AgriLIFE RESEARCH
Texas A&M System

Improving Life Through Science and Technology

Lubbock-Pecos-Halfway

Helms Research Farm

Summary Report

2009

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

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Introduction

The Texas A&M University System purchased 373 acres of farmland from the estate of Ardella Helms 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.

Loading trailers for tours during the Subsurface Drip Irrigation Field Day at Helms, 25 Aug., 2009. This was part of a technology transfer effort in conjunction with USDA-ARS, Bushland, and Kansas State University.

Cotton harvest evaluating picker versus stripper harvesting methods.

Harvesting with a modified cotton stripper. Large lint weights and fiber data sub-samples are obtained from irrigated treatments.

Weighing grain sorghum from large plot irrigation study. Treatment factors were irrigation quantity and sorghum hybrids.

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: The Helms Research Farm is a primary test site for the corn breeding program's drought tolerance study. The field has a subsurface drip irrigation system and is divided into five zones. A series of field trials has been implemented to study drought tolerance, heat tolerance, yield and other agronomic traits of experimental and commercial hybrids and lines.

Results: Over 500 hybrids and 200 lines were evaluated for yield and agronomic traits under well watered and drought conditions. In addition, the State Silage Corn Performance Test and an efficacy study of transgenic corn were conducted at halfway. Based on the results from this and other locations, we identified new superior inbred lines. Four lines have been licensed to a company for grain production, another four inbred lines with the brown midrib trait will be licensed for another company for silage corn production.

Expectations: New drought and heat tolerant lines and hybrids have been developed and will be released to the seed industry and public sectors. Multiple stress tolerant lines and hybrids developed in this program 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 corn irrigation requirements.

Fig. 1. Corn breeding presentation and discussion at the Subsurface Drip Irrigation Field Day at the Helms Research Farm, 2009.

Irrigation Termination for Improved Fiber Maturity on the Texas High Plains (Field 2)

Craig Bednarz, James P. Bordovsky, and Jason Sneed

Objective: 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 inputs.

Figure 1. View of SDI plots containing the cotton irrigation termination study, Helms Farm, 2007.

Methodology: Studies were conducted in 2007, 2008, and 2009 in a field site with sub surface drip irrigation. The sub surface drip irrigation system is sub divided into 9 zones. 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 (NAFW) = 5 +2 weeks, (2) (NAWF) = 5 + 4 weeks and, (3) (NAWF) + 6 weeks.

Results: Table 1 contains fiber quality and yield data. This table shows that there was an increase in fiber quality and lint % in the earlier termination but there was also a decrease in yield. An economic analysis will show which termination is the most profitable.

Table 1. Lint %, Lint Yield (kg ha^{-1}), Micronaire (MIC), Short Fiber Content by weight, [SFC(w)%], and Immature Fiber Content [IFC(%)] among irrigation treatments in irrigation termination studies conducted at the Texas AgriLife Research Center Helms Farm at Halfway, TX in 2007, 2008, and 2009.

Year	Termination	Lint %	Lint yield	MIC	SFC(w) %	IFC %
2007	1	36.68	1778	4.12	9.81	8.71
	2	33.84	1970	3.19	11.69	10.87
	3	33.76	2149	3.19	11.35	10.80
	LSD(0.05)	0.89	126	0.13	0.92	1.26
2008	1	27.29	1733	3.25	11.92	9.25
	2	26.31	1869	2.80	11.67	10.02
	3	25.35	1914	2.86	12.00	9.56
	LSD(0.05)	0.96	78	0.30	0.60	0.43
2009	1	36.33	1299	3.51	12.00	9.20
	2	34.28	1576	3.05	13.50	10.63
	3	34.79	1606	3.30	11.59	9.83
	LSD(0.05)	1.76	206	0.50	2.42	1.41

Evaluation of Soil Water Sensors for Irrigation Management (Field 2)
James Bordovsky, Joe Mustian, and Cora Lea Emerson

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

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 from 2007 to 2009. The 12 and 27-inch TDT sensors were left undisturbed from 2007 through the 2009 growing seasons.

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.

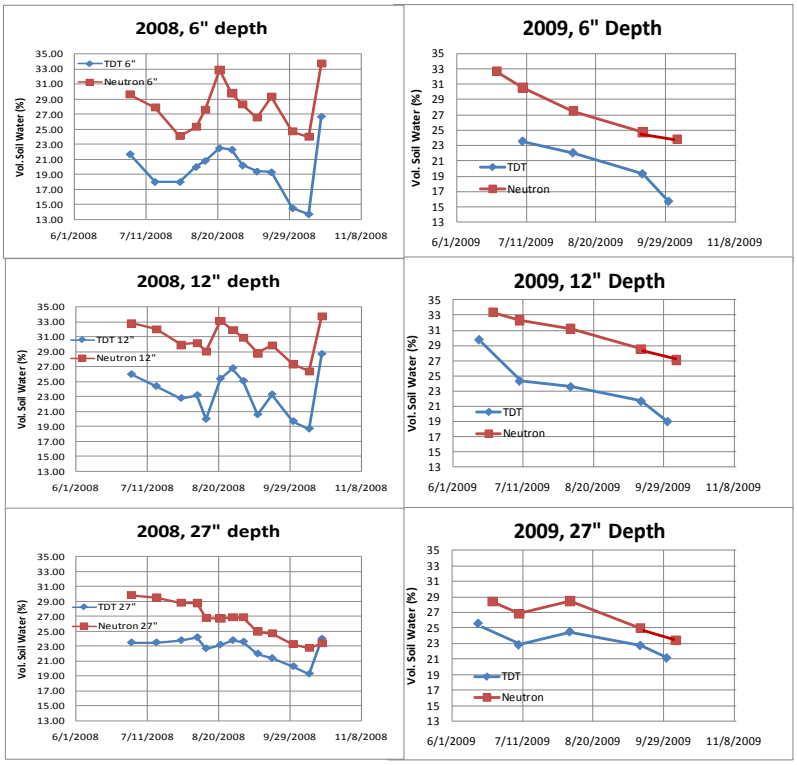


Fig. 2. Comparison of volumetric water content measured by TDT and neutron attenuation, Helms Farm, 2008 and 2009.

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. The range of TDT sensor readings, as the soil water content cycled from dry to wet, was smaller in 2008 and 2009 than in 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 Response to Irrigation Interval and Field Topography using Subsurface Drip Irrigation (Field 3)

Cora Lea Emerson, James P. Bordovsky, Joe Mustian and Doug Nesmith

Objective: To determine cotton lint yield and water use efficiency resulting from three irrigation intervals and two irrigation levels using subsurface drip irrigation (SDI).

Figure 1. SDI plots being harvested at Helms Research Farm. Halfwav. TX 2009.

Methodology: Two irrigation levels and three irrigation intervals were used to determine the effects of each level/interval combination on cotton production. The high irrigation level met approximately 100% of crop water needs using ET scheduling, while the low level was 50% of the High irrigation level. Irrigation applications were made at .5-day, 2-day and 7-day intervals. Each of four blocks contained six 8-row treatments. FiberMax 9063 B2RF was planted on 6 May at 54,129 ppa with 30" row spacing on 1300' rows. Crop responses were evaluated by harvesting 4 rows by ~60 feet at three field positions (South, Mid, & North) along the length of each 8-row plot with a John Deere 7445 stripper, determining burr weight with on-board scales, and establishing lint yield from the turnout of 1-lb sub-samples of each replicate. Seasonal water use efficiency (SIWUE) was calculated by subtracting dryland yield (pre-plant irrigation + 0" in-season irrigation) from plot yield then dividing the product by the treatment in-season irrigation, beginning 10 July and terminating 2 September ($Y_P - Y_{DL}/I_{in\text{-}season}$).

Results: Table 1 contains average lint yield (lbs/ac) and seasonal irrigation water use efficiency (SIWUE) by treatment and field position. The rows sloped from higher elevations (South) to lower elevations (North), and resulted in more SDI lateral drainage to the low field elevations in treatments with more frequent irrigations (0.5d versus 7d). Lowest average lint yields (1126 lbs/ac) were observed in the low irrigation level/7-day interval treatments (field position → Mid), and the highest yields (1554 lbs/ac) were observed in the high irrigation level/2-day interval treatments (field position → South). Average SIWUE was greater in low irrigation level treatments than respective high irrigation treatments, with the highest SIWUE obtained at the 2-day interval (field position→ North) . The lowest SIWUE was observed in the 2-day interval/high level treatment (field position → Mid). Although not significant, within low irrigation treatments, longer irrigation intervals consistently resulted in decreased lint yield and SIWUE regardless of field position; however, the opposite trend was observed in the high irrigation treatments, where lint yield and SIWUE increased with longer irrigation intervals. 2009 was the first year of this study and will be continued to determine if these trends persist.

Table 1. Average yield (lbs/ac) and SIWUE (lbs/ac-in) at two irrigation levels, three irrigation intervals and three field positions, Helms Research Farm, Halfway, TX, 2009.

	Low						*High*					
Irr. Int. (d)	South		Mid		North		South		Mid		North	
	Avg. Yield											
0.5	1292	a	1271	a	1313	a	1437	a	1342	a	1355	a
2	1164	a	1200	a	1320	a	1554	a	1400	a	1426	a
7	1275	a	1126	a	1255	a	1537	a	1428	a	1535	a
	Avg. SIWUE											
0.5	100.17	a	96.44	a	103.81	a	66.98	a	58.10	a	59.31	a
2	77.99	a	84.18	a	105.08	a	77.78	a	63.49	a	65.93	a
7	95.64	a	70.01	a	92.18	a	76.02	a	65.90	a	75.79	a

Bayer Cotton Agronomic Performance Trial at Helms Farm, Halfway, TX, 2009 (Field 5a, spans 5-8)

Wayne Keeling, Jacob Reed, Michael Petty, and Daniel Olivier

Methodology: Plot size was 4 rows by 500' long with three replications. Five cotton varieties (FiberMax 1740 B2F, FiberMax 9160 B2F, FiberMax 9170 B2F, FiberMax 9180 B2F, and Stoneville 4288 B2F) were planted 12 May. Each variety was evaluated under three irrigation levels consisting of 6.75", 10.05", and 13.35" in-season irrigation, hereafter referred to as "Low," "Medium," and "High" respectively. The plots were stripper-harvested on 5 November. Additional production information is contained in the Appendix.

Results: Five varieties were evaluated under three irrigation levels. When averaged across varieties, lint yields increased from low to medium irrigation but were not increased with additional irrigation above the base level (Table 1). When averaged across irrigation levels, lint yields ranged from 1129 – 1275 lbs/A. Lint values decreased as irrigation level increased, with little difference in loan values across varieties (Table 2). Gross revenues increased at the medium irrigation level, but not by additional irrigation input (Table 3).

Table 1. Lint yields (lb¢/A) resulting from B2RF varieties and irrigation levels at Helms Farm, Halfway, TX, 2009.

Variety	Low Irr.	Med. Irr.	High Irr.	Avg.
FM1740B2F	965	1275	1346	1195
FM9160B2F	975	1359	1371	1235
FM9170B2F	1020	1357	1449	1275
FM9180B2F	954	1332	1231	1172
ST4288B2F	884	1242	1262	1129
AVG	960	1313	1332	

Table 2. Lint values (lb¢/A) resulting from B2RF varieties and irrigation levels at Helms Farm, Halfway, TX, 2009.

Variety	Low Irr.	Med. Irr.	High Irr.	Avg.
FM1740B2F	52.87	51.58	45.18	49.88
FM9160B2F	53.42	49.93	46.18	49.84
FM9170B2F	53.82	51.13	44.18	49.71
FM9180B2F	53.82	51.68	44.52	50.00
ST4288B2F	53.62	50.23	47.60	50.48
AVG	53.51	50.91	45.53	

Table 3. Gross revenues ($/A) resulting from B2RF varieties and irrigation levels at Helms Farm, Halfway, TX, 2009.

Variety	Low Irr.	Med. Irr.	High Irr.	Avg.
FM1740B2F	353	437	610	467
FM9160B2F	363	680	463	502
FM9170B2F	408	481	640	510
FM9180B2F	375	501	548	475
ST4288B2F	474	626	459	520
AVG	395	545	544	

Incidence of Crown Gall under Various Cultural Practices (Field 5b,d,e)

Jason Woodward, Lindsey Kahler, Terry Wheeler, and James Bordovsky

Objective: To determine the incidence of Crown gall, caused by the bacterium *Agrobacterium tumefaciens*, under different irrigation levels, rotation schemes, and cultivars.

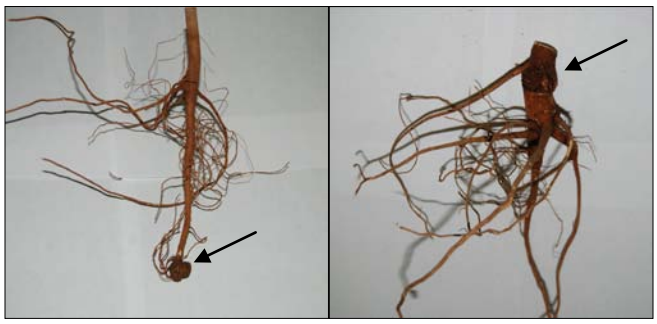


Fig. 1 Characteristic galls (arrows) associated with *Agrobacterium tumefaciens* on the tap root (left) and crown (right) of infected cotton plants

Methodology: Irrigation treatments included 50%, 100%, and 150% of a base irrigation amount, referred to hereafter as low, moderate and high, respectively. The cultivars Stoneville 5458B2F and Deltapine 104B2RF were planted at this location. Three rotation schemes C-C-C, C-S-C, and S-C-C where evaluated, where C = cotton and S = sorghum. Disease incidence was rated on 15-Jul, and plants (n=10) were destructively sampled to determine the gall size and percentage of plants with galls. Bacterial cells were isolated from galls via streak plating (Fig. 2) onto potato dextrose agar.

Results: Root galls (Fig. 1) were observed on approximately 45% of the plants examined (data not shown). This high frequency of infection is consistent with previous reports. Pure bacterial colonies were obtained from infected roots (Fig. 2). *A. tumefaciens* has been implicated in the Bronze wilt complex; however, the symptoms observed in this study were not characteristic of the disease. Both disease incidence and the number of plants exhibiting galls were affected by lower levels of irrigation (Table 1). Cultivar selection did not impact root galling caused by *A. tumefaciens.* Disease incidence, the number of galls per plant, and gall size were highest under the continuous cotton rotation scheme. While Crown gall is a minor disease of cotton, an increase in disease incidence may occur under stressful conditions. Observations from a field in Lubbock County indicated that *A. tumefaciens* galls were evident on plants co-infected with the reniform nematode (data not shown).

Table 1. Effect of irrigation level, cultivar selection, and rotation scheme on Crown gall development

Factor, level	Disease incidence (%)	Symptomatic plants (%)	Galls / plant (#)	Gall size (1-5 scale)[a]
Irrigation level				
Low	4.0	52.2	4.0	1.4
Moderate	2.9	49.5	3.3	1.2
High	0.3	28.9	2.8	1.7
LSD	3.1*	9.8‡	NS	NS
Cultivar				
ST 4554B2RF	2.2	40.7	3.3	1.4
DP 104B2RF	2.7	46.3	3.5	1.5
LSD	NS	NS	NS	NS
Rotation scheme				
C-C-C	5.2	22.8	4.4	1.8
C-S-C	1.6	21.7	2.5	1.3
S-C-C	0.5	20.8	3.3	1.2
LSD	3.1†	NS	1.5*	0.4

[a] Galls were categorized based on size: 1= < 3mm, 2 = 3 to 5 mm, 3 = 5 to 10 mm 4 = 10 to 20 mm, and 5 = > 20 mm.
[b] Symbols *, †, ‡ denotes significance levels of $P \leq 0.10$, $P \leq 0.05$, and $P \leq 0.001$, respectively. NS = $P \geq 0.10$.

Fig. 2 Colony characteristics of *Agrobacterium tumefaciens*

Effect of Crop Rotation and Irrigation Treatments on *Verticillium dahliae* Density and Incidence of Wilt (Field 5b,d,e)

Terry Wheeler, Victor Mendoza, Evan Arnold, Garrett Clark and Lindsi Clark

Objective: Verticillium wilt, which is caused by the fungus *Verticillium dahliae* is causing significant yield losses in the Southern High Plains. Since 2007, Verticillium wilt has been found at the Helms farm under the center pivot system. Prior to 2007, only an occasional plant was seen with the disease symptoms. The objective of this study is to determine the effect of irrigation amount and crop rotation on incidence of Verticillium wilt in cotton.

Methodology: Wedges at the Helms circle were either in continuous cotton, or in a sorghum rotation with 2 years cotton and 1 year sorghum. Within a wedge, there were three irrigation rates, consisting of a "dry" which received no supplemental water, base – 50%, base, and base + 50% irrigation rate. These rates were replicated three times within a wedge. There were also two varieties (Deltapine 104B2RF and Stoneville 4554B2F) planted within the irrigation treatments. During January of 2008, 2009, and 2010 composite soil samples were taken in four wedges of the Helms circle for each plot. The soil samples were assayed for microsclerotia of *V. dahliae*. During August of 2008 and 2009, wilt ratings were made in these plots.

Results: There has been a significant increase in the population density of *V. dahliae* over the last three years (Fig. 1A) in both the continuous cotton (C07/C08/C09) and rotations with sorghum. There are much higher levels of *V. dahliae* in continuous cotton compared with the sorghum rotations. However, all three wedges involved with the sorghum rotation are showing an increase over time with respect to the fungal density. For the 2010 growing season, it is likely that wedge (C07/C08/S09), which was planted into sorghum in 2009, will have significant amounts of wilt. The incidence of wilt was related to irrigation rate in the continuous cotton wedge (C07/C08/C09) (Fig. 1B). In the wedges that were rotated with sorghum, the Base+50% irrigation rate had more wilt than with the other irrigation rates. In the wedges rotated with sorghum, the "dry" treatment had similar levels of wilt as the base-50% and base irrigation rates (Fig. 1B).

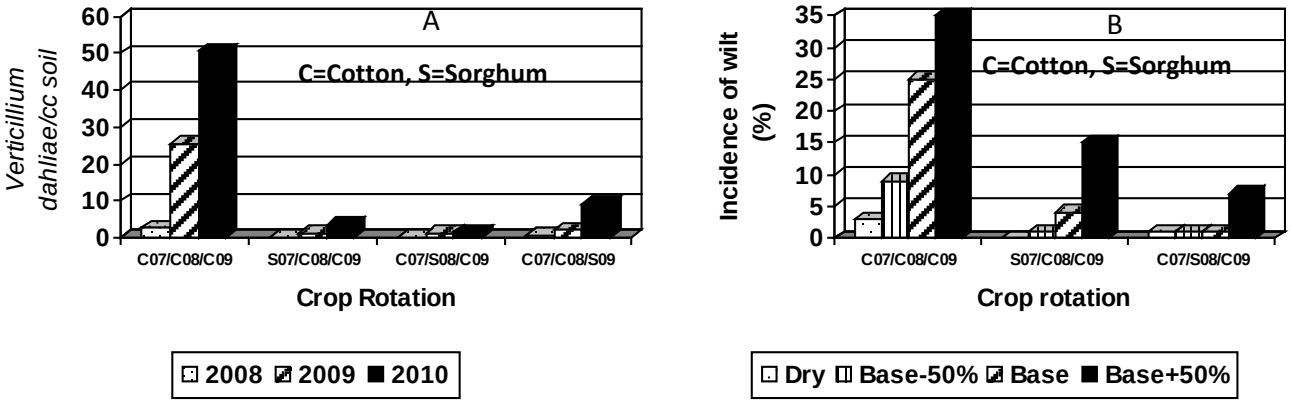


Figure 1. Influence of crop rotation on microsclerotia counts of *Verticillium dahliae* over time, and incidence of wilt in 2009 as it relates to irrigation rate and crop rotation.

Cotton Response to Irrigation Level and Crop Rotation (Field 5b,d,e)

James P. Bordovsky, Joe Mustian, Cora Lea Emerson, Doug Nesmith, and Casey Hardin

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 grain crop at Helms farm.

Methodology: 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 in areas of either continuous cotton (Cont. Cot.) or in rotation with a grain crop, with 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 among these treatments. As seen in both 2008 and 2009, having a grain crop in rotation with cotton increased cotton yield compared to Cont. Cot. (Fig. 2). In all crop sequences, the less determinate Stoneville variety resulted in a higher numerical yield at the low irrigation (0.5BI), but lower lint yield at higher irrigation levels than did the DP104 variety. Yields increased with elevated irrigation from the 0.5BI to the 1.0BI treatment; however, yields from treatments irrigated above the 1.0BI level were generally reduced except for the DP104 variety following grain. Results are partially due to the reduction in cotton diseases following sorghum and at lower irrigation levels (See Wheeler and Woodward reports.) Generally, there were significant decreases in seasonal irrigation use efficiency from the 0.5 to the 1.5BI levels. 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.

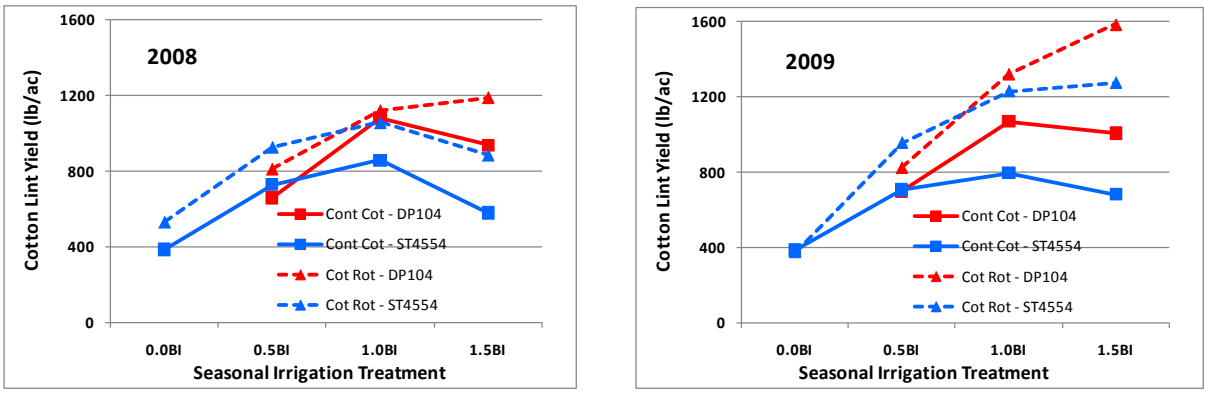


Figure 2. Cotton lint yield of two cotton varieties and two cropping sequences at three irrigation levels, Texas Agrilife Research, Halfway, 2008 and 2009.

Sorghum Hybrid Performance with Low-Energy Precision Application (LEPA) Irrigation at Helms Farm, Halfway, TX, 2009 (Field 5c, spans 2-4)

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

Grain sorghum harvest at Helms Research Farm, Halfway, TX 2009.

Methodology: Plot size was 4 rows by 500' long with three replications. Fourteen sorghum hybrids, including commercial and experimental hybrids, were planted on 20 May and harvested on 27 October. Additional production information is contained in the Appendix.

Results: Yields ranged from 7185 – 9991 lbs/A, and averaged 8936 lbs/A. Entries included hybrids in different maturity rankings and higher yields were produced with the longer maturity hybrids (Table 1). Hybrids were irrigated with 3" pre-plant irrigation and 9.3" in-season irrigation (12.3" total applied irrigation).

Table 1. Sorghum hybrids and yields (lbs/A) at Helms Farm, Halfway, TX 2009

Brand	Variety	Yield (lbs/A)
Monsanto	MSG452	9192
Monsanto	MSG347	9991
Monsanto	MSG453	9614
Dekalb	DKS53-67	9646
Dekalb	DKS54-00	9389
Dekalb	DKS54-03	9704
Asgrow	A571	9619
Pioneer	84G62	9756
Monsanto	MSG244	9141
Monsanto	MSG241	9446
Dekalb	DKS44-20	8223
Monsanto	MSF379	8136
Pioneer	85G85	7185
Monsanto	MSG250	9629
Asgrow	PULSAR	7571
Dekalb	DKS36-06	9183
Dekalb	DKS37-07	8827
NC+	NC+6B50	8163
Pioneer	86G32	7378
	Average	***8936***

Sorghum Grain Response to Different Irrigation Levels (Field 5c, spans 5-7)

James P. Bordovsky, Wayne Keeling, Jacob Reed, Michael Petty, Joe Mustian, and Cora Lea Emerson

Fig. 1. Irrigated grain sorghum at Helms Research Farm, Halfway, TX 2009.

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.

Methodology: Two grain sorghum hybrids, Pioneer 84G01 and Pioneer 84G62, were planted under three spans of a LEPA irrigation system. Sections of each pivot were modified to deliver water at three relative rates: 50, 100, and 150% of a base pivot irrigation capacity equal to 80% of ET (0.5BI, 1.0BI and 1.5BI, respectively). A non-seasonally irrigated, "0.0BI," treatment was also included. Sorghum was planted on 19 May and harvested with commercial equipment with grain weights and moisture content determined in each 8-row plot. Seasonal base irrigation was 9.34 inches.

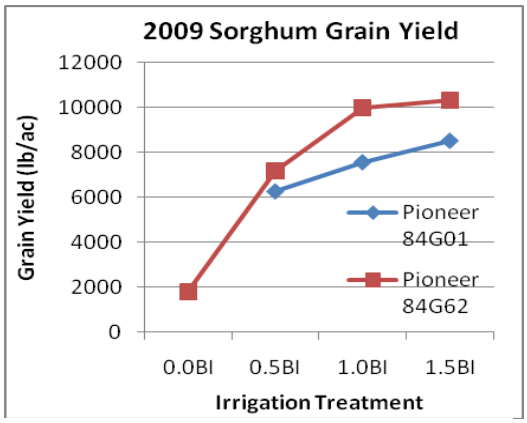


Fig. 2. Grain sorghum yield as a function of irrigation level and hybrid, Helms Research Farm, 2009.

Results: Grain yield and seasonal irrigation water use efficiency (SIWUE) response of the two sorghum hybrids to three irrigation treatments is given in Figures 2 and 3. Yields and SIWUE were significantly higher for the Pioneer 84G62 than the 84G01 hybrid at irrigation levels greater than the 1.0BI treatment indicating hybrid selection is critical for optimum water use efficiency. Grain yields ranged from 1809 lbs/ac at 0.0BI to 10307 lbs/ac at the 1.5BI irrigation level (Pioneer 84G64). Significant increases in grain yield resulted from each increase in irrigation rate up to the 1.0BI level, however, further increases in irrigation failed to produce significantly more grain (Pioneer 84G64). SIWUE of both hybrids decreased significantly for each incremental increase in irrigation indicating the highest water value in this experiment occurred at the 0.5BI level. Developing relationships between irrigation levels and irrigation water values of High Plains crops will help provide strategies to prolong groundwater availability while maintaining crop production.

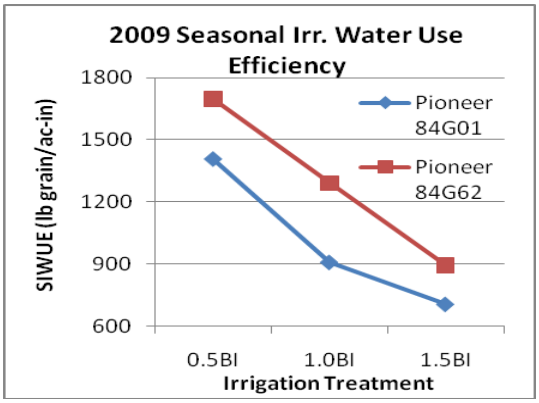


Fig. 3. Grain sorghum seasonal irrigation water use efficiency (SIWUE), Helms Research Farm, 2009.

Weed Management and Economics in Strip-till, No-till, and Conventional-till Systems in Cotton (Field 5d, spans 2-4)

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

Objective: To examine control options in three tillage systems for effective and economical weed management in Roundup Ready Flex cotton. Specific objectives were: 1) Determine if combinations of residual herbicides are more effective and economical than others in a glyphosate-based system, 2) Determine the value of residual herbicides applied PPI, PRE, POST, or PDIR, and 3) Compare weed management across conventional, strip-till and no-till systems.

Methodology: The study was conducted using an overhead spray and LEPA irrigation system and followed sorghum planted in 2008. Sixteen pre-planned treatments were established in conventional till (CT), strip-till (ST), and no-till (NT) systems using up to four soil residual herbicide timings in a Roundup-based program. Prowl at 34 oz/A was applied to designated plots on April 21. Incorporation was accomplished using a rolling cultivator in conventional till, a strip-till implement, or using 0.9 inches of irrigation in no-till and inter-row areas in strip-till. ST4554B2F was planted on May 14 and Caparol at 38.4 oz/A was applied broadcast in designated plots on the same day.

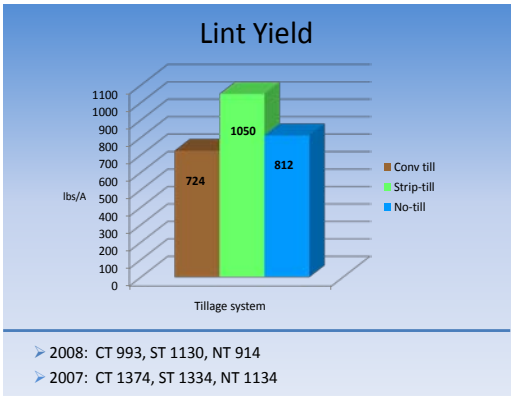


Figure 1. Cotton lint yield in three tillage systems in 2009.

Results: In ST cotton, Prowl H2O followed by Caparol controlled Palmer amaranth 86% when the first application of Roundup PowerMax was made. This control was better than the control achieved with Prowl H2O (60%) or Caparol (75%). Following the early-postemergence application on June 17 and layby application on July 10, all treatments achieved at least 89% control of Palmer amaranth. Gross returns based on lint yield were calculated by treatment in the ST system and ranged from $494 to $640. Herbicide input cost per treatment in ST ranged from $35 (Roundup, Roundup+ diuron) to $79/A (Roundup and all four residual herbicide timings), and net return above weed control costs ranged from $415 to $597. Cotton stand ranged from 1.5 to 1.7 plants per foot in all tillage systems. Effective Palmer amaranth control (93 to 96%) was achieved in all tillage systems, but input costs varied. ST lint yield was greater than CT and NT in 2009 and CT yield was greater than in NT (Figure 1). These results were similar to that observed in 2008, and 2007, CT and ST produced greater yield than NT. Net returns above herbicide and tillage costs were greater in ST compared to the CT and NT systems (Figure 2). Within tillage, weed control benefits using residual herbicides was not apparent; however, residual herbicides are an essential tool for weed resistance management.

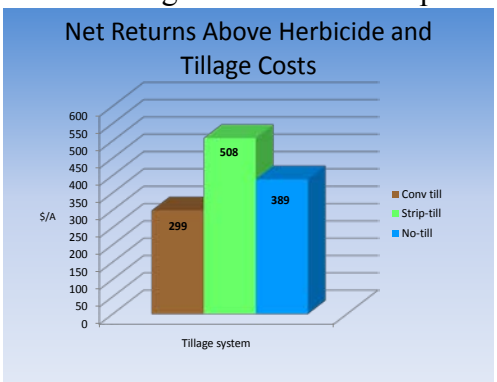


Figure 2. Net returns above herbicide and tillage costs in three tillage systems in 2009.

Cotton Variety Performance as Affected by Low-Energy Precision Application (LEPA) Irrigation Levels at Helms Farm, Halfway, TX, 2009 (Field 5f, spans 5-8)

Wayne Keeling, James Bordovsky, Jacob Reed and Michael Petty

Methodology: Plot size was 4 rows by 500' long with three replications. Four cotton varieties (Stoneville 4288 B2F, FiberMax 9180 B2F, NexGen 3348 B2RF, and DeltaPine 0912 B2RF) were planted 14 May at 52,000 ppa. Each variety was evaluated under three irrigation levels consisting of 6.75", 10.05", and 13.35" in-season irrigation, hereafter referred to as "Low," "Medium," and "High" respectively. The plots were stripper-harvested on 29 October. Additional production information is contained in the Appendix.

Table 1. Lint yields (lb/A) resulting from B2RF varieties and irrigation levels at Helms Farm, Halfway, TX, 2009.

Variety	L	M	H	Avg
NG 3348 B2RF	744 a	1241 a	1188 a	1071 A
ST 4288 B2F	776 a	1132 a	1085 a	1006 B
FM 9180 B2F	785 a	1177 a	1131 a	1041 AB
DP 0912 B2RF	695 a	974 b	853 b	842 C
Avg.	750 C	1131 A	1064 B	
% change	(-34%)	(----)	(6%)	

Table 2. Lint value (¢/lb) resulting from B2RF varieties and irrigation levels at Helms Farm, Halfway, TX, 2009.

Variety	L	M	H	Avg
NG 3348 B2RF	53.26 a	53.25 ab	47.59 a	51.37 A
ST 4288 B2F	51.83 ab	53.53 ab	48.08 a	51.66 A
FM 9180 B2F	53.20 a	53.53 ab	46.79 a	51.17 A
DP 0912 B2RF	50.15 b	52.06 b	44.76 a	48.99 B
Avg.	52.11 A	53.48 A	46.80 B	

Table 3. Gross revenues ($/a) resulting from B2RF varieties and irrigation levels at Helms Farm, Halfway, TX, 2009.

Variety	L	M	H	Avg
NG 3348 B2RF	395 a	657 a	567 a	542 A
ST 4288 B2F	400 a	623 a	522 a	516 A
FM 9180 B2F	416 a	617 a	529 a	522 A
DP 0912 B2RF	345 a	510 b	383 b	410 B
Avg.	389 B	601 A	500 AB	
% change	(-25%)	(----)	(-16%)	

Results: When averaged across varieties, yields ranged from 750 – 1131 lbs lint/A with the highest yield produced with the medium irrigation level. When averaged across irrigation levels, yields ranged from 842 to 1071 lbs lint/A with highest yields produced with NG 3348 B2RF and FM 9180 B2F (Table 1). Lint (loan) values were highest at the medium irrigation level. When averaged across irrigation levels, similar lint values were produced with the NexGen, Stoneville, and FiberMax varieties (Table 2). When averaged across varieties, gross revenues were reduced 35% with the low irrigation treatment and 16% with the high irrigation treatment compared to the medium (base) irrigation (Table 3). This field is infested with high levels of verticullium wilt, which contributed to yield reductions with the high irrigation treatment. The soil population density of *Verticillium dahliae*, the fungus which causes Verticillium wilt was similar across all irrigation rates (5.3, 7.5, and 9.2 microsclerotia/cm^3 soil for low, medium (base), and high irrigation rates, respectively). However, the amount of wilt in the field increased with the medium (22% wilt) and high (25% wilt) irrigation rates compared with the low (5% wilt) irrigation rate in mid August. Both DP 0912 B2RF and ST 4288 B2F had higher incidences of wilt in mid August (21% and 22% wilt, respectively) than did FM 9180 B2F (13% wilt) and NG 3348 B2RF (13% wilt).

Effects of B2RF Variety, SDI Irrigation Levels, and Harvest Method on Cotton Lint Yields, Lint Values, and Gross Revenues at Helms Farm, Halfway, TX, 2009 (Field 6a-f)

Wayne Keeling, Randy Boman, James Bordovsky, John Wanjura, Jacob Reed and Michael Petty

Methodology: Plot size was 4 rows by 1600' long with three replications. Four cotton varieties (NexGen 3348 B2RF, Stoneville 4288 B2RF, FiberMax 9180 B2F, and Delta Pine 0912 B2RF) were planted 13 May under two subsurface drip (SDI) irrigation levels (6.9"and 12.9" in-season irrigation), hereafter referred to as "Low" and High respectively. Four rows from each plot were picker-harvested 26 October and stripper-harvested 27 October. Additional production information is contained in the Appendix.

Results: When yields were averaged across harvest method and irrigation level, similar lint yields (1485-1536 lbs/A) were produced with NG 3348 B2RF, ST 4288 B2RF, and FM 9180 B2F, which were higher than the yield for DP 0912 B2RF (1361 lbs/A) (Table 1), and yield was higher with the high irrigation treatment. When averaged across varieties, similar yields were produced by picker and stripper harvest. Lint values were not affected by irrigation level but were higher with picker harvest in the medium irrigation treatment (Table 2). Gross revenues (yield x lint value) were increased by irrigation level and were different among varieties (Table 3).

Table 1. Lint yields (lbs/A) resulting from B2RF varieties, SDI levels, and harvest method at Halfway, TX, 2009.

	Med		High		Avg.		Variety
Variety	Pick	Strip	Pick	Strip	Pick	Strip	Avg.
NG 3348 B2RF	1281	1256	1613	1800	1447	1528	1488 a
ST 4288 B2RF	1387	1347	1564	1644	1476	1495	1485 a
FM 9180 B2F	1329	1272	1793	1751	1561	1512	1536 a
DP 0912 B2RF	1326	1051	1556	1510	1441	1280	1361 b
Avg.	1331 a	1232 a	1631 a	1676 a	1481	1454	
Irrig. Level Avg.	1281 B		1654 A				

Table 2. Lint values (¢/lb) resulting from B2RF varieties, SDI levels, and harvest method at Halfway, TX, 2009.

	Med		High		Avg.		Variety
Variety	Pick	Strip	Pick	Strip	Pick	Strip	Avg.
NG 3348 B2RF	56.53	55.82	56.42	54.18	56.48	55.00	55.74 ab
ST 4288 B2RF	55.85	54.93	56.70	55.51	56.28	55.23	55.75 ab
FM 9180 B2F	56.40	56.00	57.32	56.08	56.86	56.04	56.45 a
DP 0912 B2RF	55.12	52.93	55.28	54.03	55.20	53.48	54.34 b
Avg.	55.98 a	54.92 b	56.43 a	54.95 a	56.20	54.94	
Irrig. Level Avg.	55.45 A		55.69 A				

Table 3. Gross revenues ($/A) resulting from B2RF varieties, SDI levels, and harvest method at Halfway, TX, 2009.

	Med		High		Avg.		Variety
Variety	Pick	Strip	Pick	Strip	Pick	Strip	Avg.
NG 3348 B2RF	724	703	910	974	817	839	828 a
ST 4288 B2RF	775	737	887	913	831	825	828 a
FM 9180 B2F	749	711	1028	981	889	846	868 a
DP 0912 B2RF	730	555	860	816	795	686	741 b
Avg.	745 a	677 a	921 a	921 a	833	799	
Irrig. Level Avg.	711 B		921 A				

Influence of Soil Nitrogen Level on Seasonal Activity of Cotton Arthropods and Lint Yield under Drip Irrigation (Field 6g)

M.N. Parajulee, S.C. Carroll, R.B. Shrestha, R.J. Kesey, D.M. Nesmith, 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 20, 2009. 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 6 for residual nitrogen analysis and monitored crop growth and insect activity throughout the season. Fertility treatments were applied on July 10 with a soil applicator ground rig.

Results: Cotton arthropod activity remained low throughout the 2009 growing season, except for cotton aphids. Cotton aphid activity began in late August and densities peaked in early- to mid-September. Cotton aphid densities were significantly lower in 0 lb N/acre plots compared with that in N augmented plots, with no significant differences in aphid densities across N plots.

Nitrogen fertility level influenced fruiting profile and boll maturity. Plants quit setting additional squares in zero and 50-lb applied N plots 2 wk into flowering while higher N plots were actively producing squares. Variation in soil residual N levels, coupled with variable N application, resulted in phenotypic expression of nitrogen deficiency in cotton across treatment plots. The zero N plots produced the lowest yield (1,049 lb/acre) and yield increased curvilinearly with each additional 50 lb N added, with highest average yield (1,591 lb/acre) occurring in 150 lb N/acre treatment. The yield did not significantly increase beyond 100 lb N/acre with additional N. Consistent decline in yield beyond 150 lb N/acre suggests that N application beyond 150 lb/acre may be unfavorable for cotton yield.

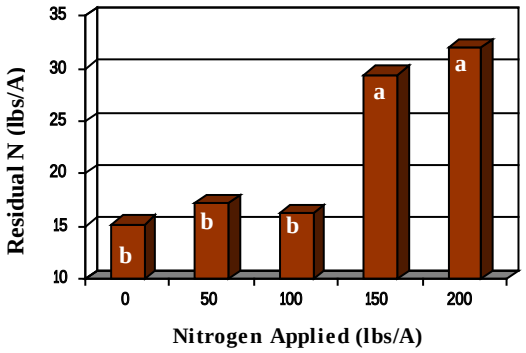


Fig. 1. Effect of nitrogen application rates on residual nitrogen after 7 years of repetitive applications, 2009.

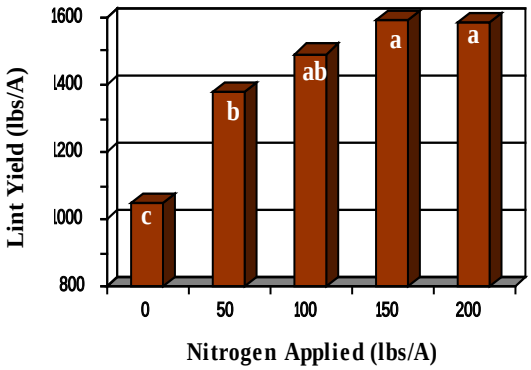


Fig. 2. Effect of nitrogen application rates on lint yield after 7 years of repetitive applications, 2009.

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.

Fig. 1 Picking SDI plots at the Helms research farm, 2009.

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 2009 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 in part to cool, wet weather at planting, hail, and a short growing season, respectively. Overall cotton yields have been fairly high. SDI yields averaged 1335 lb/ac using 14.9 inches compared to LEPA yields of 1114 lb/ac using an average of 11.8 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, 2002-2009. Data from 2004 is estimated due to inadequate module tracking and gin data.

	SDI			LEPA		
	Area (ac)	Tot. Irr. (ac-in/ac)	Yld. (lb/ac)	Area (ac)	Tot. Irr. (ac-in/ac)	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
2009	67.1	16.60	1386	93	12.80	1013
Avg.		**14.91**	**1335**		**11.79**	**1114**

APPENDIX

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

Date			Halfway @ Building	Helms @ Well 1	Field 2				Field 3								Field 5 - A spans 2-4	Field 5 - A spans 5-8				Field 5 - B spans 2-4	Field 5 - B spans 5-8			
					Drip				Drip								Pivot	Pivot				Pivot	Pivot			
					Cotton	Cotton	Cotton		Cotton								Cotton	Cotton				Cotton	Cotton			
Mo	Da	Yr			T 1	T 2	T 3	system	T1	T2	T3	T4	T5	T6	Border	system		Base	Base+50%	Base-50%	system		Base	Base+50%	Base-50%	system
2	8	2009	0.76	0.80																						
3	24	2009			0.40	0.40	0.40	D	0.41	0.41	0.41	0.41	0.41	0.41	0.41	D										
3	25	2009			0.31	0.31	0.31	D	0.35	0.35	0.35	0.35	0.35	0.35	0.35	D										
3	30	2009			0.20	0.20	0.20	D	0.22	0.22	0.22	0.22	0.22	0.22	0.22	D										
3	31	2009			0.30	0.30	0.30	D	0.34	0.34	0.34	0.34	0.34	0.34	0.34	D										
4	1	2009			0.31	0.31	0.31	D	0.34	0.34	0.34	0.34	0.34	0.34	0.34	D										
4	2	2009	0.39	0.46																						
4	7	2009			0.61	0.61	0.61	D	0.69	0.69	0.69	0.69	0.69	0.69	0.69	D										
4	8	2009			0.18	0.18	0.18	D	0.34	0.34	0.34	0.34	0.34	0.34	0.34	D										
4	9	2009			0.31	0.31	0.31	D																		
4	10	2009			0.31	0.31	0.31	D	0.69	0.69	0.69	0.69	0.69	0.69	0.69	D										
4	11	2009	0.70	0.86	0.32	0.32	0.32	D																		
4	12	2009			0.29	0.29	0.29	D																		
4	13	2009			0.06	0.06	0.06	D									0.75	0.75	0.75	0.75	S	0.75	0.75	0.75	0.75	S
4	14	2009			0.25	0.25	0.25	D																		
4	15	2009			0.36	0.36	0.36	D																		
4	16	2009	1.07	0.58																						
4	17	2009																								
4	18	2009															0.75	0.75	0.75	0.75	S	0.75	0.75	0.75	0.75	S
4	26	2009																								
4	27	2009															1.00	1.00	1.00	1.00	S	1.00	1.00	1.00	1.00	S
4	28	2009	0.14	0.05																						
5	3	2009																								
5	4	2009			0.32	0.32	0.32	D																		
5	5	2009			0.24	0.24	0.24	D																		
5	6	2009			0.28	0.28	0.28	D	0.31	0.31	0.31	0.31	0.31	0.31	0.31	D										
5	7	2009			0.30	0.30	0.30	D	0.34	0.34	0.34	0.34	0.34	0.34	0.34	D										
5	8	2009			0.34	0.34	0.34	D																		
5	9	2009			0.32	0.32	0.32	D	0.67	0.67	0.67	0.67	0.67	0.67	0.67	D										
5	10	2009			0.35	0.35	0.35	D	0.36	0.36	0.36	0.36	0.36	0.36	0.36	D										
5	11	2009			0.29	0.29	0.29	D	0.31	0.31	0.31	0.31	0.31	0.31	0.31	D										
5	12	2009			0.33	0.33	0.33	D	0.30	0.30	0.30	0.30	0.30	0.30	0.30	D										
5	13	2009			0.23	0.23	0.23	D	0.22	0.22	0.22	0.22	0.22	0.22	0.22	D										
5	18	2009			0.90	0.90	0.90	D																		
5	19	2009			0.91	0.91	0.91	D																		
5	20	2009			0.86	0.86	0.86	D									0.25	0.25	0.25	0.25	S	0.25	0.25	0.25	0.25	S
5	21	2009			0.84	0.84	0.84	D																		
5	22	2009																								
5	23	2009																								
5	24	2009	1.00	0.27																						
5	25	2009	0.28	0.27	0.09	0.09	0.09	D																		
5	26	2009	0.31	0.30	0.60	0.60	0.60	D																		
5	27	2009			0.60	0.60	0.60	D																		

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

Date			Halfway @ Building	Helms @ Well 1	Field 2				Field 3								Field 5 - A spans 2-4	Field 5 - A spans 5-8				Field 5 - B spans 2-4	Field 5 - B spans 5-8			
					Drip				Drip								Pivot	Pivot				Pivot	Pivot			
					Cotton	Cotton	Cotton		Cotton								Cotton	Cotton				Cotton	Cotton			
Mo	Da	Yr			T 1	T 2	T 3	system	T1	T2	T3	T4	T5	T6	Border	system		Base	Base+50%	Base-50%	system		Base	Base+50%	Base-50%	system
5	28	2009	0.06	0.08																						
6	1	2009	0.39	0.16																						
6	4	2009	0.55	0.32																						
6	10	2009	1.02	1.21																						
6	14	2009	0.30	0.29																						
6	18	2009	0.35	0.50																						
6	20	2009	3.60	3.52																						
6	23	2009																								
6	29	2009	0.47	0.47																						
6	30	2009																								
7	1	2009																								
7	4	2009																								
7	5	2009	0.55	0.41																						
7	7	2009	0.66	0.66																						
7	10	2009			0.10	0.10	0.10	D	0.11	0.11	0.11	0.10	0.10	0.12	0.07	D										
7	11	2009			0.14	0.14	0.14	D	0.11	0.11	0.11	0.13	0.13	0.12	0.07	D										
7	12	2009			0.10	0.10	0.10	D	0.11	0.11	0.11	0.10	0.10	0.12	0.07	D										
7	13	2009			0.10	0.10	0.10	D	0.06	0.06	0.30	0.16	0.16	0.59	0.13	D	0.70	0.70	0.70	0.70	S	0.70	0.70	0.70	0.70	S
7	14	2009			0.14	0.14	0.14	D	0.08	0.08	0.22	0.16	0.16	0.69	0.09	D										
7	15	2009			0.15	0.15	0.15	D	0.09	0.09		0.17	0.17		0.09	D										
7	16	2009	0.11	0.20	0.15	0.15	0.15	D	0.09	0.09		0.17	0.17		0.09	D										
7	17	2009	0.06	0.10	0.30	0.30	0.30	D	0.11	0.11	0.62	0.21	0.21	0.24	0.10	D										
7	18	2009			0.35	0.35	0.35	D	0.12	0.12	0.08	0.26	0.26	0.86	0.18	D										
7	19	2009			0.27	0.27	0.27	D	0.13	0.13		0.25	0.25	0.35	0.10	D										
7	20	2009	0.23	0.25	0.29	0.29	0.29	D	0.13	0.13		0.25	0.25		0.14	D										
7	21	2009			0.27	0.27	0.27	D	0.13	0.13		0.24	0.24		0.10	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
7	22	2009	0.26	0.29	0.30	0.30	0.30	D	0.13	0.13		0.27	0.27		0.15	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
7	23	2009			0.24	0.24	0.24	D	0.18	0.18		0.27	0.27		0.11	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
7	24	2009																								
7	25	2009																								
7	26	2009	0.17	0.12																						
7	27	2009			0.37	0.37	0.37	D	0.17	0.17	0.79	0.27	0.27	0.24	0.10	D										
7	28	2009			0.28	0.28	0.28	D	0.10	0.10	0.10	0.19	0.19	0.75	0.13	D										
7	29	2009	0.37	1.00	0.31	0.31	0.31	D	0.11	0.11		0.23	0.23	0.48	0.13	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
7	30	2009	0.19	0.50	0.29	0.29	0.29	D	0.11	0.11		0.20	0.20		0.13	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
7	31	2009																								
8	1	2009	0.10	0.10																						
8	2	2009																								
8	3	2009			0.33	0.33	0.33	D	0.08	0.08	0.59	0.16	0.16	0.20	0.06	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	4	2009			0.30	0.30	0.30	D	0.12	0.12	0.21	0.20	0.20	0.76	0.16	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	5	2009			0.29	0.29	0.29	D	0.12	0.12		0.27	0.27	0.70	0.14	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	6	2009			0.30	0.30	0.30	D	0.13	0.13		0.25	0.25		0.14	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	7	2009			0.31	0.31	0.31	D	0.13	0.13		0.27	0.27		0.14	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	8	2009			0.35	0.35	0.35	D	0.14	0.14		0.27	0.27		0.18	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L

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

Date			Halfway @ Building	Helms @ Well 1	Field 2				Field 3								Field 5 - A spans 2-4	Field 5 - A spans 5-8				Field 5 - B spans 2-4	Field 5 - B spans 5-8			
					Drip				Drip								Pivot	Pivot				Pivot	Pivot			
					Cotton	Cotton	Cotton		Cotton								Cotton	Cotton				Cotton	Cotton			
Mo	Da	Yr			T 1	T 2	T 3	system	T1	T2	T3	T4	T5	T6	Border	system		Base	Base+50%	Base-50%	system		Base	Base+50%	Base-50%	system
8	9	2009			0.25	0.25	0.25	D	0.12	0.12		0.21	0.21		0.10	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	10	2009			0.28	0.28	0.28	D	0.11	0.11	0.60	0.20	0.20	0.21	0.14	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	11	2009			0.29	0.29	0.29	D	0.11	0.11	0.21	0.26	0.26	0.43	0.14	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	12	2009			0.28	0.28	0.28	D	0.12	0.12		0.28	0.28	0.91	0.14	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	13	2009			0.25	0.25	0.25	D	0.13	0.13		0.23	0.23		0.14	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	14	2009	0.41	0.73	0.13	0.13	0.13	D	0.03	0.03		0.08	0.08		0.14	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	15	2009			0.25	0.25	0.25	D	0.13	0.13		0.24	0.24		0.14	D										
8	16	2009			0.26	0.26	0.26	D	0.13	0.13		0.26	0.26		0.14	D										
8	17	2009				0.25	0.25	D	0.17	0.17	0.55	0.26	0.26	0.24	0.14	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	18	2009				0.23	0.23	D	0.12	0.12		0.26	0.26	0.70	0.14	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	19	2009				0.21	0.21	D	0.13	0.13		0.21	0.21	0.11	0.14	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	20	2009				0.22	0.22	D	0.13	0.13		0.26	0.26		0.14	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	21	2009				0.27	0.27	D	0.15	0.15		0.31	0.31		0.21	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	22	2009				0.23	0.23	D	0.15	0.15		0.25	0.25		0.12	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	23	2009				0.20	0.20	D	0.12	0.12		0.21	0.21		0.09	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	24	2009				0.19	0.19	D	0.12	0.12	0.56	0.27	0.27	0.25	0.14	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	25	2009				0.26	0.26	D	0.12	0.12		0.22	0.22	0.64	0.14	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	26	2009				0.24	0.24	D	0.13	0.13		0.26	0.26	0.14	0.14	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	27	2009				0.25	0.25	D	0.13	0.13		0.27	0.27		0.14	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	28	2009				0.25	0.25	D	0.13	0.13		0.31	0.31		0.15	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	29	2009				0.23	0.23	D	0.13	0.13		0.25	0.25		0.13	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
8	30	2009				0.23	0.23	D	0.13	0.13		0.25	0.25		0.14	D										
8	31	2009					0.07	D	0.10	0.10	0.32	0.14	0.14	0.36	0.08	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
9	1	2009					0.14	D	0.06	0.06	0.18	0.11	0.11	0.39	0.06	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
9	2	2009					0.20	D	0.03	0.03	0.19	0.06	0.06	0.20	0.03	D	0.20	0.20	0.30	0.10	L	0.20	0.20	0.30	0.10	L
9	3	2009	0.43	0.60			0.16	D	0.03	0.03		0.06	0.06		0.03	D										
9	4	2009																								
9	5	2009																								
9	6	2009																								
9	7	2009					0.14	D																		
9	8	2009					0.15	D																		
9	9	2009					0.16	D																		
9	10	2009					0.14	D																		
9	11	2009																								
9	12	2009	0.27	0.19																						
9	13	2009	0.08	0.05																						
9	22	2009	0.23	0.23																						
Pre & At Plant					12.01	12.01	12.01		5.89	5.89	5.89	5.89	5.89	5.89	3.38		2.75	2.75	2.75	2.75		2.75	2.75	2.75	2.75	
Seasonal					8.02	11.28	12.44		5.75	5.75	5.85	10.77	10.77	10.80	6.04		7.30	7.30	10.60	4.00		7.30	7.30	10.60	4.00	
TOTALS			15.51	15.57	20.03	23.29	24.45		11.64	11.64	11.74	16.66	16.66	16.69	9.42		10.05	10.05	13.35	6.75		10.05	10.05	13.35	6.75	

Date			Rainfall (inches)		Helms Irrigation Amounts (inches) L = LEPA irrigation, S = spray irrigation											Helms Irrigation Amounts (inches) L = LEF					Helms Irrigation Amounts (inches) L = LEPA irrigation, S = spray irrigation								
			Halfway @ Building	Helms @ Well 1	Field 5 - C spans 2-4	Field 5 - C spans 5-8				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				Pivot	Pivot				Drip	Drip		Drip	Drip
					Cotton	Cotton				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		Base	Base+50%	Base-50%	system	1.0 B.I.	0.5 B.I.			
2	8	2009	0.76	0.80																									
3	24	2009																											
3	25	2009																											
3	30	2009																											
3	31	2009																						0.33	0.33	0.33	0.40	0.40	
4	1	2009																						0.26	0.26	0.26	0.48	0.48	
4	2	2009	0.39	0.46																				0.67	0.67	0.67	0.86	0.86	
4	7	2009																						0.30	0.30	0.30	0.34	0.34	
4	8	2009																						0.31	0.31	0.31	0.51	0.51	
4	9	2009																						0.31	0.31	0.31	0.35	0.35	
4	10	2009																						0.29	0.29	0.29	0.47	0.47	
4	11	2009	0.70	0.86																				0.27	0.27	0.27	0.28	0.28	
4	12	2009																						0.30	0.30	0.30	0.49	0.49	
4	13	2009			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						0.28	0.28	0.28	0.31	0.31	
4	14	2009																						0.31	0.31	0.31	0.50	0.50	
4	15	2009																											
4	16	2009	1.07	0.58																									
4	17	2009																						0.10	0.10	0.10	0.10	S	
4	18	2009			0.75	0.75	0.75	0.75	S	0.90	0.90	0.90	0.90	S	0.75	0.75	0.75	0.75	S											
4	26	2009																		0.75	0.75	0.75	0.75	S					
4	27	2009			1.00	1.00	1.00	1.00	S	0.85	0.85	0.85	0.85	S	1.00	1.00	1.00	1.00	S											
4	28	2009	0.14	0.05																									
5	3	2009																		0.83	0.83	0.83	0.83	S					
5	4	2009																		0.83	0.83	0.83	0.83	S	0.31	0.31	0.31	0.37	0.37
5	5	2009																							0.28	0.28	0.28	0.45	0.45
5	6	2009																							0.21	0.21	0.21	0.15	0.15
5	7	2009																							0.30	0.30	0.30	0.49	0.49
5	8	2009																							0.30	0.30	0.30	0.35	0.35
5	9	2009																							0.29	0.29	0.29	0.47	0.47
5	10	2009																							0.30	0.30	0.30	0.35	0.35
5	11	2009																							0.28	0.28	0.28	0.46	0.46
5	12	2009																							0.30	0.30	0.30	0.34	0.34
5	13	2009																							0.27	0.27	0.27	0.31	0.31
5	18	2009																											
5	19	2009																											
5	20	2009			0.50	0.50	0.50	0.50	S	0.25	0.25	0.25	0.25	S	0.25	0.25	0.25	0.25	S	0.25	0.25	0.25	0.25	S				0.46	0.46
5	21	2009																									0.47	0.47	
5	22	2009																									0.50	0.50	
5	23	2009																									0.50	0.50	
5	24	2009	1.00	0.27																									
5	25	2009	0.28	0.27																									
5	26	2009	0.31	0.30																									
5	27	2009																											

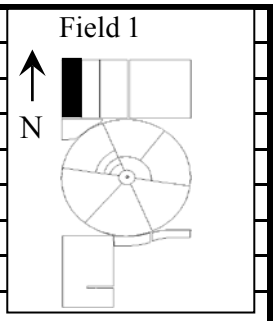
			Rainfall (inches)		Helms Irrigation Amounts (inches) L = LEPA irrigation, S = spray irrigation											Helms Irrigation Amounts (inches) L = LEF					Helms Irrigation Amounts (inches) L = LEPA irrigation, S = spray irrigation								
	Date		Halfway @ Building	Helms @ Well 1	Field 5 - C spans 2-4	Field 5 - C spans 5-8				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				Pivot	Pivot				Drip	Drip		Drip	Drip
					Cotton	Cotton				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		Base	Base+50%	Base-50%	system	1.0 B.I.	0.5 B.I.			
5	28	2009	0.06	0.08																									
6	1	2009	0.39	0.16																									
6	4	2009	0.55	0.32																									
6	10	2009	1.02	1.21																									
6	14	2009	0.30	0.29	1.00	1.00	1.00	1.00	S																				
6	18	2009	0.35	0.50																									
6	20	2009	3.60	3.52																									
6	23	2009			0.30	0.30	0.30	0.30	S																				
6	29	2009	0.47	0.47																					0.28	0.00		0.00	0.38
6	30	2009																							0.13	0.20		0.37	0.00
7	1	2009																							0.28	0.01		0.00	0.38
7	4	2009																											
7	5	2009	0.55	0.41																									
7	7	2009	0.66	0.66																									
7	10	2009																							0.15	0.22		0.35	0.14
7	11	2009																							0.28	0.00		0.00	0.38
7	12	2009																							0.12	0.19		0.37	0.00
7	13	2009			1.00	1.00	1.00	1.00	S	0.70	0.70	0.70	0.70	S	0.70	0.70	0.70	0.70	S	0.70	0.70	0.70	0.70	S	0.25	0.01		0.00	0.35
7	14	2009																							0.13	0.20		0.43	0.00
7	15	2009																							0.28	0.00		0.00	0.47
7	16	2009	0.11	0.20																					0.13	0.20		0.44	0.00
7	17	2009	0.06	0.10	0.70	0.70	0.70	0.70	S																0.32	0.05		0.00	0.49
7	18	2009																							0.21	0.23		0.44	0.03
7	19	2009																							0.30	0.03		0.00	0.44
7	20	2009	0.23	0.25																					0.18	0.21		0.45	0.00
7	21	2009								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	0.32	0.05		0.00	0.56
7	22	2009	0.26	0.29	0.50	0.50	0.75	0.25	L	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	0.20		0.37	0.12
7	23	2009			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	0.20	0.20	0.30	0.10	L	0.25	0.02		0.00	0.59
7	24	2009																							0.18	0.12		0.00	0.59
7	25	2009																							0.13	0.19		0.37	0.10
7	26	2009	0.17	0.12																					0.24	0.02		0.00	0.58
7	27	2009																							0.16	0.17		0.37	0.12
7	28	2009			0.20	0.20	0.30	0.10	L																				
7	29	2009	0.37	1.00	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	0.20	0.20	0.30	0.10	L					
7	30	2009	0.19	0.50						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	31	2009																											
8	1	2009	0.10	0.10																									
8	2	2009																											
8	3	2009			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	0.20	0.20	0.30	0.10	L	0.17	0.26		0.42	0.07
8	4	2009			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	0.20	0.20	0.30	0.10	L	0.33	0.07		0.00	0.57
8	5	2009			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	0.20	0.20	0.30	0.10	L	0.20	0.21		0.47	0.16
8	6	2009			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	0.20	0.20	0.30	0.10	L	0.35	0.07		0.00	0.60
8	7	2009			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	0.20	0.20	0.30	0.10	L	0.19	0.22		0.47	0.12
8	8	2009			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	0.20	0.20	0.30	0.10	L	0.37	0.06		0.04	0.72

			Rainfall (inches)		Helms Irrigation Amounts (inches) L = LEPA irrigation, S = spray irrigation											Helms Irrigation Amounts (inches) L = LEF					Helms Irrigation Amounts (inches) L = LEPA irrigation, S = spray irrigation									
Date			Halfway @ Building	Helms @ Well 1	Field 5 - C spans 2-4	Field 5 - C spans 5-8				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				Pivot	Pivot				Drip	Drip		Drip	Drip
					Cotton	Cotton				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		Base	Base+50%	Base-50%	system	1.0 B.I.	0.5 B.I.			
8	9	2009			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	0.20	0.20	0.30	0.10	L	0.14	0.21		0.42	0.00
8	10	2009			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	0.20	0.20	0.30	0.10	L	0.33	0.07		0.00	0.58
8	11	2009			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	0.20	0.20	0.30	0.10	L	0.20	0.21		0.47	0.14
8	12	2009			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	0.20	0.20	0.30	0.10	L	0.33	0.07		0.00	0.63
8	13	2009			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	0.20	0.20	0.30	0.10	L	0.18	0.19		0.47	0.09
8	14	2009	0.41	0.73	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	0.20	0.20	0.30	0.10	L	0.11	0.07		0.00	0.33
8	15	2009																						0.17	0.19		0.47	0.06
8	16	2009																						0.32	0.07		0.00	0.61
8	17	2009			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	0.20	0.20	0.30	0.10	L	0.16	0.18		0.46	0.10
8	18	2009			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	0.20	0.20	0.30	0.10	L	0.27	0.07		0.00	0.54
8	19	2009			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	0.20	0.20	0.30	0.10	L	0.09	0.16		0.27	0.00
8	20	2009			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	0.20	0.20	0.30	0.10	L	0.32	0.07		0.00	0.52
8	21	2009			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	0.20	0.20	0.30	0.10	L	0.20	0.25		0.46	0.15
8	22	2009			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	0.20	0.20	0.30	0.10	L	0.32	0.00		0.08	0.57
8	23	2009			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	0.20	0.20	0.30	0.10	L	0.10	0.19		0.38	0.00
8	24	2009			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	0.20	0.20	0.30	0.10	L	0.32	0.07		0.00	0.54
8	25	2009			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	0.20	0.20	0.30	0.10	L	0.15	0.18		0.46	0.08
8	26	2009			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	0.20	0.20	0.30	0.10	L	0.31	0.07		0.00	0.50
8	27	2009			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	0.20	0.20	0.30	0.10	L	0.18	0.19		0.46	0.11
8	28	2009			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	0.20	0.20	0.30	0.10	L	0.33	0.06		0.00	0.59
8	29	2009			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	0.20	0.20	0.30	0.10	L	0.18	0.21		0.46	0.03
8	30	2009																						0.30	0.05		0.00	0.51
8	31	2009			0.08	0.08	0.12	0.04	L	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	0.06		0.31	
9	1	2009			0.08	0.08	0.12	0.04	L	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	0.21	0.09		0.21	
9	2	2009			0.08	0.08	0.12	0.04	L	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	0.22	0.09		0.22	
9	3	2009	0.43	0.60																				0.23	0.12		0.23	
9	4	2009																										
9	5	2009																										
9	6	2009																										
9	7	2009																						0.25	0.11		0.23	
9	8	2009																						0.22	0.11		0.22	
9	9	2009																						0.25	0.17		0.22	
9	10	2009																						0.13	0.09		0.16	
9	11	2009																										
9	12	2009	0.27	0.19																								
9	13	2009	0.08	0.05																								
9	22	2009	0.23	0.23																								
Pre & At Plant					3.00	3.00	3.00	3.00		2.75	2.75	2.75	2.75		2.75	2.75	2.75	2.75		2.76	2.76	2.76	2.76		6.47	6.47	6.47	10.66	10.66
Seasonal					9.34	9.34	12.51	6.17		7.30	7.30	10.60	4.00		7.30	7.30	10.60	4.00		7.30	7.30	10.60	4.00		12.85	6.88	0.00	12.02	14.64
TOTALS			15.51	15.57	12.34	12.34	15.51	9.17		10.05	10.05	13.35	6.75		10.05	10.05	13.35	6.75		10.06	10.06	13.36	6.76		19.32	13.35	6.47	22.68	25.30

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	

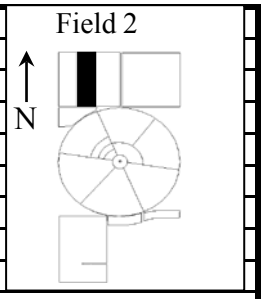
Field Operations	Date	Activity
Tillage	3/2	List
	3/3	Rolling cultivator
Fertility	4/10	applied commercially
Planting		
Herbicide/Growth Regulator	5/1	22 oz/a Roundup
	5/1	48 oz/a Atrazine
Insecticide		
Harvest aid		
Irrigation Amt.		
PrePlant & Planting		
Seasonal		
Rainfall		
PrePlant & Planting		
Seasonal		



Operations Summary

Year	2009
Farm	Helm
Field ID	Field 2
Exp. Design	
Soil Type	

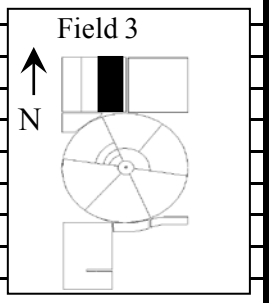
Field Operations	Date	Activity
Tillage	5/1	Cultivated with big sweeps
	5/27	Ran rotary hoe
	6/26	Cultivated and diked
Fertility	3/18	39 lbs of P2O5 & 52 lbs of N applied with thru liquid coulter rig
	7/10 to7/31	100 lbs of N (32-0-0) for zones 1 thru 9 (injected into drip lines)
Planting	5/6	Fibermax 9063 B2F at 54,129seed/ac
Herbicide/Growth Regulator	3/4	Sword 2-4-D 8 oz/ac
	4/20	Roundup at 24 oz/ac
	4/22	Roundup at 24 oz/ac
	5/8	Caparol at 48 oz/ac
	6/22	Roundup at 22 oz/ac
	7/8	Roundup at 22 oz/ac + Ammonium sulfate 17 lbs/100 gal
	8/7	Pentia 8 oz/ac
	8/13	Roundup 22 oz/ac
Insecticide	6/2	Acephate 3 oz/ac
	6/22	Acephate 3 oz/ac
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	3/24 to 5/27	12.01"
Seasonal	5/28 to 8-16	Trt. 1 8.02in.
	5/28 to8/30	Trt. 2 11.28 in.
	5/28 to 9/10	Trt. 3 12.44 in.
Rainfall		
PrePlant & Planting	2/8 to 4/28	2.75 in.
Seasonal	4/29 to 9/22	12.45 in.



Operations Summary

Year	2009
Farm	Helm
Field ID	Field 3
Exp. Design	
Soil Type	

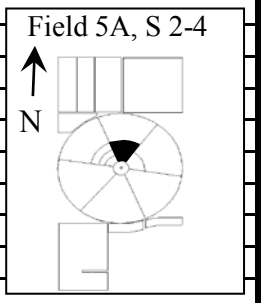
Field Operations	Date	Activity
Tillage	4/30	Cultivated with big sweeps
	5/27	Ran rotary hoe
	6/26	Cultivated
Fertility	3/18	39 lbs of P2O5 & 52 lbs of N applied with thru liquid coulter rig
	7/10 to 8/4	90 lbs of N (32-0-0) for all zones (injected into drip lines)
Planting	5/6	Fibermax 9063 B2RF 54,129 seed/ac
Herbicide/Growth Regulator	3/4	Sword 2-4-D 8 oz/ac
	4/21	Roundup at 24 oz/ac
	5/8	Caparol at 48 oz/ac
	6/17	Roundup at 22 oz/ac
	7/8	Roundup at 22 oz/ac + Ammonium sulfate 17lbs/100gal
	8/7	Stance 4 oz/ac
	8/12	Roundup 22 oz/ac
Insecticide	5/6	Temik 3 lbs/ac at planting
	6/2	Acephate 3 oz/ac
	6/17	Acephate 3 oz/ac
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	3/24 to 5/13	5.89 in.
Seasonal	7/10 to 9/3	T 1&2 5.75"
	7/10 to 9/3	T 4&5 10.77"
	7/10 to 9/2	T 3 5.85"
	7/10 to 9/2	T 6 10.8"
Rainfall		
PrePlant & Planting	2/8 to 4/28	2.75 in.
Seasonal	4/29 to 9/22	12.45 in.



Operations Summary

Year	2009
Farm	Helm
Field ID	Field 5a Spans 2-4
Exp. Design	
Soil Type	

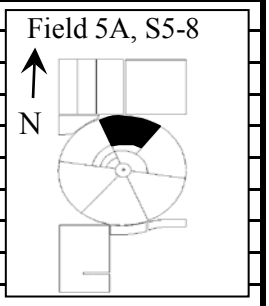
Field Operations	Date	Activity
Tillage	3/4	Offset disk to incorporate dry fertillizer
	3/5	Listed with 8-row bedder
	4/22	Rolling cultivator
	5/26	Rotary hoe
	6/12	Rotary hoe with 8-row skips
	6/16	Rotary hoe
	6/22	Rotary hoe
	7/6	Cultivator with diker
Fertility	3/2	Spread Dry 60-60-0
	7/21 to 7/23	29 lbs/ac of N thru Pivot
	8/3 to 8/6	38 lbs/ac of N thru Pivot
Planting	5/15	Stoneville 4554 B2RF 54,129 seed/ac
Herbicide/Growth Regulator	4/6	Trifluralin at 24 oz/ac
	6/3	Roundup at 24 oz/ac
	6/17	Roundup 22 oz/ac in span 1 & 2
	6/23	Roundup 22 oz/ac in span 4
	7/17	Roundup 22 oz/ac
	8/12	Pentia 8 oz/ac
	8/13	Roundup 22 oz/ac
Insecticide	5/15	Temik 3 lbs/ac at planting
	6/17	Acephate 90wsp 3 oz/ac in span 1 & 2
	6/23	Acephate 90wsp 3 oz/ac in span 4
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	4/13 to 5/20	2.75 in.
Seasonal	7/13 to 9/2	10.05 in.
Rainfall		
PrePlant & Planting	2/8 to 4/28	2.75 in.
Seasonal	4/29 to 9/22	12.45 in.



Operations Summary

Year	2009
Farm	Helm
Field ID	Field 5a Spans 5-8
Exp. Design	
Soil Type	

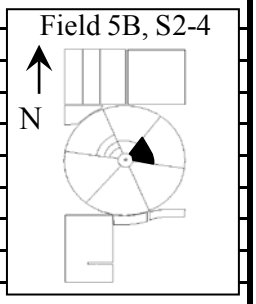
Field Operations	Date	Activity
Tillage	3/4	Ran offset disk to incorporate dry fertillizer
	3/5	Listed with 8-row bedder
	4/22	Ran rolling cultivator
	5/26	Rotary hoe
	6/12	Ran rotary hoe with 8-row skips
	6/16	Rotary hoe
	6/22	Rotary hoe
	7/6	Cultivator with diker
Fertility	3/2	Spread Dry 60-60-0
	7/21 to 7/23	29 lbs/ac of N thru Pivot +/- 50%
	8/3 to 8/6	38 lbs/ac of N thru Pivot +/- 50%
Planting	5/12	Bayer Cap (various varieties) 54,129 seed/ac
	5/30	Soybeans (Asgrow 4303RR, 7643392) 174,240 seed/ac in span 8 48rows
Herbicide/Growth Regulator	4/6	Trifluralin 24 oz/ac
	6/1	ET 2 oz/ac & COC 16oz/ac in span 8 48rows
	6/3	Roundup 24 oz/ac
	6/17	Roundup 22 oz/ac in spans 7 & 8
	6/23	Roundup 22 oz/ac in spans 5 & 6
	7/17	Roundup 22 oz/ac
	8/10	Meplex 8 oz/ac on Base and High Irr.
Insecticide	5/12	Temik 3 lbs/ac at planting
	6/17	Acephate 3 oz/ac in span 7 & 8
	6/23	Acephate 3 oz/ac in span 5 & 6
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	4/13 to 5/20	2.75 in.
Seasonal	7/13 to 9/2	Base =10.05 in. +50% = 13.35 in., -50% 6.75 in.
Rainfall		
PrePlant & Planting	2/8 to 4/28	2.75 in.
Seasonal	4/29 to 9/22	12.45 in.



Operations Summary

Year	2009
Farm	Helm
Field ID	Field 5b Spans 2-4
Exp. Design	
Soil Type	

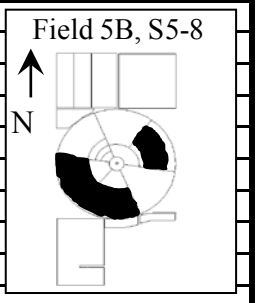
Field Operations	Date	Activity
Tillage	3/4	Offset disk to incorporate dry fertillizer
	3/5	Listed with 8-row bedder
	4/23	Rolling culivator
	5/26	Rotary hoe
	6/16	Rotary hoe
	6/22	Rotary hoe
	7/6	Cultivator with diker
Fertility	3/2	Spread Dry 60-60-0
	7/21 to 7/23	29 lbs/ac of N thru Pivot
	8/3 to 8/6	38 lbs/ac of N thru Pivot
Planting	5/14,15	Stoneville 4554 B2RF 54,129 seed/ac
Herbicide/Growth Regulator	4/6	Trifluralin 24 oz/ac
	6/4	Roundup 24 oz/ac
	6/17	Roundup 22 oz/ac in span 2
	6/23	Roundup 22 oz/ac in span 4
	7/17	Roundup 22 oz/ac
	8/12	Pentia 8 oz/ac
	8/13	Roundup 22 oz/ac
Insecticide	5/15	Temik 3 lbs/ac at planting
	6/17	Acephate 3 oz/ac in span 2
	6/23	Acephate 3 oz/ac in span 4
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	4/13 to 5/20	2.75 in.
Seasonal	7/13 to 9/2	10.05 in.
Rainfall		
PrePlant & Planting	2/8 to 4/28	2.75 in.
Seasonal	4/29 to 9/22	12.45 in.



Operations Summary

Year	2009
Farm	Helm
Field ID	Field 5bde Spans 5-8
Exp. Design	
Soil Type	

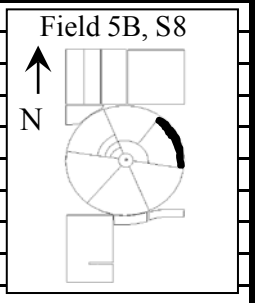
Field Operations	Date	Activity
Tillage	3/4	Offset disk to incorporate dry fertillizer
	3/5	Listed with 8-row bedder
	4/23	Rolling culivator
	5/26	Rotary hoe
	6/16	Rotary hoe
	6/22	Rotary hoe
	7/6	Cultivator with diker
Fertility	3/2	Spread Dry 60-60-0
	7/21 to 7/23	29 lbs/ac of N thru Pivot +/- 50%
	8/3 to 8/6	38 lbs/ac of N thru Pivot +/- 50%
Planting	5/13	Stoneville 4554 B2RF, DeltaPine 104 B2RF 54,129 seed/ac
Herbicide/Growth Regulator	4/6	Trifluralin 24 oz/ac
	5/15,20	Roundup 24 oz/ac in sections D,E
	6/3,4	Roundup 24 oz/ac in sections B,E all spans; section D span 5 only
	6/17,23	Roundup 22 oz/ac
	7/17	Roundup 22 oz/ac only section B
	7/27	Roundup 22 oz/ac only section D,E
	8/10,11	Pentia 8 oz/ac on Base and High Irr.
	8/13	Roundup 22 oz/ac only section D
Insecticide	5/13,14	Temik 3 lbs/ac at planting
	6/17,23	Acephate 90wsp 3 oz/ac
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	4/13 to 5/20	2.75 in.
Seasonal	7/13 to 9/2	Base =10.05 in. +50% = 13.35 in., -50% 6.75 in.
Rainfall		
PrePlant & Planting	2/8 to 4/28	2.75 in.
Seasonal	4/29 to 9/22	12.45 in.



Operations Summary

Year	2009
Farm	Helm
Field ID	Field 5b Span 8
Exp. Design	
Soil Type	

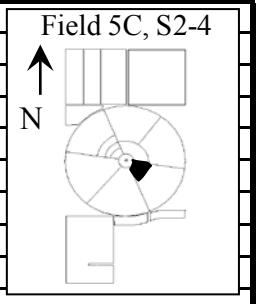
Field Operations	Date	Activity
Tillage	3/4	Offset disk to incorporate dry fertillizer
	3/5	Listed with 8-row bedder
	4/23	Rolling culivator
	5/26	Rotary hoe
	6/16	Rotary hoe
	6/22	Rotary hoe
	7/6	Cultivator with diker
Fertility	3/2	Spread Dry 60-60-0
	7/21 to 7/23	29 lbs/ac of N thru Pivot +/- 50%
	8/3 to 8/6	38 lbs/ac of N thru Pivot +/- 50%
Planting	5/30	Soybeans (Asgrow 4303RR, 7643392) 106,586 seed/ac in span 8 48rows
Herbicide/Growth Regulator	4/2	Trifluralin 32 oz/a
	6/3	Roundup 24 oz/ac
	6/17	Roundup 22 oz/ac in span 8
	7/17	Roundup 22 oz/ac
Insecticide	6/17	Acephate 90wsp 3 oz/ac
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	4/13 to 5/20	2.75 in.
Seasonal	7/13 to 9/2	Base =10.05 in. +50% = 13.35 in., -50% 6.75 in.
Rainfall		
PrePlant & Planting	2/8 to 4/28	2.75 in.
Seasonal	4/29 to 9/22	12.45 in.



Operations Summary

Year	2009
Farm	Helm
Field ID	Field 5c (Spans 2-4)
Exp. Design	
Soil Type	

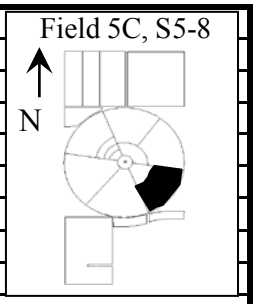
Field Operations	Date	Activity
Tillage	3/4	Offset disk to incorporate dry fertillizer
	3/5	Listed with 8-row bedder
	4/15	Rolling cultivator
	5/26	Rotary hoe
	6/8,9	Cultivated
	6/16	Furrow dike
Fertility	3/2	Spread Dry 60-60-0
	7/21 to 7/23	29 lbs/ac of N thru Pivot
	8/3 to 8/6	38 lbs/ac of N thru Pivot
Planting	5/20	Fact Test (Sorghum) 70,000 seed/ac in span 4 and 8rows in span3
		Sorghum 480 70,000 seed/ac in spans 2,3
Herbicide/Growth Regulator		
	5/15	Roundup 24 oz/ac
	5/20	Mil-Pro 31.9 oz/ac
	5/20	Dual 16 oz/ac
	6/24	Stealth 31.9 oz/ac
Insecticide		
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	4/13 to 5/20	3.00 in.
Seasonal	6/14 to 9/2	9.34 in.
Rainfall		
PrePlant & Planting	2/8 to 4/28	2.75 in.
Seasonal	4/29 to 9/22	12.45 in.



Operations Summary

Year	2009
Farm	Helm
Field ID	Field 5c Spans 5-8
Exp. Design	
Soil Type	

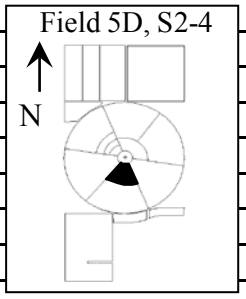
Field Operations	Date	Activity
Tillage	3/4	Offset disk to incorporate dry fertillizer
	3/5	Listed with 8-row bedder
	4/15	Rolling cultivator
	5/26	Rotary hoe
	6/8,9	Cultivated
	6/24	Cultivated and Diked
Fertility	3/2	Spread Dry 60-60-0
	7/21 to 7/23	29 lbs/ac of N thru Pivot +/- 50%
	8/3 to 8/6	38 lbs/ac of N thru Pivot +/- 50%
Planting	5/19	Sorghum Pioneer 85G62 & 85G01 70,000 seed/ac
Herbicide/Growth Regulator		
	5/15	Roundup 24 oz/ac
	5/20	Mil-Pro 31.9 oz/ac
	5/20	Dual 16 oz/ac
	6/24	Stealth 31.9 oz/ac
Insecticide		
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	4/13 to 5/20	3.00 in.
Seasonal	6/14 to 9/2	Base = 9.34in., +50% = 12.51 in., -50% = 6.17 in.
Rainfall		
PrePlant & Planting	2/8 to 4/28	2.75 in.
Seasonal	4/29 to 9/22	12.45 in.



Operations Summary

Year	2009
Farm	Helm
Field ID	Field 5d (Spans 2-4)
Exp. Design	
Soil Type	

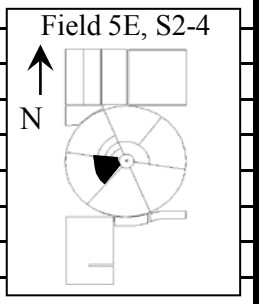
Field Operations	Date	Activity
Tillage	3/31	Offset disk to incorporate dry fertillizer
	4/1	Listed with 8 row bedder
	4/16	Rolling cultivator
	5/26	Rotary hoe
	6/16	Rotary hoe
	6/22	Rotary hoe
	7/6	Cultivator with diker
Fertility	3/12	Spread Dry 60-60-0
	7/21 to 7/23	29 lbs/ac of N thru Pivot
	8/3 to 8/6	38 lbs/ac of N thru Pivot
Planting	5/14,15	Stoneville 4554 B2RF 54,129 seed/ac
Herbicide/Growth Regulator	4/6	Trifluralin at 24 oz/ac
	5/15	Roundup 24 oz/ac
	7/13	Roundup 22 oz/ac span 3
	7/27	Roundup 22 oz/ac span 3
	8/11	Pentia 8 oz/ac
	8/13	Roundup 22 oz/ac span 3
Insecticide	5/14,15	Temik 3 lbs/ac at planting
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	4/13 to 5/20	2.75 in.
Seasonal	7/13 to 9/2	10.05 in.
Rainfall		
PrePlant & Planting	2/8 to 4/28	2.75 in.
Seasonal	4/29 to 9/22	12.45 in.



Operations Summary

Year	2009
Farm	Helm
Field ID	Field 5e (Spans 2-4)
Exp. Design	
Soil Type	

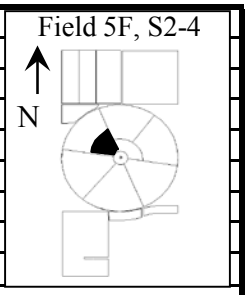
Field Operations	Date	Activity
Tillage	3/31	Offset disk to incorporate dry fertillizer
	4/1	Listed with 8 row bedder
	4/17	Rolling cultivator
	5/26	Rotary hoe
	6/16	Rotary hoe
	6/22	Rotary hoe
	7/6	Cultivator with diker
Fertility	3/12	Spread Dry 60-60-0
	7/21 to 7/23	29 lbs/ac of N thru Pivot
	8/3 to 8/6	38 lbs/ac of N thru Pivot
Planting	5/15	Fibermax 9063 B2RF 54,129 seed/ac in spans 1&2
		DeltaPine 121 RF 54,129 seed/ac in spans 3&4
Herbicide/Growth Regulator	4/6	Trifluralin at 24 oz/ac
	5/20	Roundup 24 oz/ac
	6/3	Roundup 24 oz/ac
	6/23	Roundup 22 oz/ac in span 2
	7/17	Roundup 22 oz/ac in span 2
	7/27	Roundup 22 oz/ac in span 2
	7/28	Staple 1 oz/ac with crop oil
	8/11	Pentia 8 oz/ac
Insecticide	5/15	Temik 3 lbs/ac at planting
	6/22	Acephate 90wsp 3 oz/ac in spans 3&4
	6/23	Avephate 90wsp 3 oz/ac in span 2
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	4/13 to 5/20	2.75 in.
Seasonal	7/13 to 9/2	10.05 in.
Rainfall		
PrePlant & Planting	2/8 to 4/28	2.75 in.
Seasonal	4/29 to 9/22	12.45 in.



Operations Summary

Year	2009
Farm	Helm
Field ID	Field 5f (Spans 2-4)
Exp. Design	
Soil Type	

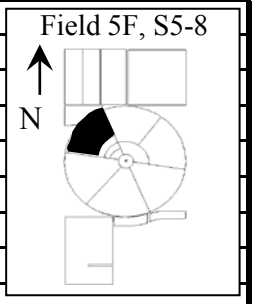
Field Operations	Date	Activity
Tillage	3/31	Offset disk to incorporate dry fertillizer
	4/2	Listed with 8 row bedder
	4/20	Rolling cultivator
	5/26	Rotary hoe
	6/16	Rotary hoe
	6/22	Rotary hoe
	7/6	Cultivator with diker
Fertility	3/12	Spread Dry 60-60-0
	7/21 to 7/23	29 lbs/ac of N thru Pivot
	8/3 to 8/6	38 lbs/ac of N thru Pivot
Planting	5/8	Paymaster 2140 B2RF 54,129 seed/ac
Herbicide/Growth Regulator	4/6	Trifluralin 24 oz/ac
	6/3	Roundup 24 oz/ac
	6/17	Roundup 22oz/ac in span 2
	6/23	Roundup 22 oz/ac on span 4
Insecticide	5/8	Temik 3 lbs/ac at planting
	6/17	Sprayed Acephate 90wsp 3 oz/ac in span 2
	6/23	Sprayed Acephate 90wsp 3 oz/ac on span 4
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	4/13 to 5/20	2.76 in.
Seasonal	7/13 to 9/2	10.06 in.
Rainfall		
PrePlant & Planting	2/8 to 4/28	2.75 in.
Seasonal	4/29 to 9/22	12.45 in.



Operations Summary

Year	2009
Farm	Helm
Field ID	Field 5f (Spans 5-8)
Exp. Design	
Soil Type	

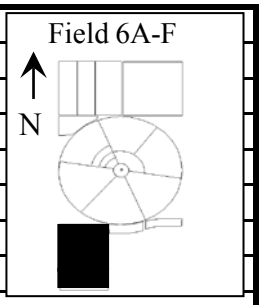
Field Operations	Date	Activity
Tillage	3/31	Offset disk to incorporate dry fertillizer
	4/2	Listed with 8 row bedder
	4/20	Rolling cultivator
	5/26	Rotary hoe
	6/16	Rotary hoe
	6/22	Rotary hoe
	7/6	Cultivator with diker
Fertility	3/12	Spread Dry 60-60-0
	7/21 to 7/23	29 lbs/ac of N thru Pivot +/- 50%
	8/3 to 8/6	38 lbs/ac of N thru Pivot +/- 50%
Planting	5/8	DeltaPine 0912 B2RF, Fibermax 9180 B2RF, Stoneville 4288 B2RF, NexGen B2RF
		54,129 seed/ac
Herbicide/Growth Regulator	4/6	Trifluralin 24 oz/ac
	6/3	Roundup 24 oz/ac
	6/17	Roundup 22 oz/ac in spans 7 & 8
	6/23	Roundup 22 oz/ac in spans 5 & 6
	8/10	Meplex 8 oz/ac on Base and High Irr.
Insecticide	5/8	Temik 3 lbs/ac at planting
	6/17	Sprayed Acephate 3 oz/ac in span 7 & 8
	6/23	Sprayed Acephate 3 oz/ac in span 5 & 6
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	4/13 to 5/20	2.76 in.
Seasonal	7/13 to 9/2	Base =10.06 in. +50% = 13.36 in., -50% 6.76 in.
Rainfall		
PrePlant & Planting	2/8 to 4/28	2.75 in.
Seasonal	4/29 to 9/22	12.45 in.



Operations Summary

Year	2009
Farm	Helm
Field ID	Field 6 - Zone A-F
Exp. Design	
Soil Type	

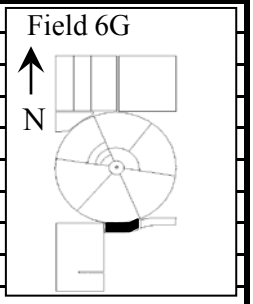
Field Operations	Date	Activity
Tillage	5/1	Cultivated with big sweeps
	5/26	Ran rotary hoe with skips
	6/17	Cultivated Zones A thru C
	6/25	Cultivated Zones D thru F
Fertility	3/17	60 lbs of P2O5 & 43 lbs of N applied with thru liquid coulter rig
	6/30 to 7/31	80 lbs of N (32-0-0) for High Irr. (injected into drip lines)
	6/30 to 7/31	40 lbs of N (32-0-0) for Low Irr. (injected into drip lines)
Planting	5/5	Fibermax 9063 B2RF, Stoneville 4288 B2RF, NexGen 3348 B2RF, DeltaPine 0912 B2RF
		54,129 seed/ac
Herbicide/Growth Regulator	3/5	Sword 2-4-D 8 oz/ac
	4/22	Roundup 24 oz/ac
	5/6	Caparol 48 oz/ac
	6/4	Roundup 24 oz/ac
	7/8	Roundup 22 oz/ac & ammonium sulfate 17 lbs/100gals
	7/9	Pentia 4 oz/ac
	7/24	Pentia 4 oz/ac
	8/7	Pentia 8 oz/ac only on High Irr. zones
	8/12	Roundup 22 oz/ac
Insecticide	5/6	Temik 3 lbs/ac at planting
	6/2	Acephate 3 oz/ac
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	3/31 to 5/14	Dry 6.68 in. Low 6.68in. High 6.68 in.
Seasonal	6/29 to9/10	Dry 0.0 in. Low 6.88 in. High 12.85 in.
Rainfall		
PrePlant & Planting	2/8 to 4/28	2.75 in.
Seasonal	4/29 to 9/22	12.45 in.



Operations Summary

Year	2009		
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	6/12	Rotary Hoe
	6/16	Rotary Hoe
	6/22	Rotary Hoe
	6/27	Cultivated
Fertility		Variouls N levels applied with coulters on wet sides of beds
Planting	5/18	Fibermax 9063B2RF 54,129 seed/ac
Herbicide/Growth Regulator	3/5	Sword 2-4-D 8 oz/ac
	4/22	Roundup 24 oz/ac
	5/22	Roundup 24 oz/ac & LI700 42.26 oz/ac
	6/22	Roundup 22 oz/ac
Insecticide	6/2	Acephate 3 oz/ac
	8/17	Karate 4 oz/ac
	8/28	Karate 4 oz/ac
	8/31	Karate 4 oz/ac
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	3/31 to 5/23	10.66 in.
Seasonal	6/29 to 9/10	12.02 in.
Rainfall		
PrePlant & Planting	2/8 to 4/28	2.75 in.
Seasonal	4/29 to 9/22	12.45 in.



Operations Summary

Year	2009	
Farm	Helm	
Field ID	Field 6 - Zone H	Cotton Drip Irrigated Variety, Herbicide, Keeling
Exp. Design	Replicated	
Soil Type		

Field Operations	Date	Activity
Tillage	6/24	Cultivated
Fertility	2/27	60-30-0 Liquid appllied with a coulter rig
Planting	5/15	Corn varieties 44,000 seed/ac, Sorghum Guacho 480 44,000 seed/ac for border
Herbicide/Growth Regulator	3/5	Sword 2-4-D 8 oz/ac
	4/24	Roundup 24 oz/ac
	5/20	Atrazin 31.9 oz/ac
	5/20	Dual 26.72 oz/ac
	6/24	Stealth 31.9 oz/ac
Insecticide		
Harvest aid		
Irrigation Amt.		
PrePlant & Planting	3/31 to 5/23	10.66 in.
Seasonal	6/29 to 8/30	14.64 in.
Rainfall		
PrePlant & Planting	2/8 to 4/28	2.75 in.
Seasonal	4/29 to 9/22	12.45 in.