - 7/20	Base=11.19 lbs/a N, +20%=11.73 lbs/a N, -20%=8.16 lbs/a N (32-0-0) through Pivot
	7/21 - 7/25	Base=17.6 lbs/a N, +20%=18.45 lbs/a N, -20%=12.85 lbs/a N (32-0-0) through Pivot
	7/27	Base=3.2 lbs/a N, +20%=3.35 lbs/a N, -20%=2.34 lbs/a N (32-0-0) through Pivot
Planting	5/10	FM 989 B2R (Spans 2-7)
	5/12	Varieties (Span 8)
Herbicide/Growth Regulator	4/25	Roundup 22 oz/a
	4/25	Prowl 48 oz/a
	6/3	Roundup 1 qt/a
	5/16	Ignite
	5/13	RU 1 qt/a (Span 8)
	5/13	Caporal 3 pt/a (Span 8)
	7/12	Glystar 32oz/a directed
	7/13	Pentia 8oz/a on 1.0 and 1.25 Irrigated
Insecticide	6/3	Acephate 3.2 oz/a
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	4/18-5/18	2.60 in.
Seasonal	5/19-8/27	Base = 15.30 in., +20% = 16.88 in., -20% = 13.07 in.
Rainfall		
PrePlant & Planting	1/1 - 5/12	2.79 in.
Seasonal	5/10 - 9/30	10.93 in.

Operations Summary

Year	2006
Farm	Helm
Field ID	Field 5b Spans 2-4
Exp. Design	
Soil Type	

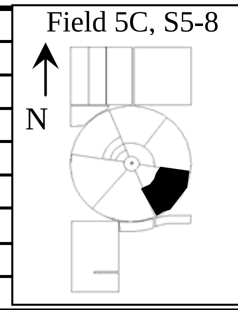
Field 5B, S2-4



Field Operations	Date	Activity
Tillage	3/27	List
	6/8	Cultivated (Span 8)
	6/9	Diked (Span 8)
Fertility	4/7-4/10	65 lbs/a P2O5 (10-34-0) and 19 lbs/a N (32-0-0) with coulter rig
	5/23	60 lbs/a N (32-0-0) with coulter rig
	6/28 - 6/29	18.7 lbs/a of N (32-0-0) through Pivot
	7/12 - 7/14	23.3 lbs/a of N (32-0-0) through Pivot
	7/18 - 7/20	13.4 lbs/a of N (32-0-0) through Pivot
	7/21 - 7/25	21.1 lbs/a of N (32-0-0) through Pivot
	7/27	3.84 lbs/a of N (32-0-0) through Pivot
Planting	5/10	FM 989 B2R (Spans 2-7)
	5/12	Varieties (Span 8)
Herbicide/Growth Regulator	4/25	Roundup 22 oz/a
	4/25	Prowl 48 oz/a
	6/3	Roundup 1 qt/a
	5/16	Ignite
	5/13	RU 1 qt/a (Span 8)
	5/13	Caporal 3 pt/a (Span 8)
	7/12	Glystar 32oz/a directed
	7/13	Pentia 8oz/a on 1.0 and 1.25 Irrigated
Insecticide	6/3	Acephate 3.2 oz/a
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	4/18-5/18	2.60 in.
Seasonal	5/19-8/27	17.11in.
Rainfall		
PrePlant & Planting	1/1 - 5/10	2.79 in.
Seasonal	5/10 - 9/30	10.93 in.

Operations Summary

Year	2006
Farm	Helm
Field ID	Field 5c Spans 5-8
Exp. Design	
Soil Type	



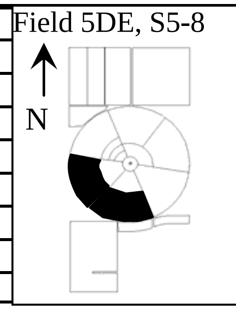
Field Operations	Date	Activity
Tillage		
	5/18	Cultivated
	6/8	Cultivated (Spans 5-8)
	5/18	Diked
Fertility	4/7-4/10	65 lbs/a P2O5 (10-34-0) and 19 lbs/a N (32-0-0) with coulter rig
		114.5 lbs/a P2O5 (10-34-0) and 34 lbs/a N (32-0-0) with coulter rig
	5/18	100 lbs/a of N (32-0-0) with coulter rig
	6/24 -6/25	41 lbs/a (32-0-0) through the Pivot
	6/27-6/30	53 lbs/a (32-0-0) through the Pivot
	7/5-7/6	26 lbs/a (32-0-0) through the Pivot
	7/10	4 lbs/a (32-0-0) through the Pivot
Planting		
	4/20	Corn 32,000 seed/a
Herbicide/Growth Regulator	4/24	Harness 1.8 qt/a
	4/24	Roundup 22 oz/a
Insecticide		
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	4/14	2.00 in.
Seasonal	4/15-8/20	23.76 in.
Rainfall		
PrePlant & Planting	1/1 - 4/19	1.65 in.
Seasonal	4/19 - 9/30	12.07 in.

Operations Summary

Year	2006	
Farm	Helm	
Field ID	Field 5c (Spans 2-4)	
Exp. Design		
Soil Type		
Field Operations	Date	Activity
Tillage		
	5/18	Cultivated
	6/8	Cultivated (Spans 5-8)
	5/18	Diked

Operations Summary

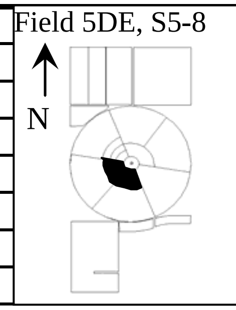
Year	2006
Farm	Helm
Field ID	Field 5de (Spans 5-8)
Exp. Design	
Soil Type	



Field Operations	Date	Activity
Tillage	3/27	List
	5/19	Scratched
	6/8	Cultivated (5e)
	6/14	Diked
Fertility	4/4-4/7	69 lbs/a P2O5 (10-34-0) and 21 lbs/a N (32-0-0) with coulter rig
	5/25	60 lbs/a N with coulter rig (32-0-0)
	6/28 - 6/29	Base=15.6 lbs/a N, +20%=16.34 lbs/a N, -20%=11.38 lbs/a N (32-0-0) through Pivot
	7/12 - 7/14	Base=19.38 lbs/a N, +20%=20.28 lbs/a N, -20%=14.16 lbs/a N (32-0-0) through Pivot
	7/18 - 7/20	Base=11.19 lbs/a N, +20%=11.73 lbs/a N, -20%=8.16 lbs/a N (32-0-0) through Pivot
	7/21 - 7/25	Base=17.6 lbs/a N, +20%=18.45 lbs/a N, -20%=12.85 lbs/a N (32-0-0) through Pivot
	7/27	Base=3.2 lbs/a N, +20%=3.35 lbs/a N, -20%=2.34 lbs/a N (32-0-0) through Pivot
Planting	5/8	FM 989 B2R on outside 8 rows, then alternated with 960 through to Span 4
Herbicide/Growth Regulator	4/20	Prowl 2 qt/a (5e)
	4/24	Prowl 2 qt/a (5d)
	5/16	Ignite
	5/19	Glystar 1 qt/a (5d)
	5/24	Glystar 1 qt/a (5e)
	6/8	Roundup Weather Max 32 oz/a
	7/10	Glystar 32oz/a directed
	7/14	Pentia 8oz/a on 1.0 and 1.2 Irrigated
Insecticide	5/8	Temik 3 lbs/a
	6/8	Acephate 3.2 oz/a
Harvest aid	10/20	Gramoxone Inteon 16 oz/a Aim 1 oz/a
Irrigation Amt.		
PrePlant & Planting	4/18-5/17	2.35 in.
Seasonal	5/18-8/26	On area "d" - Base = 13.99 in., +20% = 15.43 in., -20% = 11.97 in.
	5/18-8/26	On area "e" - Base = 14.22 in., +20% = 15.69 in., -20% = 12.15 in.
Rainfall		
PrePlant & Planting	1/1 - 5/8	2.79 in.
Seasonal	5/8 - 9/30	10.93 in.

Operations Summary

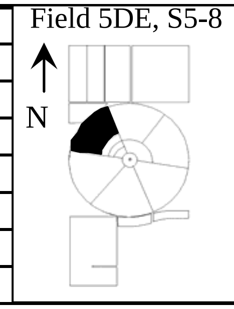
Year	2006
Farm	Helm
Field ID	Field 5de (Spans 2-4)
Exp. Design	
Soil Type	



Field Operations	Date	Activity
Tillage	3/27	List
		Tillage Treatments Described in Reports
Fertility	4/4-4/7	69 lbs/a P2O5 (10-34-0) and 21 lbs/a N (32-0-0) with coulter rig
		60 lbs/a N with coulter rig (32-0-0)
	6/29 - 6/30	18.7 lbs/a of N (32-0-0) through Pivot
	7/12 - 7/14	23.3 lbs/a of N (32-0-0) through Pivot
	7/18 - 7/20	13.4 lbs/a of N (32-0-0) through Pivot
	7/21 - 7/25	21.1 lbs/a of N (32-0-0) through Pivot
	7/27	3.84 lbs/a of N (32-0-0) through Pivot
Planting	5/11	FM 989 B2R
Herbicide/Growth Regulator	3/24	Prowl 2 qt/a
	5/12	RU 2 qt/a
	5/12	Caporal 1 qt/a
	6/8	RU 32 oz/a
	7/10	Glystar 32oz/a directed
	8/1	Pentia 8oz/a
Insecticide	6/8	Acephate 3.2 oz/a
Harvest aid	10/20	Gramoxone Inteon 16 oz/a Aim 1 oz/a
Irrigation Amt.		
PrePlant & Planting	4/18-5/17	2.35 in.
Seasonal	5/18-8/26	On area "d" - 15.66 in.
	5/18-8/26	On area "e" - 15.90 in.
Rainfall		
PrePlant & Planting	1/1 - 5/11	2.79 in.
Seasonal	5/12 - 9/30	10.93 in.

Operations Summary

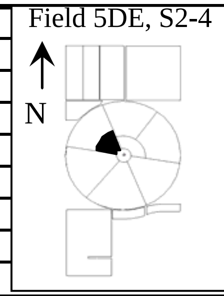
Year	2006
Farm	Helm
Field ID	Field 5f (Spans 5-8)
Exp. Design	
Soil Type	



Field Operations	Date	Activity
Tillage	3/27	List
	5/15	Scratched
	6/8	Cultivated
	6/9	Diked
Fertility	4/4-4/7	69 lbs/a P2O5 (10-34-0) and 21 lbs/a N (32-0-0) with coulter rig
	5/19	60 lbs/a N with coulter rig (32-0-0)
	6/29 - 6/30	Base=15.6 lbs/a N, +20%=16.34 lbs/a N, -20%=11.38 lbs/a N (32-0-0) through Pivot
	7/12 - 7/14	Base=19.38 lbs/a N, +20%=20.28 lbs/a N, -20%=14.16 lbs/a N (32-0-0) through Pivot
	7/18 - 7/20	Base=11.19 lbs/a N, +20%=11.73 lbs/a N, -20%=8.16 lbs/a N (32-0-0) through Pivot
	7/21 - 7/25	Base=17.6 lbs/a N, +20%=18.45 lbs/a N, -20%=12.85 lbs/a N (32-0-0) through Pivot
	7/27	Base=3.2 lbs/a N, +20%=3.35 lbs/a N, -20%=2.34 lbs/a N (32-0-0) through Pivot
Planting	5/8	4 varieties in water treatments @ 56,000 seeds/a
Herbicide/Growth Regulator	4/20	Prowl 2 qt/a
	6/3	Glystar 1 qt/a
	7/11	Glystar 32oz/a directed
	7/13	Pentia 8oz/a on 1.25 Water Treatment
Insecticide	5/8	Temik 3 lbs/a
	6/3	Acephate 3.2 oz/a
Harvest aid	10/20	Gramoxone Inteon 16 oz/a Aim 1 oz/a
Irrigation Amt.		
PrePlant & Planting	4/18-5/17	3.10 in.
Seasonal	5/18-8/26	Base = 13.87 in., +20% = 15.33 in., -20% = 11.83 in.
Rainfall		
PrePlant & Planting	1/1 - 5/8	2.79 in.
Seasonal	5/8 - 9/30	10.93 in.

Operations Summary

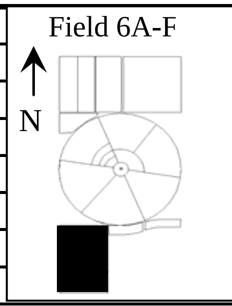
Year	2006
Farm	Helm
Field ID	Field 5f (Spans 2-4)
Exp. Design	
Soil Type	



Field Operations	Date	Activity
Tillage	3/27	List
	5/15	Scratched
	6/8	Cultivated
	6/9	Diked
Fertility	4/4-4/7	69 lbs/a P2O5 (10-34-0) and 21 lbs/a N (32-0-0) with coulter rig
	5/19	60 lbs/a N with coulter rig (32-0-0)
	6/29 - 6/30	18.7 lbs/a of N (32-0-0) through Pivot
	7/12 - 7/14	23.3 lbs/a of N (32-0-0) through Pivot
	7/18 - 7/20	13.4 lbs/a of N (32-0-0) through Pivot
	7/21 - 7/25	21.1 lbs/a of N (32-0-0) through Pivot
	7/27	3.84 lbs/a of N (32-0-0) through Pivot
Planting	5/4	ST 4892 BR @ 56,000 seeds/a
Herbicide/Growth Regulator	4/20	Prowl 2 qt/a
	6/3	Glystar 1 qt/a
	7/11	Glystar 32oz/a directed
	7/17	Pentia 8oz/a
	8/1	Pentia 8oz/a
Insecticide	5/4	Temik 3 lbs/a
	6/3	Acephate 3.2 oz/a
Harvest aid	10/20	Gramoxone Inteon 16 oz/a Aim 1 oz/a
Irrigation Amt.		
PrePlant & Planting	4/18-5/17	3.10 in.
Seasonal	5/18-8/26	15.52 in.
Rainfall		
PrePlant & Planting	1/1 - 5/4	2.57 in.
Seasonal	5/5 - 9/30	11.15 in.

Operations Summary

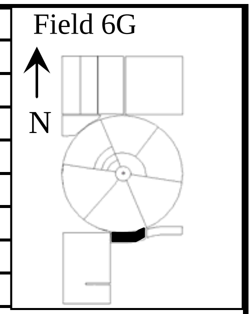
Year	2006
Farm	Helm
Field ID	Field 6 - Zone A-F
Exp. Design	Cotton Irr Level x Variety x Plant Population Keeling/Bordovsky
Soil Type	



Field Operations	Date	Activity
Tillage	3/7	Stalk puller
	3/27	List
	6/15	Diked
Fertility	4/12-4/13	77.0 lbs/a P2O5 (10-34-0) and 23 lbs/a N (32-0-0) with coulter rig
	5/30	60 lbs/a of N (32-0-0) with coulter rig for High, Low and Dry Irr.
	6/19-7/29	56 lbs/a of N (32-0-0) for Low Irr. (Injected into drip lines)
	6/19-8/2	87 lbs/a of N (32-0-0) for High Irr. (Injected into drip lines)
Planting	5/2,3	Four Flex Varieties at 3 populations
Herbicide/Growth Regulator	4/27	Roundup 22 oz/a
	4/27	Prowl 2 qt/a
	6/5	Roundup 1 qt/a
	7/12	Pentia 8oz/a in a, c, f and g
Insecticide	5/2	Temik 3 lbs/a
Harvest aid	10/20	Gramoxone Inteon 16 oz/a Aim 1 oz/a
Irrigation Amt.		
PrePlant & Planting	4/18-5/29	High, Low and Dry 4.50 in.
Seasonal	6/12-8/27	High 16.99 in. Low 10.35 in. Dry 0.0 in.
Rainfall		
PrePlant & Planting	1/1 - 5/2	2.52 in.
Seasonal	5/2 - 9/30	11.20 in.

Operations Summary

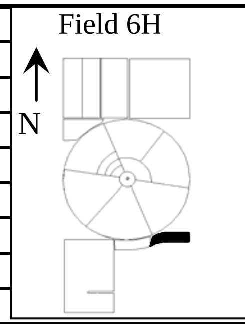
Year	2006
Farm	Helm
Field ID	Field 6 - Zone G Cotton Drip Irrigated Nitrogen Level Effects on Insects Parajulee
Exp. Design	Several Nitrogen Levels, Replicated
Soil Type	



Field Operations	Date	Activity
Tillage	3/7	Stalk puller
	6/27	Diked
Fertility	4/14	68 lbs/a P2O5 (10-34-0) and 20 lbs/a N (32-0-0) with coulter rig
	6/26	Fertilzier treaments see report
Planting	5/4	PM 2379RR at 56,000 ppa
Herbicide/Growth Regulator	4/27	Roundup 22 oz/a
	4/27	Prowl 2 qt/a
	5/5	Caporal broadcast 32 oz/a
	6/5	Roundup 1 qt/a
Insecticide		
Harvest aid	10/20	Gramoxone Inteon 16 oz/a Aim 1 oz/a
Irrigation Amt.		
PrePlant & Planting	4/18-5/29	4.32in.
Seasonal	6/12-8/27	13.22in.
Rainfall		
PrePlant & Planting	1/1 - 5/4	2.57 in.
Seasonal	5/4 - 9/30	11.15 in.

Operations Summary

Year	2006		
Farm	Helm		
Field ID	Field 6 - Zone H	Cotton Drip Irrigated Variety, Herbicide,	Keeling
Exp. Design	Replicated		
Soil Type			



Field Operations	Date	Activity
Tillage	3/7	Stalk puller
	6/15	Diked
Fertility	4/14	68 lbs/a P2O5 (10-34-0) and 20 lbs/a N (32-0-0) with coulter rig
	5/30	60 lbs/a of N (32-0-0) with coulter rig
	7/12,13	75 lbs/a of N (32-0-0) (Injected into drip lines)
Planting	5/4	FM989B2R
Herbicide/Growth Regulator	4/27	Roundup 22 oz/a
	4/27	Prowl 2 qt/a
	5/5	Caporal broadcast 32 oz/a
	6/5	Roundup 1 qt/a
	7/11	Pentia 8oz/a
	7/24	Pentia 8oz/a
Insecticide		
Harvest aid	10/20	Gramoxone Inteon 16 oz/a Aim 1 oz/a
Irrigation Amt.		
PrePlant & Planting	4/18-5/29	5.09 in.
Seasonal	6/12-8/27	14.43 in.
Rainfall		
PrePlant & Planting	1/1 - 5/4	2.57 in.
Seasonal	5/4 - 9/30	11.15 in.