AgriLIFE RESEARCH
Texas A&M System

Improving Life Through Science and Technology

Lubbock-Pecos-Halfway

Helms Research Farm

Summary Report

2008

Texas AgriLife Research / Mark A. Hussey, Director
The Texas A&M University System / College Station, Texas

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Texas AgriLife Research
Texas AgriLife Extension
Lubbock/ Halfway
Research Participants

Name	Specialty	Association[1]	E-mail Address
Jaroy Moore, Ph.D.	Resident Director	AgriLife Research	j-moore@tamu.edu
Evan Arnold, B.S.		AgriLife Research	
Jim Barber	Extension Assistant	AgriLife Extension	
Brent Bean, Ph.D.	Agronomist	AgriLife Extension	BBean@ag.tamu.edu
Craig Bednarz, Ph.D.	Plant Physiologist	AgriLife Research, AgriLife Extension	Craig.bednarz@ttu.edu
A. J. Bloodworth, B. S.	Tecnician	AgriLife Research	AJBloodworth@ag.tamu.edu
Randy Boman, Ph.D.	Agronomy – Cotton	AgriLife Extension	r-boman@tamu.edu
James P. Bordovsky, M.S.	Ag. Engineering – Irrigation	AgriLife Research	j-bordovsky@tamu.edu
Stanley C. Carroll, M.S.	Entomology – Cotton	AgriLife Extension	s-carroll2@tamu.edu
Justin Carthel	Technician	AgriLife Research	
Lindsi Clark	Technician	AgriLife Research	LCClark@ag.tamu.edu
Andy Cranmer, M.S.	Irrigation/Entomology	AgriLife Research	amcranmer@ag.tamu.edu
Jane Dever, Ph.D.	Plant Breeding-Cotton	AgriLife Research	JDever@ag.tamu.edu
Peter Dotray, Ph.D.	Agronomy – Weed Science	AgriLife Research AgriLife Extension, TTU	PDotray@ag.tamu.edu
John Everitt, M.S.	Agronomy – Weed Science	AgriLife Research	j-everitt@tamu.edu
Lyndell Gilbert, B.S.	Weed Science	AgriLife Researach	LVGilbert@ag.tamu.edu
Wayne Keeling, Ph.D.	Agronomy – Weed Science	AgriLife Research	w-keeling@tamu.edu
Mark Kelley, Ph.D.	Ext. Program Spec.- Cotton	AgriLife Extension	m-kelley@tamu.edu
Victor Mendoza, B.S.	Technician	AgriLife Research	
Valerie Morgan, B.S.	Cotton Breeding	AgriLife Research	VMorgan@ag.tamu.edu
Joe Mustian, B.S.	Engineering – Irrigation	AgriLife Research	jmustian@ag.tamu.edu
Doug Nesmith, M.S.	Research Farm Manager	AgriLife Research	d-nesmith@tamu.edu
Megha Parajulee, Ph.D.	Entomology	AgriLife Research, TTU	m-parajulee@tamu.edu
Michael Petty, B.S.	Weed Science	AgriLife Research	DMPetty@ag.tamu.edu
Jacob Reed, B.S.	Weed Science	AgriLife Research	JDReed@ag.tamu.edu
Calvin Trostle, Ph.D.	Agronomy	AgriLife Extension	CTrostle@ag.tamu.edu
Terry Wheeler, Ph.D.	Plant Pathology	AgriLife Research	twheeler@ag.tamu.edu
Wenwei Xu, Ph.D.	Corn Genetics	AgriLife Research, TTU	We-xu@tamu.edu

[1]Texas AgriLife Research, Texas AgriLife Extension, TTU – Texas Tech University

Introduction

The Texas A&M University System purchased 373 acres of farmland form 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 AgriLife 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). 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 five wells, 320 to 340 feet deep, pumping at rates of 300 to 400 gallons per minute each.

Rainout shelters used in subsurface drip irrigation seed germination experiments. Treatments involved different tillage methods with equipment guided by a RTK controlled tractor.

Harvesting was with a modified cotton stripper. The attached material transfer and weighing system reduced traditional hand harvesting within large irrigated plots thereby providing more representative data.

Grain sorghum was harvested from large test plots with a commercial combine. Irrigation level and sorghum hybrid were treatment factors in 2008.

Corn Breeding (Field 1)
Wenwei Xu

Objective:

The objective was to develop multiple stress tolerant corn lines and hybrids by transferring desirable genes from exotic germplasm into temperate lines.

Methodology:

Helms Farm is a primary test site for our corn breeding program's drought tolerance study. This field has a subsurface drip irrigation system and divided into five sections. In 2008, we conducted a series of field trials to study to drought tolerance, heat tolerance, yield and other agronomic traits of about 500 experimental and commercial hybrids and lines at the Helms Farm. All tests were planted on April 28. Three irrigation treatments were applied in this field, including well watered, V-12 drought stress and grain filling stage drought stress. Pants under well-watered treatment were watered throughout the growing season while plants under V-12 drought stress were watered at a 50% level of 100% ET, but watering was stopped two weeks before and after flowering. Plants in the grain filling drought stress were not watered after plant flowered. A severe hail storm on June 19 caused severe damage to the plants and yield loss.

Results:

- Identified new drought tolerant inbred lines for grain and silage. These lines have good stay green trait and normal seed set and grain filling.
- Testcross of BR-1, Cuba-1, DK-5, DK-7, and S2B73 and S2B73BC showed good drought tolerance and yield well under both well-watered and drought stressed conditions. Some of these lines have been licensed to seed industry.
- Results of regulated transgenic corn lines and hybrids will help seed companies to select and advance superior lines and hybrids adapted to Texas environments.

Expectations:

New drought and heat tolerant lines and hybrids have been developed and will be released to the seed industry and public sectors. About 15 companies have requested and received Tx204 and Tx205 seed. We released these lines by using the test results at Helms Farm. Our multiple stress tolerant lines and hybrids can be used for grain and silage corn production. Adoption of new corn germplasm and strategies for irrigation and crop management can save 5-10% of irrigation water requirements.

Irrigation Termination for Improved Fiber Maturity on the Texas High Plains
Craig Bednarz and James P. Bordovsky

Objective:
The objective of this study is to determine the effect of irrigation termination on lint yield and fiber quality of five cotton varieties. The hypothesis is that early irrigation termination would consistently result in more valuable cotton lint that would partially compensate for lower lint yield while reducing irrigation input.

Figure1. View of SDI plots containing the cotton

Methodology:
Preliminary studies were initiated at the Texas AgriLife Research Center in Halfway in 2007 in a field site with sub surface drip irrigation. The sub surface drip irrigation system is sub divided into 9 zones with each zone being approximately 1.0 ac. The main plot treatments were timing of irrigation termination and the sub plot treatments were cultivar. Irrigation termination treatments were (1) Nodes Above White Flower = 5, (2) Nodes Above White Flower = 5 + 2 weeks and, (3) First Cracked Boll.

Results:
Table 1 contains fiber quality and yield data. This table shows that there was an increase in fiber quality in the earlier treatments but there was also a decrease in yield. An economic analysis will show which treatment is the most profitable. Table 2 contains cultivar fiber quality data. 2008 yield and fiber quality data is not yet available.

Table 1: Fineness (Fine_mTex), Immature Fiber Content (IFC, %); Maturity Ratio (Mat) and Micronaire (MIC) among irrigation treatments in irrigation termination studies conducted at the Texas AgriLife Research Center Helms Farm at Halfway, TX in 2007.

Treatment	Fine_mTex	IFC_pct	Mat_Ratio	MIC	Yield_kg_ha
1	162.95	8.7238	0.8621	4.2	4846.81
2	150.6	10.8667	0.8207	3.1867	5820.12
3	151.4	10.8	0.8253	3.1867	6359.33
LSD(0.05)	5.18	1.26	0.0221	0.1338	321.97

Table 2: Immature Fiber Content (IFC, %); Maturity Ratio (Mat) and Micronaire (MIC) among cultivars in irrigation termination studies conducted at the Texas AgriLife Table 2: Immature Fiber Content (IFC, %); Maturity Ratio (Mat) and Micronaire (MIC) among cultivars in irrigation termination studies conducted at the Texas AgriLife Research Center Helms Farm at Halfway, TX in 2007

	Cultivar	IFC_pct	Mat_Ratio	MIC
1	FM960B2R	9.9333	0.8456	3.4111
2	FM 9063 B2F	10.0952	0.8401	3.4333
3	STV 4554B2F	10.7111	0.8289	3.6444
4	DP444BR	10.3111	0.8278	3.3778
5	PHY370WR	9.6	0.8378	3.6222
LSD(0.05)		0.693435	0.01839	0.131097

Evaluation of Soil Water Sensors for Irrigation Management

James Bordovsky, Joe Mustian, and Andy Cranmer

Objective: Compare volumetric soil water content of time domain transmissometry (TDT) sensors to that of nuclear measurement methods in cotton irrigated by subsurface drip.

Fig. 1. Data logger and recorder for TDT soil sensors located in a drip irrigated cotton field at the Helms Research farm, 2007 and 2008.

Methodology: Use of common soil moisture sensors for irrigation scheduling has never been widely adopted on the South Plains due to their reputation for inaccuracy, inconsistency, and difficulty of use. Neutron scattering methods are the standard measurement method used in irrigation research, but are not practical in normal crop production due to licensing requirements and expense. Time domain transmissometry (TDT) sensors are reported to respond immediately to changes in soil moisture, providing accuracy to 1% volumetric soil moisture, and can be used in permanent installations. Three TDT sensors (Gro-Point, E.S.I. Environmental Sensors, Inc., Sidney, BC) were positioned at 6, 12, and 27-inch depths in a drip irrigated field in May 2007. Four access tubes were installed at precise locations relative to drip lines and cotton rows adjacent to the TDT installation. Soil water measurements were obtained using both sensing methods during the 2007 and 2008 growing seasons. The 12 and 27-inch TDT sensors were left undisturbed from the 2007 through the 2008 growing seasons.

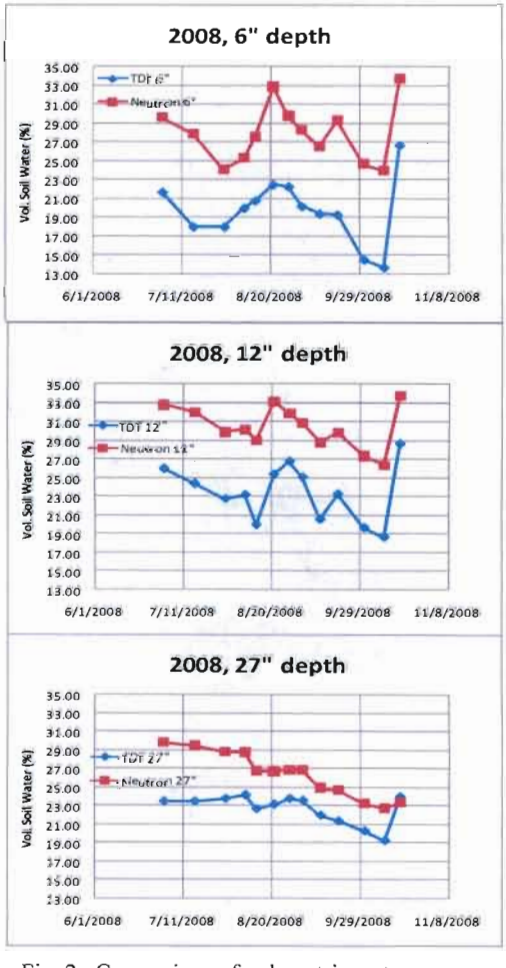


Fig. 2. Comparison of volumetric water content measured by TDT and neutron attenuation, Helms Farm, 2008.

Results: The factory calibrated TDT sensors resulted in lower volumetric water content than the neutron scatter method (Figure 2). However, relative changes in soil water content were very similar for both methods, particularly at the 6 and 12 inch depths. The range of TDT sensor readings, as the soil water content cycled from dry to wet, was smaller in 2008 than 2007 leading to the assumption that the sensor/soil contact improved over time and that relative readings would be more stable in future years. Soil water sensor evaluations will continue in an effort to provide useful tools for efficient irrigation management.

Cotton Variety Performance as Affected by Irrigation Level
Wayne Keeling, Jacob Reed and Michael Petty

Objective:
Fourteen cotton varieties, including commercial varieties and experimentals from Bayer Crop Science, were evaluated under three irrigation levels for lint yield and fiber quality.

Methodology:
The plot size was 8- rows by 700-1300 feet with 3 replications. Additional information is contained in the appendix (Field 5a, Spans 5-8). The varieties planted included:

FM 1740 B2F	ST 5327 B2RF	FM 9160 B2F	FM 9063 B2F
FM 9058F	FM 1880 B2F	ST 4554 B2RF	DP141 B2RF
ST 5458 B2RF	BCSX0870B2F	ST 4288 B2F	ST 4498 B2RF
FM 9180 B2F	DP 161 B2RF		

Results:
Fourteen varieties were planted under three irrigation levels. These included base, base -50%, and base +50% which totaled 6.49, 11.92, and 17.36 in/A in-season respectively. Under the low irrigation level, yields ranged from 846-1349 lbs/A. Under the medium irrigation level, yields ranged from 785-1451 lbs/A. With the high irrigation treatment, yields ranged from 535 to 1383 lbs/A. Fiber quality declined as irrigation level increased. Cotton lint yields, loan value, and $ value/A are summarized in Table 1.

Table 1. Effects of irrigation level on cotton lint yields, loan value, and gross revenue for fourteen cotton varieties at Halfway, TX, 2008.

	Yield (lbs/A)			Loan Value (¢/lb)			Gross return ($/A)		
Irrigation Level	L	M	H	L	M	H	L	M	H
Variety									
ST 5458 B2RF	1193	1423	714	55.85	49.45	45.35	666	704	324
ST 5327 B2RF	1075	1451	1141	56.65	52.55	47.35	609	762	540
ST 4554 B2RF	999	1311	794	56.65	50.90	45.50	566	667	361
ST 4498 B2RF	1162	785	832	56.75	49.35	45.50	659	387	379
FM 9180 B2F	1045	1272	1251	54.15	52.35	49.65	566	666	621
FM 9063 B2F	881	1225	1170	56.65	52.35	47.15	499	641	552
FM 9058 F	1201	1297	1270	56.60	49.45	47.90	680	641	608
FM 1880 B2F	1069	1428	1021	52.35	49.45	47.35	559	706	483
FM 1740 B2F	1349	1382	1219	56.50	53.85	45.50	762	744	555
DP 161 B2RF	968	811	535	56.75	49.45	46.80	550	401	250
DP 141 B2RF	846	994	710	53.95	46.80	45.25	456	465	321
FM 9160 B2F	1019	1251	1170	56.70	52.35	45.65	578	655	534
BCSX0870	1047	1326	1338	57.05	49.45	46.00	597	656	616
ST 4288 B2F	979	1030	1383	56.55	52.35	47.15	553	539	652

Strip-till, No-till, and Conventional-till Weed Management Systems in Cotton

Peter Dotray, AJ Bloodworth, Wayne Keeling, Brent Bean, and Lyndell Gilbert

Objective:

The overall objective was to examine weed control in three different tillage systems for effective and economical weed management in Roundup Ready Flex cotton.

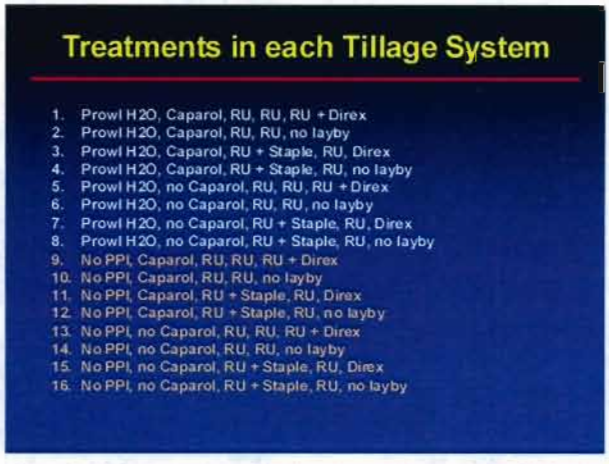


Figure 1. Sixteen preplanned treatments per tillage system. Note the number of residual herbicides range from four (treatment 3) to zero (treatment 14).

Methodology:

The study was conducted using an overhead sprinkler irrigation system and followed sorghum that was planted in 2007. Sixteen preplanned treatments were established in conventional-till, strip-till, and no-till systems using up to four different soil residual herbicide timings in a Roundup-based weed management program. Figure 1 is a list of these 16 treatments per tillage. Prowl at 34 oz/A was applied to designated plots on May 2. Incorporation was accomplished using a rolling cultivator in conventional-till, a strip-till implement, or using one inch of water in no-till and inter-row areas in strip-till. ST4554B2F was planted on May 19 and Caparol at 38.4 oz/A was applied broadcast to designated plots on the same day.

Results:

There were no differences in cotton stand in conventional-till compared to strip-till; however, stand in no-till was less when compared to conventional- and strip-till. Palmer amaranth control was excellent throughout the growing season in all tillage systems. No difference was observed among treatments two weeks after the first POST application, four weeks after the layby treatment, or among tillage systems. Strip-till lint yield was greater than conventional- and no-till. Conventional-till yield was greater than in no-till. Gross returns based on lint yield were calculated by treatment in the strip-till system and ranged from $503 to $707/A. Herbicide input cost per treatment in strip-till ranged from $33 (Roundup-only program) to $83/A (Roundup and all four residual herbicide timings), and net return above weed control costs ranged from $426 to $652 (Figure 2). Although the benefit of a residual herbicide was not apparent in this study (and in 2007), the concern of glyphosate-resistant weeds must be considered when developing long term weed management strategies. This experiment will be conducted for a third year in 2009.

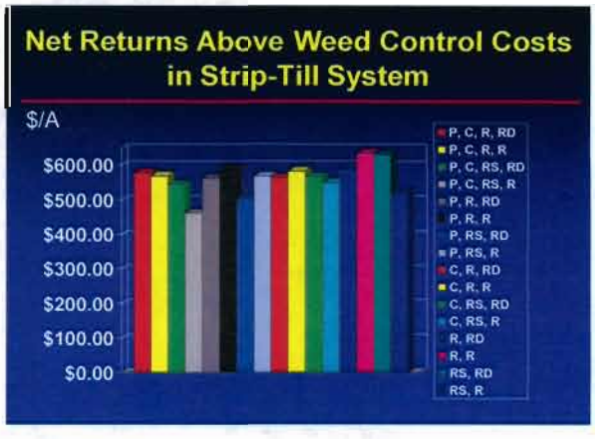


Figure 2. Net returns above weed control costs by treatment in the strip-tillage system.

Cotton Response to Irrigation Level and Crop Rotation

James P. Bordovsky, Joe Mustian, Andy Cranmer, and Doug Nesmith

Objective: A field experiment was conducted to determine yield and in-season irrigation water use efficiency of cotton resulting from two popular cotton varieties, three irrigation levels, and three crop sequences.

Fig. 1. Cotton following a 2007 grain crop at Helms

Materials & Methods: Cotton varieties were Stoneville, ST4554B2RF, a full season "picker" variety that has recently produced high yields on the High Plains, and Delta Pine, DP104B2RF, a high yielding, more determinate "stripper" type that has performed well and is perhaps more tolerant to water stress. The base irrigation level (1.0BI treatment) met approximately 80% of crop water needs using ET scheduling. The other water levels were ±50% of this amount (0.5BI and 1.5BI). All variety x irrigation treatments were planted at 55,000 ppa in areas of either continuous cotton (Cont. Cot.) or in rotation with a grain crop, with corn or sorghum planted every three years (Cot-Grain-Cot or Cot-Cot-Grain treatments). Crop responses were evaluated by harvesting 4 rows x 60^0 pivot arc with a John Deere 7445 stripper, determining burr weight with calibrated trailer scales, and establishing turnout and fiber data from 1-lb sub-samples from each of three replicates.

Results: The crop sequence areas were not replicated, therefore, only general comparisons can be made between these treatments. As seen in previous year, having a grain crop in rotation with cotton increased cotton yield 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 all crop sequences, the less determinate Stoneville variety resulted in a higher numerical yield at low irrigation (0.5BI), but lower lint yield at higher irrigation levels than did the DP104 variety. Yields increased with the increase in irrigation from the 0.5BI to the 1.0BI treatment; however, lint yields from treatments irrigated above the 1.0BI level were generally reduced. Figure 2 shows decreased seasonal irrigation use efficiency from the 0.5 to the 1.5BI irrigation levels with less dramatic decrease for the DP104 variety up to the 1.0BI level. These field tests are used to evaluate management options that help maintain productivity in the short term while providing information to improve water value in the future.

Table 1. Cotton lint yield of two varieties, three crop sequences at three irrigation levels at Texas AgriLife Research, Halfway, Helms Farm, 2008.

		Crop Sequence			
Irrigation Level	Variety	Cont. Cot	Cot-Cot-Grain	Cot-Grain-Cot	Avg.
0.0BI	ST 4554 B2RF	386 e	532 d	329 c	416
0.5BI	DP 104 B2RF	660 cd	814 c	689 b	721
	ST 4554 B2RF	730 bcd	930 bc	864 b	841
	Avg.	695	872	777	781
1.0BI	DP 104 B2RF	1081 a	1121 a	1205 a	1136
	ST 4554 B2RF	858 abc	1060 ab	1074 a	997
	Avg.	970	1091	1140	1067
1.5BI	DP 104 B2RF	938 abc	1189 a	1172 a	1100
	ST 4554 B2RF	581 de	888 c	831 b	767
	Avg.	760	1039	1002	933

Column means followed by the same lower case letter are not significantly different (P<.05, LSD)

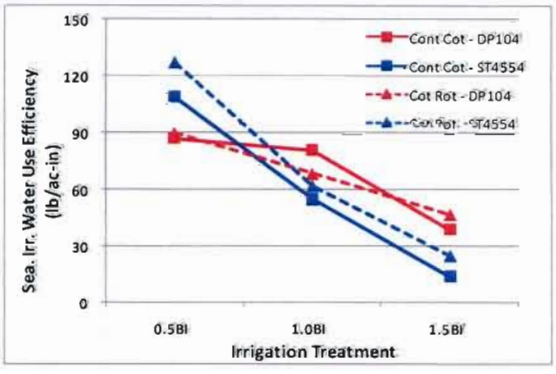


Figure 2. Seasonal irrigation water use efficiencies of two cotton varieties and two cropping sequences at three irrigation levels, Texas Agrilife Research, Halfway, 2008.

Verticillium Wilt Response to Crop Sequence and Irrigation Level

Terry Wheeler, Victor Mendoza, Evan Arnold, Lindsi Clark, and Justin Carthel

Objective: Determine the effect of irrigation and crop rotation on incidence of Verticillium wilt in cotton.

Methodology: Two cotton varieties were planted in each of three cropping sequences and irrigated at each of three relative rates. Soil sampling for *Verticillium dahlia* was conducted in Feb. of 2008 and Jan. of 2009 (one sample/plot). Plant stands were counted for 35 ft. of row and incidence of plants with Verticillium wilt were measured on 22 Aug. for three locations within each plot.

Results: Verticillium wilt incidence was affected by irrigation rate, but not by varieties or their interaction for each of the three rotation combinations where cotton was grown in 2008. Wilt incidence was low and not likely to influence yield where only 50% of the base irrigation rate was applied, compared with plots having 150% of the base irrigation rate. This irrigation effect was seen for all rotation combinations. There were higher levels of wilt in continuous cotton (C/C/C) than in cotton areas which were in a two-year cotton, one- year sorghum rotation (Table 1). However, the trend was that the cotton crop following sorghum (C/S/C) had lower incidence of wilt than the cotton that was two years removed from sorghum (S/C/C) (Table 1). In Feb. of 2008, the areas in rotation with sorghum had more plots where no *V. dahliae* was found in the soil (0 propagules/cm^3 soil) than for plots where cotton was grown continuously (Fig. 1). The plots in continuous cotton in 2008 and 2009 had a much higher frequency of samples where *V. dahliae* ranged from 3.5 to 10 microsclerotia/cm^3 soil than the plots that were in a sorghum rotation (Fig. 1). In 2009, there was also a higher frequency of plots with > 10 propagules of *V. dahliae*/cm^3 soil for the continuous cotton than from plots rotated with sorghum (Fig. 1). There is a high potential for Verticillium wilt problems in the test area in continuous cotton compared with the test area in a sorghum rotation. This was seen in 2008 from the Verticillium wilt measured in the field, and is also indicated by the higher soil population of the fungus.

Table 1. Affect of irrigation and crop rotation on incidence of Verticillium wilt (%) in cotton on 7 June 2008.

Rotation[1]	Irrigation rate[2]		
	0.5 BI	1 BI	1.5 BI
C/C/C	1.8 b	10.6 b	32.5 a
C/S/C	0.0 b	2.1 a	3.5 a
S/C/C	0.2 b	3.0 ab	9.0 a

[1]C = cotton, S = sorghum

[2]Irrigation rates were base rate (BI) which was approximately 80% ET, 50% and 100% of BI.

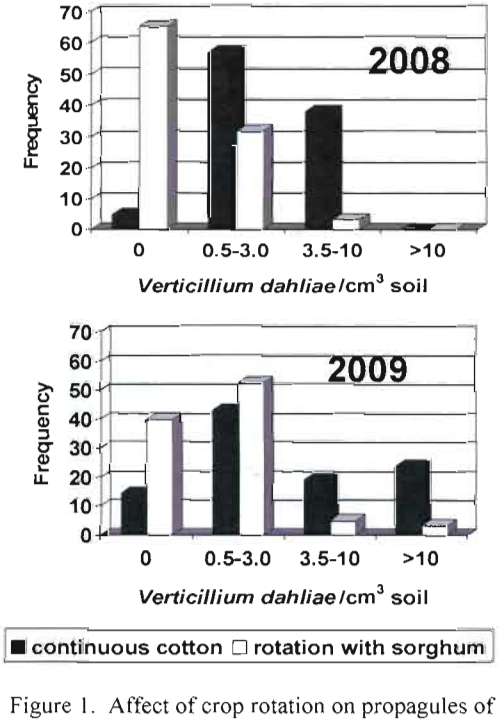


Figure 1. Affect of crop rotation on propagules of *Verticillium dahlia* in the soil.

Sorghum Grain Response to Different Irrigation Levels

James Bordovsky, Wayne Keeling, Jacob Reed, Michael Petty, and Doug Nesmith

Objective: A renewed interest in the water requirement of grain sorghum has been sparked by the construction of several grain ethanol plants in the area. A field experiment was conducted to determine yield and in-season water use efficiency of two grain sorghum varieties at three irrigation levels.

Fig. 1. Harvesting grain sorghum plots at the Helms Research farm, 2008.

Methodology: The grain sorghum hybrids NC+ 7C22 and Pioneer 84G62 were planted under four spans of a LEPA irrigation system. Sections of each pivot span were modified to deliver water at three relative rates: 50, 100, and 150% of the base pivot irrigation capacity with treatment names of 0.5BI, 1.0BI, and 1.5BI, respectively. A non-seasonally irrigated, "0.0BI", treatment was also included. Sorghum was planted on 15 June and harvested with commercial equipment with grain weighs and moisture content determined in each 8-row plot. Seasonal base irrigation was 12.37 inches.

Results: Grain yield response to the three irrigation treatments in 2008 is given in Figure 1. Yields ranged from 418 lbs/ac at 0.0BI (0" seasonal irrigation) to 9870 lbs/ac at the 1.5BI irrigation level (17.8" seasonal irrigation with the Pioneer 84G62 hybrid). In the dry 2008 growing season and for both hybrids, significant grain yield increases resulted from each increase in irrigation rate. Also, seasonal irrigation water use efficiency (SIWUE) increased sharply from 0.5BI to the 1.0BI irrigation treatment before beginning to moderate with the next increment of irrigation (Figure 2). Pioneer 84G62 resulted in significantly higher yield and SIWUE than the NC+ 7C22 when irrigation levels were at or exceeded the 1.0BI rate.

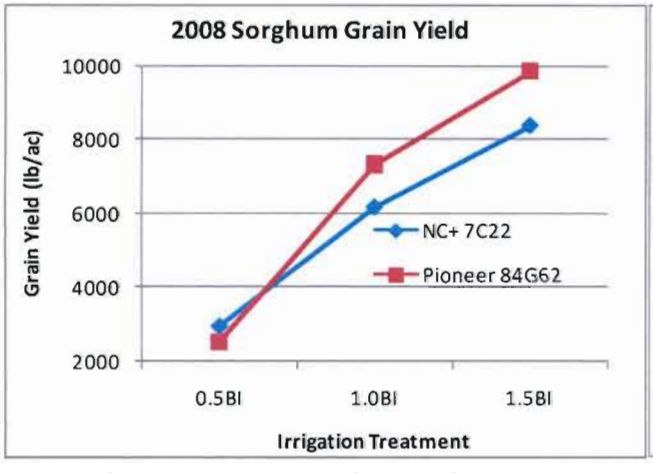


Fig. 1. Grain sorghum yield as a function of irrigation level and hybrid, Helms Farm, 2008.

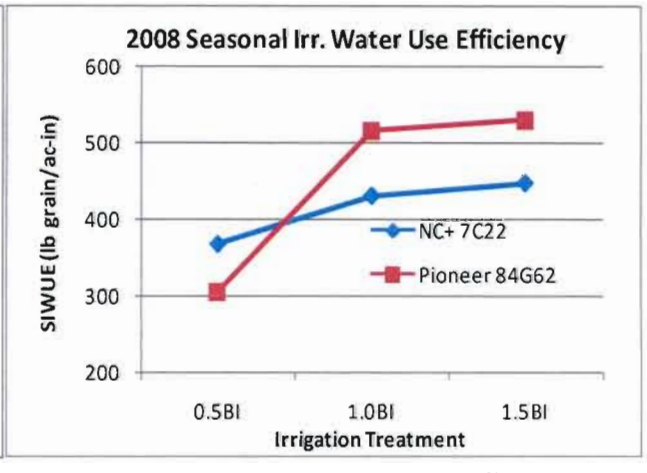


Fig. 2 Sorghum seasonal irrigation water use efficiency, Helms Farm, 2008.

Sorghum FACT trial at Helms Farm, Halfway, TX, 2008

Wayne Keeling, James P. Bordovsky, Doug Nesmith, Jacob Reed and Michael Petty

Figure 1. Sorghum FACT at Helms Farm, 2008.

Methodology:

The plot size was 4 rows by 500-660 feet long with one replication. Planting date was May 22 and harvest date was October 27.Additional production information is contained in the appendix (Field 5d, span 2-4).

Results:

Fourteen sorghum varieties, including commercial and experimental varieties, were evaluated in a large plot, non-replicated trail in 2008. Yields ranged from 6066 to 9993 lbs./A, with a test average of 8535 lbs/A. These varieties were produced under the base irrigation treatment of 12.3" applied in-season. The test was planted on May 22 and harvested on October 27. Yields are summarized in Table 1.

Table 1. Sorghum Varieties and yields at Helms Farm, 2008.

Brand	Variety	Yield (lbs / A)
Dekalb	DKS37-07	7645
Asgrow	PULSAR	9516
Monsanto	MSF275	9993
Monsanto	MSF277	8035
Monsanto	MSF281	8109
Dekalb	DKS44-20	6066
Monsanto	MSF379	9010
Dekalb	DKS53-67	9560
Dekalb	DKS54-00	9569
Dekalb	DKS54-03	8665
NC+	NC+7B47	7773
Pioneer	85G01	8011
Pioneer	84G62	8453
Pioneer	86G08	9087
	Avg.	8535

Grain Sorghum Seeding Rate Effect on Irrigated Yield
Calvin Trostle and Jim Barber

Objective: Determine the effect of seeding rate under irrigation for two grain sorghum hybrids.

Methodology: Test plots were planted as noted below for two grain sorghum hybrids. Pioneer 84G62 is a popular high-yielding medium-long maturity grain sorghum hybrid. DeKalb DK-44 is a medium maturity hybrid that is often chosen for dryland conditions due to its minimal tillering. Six replicated plots (four rows X ~40') were planted for each hybrid at seeding rates ranging from 1.5 to 7.5 seeds per foot on 30-inch rows (26,136 to 130,380) as set using a John Deere Max Emerge planter. The test received 9.1" of rain during the growing season in addition to 15.6" of irrigation.

Results: Grain sorghum seeding rates are often higher than needed to achieve good yields. No significant differences were observed in this test due to seeding rate. Extension recommendations for this field based on soil moisture at seeding and projected irrigation suggest ~70,000 seeds/acre. Tillering compensated for yield particularly in Pioneer 84G62 although it appears that there may have been a yield reduction at the lowest seeding rate. Otherwise there was no trend in yield with seeding rate. For DK-44 there was no trend in yield across seeding rate. This hybrid did tiller to some extent, but even at low plant populations yield was not diminished though yields were much less than the longer maturity hybrid.

Table 1A-1B. Irrigated grain sorghum yield response to seeding rate, Helms Farm, Hale Co., TX, 2008.

Hybrid	Target Seeds per ft. (30" rows)	Target seeds/A	Measured Plants/ acre	Yield at 14% H2O (Lbs./A)	Test Wt. (Lbs./bu)	Measured Plants/A as % of Seed Drop
Pioneer 84G62	1.50	26,136	23,500	8,589	57.8	90%
Pioneer 84G62	2.25	39,204	33,600	9,820	57.9	86%
Pioneer 84G62	3.00	52,272	50,700	9,653	58.5	97%
Pioneer 84G62	3.75	65,340	58,800	9,267	58.6	90%
Pioneer 84G62	4.50	78,408	67,100	9,431	58.7	86%
Pioneer 84G62	5.25	91,476	72,900	9,043	58.3	80%
Pioneer 84G62	6.00	104,544	74,100	10,096	58.0	71%
Pioneer 84G62	6.75	117,612	75,800	9,228	58.0	64%
Pioneer 84G62	7.50	130,380	80,400	9,280	58.4	62%
		Average	**59,700**	**9,359**	**58.3**	
		Fisher's PLSD (0.10)	6,000	NS	NS	
DeKalb DK-44	1.50	26,136	22,200	7,258	57.1	85%
DeKalb DK-44	2.25	39,204	32,900	7,522	56.1	84%
DeKalb DK-44	3.00	52,272	46,200	6,572	56.1	88%
DeKalb DK-44	3.75	65,340	60,200	6,981	55.6	92%
DeKalb DK-44	4.50	78,408	70,300	7,795	56.7	90%
DeKalb DK-44	5.25	91,476	74,600	6,254	56.5	82%
DeKalb DK-44	6.00	104,544	76,700	7,022	57.7	73%
DeKalb DK-44	6.75	117,612	78,800	7,074	56.3	67%
DeKalb DK-44	7.50	130,380	81,800	7,121	53.9	63%
		Average	**55,700**	**7,053**	**56.3**	
		Fisher's PLSD (0.10)	6,500	NS	1.3	

Influence of water level on yield performance of 24 commercial cultivars at Helms Farm, 2008.

Jane Dever, Randy Boman, and Valerie Morgan

Introduction:

Twenty-four commercial cultivars were planted in four separate small –plot replicated yield trials where water level was different in each trial to determine any water by variety interaction of currently available cotton varieties.

Methodology:

Planting Date:	May 19
Plot Size:	2 row plots by 35 feet, 4 replications repeated across 4 water levels
Herbicide:	Triflurin @ 32 oz/A applied pre-plant
	Glyfos extra @ 32 oz/A applied May 19
	Glyfos extra @ 32 oz/A applied July 9
Fertilizer:	60-30-0 lbs/A applied pre-plant
	90 lbs/A N applied through pivot July 7-August 1
Irrigations:	3.2 acre inches applied pre-plant
	High-17.4 acre inches applied May-September
	Medium-11.9 acre inches applied May-September
	Low-6.49 acre inches applied May-September
	Dryland-9.1 inches rainfall May-September
Insecticide:	Temik @ 4 lbs/A at planting
Growth Regulator:	Pentia @ 8 oz/A applied July 24
Harvest Date:	December 19
Freeze Date:	October 23

Results:

In general, cultivars that had higher overall yield average had lower genotype x environment response, indicating they performed relatively well under all water treatments. All-Tex Summit B2RF performed better under water stress than it did under full irrigation and PhytoGen 425 RF performed relatively better under full irrigation. Full detailed results with fiber data and other agronomic properties are available in Texas AgriLife Research Technical Report No. 09-2.

		High		Medium		Low		Dry		
Variety	OverAll	Yield	Rank	Yield	Rank	Yield	Rank	Yield	Rank	GxE
FiberMax FM 1740B2RF	754	916	3	884	3	790	5	424	3	3084
FiberMax FM 9058F	737	1053	1	827	8	639	13	428	2	5853
Stoneville ST 4664F	734	857	11	886	2	710	8	484	1	6826
NexGen NG 1527 RF	712	859	10	795	12	837	1	357	8	7946
AFD 5064F	686	936	2	791	13	816	4	202	23	13032
Stoneville ST 4427B2RF	686	874	7	894	1	714	7	262	15	15056
Deltapine DP 104 B2RF	666	897	4	758	17	721	6	287	12	11887
Dyna-Gro DG 2242B2RF	664	784	16	811	9	645	10	417	4	15075
Stoneville ST 4554B2RF	658	860	9	796	11	626	15	351	9	13632
Americot AM 1532 B2RF	656	819	12	870	4	534	21	402	5	19233
FiberMax FM 9063B2RF	645	883	6	780	15	639	14	279	13	15390
Paymaster PM 2141 B2RF	644	872	8	684	20	824	2	196	24	19996
AFD 5065B2F	629	776	17	665	21	821	3	252	17	22906
Dyna-Gro DG 2570B2RF	625	673	24	856	5	642	12	329	10	25986
Americot AM 1622 B2RF	622	795	14	737	18	559	19	398	6	21986
Deltapine DP 121 RF	622	791	15	810	10	567	18	321	11	21896
PhytoGen PHY 425 RF	620	891	5	837	6	508	23	245	19	24356
Americot AM 1664 B2RF	608	801	13	828	7	584	16	220	20	25195
All-Tex AT Marathon B2RF	605	732	22	783	14	646	9	260	16	25252
All-Tex AT Summit B2RF	603	762	20	629	23	642	11	380	7	25468
PhytoGen PHY 485 WRF	601	772	18	774	16	582	17	274	14	25310
Deltapine DP 164 B2RF	562	755	21	719	19	522	22	250	18	34176
All-Tex AT Arid B2RF	546	763	19	662	22	544	20	215	22	37016
Deltapine DP 143 B2RF	488	704	23	591	24	441	24	216	21	55281

Cotton Variety Performance as Affected by LEPA Irrigation Levels, 2008

Wayne Keeling, James P. Bordovsky, Randy Boman, Terry Wheeler, Jacob Reed, and Michael Petty.

Methodology:

Plot sizes were 4 rows by 700 to 1300 feet with 4 replications. Plant stands were counted for 35 ft. of row and incidence of plants with Verticillium wilt were measured on 22 Aug for three locations within each plot (35 ft. of row at each location). Additional production data is given in the appendix (F5f, spans 5-8).

Results:

Cotton lint yields ranged from 624-976 lbs/A. When averaged across irrigation treatments, highest yields were produced with FM 9063 B2RF. When averaged across varieties, similar yields were produced with the low and medium (base) irrigation treatments, while yields were reduced with the high irrigation treatment (Table 1). Highest loan values were achieved with FM 9063 B2RF, while increasing irrigation level reduced fiber quality and loan values (Table 2) and gross revenue values per acre (not shown). Verticillium wilt incidence was affected by irrigation rate, but not by variety or their interaction. The low, medium (base), and high irrigation rates had incidences of wilt of 0.1, 9.1, and 14.5%, respectively. The soil population density of *V. dahliae* (the fungus that causes Verticillium wilt) in 2008 had more samples with higher densities of the fungus at the medium and high irrigation rates than the low irrigation rate (Fig. 1). However, in Jan. of 2009, the density of the fungus was similar across all irrigation rates (Fig. 1). This suggests that the differences in wilt observed during the 2008 season were due to environmental effects (i.e. irrigation rate) and not because of different levels of the fungus in the soil. Apparently enough propagules of the fungus are forming under all irrigation treatments to lead to substantial disease, but only the medium and high irrigation rates are creating an environment where substantial disease actually occurs. With lower yield and quality reductions in the medium and high irrigation rates, FM 9063 B2RF has been shown to tolerate verticillium wilt better than ST 4554 B2RF, AM 1664 B2RF, and DP 117 B2RF.

Table 1. Effects of RRF/BGII variety and LEPA irrigation levels on cotton lint yields at Helms Farm, Halfway, TX, 2008.

Variety	L	M	H	Avg.
	----------lbs lint/A----------			
ST 4554 B2RF	837	743	412	664 B
AM 1664 B2RF	757	785	484	676 B
DP 117 B2RF	624	687	431	581 B
FM 9063 B2RF	881	976	567	808 A
	775 a	798 a	474 b	

Table 2. Effects of RRF/BGII variety and LEPA irrigation levels on cotton lint values at Helms Farm, Halfway, TX, 2008

Variety	L	M	H	Avg.
	----------¢/lb----------			
ST 4554 B2RF	47.99	41.69	38.55	42.74 B
AM 1664 B2RF	46.05	42.46	38.36	42.29 B
DP 117 B2RF	45.04	40.46	39.71	41.74 B
FM 9063 B2RF	50.04	41.18	43.28	46.16 A
	47.28 a	42.45 b	39.98 b	

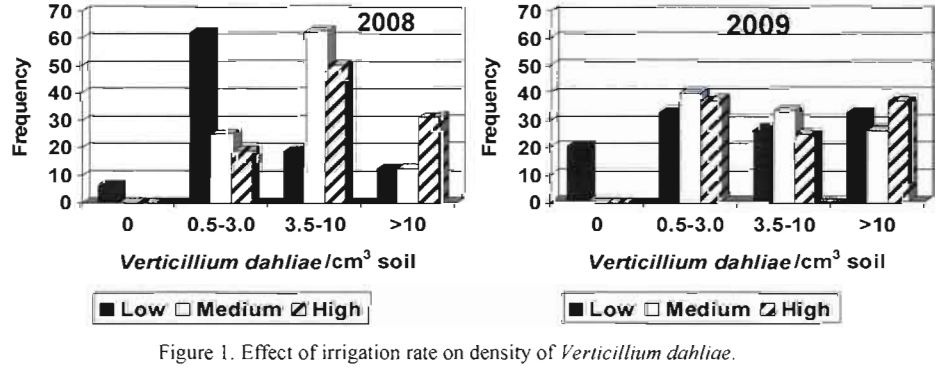


Figure 1. Effect of irrigation rate on density of *Verticillium dahliae*.

Cotton Variety Performance as Affected by Subsurface Drip Irrigation (SDI) Levels at Helms Farm, Halfway, TX, 2008

Wayne Keeling, James P. Bordovsky, Randy Boman, Jacob Reed, and Michael Petty

Figure 1. SDI plots being harvested, Helms Farm, 2008.

Methodology:

Plot Sizes were 4 rows by 1600 feet with 3 replications, the planting date was May 12 and harvest date was December 18. Additional production data is given in the appendix (F6a, zones a-f).

Results:

Four Roundup Ready Flex/Bollgard II varieties were planted in two SDI irrigation levels. Cotton lint yields ranged from 1084 to 1647 lbs/A (Table 1). When averaged across irrigation levels, highest yields were produced with FM 9063 B2RF. Similar yields were produced with the other three varieties. When averaged across varieties, lower yields were produced with the high irrigation treatment. Highest loan values and gross revenues were also produced with FM 9063 B2RF (Tables 2 and 3).

Table 1. Effects of variety and SDI irrigation levels on cotton lint yields at Helms Farm, Halfway, TX, 2008.

Variety	M	H	Avg.
		----------lbs lint/A----------	
ST 4554 B2RF	1559	1112	1335 b
AM 1664 B2RF	1497	1222	1360 b
DP 117 B2RF	1317	1084	1201 b
FM 9063 B2RF	1647	1528	1587 a
	1505 a	1236 b	

Table 2. Effects of variety and SDI irrigation levels on cotton lint values at Helms Farm, Halfway, TX, 2008.

Variety	M	H	Avg.
		----------¢/lb----------	
ST 4554 B2RF	49.63	49.83	45.63 b
AM 1664 B2RF	47.88	45.47	46.68 b
DP 117 B2RF	46.35	47.58	46.97 b
FM 9063 B2RF	51.95	41.63	50.89 a
	48.95 a	46.13 b	

Table 3. Effects of variety and SDI irrigation levels on gross revenues at Helms Farm, Halfway, TX, 2008.

Variety	M	H	Avg.
		-------gross return $/A-------	
ST 4554 B2RF	772	461	616 b
AM 1664 B2RF	713	556	635 b
DP 117 B2RF	611	516	564 b
FM 9063 B2RF	851	759	805 a
	737 a	573 b	

Cotton Performance as Affected by Seeding Rate at Helms Farm, Halfway, TX, 2008
Wayne Keeling, James P. Bordovsky, Randy Boman, Jacob Reed, and Michael Petty.

Methodology:
Plot sizes were 4 rows by 1600 feet with three replications, varieties were Stoneville 4554 B2RF and FiberMax 9063 B2RF, planting date was May 12 and harvest date was December 18. Additional production data is given in the appendix (F6a, zones a-f).


Figure 1. SDI plots, Helms Farm, 2008.

Results:
Two varieties were planted at three seeding rates under two SDI irrigation levels. Seeding rates were 32, 56, and 80 thousand seeds/A with final plant populations of 27, 42 and 54 thousand plants/A respectively. This represented survival rates of 84, 75, and 67% for the three seeding rates. There was a trend towards high yields with increased seeding rates (Table 1). Little difference in cotton lint value was observed between seeding rates (Table 2). Gross revenues tend to be maximized at the highest seeding rate (Table 3).

Table 1. Effects of plant population and SDI irrigation levels on cotton lint yields at Helms Farm, Halfway, TX, 2008.

Variety	32 (27K)	56 (42K)	80 (54K)
		----------lbs lint/A----------	
FM 9063 B2RF Med Irrigation	1657	1647	1782
FM 9063 B2RFHigh Irrigation	1313	1528	1647
ST 4554 B2RFMed Irrigation	1274	1559	1611
ST 4554 B2RFHigh Irrigation	987	1112	1289
	1337 a	1461 a	1582 a

Table 2. Effects of plant population and SDI irrigation levels on cotton lint values at Helms Farm, Halfway, TX, 2008.

Variety	32 (27K)	56 (42K)	80 (54K)
		----------¢/lb----------	
FM 9063 B2RF Med Irrigation	52.52	51.95	51.52
FM 9063 B2RFHigh Irrigation	50.78	49.83	49.35
ST 4554 B2RFMed Irrigation	45.53	49.63	49.43
ST 4554 B2RFHigh Irrigation	40.33	41.63	43.98
	47.92 a	48.26 a	48.57 a

Table 3. Effects of plant population and SDI irrigation levels on gross revenues at Helms Farm, Halfway, TX, 2008.

Variety	32 (27K)	56 (42K)	80 (54K)
		-------gross return $/A-------	
FM 9063 B2RF Med Irrigation	864	851	915
FM 9063 B2RFHigh Irrigation	667	759	809
ST 4554 B2RFMed Irrigation	580	772	796
ST 4554 B2RFHigh Irrigation	399	461	567
	648 a	711 a	772 a

Effect of Different Rates of the Soil Amendment ZEBA on Germination and Cotton Yield with Subsurface Drip Irrigation

Andy M. Cranmer, James P. Bordovsky, Joe T. Mustian, and Doug M. Nesmith

Objective: The goal of this project was to evaluate the effect on cottonseed germination and final lint yield of different rates of the soil amendment Zeba in fields irrigated with SDI in the Texas High Plains.

Materials and Methods: The soil amendment Zeba™ (Absorbent Technologies, Inc., Beaverton, Oregon) is a superabsorbent polymer derived from natural cornstarch that absorbs up to 400 times its original weight in water. The amendment was applied prior to planting using the insecticide boxes of an eight row planter. Treatments included application rates of 3.2, 6.9, and 10.8 lbs/ac and an untreated check. TDR sensors were installed in the seed bed perpendicular to the soil surface at 3 locations in each treatment plot. Wetting of seedbeds was with irrigation and rainfall. Volumetric soil water content was measured from May through September.

Results: Early seasonal rainfall masked potential differences in cottonseed germination that may have been caused by treatments. The average change in volumetric soil water content (VWC) for each treatment is shown in Figure 1. VWC of all treatments followed the same pattern and the rate of sensor wetting (and drying) was not significantly affected by the Zeba application rates. The periods of peak VWC were the result of rainfall events in the month of August. The untreated check resulted in a cotton lint yield of 1576 lbs/acre compared to the three rates of Zeba with treatment yields of 1456, 1681, and 1701 lbs/acre, respectively (Fig 2). Additional evaluations using combinations of soil amendments and tillage methods will be conducted.

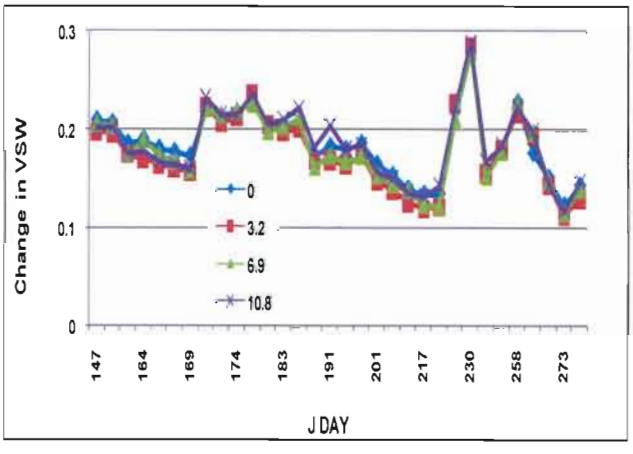


Fig. 1. Changes in volumetric soil water due to SDI irrigation and rainfall sensed by TDR probes up to 8" deep in the seedbed.

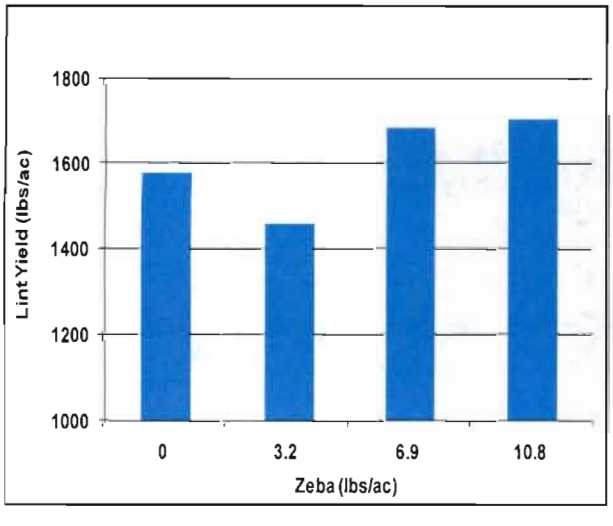


Fig 2. Effects of pre-plant Zeba application rates on cotton lint yield, 2008.

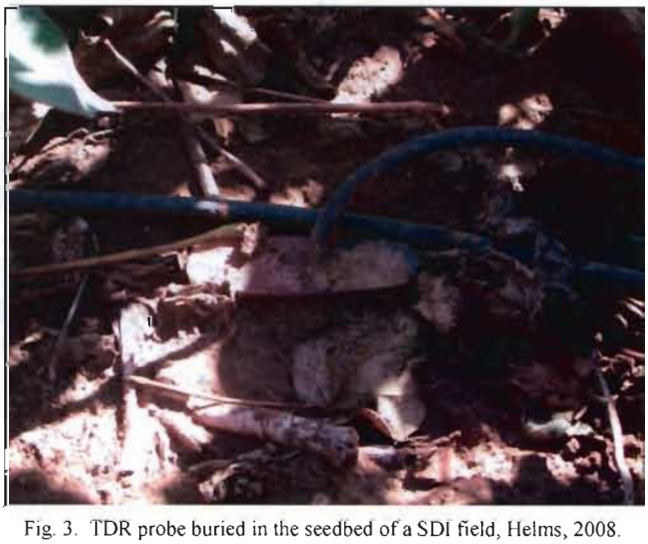


Fig. 3. TDR probe buried in the seedbed of a SDI field, Helms, 2008.

Influence of Soil Nitrogen Level on Seasonal Activity of Cotton Arthropods and Lint Yield under Drip Irrigation

M. N. Parajulee, S. C. Carroll, R. J. Kesey, D. M. Nesmith, and J. P. Bordovsky

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

Methodology: Experimental plots of FM 960B2R cotton were planted on May 13, 2008 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 side-dress applications of nitrogen fertilizer at rates 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 July 14 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 reach treatment threshold in 2008. Thrips densities averaged <1 thrips/plant and did not vary among nitrogen treatments. *Lygus* bug and fleahopper densities also remained much below economic thresholds. Cotton aphid populations did not develop despite repeated attempts to enhance the population by spraying cyhalothrin in late August. After five years of continuous application of variable rate of N, residual N levels varied significantly between the 200 lbs/A and lower nitrogen level (<100 lbs/A) treatments (Fig. 1). The two highest N treatments had similar amounts of residual N. Plots with 150 lbs/A N had consistently the highest root length, plant height, and leaf size.

Variation in residual N levels coupled with variable N application resulted in phenotypic expression of nitrogen deficiency in cotton across treatment plots, especially between zero-N plots and N-applied plots. The zero-N plots produced the lowest yield (1,236 lbs/A) and the yield increased curvilinearly with each additional 50 lbs of added N with numerically highest yield (1,742 lbs/A) at 150 lbs/A (Fig. 2).

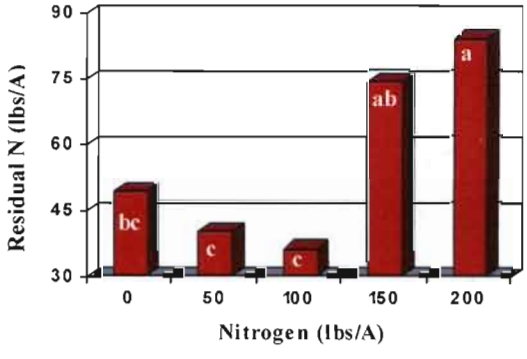


Fig. 1. Effect of nitrogen application rates on residual nitrogen after six years of repetitive applications, 2008.

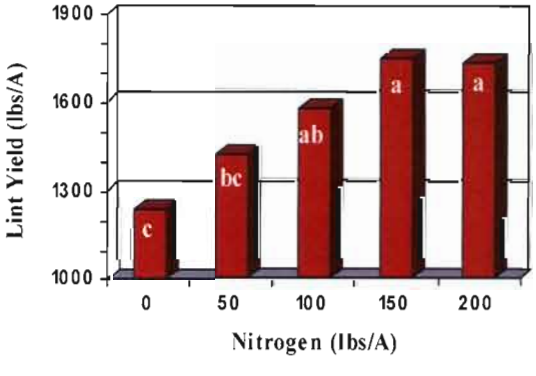


Fig. 2. Effect of nitrogen application rates on lint yields after six years of repetitive applications, 2008.

Tillage Evaluations to Improve Germination with Subsurface Drip Irrigation

Andy M. Cranmer, James P. Bordovsky, Joe T. Mustian, and Doug M. Nesmith

Objective: Achieving uniform cottonseed germination during planting periods of low rainfall and high air temperatures and wind speeds has been a major challenge when using subsurface drip irrigation (SDI) in the Texas High Plains. A field experiment evaluating two tillage methods was conducted in an attempt to improve soil surface wetting and germination with SDI.

Fig. 1. Strip tillage implement

Materials and Methods: Two tillage methods were evaluated to determine their effect on seed zone wetting with SDI. The treatments were land preparation using strip tillage (ST) and the combination of a Paratill™ (PT, Bigham Brothers, Lubbock, TX) and ST. A non-treated check was also evaluated. All treatments were applied within each of four blocks resulting in 12 plots. Twelve days after tillage, Time Domain Reflectometry (TDR) sensors were installed in each treatment plot. Sensors were placed at seed-drill locations in the top-center of the 30-in beds at depths of 2 and 6 inches below the soil surface. A 10 ft x 10 ft rainout shelter was placed over each treatment area, irrigations were initiated, and soil volumetric water content (VWC) for each treatment determined.

Results: Neither the ST nor the PT&ST treatment resulted in faster wetting of the seed germination area than did the non-tilled check. The time to wet soil sensors from irrigation initiation, the average VWC from sensor wetting to irrigation termination and the increase in VWC due to irrigation at TDR locations is shown in Table 1. Each treatment wetted the seed germination zones very rapidly, within a 3-day period. At the 2" sensor location, the increase in measured soil VWC over the irrigation period was much larger for the check treatment at 0.14 cm/cm than the ST and PT&ST treatments at 0.063 and 0.051 cm/cm, respectively. Also the average VWC after irrigation was much higher for the check treatment at 0.240 cm/cm than the ST and PT&ST treatments at 0.13 cm/cm and 0.125 cm/cm, respectively. These results were partially due to poorer soil to sensor contact in the tillage treatments compared to the check treatment. Protocol modifications may provide more meaningful results in the future.

Table 1. Time required to wet sensors from irrigation initiation, average VWC from sensor wetting to irrigation termination, and the increase in VWC due to irrigation at given TDR sensors locations in plots at Texas AgriLife Research, Halfway, TX, 2008.

	Sensor Depth	Check	Strip Till	Para & Strip Till	Average
Time to Wet Sensor (days)	2"	3.0	3.0	3.0	3.0
	6"	3.0	3.0	3.0	3.0
		3.0	3.0	3.0	
Average VWC during irrigation, day 233 to 252 (cm/cm)	2"	0.240	0.130	0.125	0.165
	6"	0.260	0.135	0.170	0.188
		0.250	0.133	0.148	
Increase in measured VWC due to irrigation (cm/cm)	2"	0.140	0.063	0.051	0.085
	6"	0.090	0.061	0.050	0.067
		0.115	0.062	0.051	

Farm Scale Yield Comparisons of Subsurface Drip Irrigation to Center Pivot Irrigation
James P. Bordovsky and Doug Nesmith

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

Methodology: Interest in subsurface drip continues as water availability decreases and opportunities for cost share assistance for water conserving irrigation equipment remains available. The question of cotton production using SDI verse pivot is continually asked. The Helms Research Farm at Halfway provides a unique, controlled environment that sheds light on this question. The problems not normally encountered in small plot research, such as limited irrigation water, inconsistent soils, and/or challenging topography, are reflected in results while irrigating with SDI and LEPA systems over the 2002 to 2008 growing seasons. Details of SDI and LEPA irrigation experiments are contained elsewhere within this document. This individual report contains average commercial cotton gin yields and irrigation amounts used to achieve those yields with respective irrigation systems.

Results: Lack of early season rainfall and typical high winds and low humidity at planting have caused cotton germination problems in SDI areas in some 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, 2005 and 2008 due to cool, wet weather at planting, hail, and short growing season, respectively. Overall cotton yields have been fairly high. SDI yields averaged 1328 lb/ac using 14.7 inches compared to LEPA yields of 1128 lb/ac using an average of 11.7 inches of total annual irrigation. Drip yields from various experiments ranged from over 2400 to 0 lb/acre. LEPA yields ranged within 600 to 2000 lb/acre.

Table 1. Commercial cotton gin lint yield and total irrigation water delivered by SDI and LEPA irrigation systems at Helms, 2002-2008. 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
2007	55.3	8.95	1642	104	8.06	1232
2008	71.3	18.13	1335	93	15.13	909
Avg.		14.67	1328		11.65	1128

APPENDIX

Helms Irrigation Amounts and Seasonal Rainfall

Rainfall (inches) Helms Irrigation Amounts (inches) D= drip irrigation, L = LEPA irrigation, S = spray irrigation, F= furrow water

Date			Rainfall (inches)		Helms Irrigation Amounts (inches)																					
			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	Cotton				Cotton	Cotton			
Mo	Da	Yr			T 1	T 2	T 3	system	T1-6	Border		Base	Base+50%	Base-50%	system		Base	Base+50%	Base-50%	system		Base	Base+50%	Base-50%	system
2	16	2008	0.71	0.71																					
3	18	2008																							
3	19	2008							0.54	0.54															
3	20	2008							0.54	0.54															
3	21	2008																							
3	22	2008																							
3	23	2008																							
3	24	2008							0.54	0.54	0.45	0.45	0.45	0.45	L	0.45	0.45	0.45	0.45	L	0.45	0.45	0.45	0.45	L
3	25	2008							0.54	0.54	0.45	0.45	0.45	0.45	L	0.45	0.45	0.45	0.45	L	0.45	0.45	0.45	0.45	L
3	26	2008							0.42	0.42	0.45	0.45	0.45	0.45	L	0.45	0.45	0.45	0.45	L	0.45	0.45	0.45	0.45	L
3	27	2008									0.45	0.45	0.45	0.45	L	0.45	0.45	0.45	0.45	L	0.45	0.45	0.45	0.45	L
3	28	2008									0.45	0.45	0.45	0.45	L	0.45	0.45	0.45	0.45	L	0.45	0.45	0.45	0.45	L
3	31	2008			8.00 '	8.00 '	8.00 '	F																	
4	9	2008	0.23	0.21																					
4	14	2008																							
4	17	2008																							
4	18	2008																							
4	19	2008																							
4	20	2008							0.43	0.43															
4	21	2008			0.27	0.27	0.27	D	0.33	0.33															
4	22	2008			0.24	0.24	0.24	D	0.23	0.23															
4	23	2008			0.23	0.23	0.23	D	0.36	0.36															
4	24	2008			0.22	0.22	0.22	D	0.23	0.23															
4	25	2008			0.35	0.35	0.35	D	0.21	0.21															
4	26	2008			0.29	0.29	0.29	D	0.21	0.21															
4	27	2008			0.29	0.29	0.29	D	0.21	0.21															
4	28	2008			0.31	0.31	0.31	D	0.22	0.22	0.33	0.33	0.33	0.33	S	0.33	0.33	0.33	0.33	S	0.33	0.33	0.33	0.33	S
4	29	2008			0.29	0.29	0.29	D	0.21	0.21	0.33	0.33	0.33	0.33	S	0.33	0.33	0.33	0.33	S	0.33	0.33	0.33	0.33	S
4	30	2008			0.29	0.29	0.29	D	0.21	0.21	0.33	0.33	0.33	0.33	S	0.33	0.33	0.33	0.33	S	0.33	0.33	0.33	0.33	S
5	1	2008			0.36	0.36	0.36	D	0.21	0.21															
5	2	2008							0.21	0.21															
5	3	2008							0.21	0.21															
5	4	2008							0.21	0.21															
5	5	2008	0.92	1.04					0.21	0.21															
5	6	2008	1.51	1.10																					
5	7	2008	0.07	0.04																					
5	8	2008																							
5	9	2008																							
5	10	2008																							
5	11	2008																							
5	12	2008																							
5	13	2008																							
5	14	2008	0.65	0.47																					
5	17	2008																							
5	18	2008																							
5	19	2008																							
5	20	2008																							
5	21	2008																							
5	22	2008									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	23	2008									0.30	0.30	0.30	0.30	S	0.20	0.20	0.20	0.20	S	0.20	0.20	0.20	0.20	S
5	24	2008																							
5	25	2008																							
5	26	2008																							
5	27	2008																							

Helms Irrigation Amounts and Seasonal Rainfall

Rainfall (inches) | Helms Irrigation Amounts (inches) D= drip irrigation, L = LEPA irrigation, S = spray irrigation, F= furrow water

Date			Rainfall (inches)		Helms Irrigation Amounts (inches)																					
			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	Cotton				Cotton	Cotton			
Mo	Da	Yr			T 1	T 2	T 3	system	T1-6	Border			Base	Base+50%	Base-50%	system		Base	Base+50%	Base-50%	system		Base	Base+50%	Base-50%	system
5	28	2008																								
5	29	2008																								
5	30	2008																								
5	31	2008																								
6	1	2008																								
6	2	2008																								
6	5	2008																								
6	8	2008																								
6	9	2008			0.30	0.47	0.31	D	0.34	0.28																
6	10	2008			0.29	0.47	0.30	D	0.34	0.23																
6	11	2008			0.31	0.09	0.29	D	0.35	0.23																
6	12	2008			0.15	0.08	0.14	D																		
6	13	2008										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
6	14	2008																								
6	15	2008																								
6	16	2008			0.08	0.07	0.07	D																		
6	17	2008	0.09	0.10																						
6	18	2008	0.04	0.04					0.06	0.04																
6	19	2008	0.60	0.73	0.31	0.29	0.30	D	0.34	0.19																
6	20	2008																								
6	21	2008																								
6	22	2008	0.41	0.45																						
6	23	2008	0.18	0.50																						
6	24	2008	0.55	0.75																						
6	25	2008																								
6	26	2008																								
6	27	2008																								
6	28	2008																								
6	29	2008	0.15	0.10																						
6	30	2008			0.30	0.28	0.29	D	0.33	0.19		0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
7	1	2008			0.31	0.29	0.30	D	0.35	0.19		0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
7	2	2008			0.30	0.28	0.28	D	0.34	0.18		0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
7	3	2008			0.32	0.29	0.3	D	0.36	0.18		0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
7	4	2008										0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
7	5	2008																								
7	6	2008																								
7	7	2008			0.31	0.26	0.30	D	0.34	0.18		0.20	0.20	0.30	0.10		0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
7	8	2008	0.36	0.40	0.31	0.39	0.30	D	0.28	0.18		0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
7	9	2008			0.31	0.39	0.30	D	0.38	0.18		0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
7	10	2008										0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
7	11	2008										0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
7	12	2008																								
7	13	2008	0.35	0.37																						
7	14	2008										0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
7	15	2008	0.26	0.31								0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
7	16	2008			0.32	0.20	0.31	D	0.36	0.18		0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
7	17	2008			0.30	0.19	0.30	D	0.34	0.18		0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
7	18	2008			0.28	0.26	0.28	D	0.28	0.18		0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
7	19	2008			0.33	0.31	0.33	D	0.40	0.18		0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
7	20	2008										0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
7	21	2008										0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
7	22	2008			0.32	0.30	0.30	D	0.35	0.18		0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
7	23	2008			0.29	0.28	0.30	D	0.33	0.18		0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
7	24	2008			0.32	0.29	0.30	D	0.35	0.18		0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
7	25	2008			0.34	0.31	0.33	D	0.38	0.18		0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
7	26	2008										0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L

Helms Irrigation Amounts and Seasonal Rainfall

Rainfall (inches) — Helms Irrigation Amounts (inches) D= drip irrigation, L = LEPA irrigation, S = spray irrigation, F= furrow water

Date			Rainfall (inches)		Helms Irrigation Amounts (inches)																				
			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	Cotton				Cotton	Cotton			
Mo	Da	Yr			T 1	T 2	T 3	system	T1-6	Border		Base	Base+50%	Base-50%	system		Base	Base+50%	Base-50%	system		Base	Base+50%	Base-50%	system
7	27	2008									0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
7	28	2008			0.31	0.40	0.31	D	0.35	0.18	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
7	29	2008			0.30	0.20	0.30	D	0.34	0.18	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
7	30	2008			0.31	0.38	0.30	D	0.34	0.18	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
7	31	2008			0.18	0.28	0.32	D	0.33	0.18	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
8	1	2008			0.44	0.29	0.40	D	0.34	0.18	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
8	2	2008			0.27	0.25	0.25	D	0.34	0.18	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
8	3	2008			0.27	0.25	0.25	D	0.34	0.18	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
8	4	2008			0.31	0.29	0.30	D	0.34	0.18	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
8	5	2008			0.31	0.30	0.31	D	0.34	0.18	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
8	6	2008			0.29	0.27	0.28	D	0.32	0.18	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
8	7	2008			0.31	0.30	0.31	D	0.35	0.18	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
8	8	2008									0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
8	9	2008									0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
8	10	2008	0.34	1.37							0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
8	11	2008									0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L
8	12	2008			0.41	0.39	0.30	D	0.34	0.18															
8	13	2008			0.20	0.22	0.31	D	0.34	0.18															
8	14	2008	0.58	0.65	0.21	0.40	0.30	D	0.34	0.18															
8	15	2008	0.63	0.95																					
8	16	2008																							
8	17	2008	1.14	0.61																					
8	18	2008																							
8	19	2008				0.11	0.11	D	0.10	0.12															
8	20	2008				0.10	0.11	D	0.10	0.10															
8	21	2008				0.11	0.11	D	0.11	0.11															
8	22	2008				0.11	0.11	D	0.11	0.11	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	23	2008				0.11	0.11	D	0.10	0.09															
8	24	2008				0.07	0.12	D	0.10	0.09															
8	25	2008				0.17	0.11	D	0.10	0.20	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	26	2008				0.20	0.13	D	0.10	0.10	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	27	2008				0.20	0.21	D	0.10	0.11	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	28	2008				0.20	0.21	D	0.10	0.10	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	29	2008	0.08	0.10		0.20	0.21	D	0.10	0.10	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	30	2008				0.20	0.21	D	0.12	0.10															
8	31	2008				0.20	0.21	D	0.09	0.10															
9	1	2008				0.02	0.16	D	0.15	0.11	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
9	2	2008					0.18	D	0.16	0.08	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
9	3	2008					0.19	D	0.16	0.08	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
9	4	2008					0.12	D	0.14	0.07	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
9	5	2008									0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
9	6	2008																							
9	9	2008	0.48	0.71																					
9	11	2008	0.05	0.09																					
9	12	2008	0.90	0.90																					
9	20	2008																							
9	10	2008																							
9	11	2008																							
9	12	2008																							
9	13	2008																							
9	14	2008																							
9	15	2008																							
9	16	2008					0.17	D	0.15	0.09															
9	17	2008					0.17	D	0.17	0.11															
9	18	2008					0.17	D	0.16	0.08															
9	19	2008																							
Pre & At Plant					11.14	11.14	11.14		6.48	6.48	3.24	3.24	3.24	3.24		3.24	3.24	3.24	3.24		3.24	3.24	3.24	3.24	
Seasonal					10.22	12.01	13.29		13.77	8.26	11.92	11.92	17.36	6.49		11.82	11.82	17.26	6.39		11.82	11.82	17.26	6.39	
TOTALS			11.28	12.70	21.36	23.15	24.43		20.25	14.74	15.16	15.16	20.60	9.73		15.06	15.06	20.50	9.63		15.06	15.06	20.50	9.63	

[1]Furrow watered for a week to apply 8.00"

Helms Irrigation Amounts and Seasonal Rainfall

			Rainfall (inches)		Helms Irrigation Amounts (inches) L = LEPA irrigation, S = spray irrigation																				
	Date		Halfway @ Building	Helms @ Well 1	Field 5 - D spans 2-4	Field 5 - D spans 5-8				Field 5 - E spans 2-4	Field 5 - E spans 5-8				Field 5 - F spans 2-4	Field 5 - F spans 5-8				Field 6 - A,C,F	Field 6 - B,D,E	Field 6 - DRY	Field 6 - G	Field 6 - H
					Pivot	Pivot				Pivot	Pivot				Pivot	Pivot				Drip	Drip		Drip	Drip
					Sorghum	Sorghum				Cotton	Cotton				Cotton	Cotton				Cotton	Cotton		Cotton	Cotton
Mo	Da	Yr				Base	Base+50%	Base-50%	system		Base	Base+50%	Base-50%	system		Base	Base+50%	Base-50%	system	1.0 B.I.	0.5 B.I.			
2	16	2008	0.71	0.71																					
3	18	2008																							
3	19	2008																		0.34	0.34				
3	20	2008																		0.34	0.34				
3	21	2008																		0.34	0.34				
3	22	2008																		0.34	0.34				
3	23	2008																		0.26	0.26				
3	24	2008			0.45	0.45	0.45	0.45	L	0.45	0.45	0.45	0.45	L	0.45	0.45	0.45	0.45	L						
3	25	2008			0.45	0.45	0.45	0.45	L	0.45	0.45	0.45	0.45	L	0.45	0.45	0.45	0.45	L						
3	26	2008			0.45	0.45	0.45	0.45	L	0.45	0.45	0.45	0.45	L	0.45	0.45	0.45	0.45	L						
3	27	2008			0.45	0.45	0.45	0.45	L	0.45	0.45	0.45	0.45	L	0.45	0.45	0.45	0.45	L						
3	28	2008			0.45	0.45	0.45	0.45	L	0.45	0.45	0.45	0.45	L	0.45	0.45	0.45	0.45	L						
3	31	2008																							
4	9	2008	0.23	0.21																					
4	14	2008																							
4	17	2008																		0.16	0.16		1.05	0.98	
4	18	2008																		0.17	0.17		1.06	1.03	
4	19	2008																							
4	20	2008																							
4	21	2008																		0.31	0.31				
4	22	2008																		0.32	0.32				
4	23	2008																		0.31	0.31				
4	24	2008																					0.91	0.86	
4	25	2008																		0.18	0.18				
4	26	2008																		0.24	0.24		0.22	0.36	
4	27	2008																		0.31	0.31		0.35	0.33	
4	28	2008			0.33	0.33	0.33	0.33	S	0.33	0.33	0.33	0.33	S	0.33	0.33	0.33	0.33	S	0.32	0.32		0.35	0.33	
4	29	2008			0.33	0.33	0.33	0.33	S	0.33	0.33	0.33	0.33	S	0.33	0.33	0.33	0.33	S	0.31	0.31		0.35	0.33	
4	30	2008			0.33	0.33	0.33	0.33	S	0.33	0.33	0.33	0.33	S	0.33	0.33	0.33	0.33	S	0.31	0.31		0.35	0.33	
5	1	2008																		0.31	0.31		0.35	0.33	
5	2	2008																		0.32	0.32		0.35	0.33	
5	3	2008																		0.31	0.31		0.35	0.33	
5	4	2008																		0.30	0.30		0.35	0.32	
5	5	2008	0.92	1.04																0.30	0.30		0.35	0.33	
5	6	2008	1.51	1.10																					
5	7	2008	0.07	0.04																					
5	8	2008																							
5	9	2008																							
5	10	2008																							
5	11	2008																							
5	12	2008																							
5	13	2008																							
5	14	2008	0.65	0.47																					
5	17	2008																							
5	18	2008																							
5	19	2008																							
5	20	2008																							
5	21	2008																							
5	22	2008			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	23	2008								0.20	0.20	0.20	0.20	S	0.30	0.30	0.30	0.30	S						
5	24	2008																							
5	25	2008																							
5	26	2008																							
5	27	2008																							

Helms Irrigation Amounts and Seasonal Rainfall

Date			Rainfall (inches)		Helms Irrigation Amounts (inches) L = LEPA irrigation, S = spray irrigation																				
			Halfway @ Building	Helms @ Well 1	Field 5 - D spans 2-4	Field 5 - D spans 5-8				Field 5 - E spans 2-4	Field 5 - E spans 5-8				Field 5 - F spans 2-4	Field 5 - F spans 5-8				Field 6 - A,C,F	Field 6 - B,D,E	Field 6 - DRY	Field 6 - G	Field 6 - H
					Pivot	Pivot				Pivot	Pivot				Pivot	Pivot				Drip	Drip		Drip	Drip
					Sorghum	Sorghum				Cotton	Cotton				Cotton	Cotton				Cotton	Cotton		Cotton	Cotton
Mo	Da	Yr				Base	Base+50%	Base-50%	system		Base	Base+50%	Base-50%	system		Base	Base+50%	Base-50%	system	1.0 B.I.	0.5 B.I.			
5	28	2008																							
5	29	2008																							
5	30	2008			0.50	0.50	0.50	0.50	S																
5	31	2008																							
6	1	2008																							
6	2	2008			0.25	0.25	0.25	0.25	S																
6	5	2008																							
6	8	2008																							
6	9	2008																		0.47	0.09		0.49	0.27	
6	10	2008																		0.26	0.32		0.39	0.55	
6	11	2008																							
6	12	2008																		0.54	0.11		0.56	0.31	
6	13	2008			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	0.12	0.17				
6	14	2008																							
6	15	2008																							
6	16	2008																							
6	17	2008	0.09	0.10																					
6	18	2008	0.04	0.04																					
6	19	2008	0.60	0.73																0.53	0.07			0.80	
6	20	2008																			0.16				
6	21	2008																							
6	22	2008	0.41	0.45																					
6	23	2008	0.18	0.50																					
6	24	2008	0.55	0.75																					
6	25	2008																							
6	26	2008																							
6	27	2008																							
6	28	2008																							
6	29	2008	0.15	0.10																					
6	30	2008			0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.56	0.03		0.35	0.47	
7	1	2008			0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.23	0.35		0.58	0.35	
7	2	2008			0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.55	0.04		0.26	0.50	
7	3	2008			0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.24	0.36		0.58	0.38	
7	4	2008			0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L						
7	5	2008																							
7	6	2008																							
7	7	2008			0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10		0.20	0.20	0.30	0.10		0.25	0.35		0.36	0.47	
7	8	2008	0.36	0.40	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.54	0.05		0.49	0.38	
7	9	2008			0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.24	0.34		0.28	0.49	
7	10	2008			0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L						
7	11	2008			0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L						
7	12	2008																							
7	13	2008	0.35	0.37																					
7	14	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L						
7	15	2008	0.26	0.31	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L						
7	16	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.54	0.05		0.57	0.38	
7	17	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.24	0.34		0.36		
7	18	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L						
7	19	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.01			0.01		
7	20	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.50	0.02		0.47	0.39	
7	21	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.22	0.35		0.24	0.48	
7	22	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.56	0.04		0.60	0.38	
7	23	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.22	0.35		0.24	0.48	
7	24	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.56	0.04		0.60	0.36	
7	25	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.25	0.38		0.34	0.49	
7	26	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L						

Helms Irrigation Amounts and Seasonal Rainfall

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

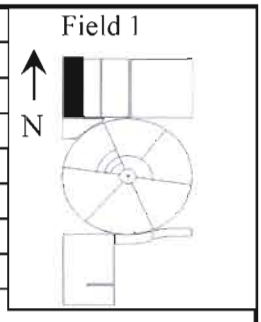
Date			Halfway @ Building	Helms @ Well 1	Field 5 - D spans 2-4	Field 5 - D spans 5-8				Field 5 - E spans 2-4	Field 5 - E spans 5-8				Field 5 - F spans 2-4	Field 5 - F spans 5-8				Field 6 - A,C,F	Field 6 - B,D,E	Field 6 - DRY	Field 6 - G	Field 6 - H
					Pivot	Pivot				Pivot	Pivot				Pivot	Pivot				Drip	Drip		Drip	Drip
					Sorghum	Sorghum				Cotton	Cotton				Cotton	Cotton				Cotton	Cotton		Cotton	Cotton
Mo	Da	Yr				Base	Base+50%	Base-50%	system		Base	Base+50%	Base-50%	system		Base	Base+50%	Base-50%	system	1.0 B.I.	0.5 B.I.			
7	27	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L					
7	28	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.57	0.05		0.52	0.47
7	29	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.25	0.35		0.37	0.39
7	30	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.53	0.04		0.47	0.45
7	31	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.24	0.35		0.34	0.40
8	1	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.54	0.04		0.52	0.39
8	2	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.25	0.35		0.34	0.50
8	3	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.53	0.05		0.47	0.41
8	4	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.24	0.35		0.35	0.40
8	5	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.52	0.06		0.47	0.42
8	6	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.19	0.35		0.36	0.29
8	7	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.53	0.05		0.48	0.46
8	8	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L					
8	9	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L					
8	10	2008	0.34	1.37	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L					
8	11	2008			0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L	0.23	0.23	0.35	0.12	L					
8	12	2008																		0.50	0.08		0.17	0.63
8	13	2008																		0.28	0.31		0.46	
8	14	2008	0.58	0.65																0.48	0.08		0.16	0.63
8	15	2008	0.63	0.95																				
8	16	2008																						
8	17	2008	1.14	0.61																				
8	18	2008																						
8	19	2008																		0.12	0.03		0.13	0.18
8	20	2008																		0.07	0.07			0.18
8	21	2008																		0.14	0.04		0.18	0.18
8	22	2008			0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.07	0.07			0.18
8	23	2008																		0.14	0.04		0.18	
8	24	2008																		0.07	0.07			0.10
8	25	2008			0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.15	0.03			0.26
8	26	2008			0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.15	0.17		0.33	0.10
8	27	2008			0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.26	0.04		0.01	0.27
8	28	2008			0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.16	0.18		0.35	0.11
8	29	2008	0.08	0.10	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.25	0.04			0.27
8	30	2008																		0.18	0.19		0.35	0.11
8	31	2008																		0.11	0.07			0.22
9	1	2008			0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.08	0.10		0.08	0.04
9	2	2008			0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.13	0.03			
9	3	2008			0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.07	0.09		0.08	0.04
9	4	2008			0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L		0.06			
9	5	2008			0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L					
9	6	2008																						
9	9	2008	0.48	0.71																				
9	11	2008	0.05	0.09																				
9	12	2008	0.90	0.90																				
9	20	2008																						
9	10	2008																						
9	11	2008																						
9	12	2008																						
9	13	2008																						
9	14	2008																						
9	15	2008																						
9	16	2008																						
9	17	2008																						
9	18	2008																						
9	19	2008																						
Pre & At Plant					3.24	3.24	3.24	3.24		3.24	3.24	3.24	3.24		3.24	3.24	3.24	3.24		6.10	6.10		6.39	6.19
Seasonal					12.37	12.37	17.81	6.94		11.82	11.82	17.26	6.39		11.92	11.92	17.36	6.49		15.43	7.84		14.94	16.01
TOTALS			11.28	12.70	15.61	15.61	21.05	10.18		15.06	15.06	20.50	9.63		15.16	15.16	20.60	9.73		21.53	13.94		21.33	22.20

[1]Furrow watered for a week to a

Operations Summary

Year	2008
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	

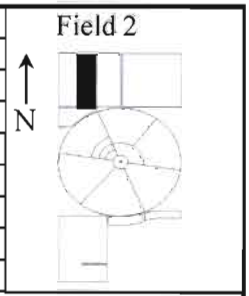
Field Operations	Date	Activity
Tillage	3/2	List
	3/3	Rolling cultivator
Fertility	4/10	applied commercially
Planting		
Herbicide/Growth Regulator	5/1	22 oz/a Roundup
	5/1	48 oz/a Atrazine
Insecticide		
Harvest aid		
Irrigation Amt.		
PrePlant & Planting		
Seasonal		
Rainfall		
PrePlant & Planting		
Seasonal		



Operations Summary

Year	2008
Farm	Helm
Field ID	Field 2
Exp. Design	
Soil Type	

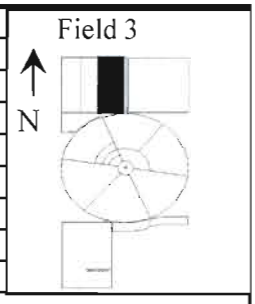
Field Operations	Date	Activity
Tillage	1/7	Stalk puller
	2/12	Disk
	2/27	Sweep plow
	2/29	List
	4/8	Re-list
	6/17	Furrow dike
Fertility	2/26	60-30-0 liquid applied with coulter rig
	6/17	2 lbs/ac of Zinc & 0.8 lbs/ac of N for zones 1 thru 9 (Injected into drip lines)
	7/8 to 8/8	100 lbs/ac of N (32-0-0) for zones 1 thru 9 (Injected into drip lines)
Planting	5/13	FM 9063B2RF 56,000 seed/ac
Herbicide/Growth Regulator	2/11	Trifluralin 32 oz/a
	5/15	Cotton Pro 48 oz/a
	6/13	Glyfos Extra 32 oz/a
	7/22	Roundup Weather Max 22 oz/a
	7/24	Pentia 8 oz/a
Insecticide	5/13	Temik 4 lbs/a
	6/13	Orthene 3 oz/a
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	3/31 to 5/1	11.14 in. (~ 6" furrow irrigation + SDI to fill root zone)
Seasonal	6/9 to 8/14	Trt. 1 10.22 in.
	6/9 to 9/1	Trt. 2 12.01 in.
	6/9 to 9/18	Trt. 3 13.29 in.
Rainfall		
PrePlant & Planting	1/1 to 5/31	3.1 in.
Seasonal	5/14 to 9/12	9.6 in.



Operations Summary

Year	2008
Farm	Helm
Field ID	Field 3
Exp. Design	
Soil Type	

Field Operations	Date	Activity
Tillage	2/20	Disk
	2/28	Sweep plow
	2/29	List
	4/17	Re-list
	6/17	Furrow dike
Fertility	2/27	60-30-0 liquid applied with coulter rig
	6/18	1 lbs/ac of Zinc & 0.4 lbs/ac of Nitrogen for all zones (Injected into drip lines)
	7/9 to 8/7	50 lbs/ac of N (32-0-0) for all zones (Injected into drip lines)
Planting	5/13	FM 9063B2RF 56,000 seed/ac
Herbicide/Growth Regulator	2/20	Trifluralin 32 oz/a
	5/15	Cotton Pro 48 oz/a
	6/13	Glyfos Extra 32 oz/a
	7/14	Glyfos extra 32 oz/a
	8/11	Pentia 12 oz/a
Insecticide	5/13	Temik 4 lbs/a
	6/13	Orthene 3 oz/a
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	3/24 to 5/5	6.48 in.
Seasonal	6/9 to 9/18	13.77 in.
Rainfall		
PrePlant & Planting	1/1 to 5/13	3.1 in.
Seasonal	5/14 to 9/12	9.6 in.

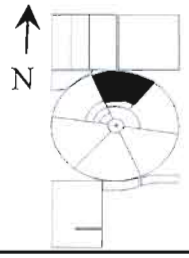


Operations Summary

Year	2008
Farm	Helm
Field ID	Field 5a Spans 5-8
Exp. Design	
Soil Type	

Field Operations	Date	Activity
Tillage	12/6	Terratill
	1/4	Rolling cultivator
	3/13	Rolling cultivator
	3/26	Stalk chopper
	4/22	Furrow dike
	5/12	Rotary hoe
	6/16	Furrow dike
Fertility	3/19	60-30-0 dry
	7/7/ to 8/1	90 lbs/a N applied through the pivot (32-0-0)
Planting	5/5	Mixed Flex Varieties at 56,000 seed/ac
	5/21	Replant at 56,000 seed/ac
Herbicide/Growth Regulator	3/19	Trifluralin 32 oz/a
	5/20	Cotton Pro 48 oz/a
	5/20	Glyfos Extra 32 oz/a
	5/23	Gramoxone Inteon 24 oz/a
	6/29	Glyfos Extra 32 oz/a
	8/1	Roundup Weather Max 22 oz/a
Insecticide	5/5	Temik 4 lbs/a
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	3/24 to 4/30	3.24 in.
Seasonal	5/22 to 9/5	Base = 11.92 in. +50% = 17.36 in., -50% 6.49 in.
Rainfall		
PrePlant & Planting	1/1 to 5/5	1.96 in.
Seasonal	5/6 to 9/12	10.74 in.

Field 5A, S5-8

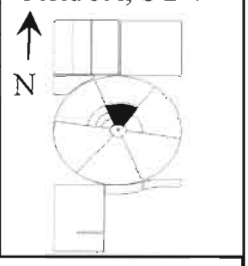


Operations Summary

Year	2008
Farm	Helm
Field ID	Field 5a Spans 2-4
Exp. Design	
Soil Type	

Field Operations	Date	Activity
Tillage	12/6	Terratill
	1/4	Rolling cultivator
	3/13	Rolling cultivator
	3/26	Stalk chopper
	4/22	Furrow dike
	5/12	Rotary hoe
	6/16	Furrow dike
Fertility	3/19	60-30-0 dry
	7/7/ to 8/1	90 lbs/a N applied through the pivot (32-0-0)
Planting	5/5	FM 9063B2RF at 56,000 seed/ac
	5/21	Replant at 56,000 seed/ac
Herbicide/Growth Regulator	3/19	Trifluralin 32 oz/a
	5/20	Cotton Pro 48 oz/a
	5/20	Glyfos Extra 32 oz/a
	5/23	Gramoxone Inteon 24 oz/a
	6/29	Glyfos Extra 32 oz/a
	8/1	Roundup Weather Max 22 oz/a
Insecticide	5/5	Temik 4 lbs/a
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	3/24 to 4/30	3.24 in.
Seasonal	5/22 to 9/5	11.92 in.
Rainfall		
PrePlant & Planting	1/1 to 5/5	1.96 in.
Seasonal	5/6 to 9/12	10.74 in.

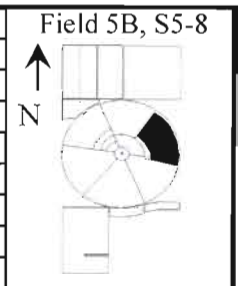
Field 5A, S 2-4



Operations Summary

Year	2008
Farm	Helm
Field ID	Field 5b Spans 5-7
Exp. Design	
Soil Type	

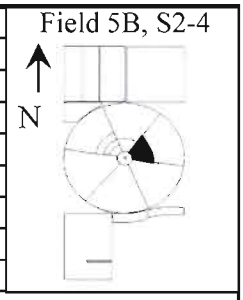
Field Operations	Date	Activity
Tillage	2/21	Disk
	2/28	List
	3/13	Rolling culivator
	4/11	Stalk chopper
	5/1	Furrow dike
	6/16	Furrow dike
Fertility	3/19	60-30-0 dry
	7/7/ to 8/1	90 lbs/a N applied through the pivot (32-0-0)
Planting	5/14	ST 4554B2RF & DP 104 B2RF at 56,000 seed/ac
Herbicide/Growth Regulator	4/2	Trifluralin 32 oz/a
	5/20	Cotton Pro 48 oz/a
	5/20	Glyfos Extra 32 oz/a
	6/9	Touchdown 32 oz/a
	7/17	Round up Weather Max 22oz/a
Insecticide	5/14	Temik 4 lbs/a
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	3/24 to 4/30	3.24 in.
Seasonal	5/22 to 9/5	Base = 11.92 in., +50% = 17.36 in., -50% = 6.49 in.
Rainfall		
PrePlant & Planting	1/1 to 5/14	3.58 in.
Seasonal	5/15 to 9/12	9.13 in.



Operations Summary

Year	2008
Farm	Helm
Field ID	Field 5b Spans 2-4
Exp. Design	
Soil Type	

Field Operations	Date	Activity
Tillage	2/21	Disk
	2/28	List
	3/13	Rolling culivator
	4/11	Stalk chopper
	5/2	Furrow dike
	5/2	Rolling cultivator span 4
	5/2	Striptill span 4
	6/16	Furrow dike
Fertility	3/19	60-30-0 dry
	7/7/ to 8/1	90 lbs/a N applied through the pivot (32-0-0)
Planting	5/12	FM 9063B2RF at 56,000 seed/ac
Herbicide/Growth Regulator	4/2	Trifluralin 32 oz/a
	5/20	Cotton Pro 48 oz/a
	5/20	Glyfos Extra 32 oz/a
	7/11	Glyfos Extra 32 oz/a
Insecticide	5/12	Temik 4 lbs/a
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	3/24 to 4/30	3.24 in.
Seasonal	5/22 to 9/5	11.92 in.
Rainfall		
PrePlant & Planting	1/1 to 5/12	3.1 in.
Seasonal	5/13 to 9/12	9.6 in.

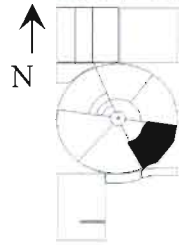


Operations Summary

Year	2008
Farm	Helm
Field ID	Field 5c Spans 5-7
Exp. Design	
Soil Type	

Field Operations	Date	Activity
Tillage	12/6	Terratill
	1/4	Rolling cultivator
	3/12	Rolling cultivator
	4/11	Stalk chopper
	4/24	Furrow dike
	6/16	Furrow dike
Fertility	3/19	60-30-0 dry
	7/7/ to 8/1	90 lbs/a N applied through the pivot (32-0-0)
Planting	5/14	ST 4554B2RF & DP 104 B2RF at 56,000 seed/ac
Herbicide/Growth Regulator	4/2	Trifluralin 32 oz/a
	5/20	Cotton Pro 48 oz/a
	5/20	Glyfos Extra 32 oz/a
	6/13	Glyfos Extra 32 oz/a
	7/17	Round up Weather Max 22oz/a
Insecticide	5/14	Temik 4 lbs/a
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	3/24 to 4/30	3.24 in.
Seasonal	5/22 to 9/5	Base = 11.92 in., +50% = 17.36 in., -50% = 6.49 in.
Rainfall		
PrePlant & Planting	1/1 to 5/14	3.58 in.
Seasonal	5/15 to 9/12	9.13 in.

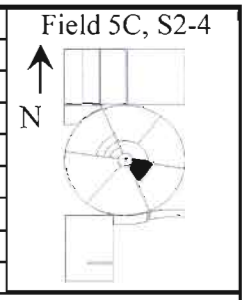
Field 5C, S5-8



Operations Summary

Year	2008
Farm	Helm
Field ID	Field 5c (Spans 2-4)
Exp. Design	
Soil Type	

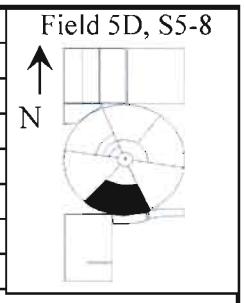
Field Operations	Date	Activity
Tillage	12/6	Terratill
	1/4	Rolling cultivator
	3/12	Rolling cultivator
	4/11	Stalk chopper
	4/24	Furrow dike
	6/16	Furrow dike
Fertility	3/19	60-30-0 dry
	7/7/ to 8/1	90 lbs/a N applied through the pivot (32-0-0)
Planting	5/12	FM 9063B2RF at 56,000 seed/ac
Herbicide/Growth Regulator	4/2	Trifluralin 32 oz/a
	5/20	Cotton Pro 48 oz/a
	5/20	Glyfos Extra 32 oz/a
	6/13	Glyfos Extra 32 oz/a
	7/11	Glyfos Extra 32 oz/a
Insecticide	5/12	Temik 4 lbs/a
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	3/24 to 4/30	3.24 in.
Seasonal	5/22 to 9/5	11.92 in.
Rainfall		
PrePlant & Planting	1/1 to 5/12	3.1 in.
Seasonal	5/13 to 9/12	9.6 in.



Operations Summary

Year	2008
Farm	Helm
Field ID	Field 5d Spans 5-8
Exp. Design	
Soil Type	

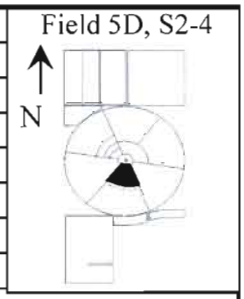
Field Operations	Date	Activity
Tillage	12/6	Terratill
	1/4	Rolling cultivator
	3/12	Rolling cultivator
	4/11	Stalk chopper
	4/24	Furrow dike
Fertility	3/19	60-30-0 dry
	7/7/ to 8/1	90 lbs/a N applied through the pivot (32-0-0)
Planting	5/30	NC+7C22 and Pioneer 84G
Herbicide/Growth Regulator	5/27	Glyfos Extra 32 oz/a
	5/30	Milo Pro 40 oz/a
Insecticide		
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	3/24 to 5/29	3.54 in.
Seasonal	5/30 to 9/5	Base = 12.37 in., +50% = 17.81 in., -50% = 6.94 in.
Rainfall		
PrePlant & Planting	1/1 to 5/29	3.58 in.
Seasonal	5/30 to 9/12	9.13 in.



Operations Summary

Year	2008
Farm	Helm
Field ID	Field 5d (Spans 2-4)
Exp. Design	
Soil Type	

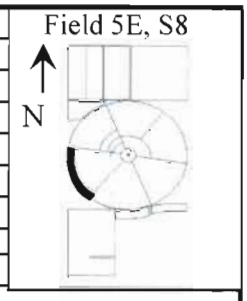
Field Operations	Date	Activity
Tillage	12/6	Terratill
	1/4	Rolling cultivator
	3/12	Rolling cultivator
	4/11	Stalk chopper
	4/24	Furrow dike
Fertility	3/19	60-30-0 dry
	7/7/ to 8/1	90 lbs/a N applied through the pivot (32-0-0)
Planting	5/22	Span 4, FACT trial, several varieties
	5/30	Span 2-3, Several varieite and several plant populations
Herbicide/Growth Regulator	5/27	Glyfos Extra 32 oz/a
	5/30	Milo Pro 40 oz/a
Insecticide		
Harvest date	10/27	(Span 4 - FACT trial)
Irrigation Amt.		
PrePlant & Planting	3/24 to 5/29	3.54 in.
Seasonal	5/30 to 9/5	12.37 in.
Rainfall		
PrePlant & Planting	1/1 to 5/29	3.58 in.
Seasonal	5/30 to 9/12	9.13 in.



Operations Summary

Year	2008
Farm	Helm
Field ID	Field 5e (Span 8)
Exp. Design	
Soil Type	

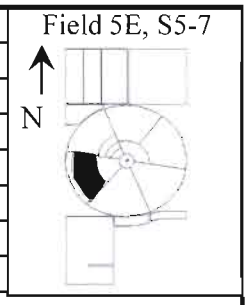
Field Operations	Date	Activity
Tillage	12/6	Terratill
	1/4	Rolling cultivator
	3/12	Rolling cultivator
	3/26	Stalk chopper
	4/22	Furrow dike
	6/5	Furrow dike
Fertility	3/19	60-30-0 dry
	7/7/ to 8/1	90 lbs/a N applied through the pivot (32-0-0)
Planting	5/15	Dever selections
Herbicide/Growth Regulator	3/19	Trifluralin 32 oz/a
	5/19	Glyfos extra 32 oz/a
	7/9	Glyfos Extra 32 oz/a
	7/24	Pentia 8 oz/a
Insecticide	5/14	Temik 4 lbs/a
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	3/24 to 4/30	3.24 in.
Seasonal	5/22 to 9/5	Base = 11.92 in., +50% = 17.36 in., -50% = 6.49 in.
Rainfall		
PrePlant & Planting	1/1 to 5/14	3.58 in.
Seasonal	5/15 to 9/12	9.13 in.



Operations Summary

Year	2008
Farm	Helm
Field ID	Field 5e (Spans 5-7)
Exp. Design	
Soil Type	

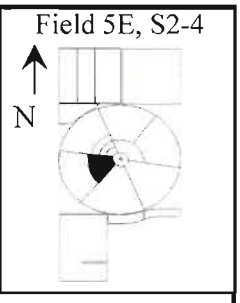
Field Operations	Date	Activity
Tillage	12/6	Terratill
	1/4	Rolling cultivator
	3/12	Rolling cultivator
	3/26	Stalk chopper
	4/22	Furrow dike
	6/5	Furrow dike
Fertility	3/19	60-30-0 dry
	7/7/ to 8/1	90 lbs/a N applied through the pivot (32-0-0)
Planting	5/14	ST 4554B2RF & DP 104 B2RF at 56,000 seed/ac
Herbicide/Growth Regulator	3/19	Trifluralin 32 oz/a
	5/19	Glyfos extra 32 oz/a
	7/9	Glyfos Extra 32 oz/a
Insecticide	5/14	Temik 4 lbs/a
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	3/24 to 4/30	3.24 in.
Seasonal	5/22 to 9/5	Base = 11.92 in., +50% = 17.36 in., -50% = 6.49 in.
Rainfall		
PrePlant & Planting	1/1 to 5/14	3.58 in.
Seasonal	5/15 to 9/12	9.13 in.



Operations Summary

Year	2008
Farm	Helm
Field ID	Field 5e (Spans 2-4)
Exp. Design	
Soil Type	

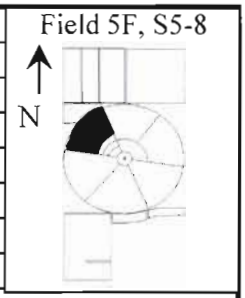
Field Operations	Date	Activity
Tillage	12/6	Terratill
	1/4	Rolling cultivator
	3/12	Rolling cultivator
	3/26	Stalk chopper
	4/22	Furrow dike
	6/5	Furrow dike
Fertility	3/19	60-30-0 dry
	7/7/ to 8/1	90 lbs/a N applied through the pivot (32-0-0)
		on base irrigation rate - proportional with irrigation
Planting	5/12	FM 9063B2RF at 56,000 seed/ac
Herbicide/Growth Regulator	3/19	Trifluralin 32 oz/a
	5/19	Glyfos extra 32 oz/a
	7/9	Glyfos Extra 32 oz/a
Insecticide	5/12	Temik 4 lbs/a
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	3/24 to 4/30	3.24 in.
Seasonal	5/22 to 9/5	11.92 in.
Rainfall		
PrePlant & Planting	1/1 to 5/12	3.1 in.
Seasonal	5/13 to 9/12	9.6 in.



Operations Summary

Year	2008
Farm	Helm
Field ID	Field 5f (Spans 5-8)
Exp. Design	
Soil Type	

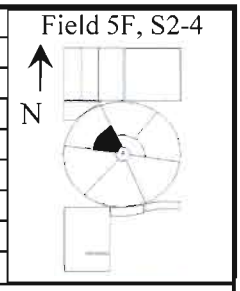
Field Operations	Date	Activity
Tillage	12/6	Terratill
	1/4	Rolling cultivator
	3/5	Rolling cultivator
	3/26	Stalk chopper
	4/22	Furrow dike
	5/12	Rotary hoe
	6/10	Furrow dike
Fertility	3/19	60-30-0 dry
	7/7/ to 8/1	90 lbs/a N applied through the pivot (32-0-0)
Planting	5/5	Mixed Flex Varieties at 56,000 seed/ac
	5/21	Replant at 56,000 seed/ac
Herbicide/Growth Regulator	3/19	Trifluralin 32 oz/a
	5/23	Gramoxone Inteon 24 oz/a
	6/29	Glyfos Extra 32 oz/a
	8/1	Roundup Weather Max 22 oz/a
Insecticide	5/5	Temik 4 lbs/a
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	3/24 to 4/30	3.24 in.
Seasonal	5/22 to 9/5	Base = 11.92 in. +50% = 17.36 in., -50% 6.49 in.
Rainfall		
PrePlant & Planting	1/1 to 5/5	1.96 in.
Seasonal	5/6 to 9/12	10.74 in.



Operations Summary

Year	2008
Farm	Helm
Field ID	Field 5f (Spans 2-4)
Exp. Design	
Soil Type	

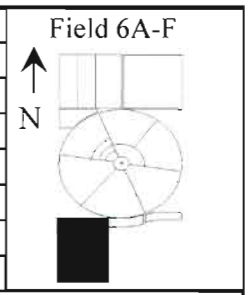
Field Operations	Date	Activity
Tillage	12/6	Terratill
	1/4	Rolling cultivator
	3/5	Rolling cultivator
	3/26	Stalk chopper
	4/22	Furrow dike
	5/12	Rotary hoe
	6/10	Furrow dike
Fertility	3/19	60-30-0 dry
	7/7/ to 8/1	90 lbs/a N applied through the pivot (32-0-0)
Planting	5/5	FM 9063B2RF at 56,000 seed/ac
	5/21	Replant at 56,000 seed/ac
Herbicide/Growth Regulator	3/19	Trifluralin 32 oz/a
	5/23	Gramoxone Inteon 24 oz/a
	6/29	Glyfos Extra 32 oz/a
	8/1	Roundup Weather Max 22 oz/a
Insecticide	5/5	Temik 4 lbs/a
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	3/24 to 4/30	3.24 in.
Seasonal	5/22 to 9/5	11.92 in.
Rainfall		
PrePlant & Planting	1/1 to 5/5	1.96 in.
Seasonal	5/6 to 9/12	10.74 in.



Operations Summary

Year	2008
Farm	Helm
Field ID	Field 6 - Zone A-F
Exp. Design	
Soil Type	

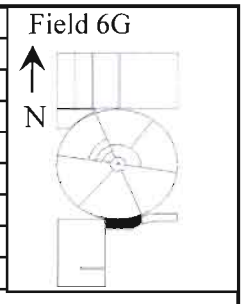
Field Operations	Date	Activity
Tillage	11/26	Shred stalks
	1/2	Stalk puller
	2/29	Sweep plow
	3/10	List
	6/18	Cultivate
	6/26	Furrow dike
Fertility	2/28	60-30-0 Liquid appllied with a coulter rig
	1/3	Manure applied providing:
		7.7 N, 29.9 P,52.2 K, 5.4 S, 35.2 Ca, 8.8 Mg, 17.5 Na, 0.2 Zn, 5.9 Fe, 0.1 Mn lbs/a
	7/9 to 8/7	50 lbs/ac of N (32-0-0) for Low Irr. (injected into drip lines)
	7/9 to 8/7	80 lbs/ac of N (32-0-0) for High Irr. (injected into drip lines)
Planting	5/12	ST 4554B2RF, FM 9063B2RF, ST 4700B2RF, DP 117B2RF
		at 32,000, 56,000, 80,000 seeds/ac
Herbicide/Growth Regulator	2/19	Trifluralin 32 oz/a
	5/19	Glyfos Extra 32 oz/a
	7/16	Glyfos Extra 32 oz/a
	7/24	Pentia 8 oz/a
Insecticide	5/12	Temik 4 lbs/a
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	3/19 to 5/5	Dry 0.0 in. Low 6.10 in. High 6.10 in.
Seasonal	6/9 to 9/4	Dry 0.0 in. Low 7.84 in. High 15.43 in.
Rainfall		
PrePlant & Planting	1/1 to 5/12	3.1 in.
Seasonal	5/13 to 9/12	9.6 in.



Operations Summary

Year	2008		
Farm	Helm		
Field ID	Field 6 - Zone G	Cotton Drip Irrigated Nitrogen Level Effects on Insects	Parajulee
Exp. Design			
Soil Type			

Field Operations	Date	Activity
Tillage	11/28	Shred stalks
	12/20	Stalk puller
	2/29	Sweep plow
	4/7	List
	6/26	Cultivate
	6/26	Furrow dike
Fertility		
Planting	5/13	FM 9063B2RF at 56,000 seed/ac
Herbicide/Growth Regulator	2/20	Trifluralin 32 oz/a
	6/12	Glyfos Extra 32 oz/a
	7/16	Glyfos Extra 32 oz/a
	7/30	Round Up Weather Max 22 oz/a
Insecticide	6/12	Orthene 3 oz/a
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	4/17 to 5/5	6.39 in.
Seasonal	6/9 to 9/3	14.94 in.
Rainfall		
PrePlant & Planting	1/1 to 5/13	3.1 in.
Seasonal	5/14 to 9/12	9.6 in.



Operations Summary

Year	2008	
Farm	Helm	
Field ID	Field 6 - Zone H	Cotton Drip Irrigated Variety, Herbicide, Keeling
Exp. Design	Replicated	
Soil Type		

Field Operations	Date	Activity
Tillage	11/28	shred stalks
	12/20	Stalk puller
	2/29	Sweep plow
	4/7	List
	6/26	Cultivate
	6/26	Furrow dike
Fertility	2/27	60-30-0 Liquid appllied with a coulter rig
Planting	5/14	ST 4554B2RF, FM 989B2RF at 56,000 seed/ac
Herbicide/Growth Regulator	2/20	Trifluralin 32 oz/a
	6/12	Glyfos Extra 32 oz/a
	7/16	Glyfos Extra 32 oz/a
	7/24	Pentia 8 oz/a
Insecticide	5/14	Temik 4 lbs/a
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	4/17 to 5/5	6.19 in.
Seasonal	6/9 to 9/3	16.01 in.
Rainfall		
PrePlant & Planting	1/1 to 5/14	3.58 in.
Seasonal	5/15 to 9/12	9.13 in.