NORTH PLAINS
GROUNDWATER
Conservation District

200 -12 Reduced Irrigation on Corn Demonstration Project – 2012

Principal Participants:

Leon New- Agricultural Engineer (District Conservationist)

Randy Coon- Natural Resource Specialist (NPGCD)

Paul Sigle- Biological & Agricultural Engineer Intern (Texas A&M)

Brian Downs- Agricultural Systems Management Intern (Texas A&M)

Joe Reinart- Sherman County Cooperator

Harold Grall- Moore County Cooperator

Tommy Laubhan- Lipscomb County Cooperator

Dennis Buss, JBS Hartley Feeders- Hartley County Cooperator

Brent Clark- Hartley County Cooperator

Richard Schad- Hansford County Cooperator

Danny Krienke- Ochiltree County Cooperator

Phil Haaland- Hartley County Cooperator

Myles Frische- Moore County Cooperator

David Ford- Hartley County Cooperator

Chad Hicks- Hartley County Cooperator

Brian Bezner- Dallam County Cooperator

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Texas Water Development Board – Agricultural Water Conservation Grant

USDA NRCS-Conservation Innovation Grant

A special thanks goes out to all who help to make the 200-12 demonstrations possible.

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Executive Summary

In 2009, the District began planning a demonstration project, referred to as the "200-12 Project". The purpose of the project is to implement conservation technologies and practices to attempt to grow 200 bushels of corn on 12 inches of irrigation per crop acre. Corn irrigation averaged 21 inches per acre over 10 years according to the AgriPartner field demonstrations conducted by AgriLife Extension. The 200-12 Project is a five year on-farm, field scale project that demonstrates how water conservation technologies and irrigation management practice adjustments can reduce groundwater use and allow agricultural irrigation producers to remain profitable and financially viable with restricted and/or diminishing groundwater resources. For the 2012 growing year, the District increased the number of demonstration sites from 3 that included 270 acres in 2009, 9 sites and 682 acres in 2011, to 24 sites and 2152 acres in 2012.

In 2010, three District directors (Harold Grall, Danny Krienke and Phil Haaland) dedicated their own irrigated acres to the first year of the 200-12 Project. The cooperators implemented new and proven irrigation management technologies and practices to aid in strategic management of each reduced irrigation demonstration site. In 2011, six more participants (Dennis Buss "JBS Hartley Feeders", Chad Hicks, Joe Reinart, James Born, Steve Shields, and Brian Bezner) joined the project and also implemented new strategic management practices. In 2012, Brent Clark, David Ford, Frische Brothers, Richard Schad and Tommy Laubhan joined the project while James Born and Steve Shields did not participate. Each 2012 participant committed two fields to the project, one called the "200-12" field, the other the "control" field.

2010 was a year with above average rainfall but 2011 was the opposite with well below average rainfall. Overall, 2012 was better than 2011 but beginning soil water and seasonal rainfall was below normal and limited production to less than expected and needed. High temperatures during the last two weeks in July and the first week in August, with only limited to no rainfall created the need for more irrigation. Six fields received hail damage that reduced harvest yields. Due to the lack of supplemental rainfall, one participant was forced to divert water to fields that required more input to prevent devastating financial loss. Another participant harvested silage.

Joe Reinart of Sherman County dedicated 135 acres to the on-farm demonstration in two separate fields irrigated by different center pivot systems. Reinart strip tilled and planted 60 acres of corn at 25,000 seeds/acre May 16 for his "200-12" field. He strip tilled and planted 75 acres at 33,000 seeds/acre on April 23 for his "control" field. The 200-12 field produced a 170 bushel per acre corn yield. Irrigation totaled 18.20 inches. Production in the control field was 205 bushels per acre, where seasonal irrigation was 21.25 and pre-water 6.50 inches to establish a total of 27.75 inches. The control field's net gain was $116.91 per acre with 9.55 inches more irrigation used compared to production from the 200-12 field. Reinart stated,

"if you didn't have to count the outside and southwest side of the circle, it all would have been really good corn".

Harold Grall of Moore County dedicated 240 acres to the on-farm demonstration in two separate fields irrigated by different center pivots. Grall strip tilled and planted 120 acres of corn on May 28 at 28,000 seeds/acre "200-12" field. Grall planted 120 acres, also strip tilled, on May 24 at 26,000 seeds/acre for his "control" field. The 200-12 field produced a 167 bushel per acre corn yield. Irrigation totaled 16.87 inches. Production in the control field was 140 bushels per acre, where seasonal irrigation was 18.07 inches. There was no pre-water in either field. In comparison, the 200-12 field produced 27 more bushels per acre than the control with 1.20 less inches of irrigation. The 200-12 field's net gain was $163.66 per acre with 1.20 inches less irrigation used compared to production from the control field.

Tommy Laubhan of Lipscomb County dedicated 122 acres in the same field irrigated by the same center pivot to the on-farm demonstration. Laubhan strip tilled and planted 61 acres of corn in the southwest quarter of the circle on May 4 at a seeding rate of 31,000 seeds/acre for his "200-12" field. He planted the northwest quarter, 61 acres, also strip tilled, on May 4 at 31,000 seeds/acre for his "control" field. The 200-12 field produced a 165 bushel per acre corn yield. Irrigation totaled 20.31 inches. Production in the control field was 174 bushels per acre. Seasonal irrigation totaled 22.78 inches. There was no pre-season irrigation. The control field's net gain was $44.40 per acre with 2.47 inches additional irrigation used compared to production from the 200-12 field. Laubhan thinks the primary reason corn yield was greater in the control is that the soil is better in more of the field for crop production. His farm average yield was 186 bushels per acre. Laubhan says the NPGCD 200-12 project provides good information and that he is glad to participate.

Hartley Feeders (Dennis Buss) of Hartley County dedicated 180 acres in two separate fields irrigated by different center pivots to the on-farm demonstration. Hartley Feeders strip tilled and planted 60 acres of corn on May 28 at 28,000 seeds/acre in the north half of the circle for their "200-12" field. Hartley Feeders planted 120 acres, also strip tilled, on May 28 at 28,000 seeds/acre for their "control" field. The 200-12 field produced a 160 bushel per acre corn yield. Irrigation totaled 20.68 inches. Production in the control field was 115 bushels per acre, where seasonal irrigation totaled 21.54 inches. In comparison, the 200-12 field produced 45 more bushels per acre than the control with 0.86 inches less irrigation. The 200-12 field's net gain was $285.38 per acre with 0.86 inches less irrigation used compared to production from the control field. Dennis Buss thinks the primary reason for the lower yield in the control field is that the field was not strip tilled when 3.45 inch rain fell in April. The 200-12 field was already strip tilled and stored more of the early season rainfall.

Brent Clark of Hartley County dedicated 240 acres in two separate fields irrigated by different center pivots to the on-farm demonstration. Clark strip tilled and planted 120 acres of corn on April 23 at 27,000 seeds/acre for his "200-12" field. Clark planted 120 acres on April 23 at 32,000 seeds/acre, also strip tilled, for his "control" field. The 200-12 field produced a 143 bushel per acre corn yield. Irrigation totaled 14.90 inches. Production in the control field was 133 bushels per acre, where seasonal irrigation totaled 18.63 inches. In comparison, the 200-12 field produced ten more bushels per acre than the control with 3.73 inches less irrigation. The 200-12 field's net gain was $120.40 per acre with 3.75 inches less irrigation used compared to production from the control field. Both fields were affected by significant hail damage but recovered to produce a partial crop.

Richard Schad of Hansford County dedicated 164 acres in two separate fields irrigated by different center pivots to the on-farm demonstration. Schad strip tilled and planted 41 acres of corn on May 11 at 24,000 seeds/acre in the west half circle for his "200-12" field. Schad planted 123 acres on May 1 at 32,500 seeds/acre, also strip tilled, for his control. The 200-12 field produced a 135 bushel per acre corn yield. Irrigation totaled 19.53 inches. Production in the control field was 205 bushels per acre, where irrigation was 20.59 inches. Pre -season irrigation was 3.11 inches for the 200-12 field and 5.11 for the control. In comparison, the control field produced 72 more bushels per acre than the 200-12 with 1.06 additional inches of irrigation. The control field's net gain was $376.51 per acre with 1.06 inches more irrigation used compared to production from the 200-12 field. Schad stated, "I was really stretched for water to irrigate the fields. We had two new center pivots and another one moved to previous dry land acres. There were delays getting the irrigation systems ready and the crops planted. I thought we had lost too much of the crops in July when it didn't rain. However, crop yields were much better than expected earlier in the season."

Danny Krienke of Ochiltree County dedicated 120 acres in one field irrigated by the same center pivot to the on-farm demonstration. Krienke strip tilled and planted 60 acres of corn on May 21 at 27,000 seeds/acre in the southwest quarter of the circle for his 200-12 field. He planted the southeast quarter circle 60 acres on May 21 at 27,000 seeds/acre, also strip tilled, for his control field. The 200-12 field produced a 134 bushel per acre corn yield. Irrigation totaled 24.57 inches. Production in the control field was 131 bushels per acre. Seasonal irrigation totaled 26.62 inches. There was no pre-season irrigation. The 200-12 field produced three more bushels per acre than the control and irrigation was 2.10 inches less. The 200-12 field's net gain was $28.59 per acre with 2.10 inches less irrigation used compared to production from the control field.

Phil Haaland of Hartley County dedicated 120 acres in one field irrigated by the same center pivot to the on-farm demonstration. Haaland strip tilled and planted 15 acres from, 270 to

315 degrees in the circle, to corn on May 24 at 26,000 seeds/acre for his 200-12 field. He planted the remaining 105 acres in the circle on May 24 at 30,000 seeds/acre, also strip tilled, for his control field. The 200-12 field produced a 116 bushel per acre corn yield. Irrigation totaled 24.47 inches. Production in the control field was 209 bushels per acre. Seasonal irrigation totaled 28.08 inches. Pre-season irrigation was 3.33 inches in both fields. In comparison, the 200-12 field produced 93 less bushels per acre than the control and irrigation was 3.61 inches less. The 200-12 field's net loss was $554.32 per acre with 3.61 inches less irrigation used compared to production from the control field. It was too long between irrigations for the 200-12 field in July. Haaland says the lack of rainfall during the 2012 growing season created another unwanted challenge for growers.

Frische Brothers of Moore County dedicated 107 acres in one field irrigated by the same center pivot to the on-farm demonstration. Frische Brothers strip tilled and planted 53 acres of corn in the west half circle on May 6 at 28,000 seeds/acre for their 200-12 field. They planted the east half, 53 acres, on May 6 at 28,000 seeds/acre, also strip tilled, for their control field. The 200-12 field produced a 104 bushel per acre corn yield. Irrigation totaled 13.52 inches. Production in the control field was 105 bushels per acre. Seasonal irrigation totaled 14.64 inches. Pre-season irrigation was 1.50 inches in both fields. Plants in both fields were damaged by hail in mid-June. In comparison, the 200-12 field produced one less bushel per acre than the control and irrigation was 1.12 inches less. The 200-12 field's net loss was $0.87 per acre with 1.12 inches less irrigation used compared to production from the control field. Myles Frische said the hail caused a reduction in plant population plus additional evapotranspiration due to less canopy. And, with hindsight, the crop likely should have been replanted.

David Ford of Hartley County dedicated 120 acres in one field irrigated by the same center pivot to the on-farm demonstration. Ford strip tilled and planted 60 acres of corn in the south half circle on May 15 at 28,000 seeds/acre for his 200-12 field. He planted the north half circle 60 acres on May 15 at 32,000 seeds/acre, also strip tilled, for his control field. The 200-12 field produced an 86 bushel per acre corn yield. Irrigation totaled 15.61 inches. Production in the control field was 173 bushels per acre. Seasonal irrigation totaled 20.64 inches. Pre-season irrigation was 2.60 inches in both fields. Both fields were damaged by hail at the seven leaf stage. The 200-12 field's net loss was $487.61 per acre with 5.03 inches less irrigation used compared to production from the control field. Ford says the 2012 demonstration was not a good comparison due to the hail damage. Also Ford says that reduced corn irrigation following a previous cotton crop is not a good farming practice.

Chad Hicks & 14 Mile Ranch dedicated 360 acres in two fields irrigated by separate center pivot irrigation systems to the on-farm demonstration. Hicks strip tilled and planted 49 acres

of corn on May 7 at 24,000 seeds/acre for his 200-12 field. Hicks planted 310 acres, also strip tilled, in the north half of a 620 acre circle on May 17 at 28,000 seeds/acre for his control field. The 200-12 field produced a 14 bushel per acre corn yield. Irrigation totaled 6.20 inches. There was not sufficient water available to irrigate the crop as needed after mid-June. The water was applied on larger crop acres that included the control field. Production in the control field was 218 bushels per acre, where seasonal irrigation and pre-water totaled 23.74 inches. Preseason irrigation was 1.95 inches in the 200-12 field and 3.89 in the control. The control field's net gain was $1024.54 per acre with 17.54 inches more irrigation used compared to production from the 200-12 field. Unfortunately, Hicks lack of available water for his 200-12 field when rainfall is less than normal is a condition all growers are addressing, and it is the purpose of the NPGCD's 200-12 reduced corn irrigation project.

Brian Bezner dedicated 244 acres in two fields irrigated by separate center pivot irrigation systems to the on-farm demonstration. Bezner strip tilled and planted 120 acres of corn on May 16 at 27,000 seeds/acre for his 200-12 field. He planted 124 acres on June 2, following wheat, at 33,000 seeds/acre, also strip tilled, for his control field. The 200-12 field was harvested for corn silage on August 17. With only limited rainfall, available irrigation water was not sufficient to produce a grain crop. The field produced 8.73 tons of silage per acre. Irrigation totaled 9.54 inches. Production in the control field was 194 bushels per acre, where seasonal irrigation totaled 26.59 inches. There was no pre-season irrigation in either field. The control field's net gain for corn grain is $929.26 per acre with 17.05 inches more irrigation used compared to production from the 200-12 silage field.

Summary: All 2152 acres dedicated to the project were harvested. Only two percent (49 acres) of the 200-12 field acreage was basically abandoned due to the lack of available water. Another 5 percent (120 acres) was harvested as corn silage. Corn yields averaged 138 bushels per acre in ten 200-12 fields. Irrigation averaged 18.86 inches. Average Irrigation, rainfall plus net soil water totaled 25.36 inches. Production averaged 167 bushels per acre in 12 control fields. Average Irrigation was 22.47 inches. Irrigation, rainfall and net soil water averaged 27.78 inches. A summary table is in Appendix A.

What We Learned - Yields were boosted by LEPA equipped center pivots

Planting tended to be later, mostly in May

Mostly Drought tolerant hybrids were planted

Crop Residue is essential

Growers must manage for production per inch of water

By reducing current irrigation volumes by as little as three inches over the one million acres of irrigated cropland within the District, it is possible to save up to 250,000 acre-feet of groundwater per year and prolong the viability of irrigated agriculture irrigation in the area.

NRCS CIG and TWDB grant funds partially funded the 2012 NPGCD 200-12 Reduced Irrigation on Corn Demonstration Project.

Introduction

In 2009, the District began planning a demonstration project, dubbed the "200-12 Project," that would use the latest water conservation technologies and practices to grow 200 bushels of corn on 12 inches of irrigation water per acre. The project is based on 12 inches of irrigation, 8 inches of seasonal rainfall and 6 inches of available soil water, to establish 26 inches of total water as guidelines for achieving the goal. The District acknowledges adjustments may be necessary when rainfall and or soil water are less than the guidelines call for. Corn irrigation averaged 21 inches per acre, while irrigation, rainfall and net soil water averaged 31 inches over the 10 year AgriPartner field demonstration project conducted by AgriLife Extension from 1998-2007. The AgriPartner project included 129 field scale corn demonstrations on 18,815 acres with approximately 150 cooperating growers over the ten year period. The 200-12 Project demonstrates how water conservation technologies and irrigation management practices can reduce groundwater use and allow agricultural irrigation producers to remain financially viable with restricted and diminishing groundwater resources. The 200-12 Project is designed as a five year initiative that provides field-scale profitability and feasibility demonstrations of producing 200 bushels of corn utilizing 12 inches of irrigation water combined with seasonal rainfall and available water within the crop's root zone. In **2010**, the 200-12 Project's first year, three of the District's directors, Harold Grall, Phil Haaland and Danny Krienke dedicated 270 of their own irrigated acres to establish the program. In **2011**, six additional farmers joined the project: Brian Bezner dedicated 60 acres in Union county; Dennis Buss "JBS Hartley Feeders" dedicated 62 acres in Hartley County; Chad Hicks dedicated 50 acres in Hartley County; Joe Reinart dedicated 75 acres in Sherman County; Steve Shields dedicated 65, acres in Hutchinson county; and James Born dedicated 115 acres in Ochiltree county. Grall and Krienke used 120 acres each again and Haaland 15, making the total 682 acres in 2011. In **2012**, 2152 acres were dedicated as follows: Joe Reinart 135 acres in Sherman county; Harold Grall 240 acres in Moore county; Tommy Laubhan 122 acres in Lipscomb county; Dennis Buss "JBS Hartley Feeders" 180 acres in Hartley county; Brent Clark 240 acres in Hartley county; Richard Schad 164 acres in Hansford county; Danny Krienke 120 acres in Ochiltree county; Phil Haaland 120 acres in Hartley county; Frische Brothers 107 acres in Moore county; David Ford 120 acres in Hartley county; Chad Hicks & 14 Mile Ranch 360 acres in Hartley county and Brian Bezner 240 acres in Dallam county. The District is committed to continuing the demonstrations for the remaining two years. Information in this report provides results of the field scale demonstrations conducted in 2012.

Methods

Each of the twelve cooperators individually selected two fields irrigated by center pivot systems for his demonstration. Irrigation was managed within the NPGCD's 200-12 project protocols and guidelines in one field called the "200-12". Each cooperator managed irrigation in the second field, called the "control", according to his normal practices. Each cooperator individually chose commercially available corn hybrids based on their experience as growers. Seeding and fertilizer rates, as well as pesticide and herbicide applications, were also selected by each cooperator. At each demonstration site, the District installed water meters to record and verify the amount of irrigation applied on each field, rain gauges to measure rainfall, gypsum block moisture sensors at 1, 2, 3, 4 and 5 foot depths in the crop's root zone to monitor soil water content, and AquaSpy® or John Deere Water continuous soil water monitoring probes down to 60 inches. Each irrigation system was equipped with PivoTrac™ remote continuous tracking and control to monitor and manage irrigation application frequency. Each field was provided soil and plant leaf sampling four times during the growing season to monitor and guide fertility levels by Better Harvest, Inc. During the growing season, District personnel collected data and maintained recording equipment weekly in each demonstration field. The District's tabulated demonstration field data is included with each cooperator report that follows.

Cooperators and the District's conservationist used the real-time data from AquaSpy®, John Deere Water and PivoTrac™ along with the data collected at least weekly from each demonstration field to monitor crop and soil moisture conditions, as well as to schedule irrigation frequency and volumes in the 200-12 fields. Where the 200-12 and control fields were both irrigated by the same center pivot system, Pivotrac delivered a text message to the District conservationist who recorded when irrigation stopped in one field and began in the other field. Time the irrigation system was in the 200-12 or control field, along with weekly gpm water meter readings, established a method to track irrigation. All demonstrations began at planting and ended at harvest, which each cooperator managed. The District compared harvest and irrigation results from the "200-12" field with that from the "control" field for each grower, and to that of other fields which the cooperator farmed. Yields for each field were adjusted to reflect 15.5% moisture content for corn based on the formula used by the National Corn Growers Association. The district analyzed production gains and losses based on a corn price of $6.59 per bushel and the growers expenses relating to irrigation, seed, fertilizer and harvest costs. For the comparison, a common price for seed, fertilizer, irrigation and harvest costs were as follows, seed, $2.40 per thousand; fertilizer, $5.60 per thousand seed planted; irrigation $4.80 per inch applied and harvest $0.34 per bushel. The district did not analyze land costs because land costs are highly variable between growers and across the district. Variable Rate Irrigation (VRI) prescriptions were written

using the Electrical Conductivity Mapping Dual EM subsoil layer option provided by Midwest Soil Samplers and CropMetrics. Each VRI prescription was written by NPGCD personnel in cooperation with the grower using CropMetrics Virtual Agronomist software. Each VRI prescription was loaded on Pivotrac's automatic center pivot speed control system to accomplish the VRI process. Variable Rate Irrigation by center pivot speed control was conducted in two 200-12 fields and on control field in 2012 to initiate and learn the process. Midwest Soil Samplers provided electrical conductivity mapping (EM) for all 2152 acres in the NPGCD reduced corn irrigation project in 2012. The data will be used in 2013 to continue and expand variable rate irrigation where cooperating growers agree to use it. The following discussion provides detailed 2012 growing season results and information for each grower's two fields.

Joe Reinart- Sherman County Demonstration, 2012

Planting and Crop Information - For his demonstration, Joe Reinart strip tilled and planted 60 acres of corn in the northwest quarter of section 217, S2, for his "200-12" field, "Reinart 200-12". He planted the field with Channel209-85 at a seeding rate of 25,000 seeds/acre. Reinart planted 75 acres, also strip tilled, in the southwest quarter of section 217, S3 to Channel214-77 at 33,000 seeds/acre for his "control" field, "Reinart Control". The 200-12 field was irrigated using a center pivot where seasonal water meter readings average 425 gpm and delivered an average of 1.89 inches of irrigation in a 5.0 day revolution. Water meter readings averaged 480 gpm for the center pivot that irrigated the control field and delivered 1.70 inches in a 5.0 day revolution. Planting and crop information for "Reinart 200-12" and "Reinart Control" are shown in the table below. Each is the same unless specified.

Table – Planting and Crop Information for Joe Reinart

200-12		***Control***	
Planted:	May 16	***Planted:***	*April 23*
Fertilizer:	150-29-0-11s	**Fertilizer:**	195-29-0-11s
Hybrid:	Ch209-85	**Hybrid:**	Ch214-77
Seeding Rate	25,000	**Seeding Rate**;	32,000
Soil Type:	Sherm&Sunray Clay Loam	**Soil Type:**	Sunray & Conlen clay loam
Row Width:	30 Inches	**Tillage:**	Strip Till
No Acres:	60	**No. Acres:**	75
Herbicide:	Aatrex, balance flex, glyph, dicamba on both		
GPM Per Acre:	7.1	**GPM Per Acre:**	6.4
Insecticide:	Oberon	**Insecticide:**	none
Irrig/Rain/Soil Water:	28.92"	**Irrig/Rain/Soil Water:**	35.00"
Harvested:	October 3	**Harvested:**	September 19

Beginning Soil Water Profile and Growing Season Rainfall

"200-12": There was no preseason soil water at 2 and 5 feet when gypsum blocks were installed in April. It was good at 1, 3 and 4 feet. An irrigation following planting refilled the 2 foot profile, but soil at the 5 foot depth remained relatively dry during the growing season. Weekly gypsum block readings show the crop depleted soil water at one foot and used most from 2, 3 and some from 4 feet plus all irrigation during the hot daily temperatures in late July and early August. The gypsum blocks were installed in Sunray clay loam soil which holds approximately 2.0 inches of available water per foot for potential crop use. The gypsum blocks were installed in mid-April prior to planting to obtain advanced soil water conditions.

"Control": Soil moisture sensing gypsum blocks were installed in late May following planting. The soil profile was full from 6.50 inches of pre-water and irrigation following planting. Weekly gypsum block readings show the crop had adequate available water throughout the growing season. Gypsum blocks were installed in Sunray clay loam that holds approximately 2.0 inches of available water per foot for potential crop use.

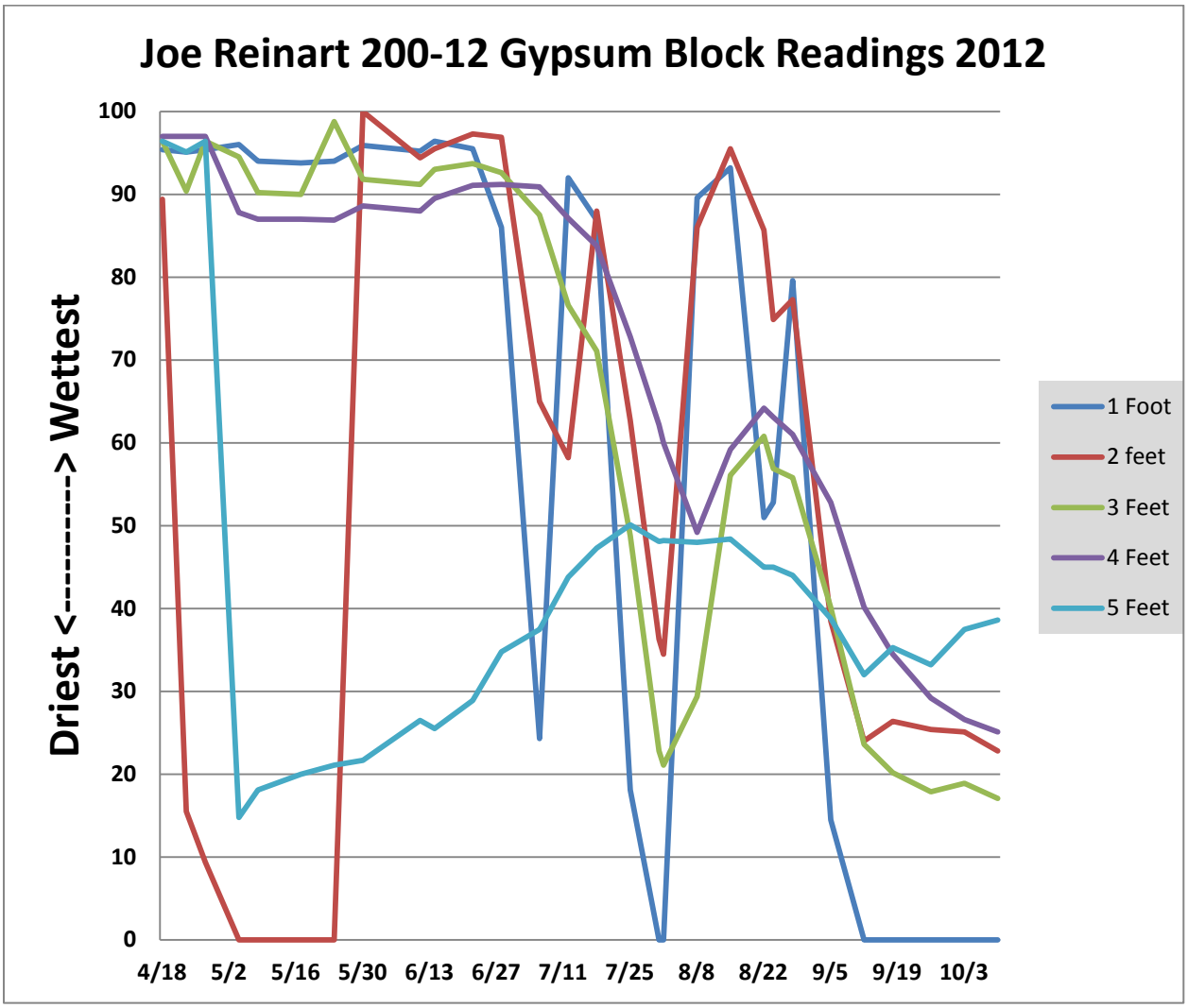
Both: Seasonal rainfall totaled 6.82 inches for the 200-12 field and 7.25 for the control. The 200-12 crop was in the pollinating to blister growth stages during the more extreme heat in late July and early August. Plants in the control field were in the milk to dough stages. The following table shows monthly rainfall as recorded by a district rain gauge located at the two fields.

Table – Monthly Rainfall Data for Joe Reinart "200-12" & "Control"

200-12	May- .68"	June- 3.02"	July- 1.41"	August- 1.71"	Sept- 0"	Total: 6.82"
Control	May- 1.11"	June- 3.02"	July- 1.41"	August- 1.71"	Sept.-0"	Total: 7.25"

Growing Season Water Tracking – The district tracked crop total water throughout the growing season using rain gauges, water meters and both gypsum blocks and AquaSpy® soil moisture sensors. A set of five gypsum block soil moisture sensors was installed at 1, 2, 3, 4 and 5 feet and an AquaSpy™ soil moisture probe was installed down to five feet in the root zone at one location to monitor soil water levels in the 200-12 field. Another set of the same type of sensors were installed in the Control field. Both sensors were installed in close proximity to each other in the field. Gypsum blocks were installed in the 200-12 field prior to planting. Gypsum blocks were installed in the Control field and the AquaSpy® probe in each field following crop emergence. Following this paragraph, a series of graphs and tables shows weekly gypsum block readings for the season; growing season water, including rainfall, irrigation, and soil moisture at various growth stages; and the order of irrigation and rainfall events for each field. Finally a form describes the protocols for each field. "Total Water," as shown on the graph for growing season water, is the sum of seasonal irrigation, rainfall and net soil water. Graphs and tables for the 200-12 field are shown first, followed by the illustrations for the Control field.

Graph – Gypsum Block Readings for Joe Reinart 200-12



Graph – Growing Season Water Tracking for Joe Reinart 200-12

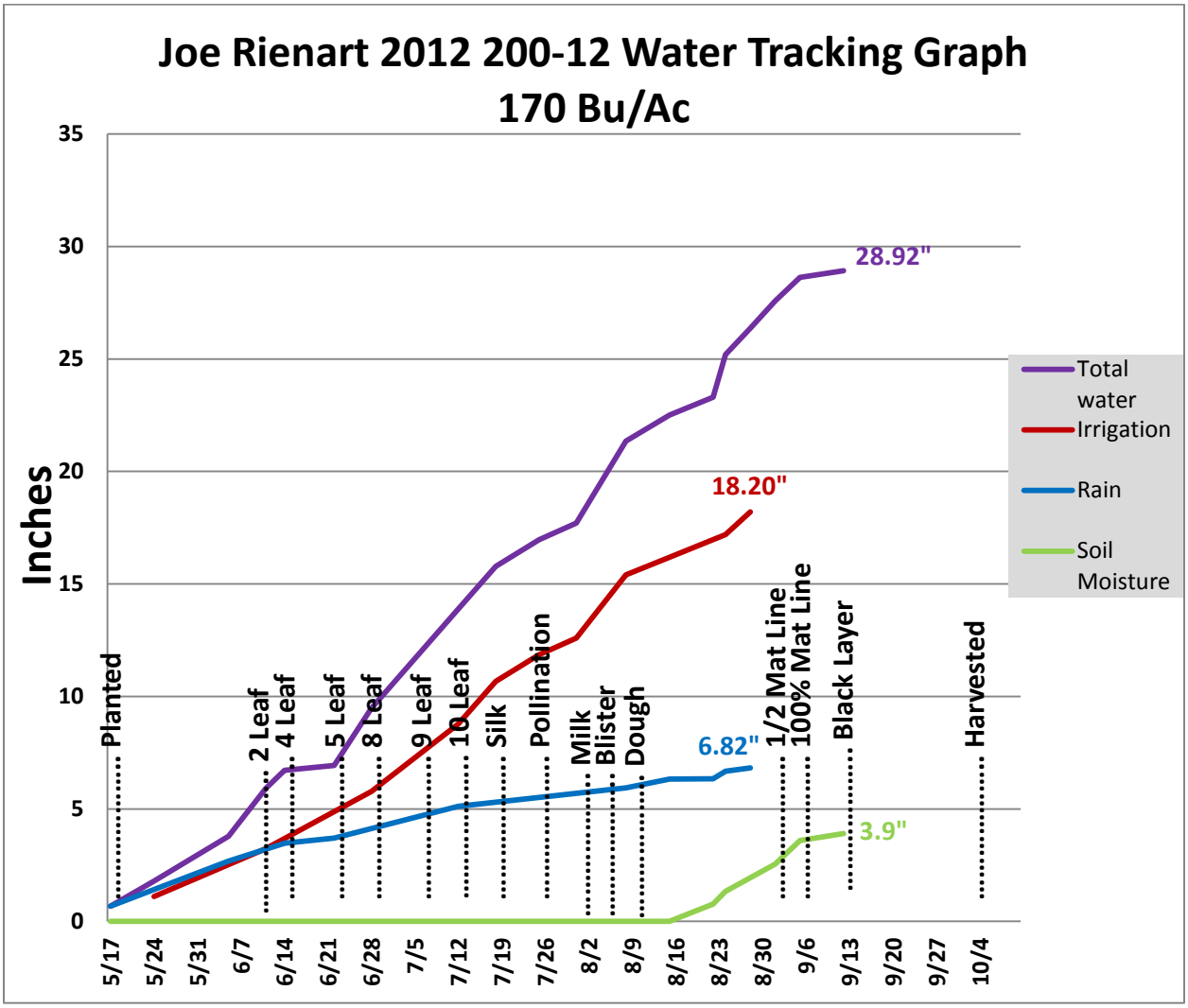


Table- Demonstration Field Data Joe Reinart 200-12

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
4/18			0.02		95.4	89.4	96.4	97.0	96.4			
4/23			0.02		95.1	15.5	90.4	97.0	95.1			
4/27	0.05		0.02		95.4	9.4	96.4	97.0	96.4		260 N	
5/4	0.38		0.02		96.0	0	94.5	87.8	14.8		260 N	
5/8			0.02		94.0	0	90.2	87.0	18.1		260 N	
5/17	0.68		0.02		93.8	0	90.0	87.0	20.0	Planted	260 N	
5/24		1.11	5.56		94.0	0	98.8	86.9	21.1	200-12	265 N	
5/30			14.5	2 leaf	95.9	100	91.8	88.6	21.7		170 Y	418
6/5	2.00											
6/11		2.12	16.15	Emergence	95.2	94.4	91.2	88.0	26.5	200-12	285 N	
6/14	0.80		16.15	4 leaf	96.4	95.5	93.0	89.5	25.5		276 N	
6/22	0.22		19.44	5 leaf	95.5	97.3	93.7	91.1	28.9		58 Y	408
6/28		2.54	28.83	8 leaf	86.0	96.9	92.6	91.2	34.8	200-12	225 N	
6/30			28.85	8 leaf							225 N	
7/6			30.66	9 leaf	24.3	65.0	87.5	90.9	37.5		291 Y cw	427
7/12	1.41	3.00	43.91	10 leaf	92.0	58.2	76.6	87.1	43.8	200-12	72 Y cw	415
7/18		1.90	53.39	Silk	86.9	88.0	71.1	83.8	47.3	200-12	72 N	
7/25		1.19	59.43	Pollination	18.1	62.7	48.8	72.8	50.1	200-12	164 Y cw	413
7/31		0.73	63.05	Blister	0.0	36.3	22.8	62.2	48.1	200-12	74 N	
8/1			63.05	Milk	0.0	34.5	21.1	60.0	48.2		76 N	
8/8	0.83	2.82	77.14	Dough	89.6	86.0	29.4	49.2	48.0	200-12	121 Y cw	475
8/15	0.38	0.78	81.04	Dough	93.2	95.5	56.1	59.2	48.4	200-12	252 N	
8/22	0.02		81.04	Dough	51.0	85.7	60.8	64.2	45.0		252 N	
8/24	0.33	1.00	86.04	Dough	52.8	74.9	56.9	63.1	45.0		180 Y ccw	
8/28	0.15	1.01	91.09	1/4 Mat Ln	79.6	77.3	55.8	61.0	44.0	200-12	241 N	
9/5			91.09	1/2 Mat Ln	14.5	38.5	40.1	52.8	38.8		241 N	
9/12			91.10	1.0 Mat Ln	0.0	24.0	23.6	40.2	32.0		241 N	
9/18			91.10	Blk Layer	0.0	26.4	20.2	34.5	35.3		241 N	
9/26			91.10	Blk Layer	0.0	25.4	17.9	29.2	33.2		241 N	
10/3			91.10	Blk Layer	0.0	25.1	18.9	26.6	37.5		253 N	
10/10			91.10		0.0	22.8	17.1	25.1	38.6		253 N	
Total	6.82	18.20			2.0	0.46	1.46	1.20	0.30			
Net Soil Water is 3.90”												
Irrigation, Rainfall plus Net Soil Water is 28.92 inches												

- Numbers in red are not counted in total

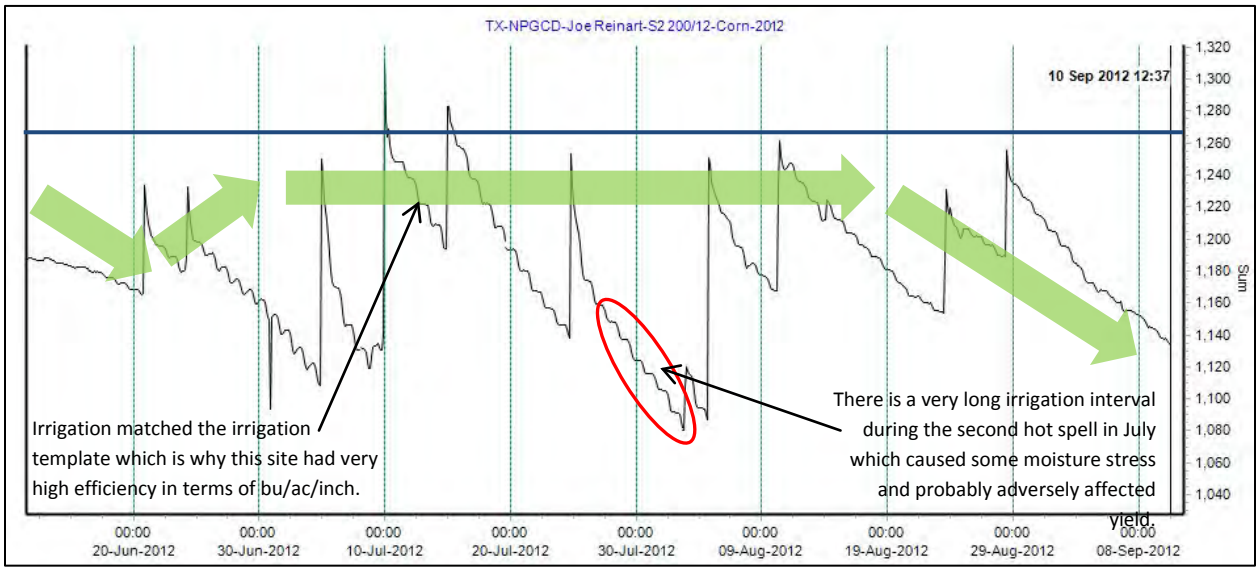
NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

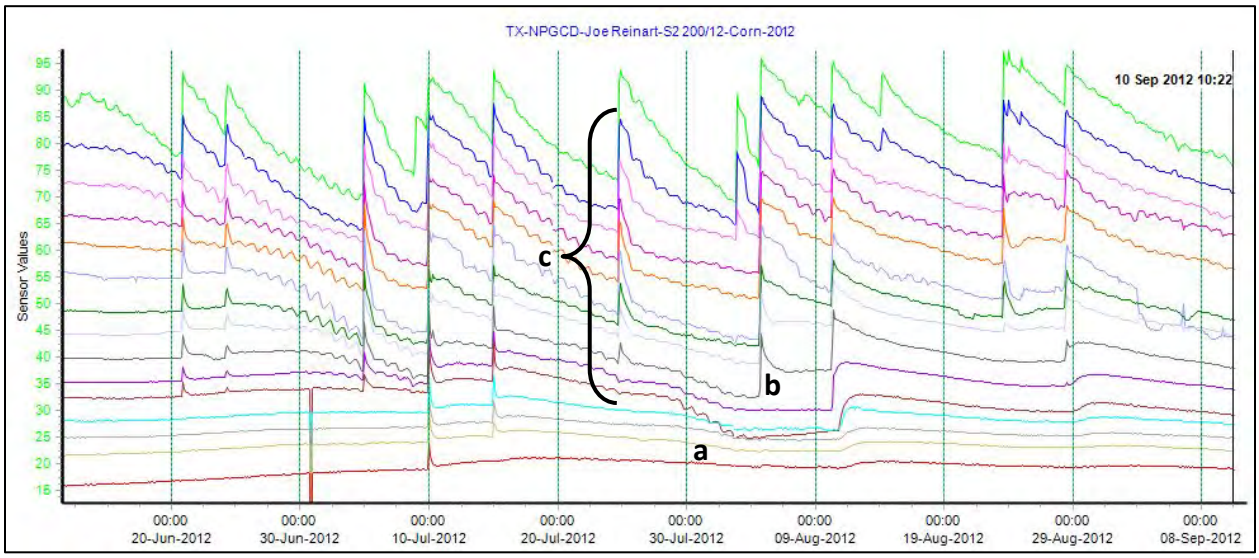
200-12

Year:	*2012*	**County:**	*Sherman*	**Grower:**	*Joe Reinart*
No. Acres:	*60*	**Variety/Hyb:**	*CH20985*	**Soil Type:**	*Sherm & Sunray Clay Loam*
Meter Type:	*Seametrics*				
Meter Mult:	*Ac Ft x 1*	**Tillage:**	*Strip Till*		
Fertilizer:	*150-29-0-11s*	**Seeding:**	*25,000*		
Planted:	*May 16, 2012*	**Harvest:**	*October 3, 2012*		
Herbicide:	*Aatrex, Balance Flex, Glyph, Diacambia*			**Insecticide:**	*Oberon*
Yield:	*170 Bu/Acre*	**Prev. crop:**	*Corn*	**Row width:**	*30 Inch*
Irrigation method:	*Center Pivot*	**Prewater:**	*None*	**Well GPM:**	*425*
Distance between drops:	*60”*	**Distance from nozzle to ground:**		*16”*	
Application pattern:	*Spray*	**Crop row direction :**		*Circle*	
		GPS Location:	Latitude:	*36.30505*	
			Longitude:	*-102.14876*	

Joe Reinart: AquaSpy 200-12 Site (170 bu/ac; 18.2" irrigation)

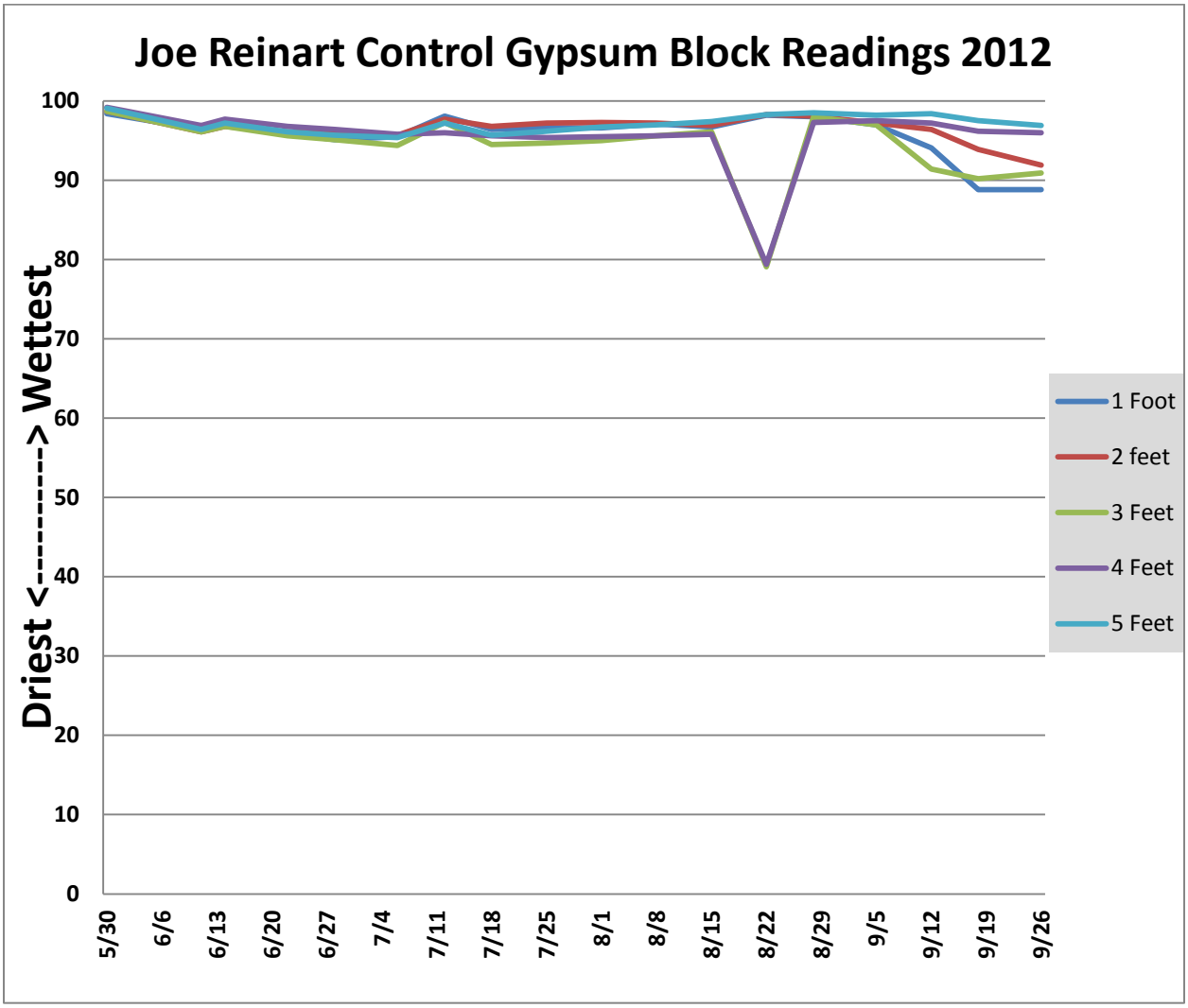


Irrigation was able to refill the soil moisture profile at almost every irrigation, allowing irrigation to largely follow the template. This resulted in a good yield and excellent water use efficiency. It is evident that the soil moisture conditions were excellent during early-mid July during the pollination phase.



(a) Root activity to 56", with strong water extraction to 44".
(b) Irrigation penetrating to 36"with many other irrigations penetrating 44-60"
(c) Root system is active over the full range due to good moisture penetration

Graph – Gypsum Block Readings for Joe Reinart Control



Graph – Growing Season Water Tracking for Joe Reinart Control

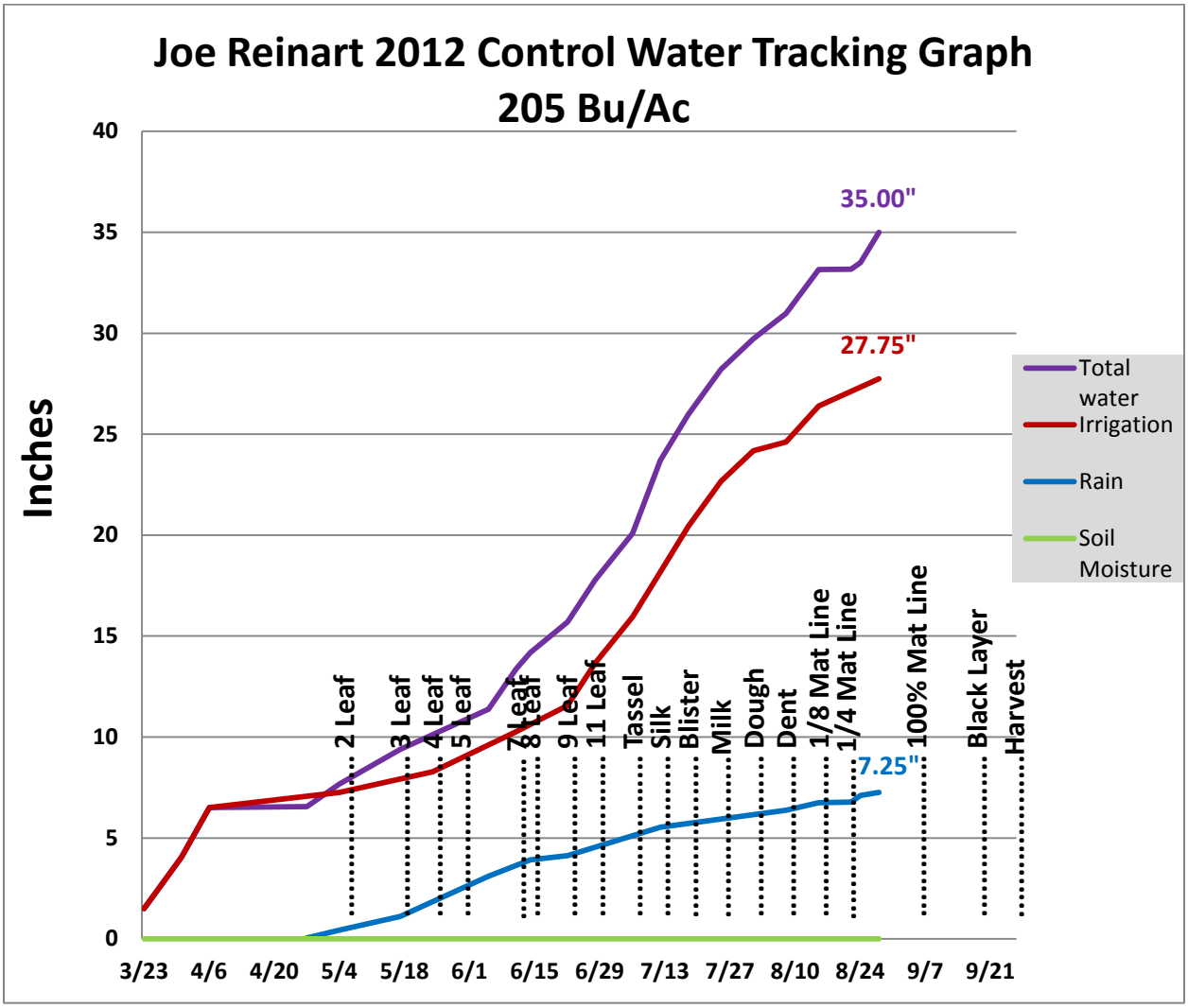


Table- Demonstration Field Data Joe Reinart Control

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
3/23		1.50	101 hrs							Prewater		500
3/31		2.53	171 hrs							Prewater		500
4/6		2.47	167 hrs							Prewater		500
4/18			268935									
4/23			268935							Planted		
4/27	0.05		281399									
5/4	0.38	0.75	284238							Control		
5/5			284238	2 leaf							N	
5/17	0.68		284238	3 leaf								
5/24		1.02	305040	4 leaf						Control	358 N	
5/30			305040	5 leaf	98.4	98.7	98.7	99.2	99.1		15 N	
6/5	2.00											
6/11		2.00	345667	7 leaf	96.4	96.1	96.1	96.9	96.4	Control	0 N	
6/14	0.80		345667	8 leaf	97.1	96.8	96.8	97.7	97.2		346 N	
6/22	0.22	1.29	372000	9 leaf	95.9	96.1	95.6	96.8	96.1	Control	92 Y	490
6/28		2.11	414930	11 leaf	95.1	95.9	95.1	96.4	95.7	Control	135 Y	
6/30			427830	11 leaf								450
7/6		2.28	461397	Tassel	95.5	95.7	94.4	95.8	95.4	Control	286 Y cw	454
7/12	1.41	2.23	507796	Silk	98.1	97.7	97.3	96	97.2	Control	38 Y cw	545
7/18		2.25	553725	Blister	96.4	96.8	94.5	95.6	95.7	Control	94 Y cw	461
7/25		2.24	599421	Milk	96.6	97.2	94.7	95.4	96.2	Control	164 N	
8/1		1.51	630270	Dough	96.6	97.3	95	95.5	96.7	Control	73 Y cw	537
8/8	0.83	0.44	639239	Dent	97.1	97.2	95.6	95.6	97.0	Control	154 N	
8/15	0.38	1.78	675606	1/8 Mat Ln	96.7	96.9	96.1	95.8	97.4	Control	134 Y cw	483
8/22	0.02		702423	1/4 Mat Ln	98.2	98.3	79.1	79.4	98.3		179 Y cw	420
8/24	0.33											
8/28	0.15	1.35	703069	7/8 Mat Ln	98.0	98.1	98.0	97.3	98.5	Control	194 N	
9/5			703069	1.0 Mat Ln	97.0	97.2	97.00	97.5	98.2		194 N	
9/12			703069	1.0 Mat Ln	94.1	96.4	91.4	97.2	98.4		195 N	
9/18			703069	Blk Layer	88.8	93.9	90.2	96.2	97.5		195 N	
9/26			703069	Harvest	88.8	91.9	90.9	96.0	96.9		173 N	
Total	7.25	27.75			0	0	0	0	0			
Irrigation, Rainfall , Net Soil Water is 35.00 Inches												

- Numbers in red are not counted in total

NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

Control

Year: *2012* **County:** *Sherman* **Grower:** *Joe Reinart*

No. Acres: *75* **Variety/Hyb:** *CH214-77* **Soil Type:** *Sunray & Conlen Clay Loam*

Meter Type: *McCrometer*

Meter Mult: *Gallons x 100* **Tillage:** *Strip Till*

Fertilizer: *195-29-0-11s* **Seeding:** *32,000*

Planted: *April 23, 2012* **Harvest:** *September 26, 2012*

Herbicide: *Aatrex, Balance Flex,Glyph, Diacambia* **Insecticide:** *None*

Yield: *205 Bu/Acre* **Prev. crop:** *Corn* **Row width:** *30 inch*

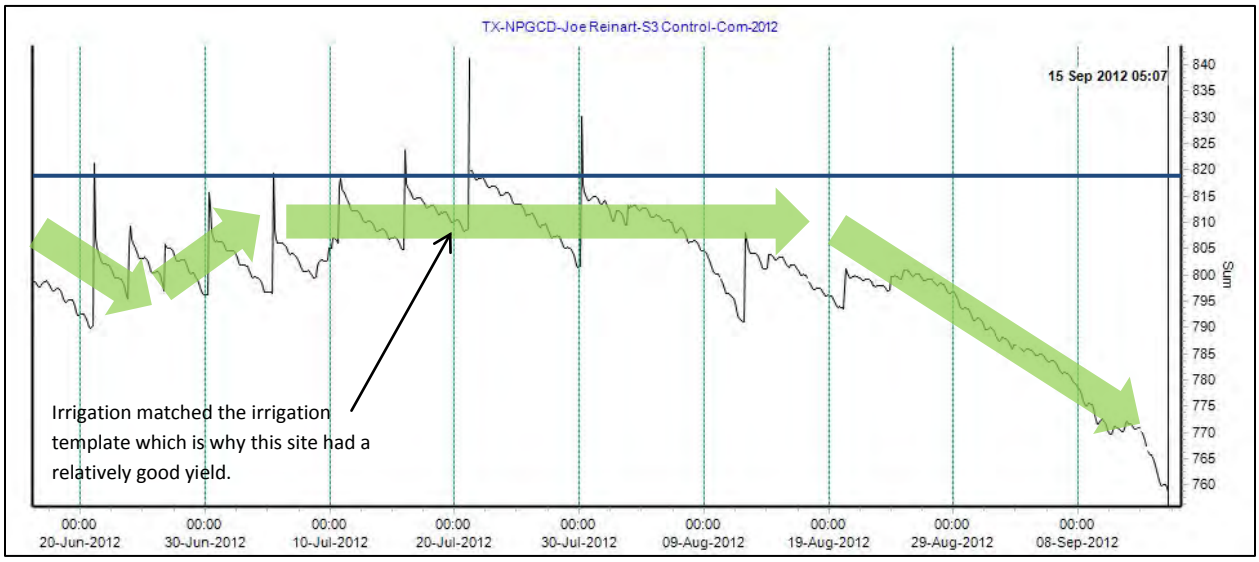
Irrigation method: *Center Pivot* **Prewater:** *Yes* **Well GPM:** *480*

Distance between drops: *60”* **Distance from nozzle to ground:** *16”*

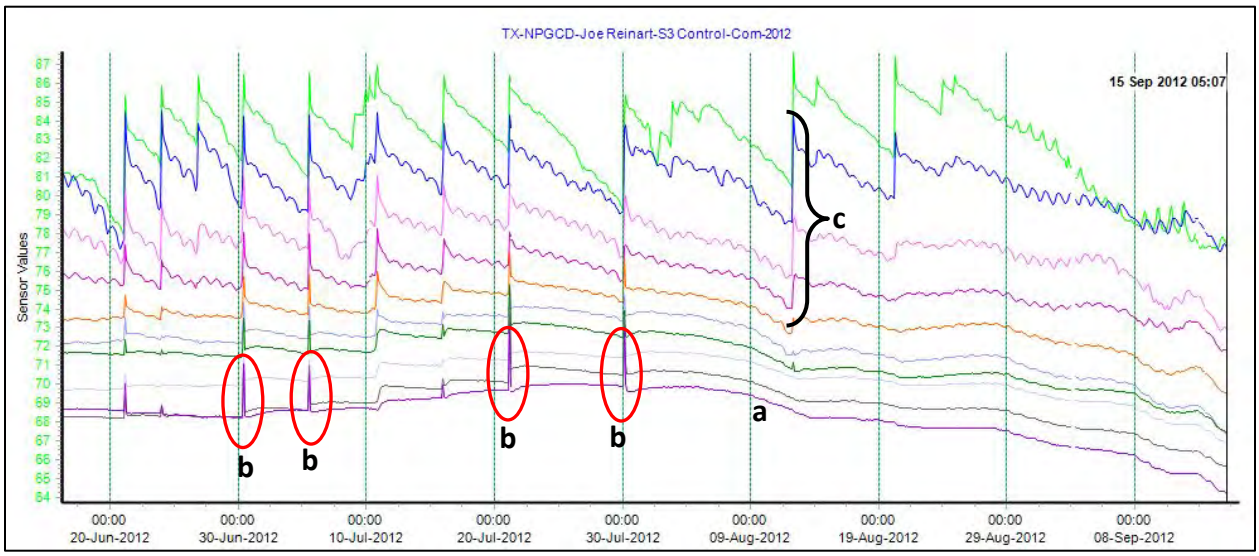
Application pattern: *Circle* **Crop row direction :** *Straight*

GPS Location: Latitude: *36.30359*
Longitude: *-102.30359*

Joe Reinart: AquaSpy Control Site (205 bu/ac; 21.3" irrigation)



It would appear that the soil moisture was wet up to full point early in the season and this moisture level maintained for much of the season. This ensured that there was a good yield at this site but there are some indications of drainage, which may have reduced the water use efficiency. While there was good moisture at depth, root activity wasn't as good below 20", which may be due to soil structure or some other factor. This may have also restricted water and nutrient uptake and yield potential.



(a) Root activity to 40" (which was the bottom sensor on this probe)

(b) Evidence of drainage, which may have reduced the water use efficiency of this site. Almost every irrigation was penetrating to depth, which helped refill the profile each time.

(c) Active roots largely confined to top 20", which may be due to soil structure or other issue

Harvest Results -The 200-12 field produced a 170 bushel per acre corn yield. Irrigation totaled 18.20 inches. Production in the control field was 205 bushels per acre, where seasonal irrigation was 21.25 and pre-water 6.50 inches to establish a total of 27.75 inches. No pre -season irrigation was applied to the 200-12 field. Pre-season irrigation is included in total irrigation. In comparison, the control field produced 35 more bushels per acre than the 200-12 with 9.55 additional inches of irrigation. Corn production was 9.34 bushels (523lbs) per inch of irrigation in the 200-12 field compared to 7.38 bushels (413lbs) in the control. Production from each inch of irrigation, rainfall and net soil water that totaled 28.92 inches was 5.88 bushels (329lbs) per acre in the 200-12 field. Irrigation, rainfall and net soil water totaled 35.0 inches in the control field where production was 5.86 bushels (328lbs) per inch. Crop production costs were $113.74 per acre more for the control field than for the 200-12 from increased seed, fertilizer, irrigation and harvest expenses. At $6.59 per bushel, the additional 35 bushel per acre corn yield amounts to $230.65 more per acre. The control field's net gain was $116.91 per acre with 9.55 inches more irrigation used compared to production from the 200-12 field. Reinart stated, "We had some germination problems in the control field that affected yield a little". And, "nearly all corn had some stalk rot that caused yield reduction to different degrees". Also, "if you didn't have to count the outside and southwest side of the circle, it all would have been really good corn". A summary of the demonstration results are shown in the following table.

Table – 2012 Demonstration Results for Joe Reinart 200-12 & Control

Irrigation		Irrig/Rain/Soil	PRODUCTION		CROP VALUE @ $6.59/Bu		
field	Inches	Inches	Bu/Ac	Bu/Ac-In Irrigation	Per Acre	Acre-In of Irrigation	Ac-In of Irrig/Rain/Soil
200-12	18.20	*28.92	170	9.34	$1120.30	$61.55	$38.74
Control	27.75	+35.00	205	7.38	$1350.95	$48.68	$38.60

***Includes 3.90 inches of water removed from five feet of soil, plus rainfall, and irrigation.**
+Includes 0 inches of soil water removed from five feet of soil, plus rainfall and irrigation.

Additional Hybrid and Plant Population Harvest Results- All growers are searching for the best corn hybrid, seeding rate, planting date and other information to help maintain profitable corn production levels with less irrigation and rainfall. Below are results of six Channel and Pioneer hybrids and two additional seeding rates from within Reinart's 200-12 field. Irrigation and rain are the same as that reported for the 200-12 field.

Table – 2012 Corn Yields from Different Corn Hybrids and seeding rates

Hybrid	Seeding Rate	Bushels/Acre
P1151HR	25,000	203
P1564HR	27,500	191
Ch209-85VT3P	25,000	188
P0876HR	27,500	187
P1564HR	25,000	179
P0876HR	25,000	161

Harold Grall- Moore County Demonstration, 2012

Planting and Crop Information - For his demonstration, Harold Grall strip tilled and planted 120 acres of corn in the northwest quarter of section 414 for his "200-12" field, "Grall 200-12". He planted the field with Pioneer 1151HR at a seeding rate of 28,000 seed/acre. Grall planted 120 acres, also strip tilled, in the northeast quarter of section 417 to Pioneer 1151HR at 26,000 seeds/acre for his "control" field, "Grall Control". The 200-12 field was irrigated using a center pivot where seasonal water meter readings average 450 gpm and delivered an average of 1.40 inches of irrigation in a 7.0 day revolution. The center pivot was renozzled to 400 gpm in mid-August due to low system operating pressure. Irrigation was then 1.25 inches in a 7 day revolution. Water meter readings averaged 310 gpm for the center pivot that irrigated the control field and delivered 1.10 inches in an 8.0 day revolution. Planting and crop information for "Grall 200-12" and "Grall Control" are shown in the table below. Each is the same unless specified.

Table – Planting and Crop Information for Harold Grall

200-12		***Control***	
Planted:	May 28	***Planted:***	*May 24*
Fertilizer:	159-64-2	**Fertilizer:**	162-55-2
Hybrid:	P1151HR	**Soil Type:**	Sherm Clay Loam
Seeding Rate:	28,000	**Seeding Rate:**	26,000
Row Width:	30 Inches	**Tillage:**	Strip Till
No Acres:	120	**Insecticide:**	Comite, Quilt Fungicide
Herbicide:	*Basis, Atrazine, Rifle, Medal, Powermax*		
GPM Per Acre:	2.6	**GPM Per Acre:**	3.3
Irrig/Rain/SoilWater:	24.18"	**Irrig/Rain/SoilWater:**	21.92"
Harvested:	October 24	**Harvested:**	October 16

Beginning Soil Water Profile and Growing Season Rainfall

"200-12": A two inch rain in April refilled the soil profile where it was dry at 1 and three feet. Soil water was good at planting in late May. Weekly gypsum block readings show the crop depleted soil water at one foot and used most from 2, and 3 plus all irrigation during the hot daily temperatures in late July and early August. Plants used water from 4 and 5 feet during the grain maturity stage in September after irrigation stopped. Gypsum blocks were installed in Sherm clay loam soil that holds approximately 2.0 inches of available water per foot for potential crop use. The gypsum blocks were installed in late March prior to planting to obtain advanced soil water conditions.

"Control": Soil moisture sensing gypsum blocks were installed in early June following planting. The soil profile was full from irrigation prior to the gypsum blocks being installed. Weekly gypsum block readings show the crop used all available soil water at 1, 2 and 3 feet

plus irrigation during July and August. Most soil water was used from 4 feet and about half that stored at 5 feet in late August and September. Gypsum blocks were installed in Sherm clay loam that holds approximately 2.0 inches of available water per foot for potential crop use.

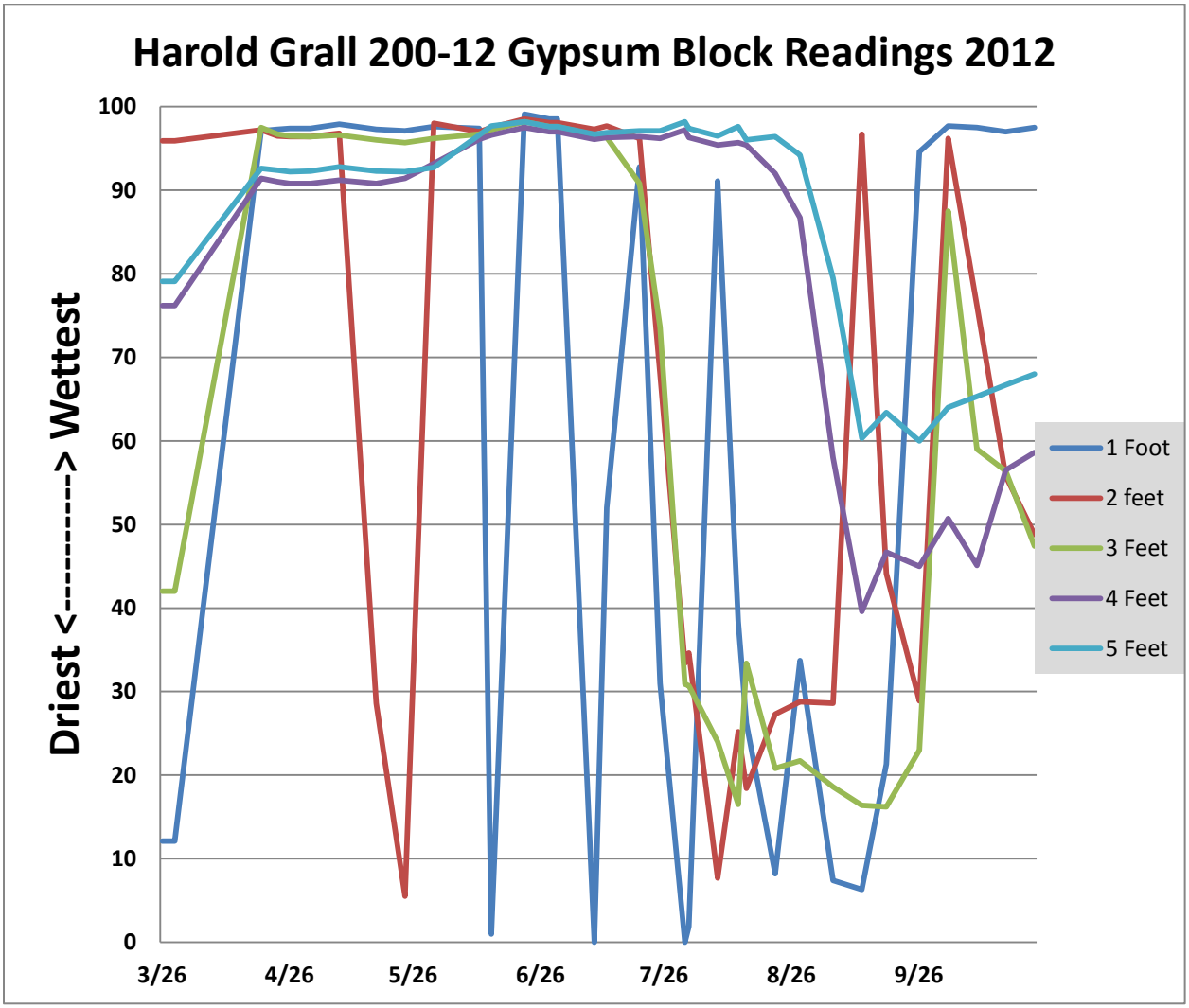
Both: Seasonal rainfall totaled 3.14 inches for the 200-12 field and 3.85 for the control. Both the 200-12 crop and control were in the pollinating to blister growth stages during the more extreme heat in late July and early August. The following table shows the monthly rainfall as recorded by a district rain gauge located at the two fields.

Table – Monthly Rainfall Data for Harold Grall "200-12" & "Control"

200-12	May- 0"	June- 1.07"	July- .45"	August- .80"	Sept- .82"	Total: 3.14"
Control	May- 0 "	June-1.19"	July- .34"	August- 1.36"	Sept.- .96"	Total: 3.85"

Growing Season Water Tracking – The district tracked crop total water throughout the growing season using rain gauges, water meters and both gypsum block and AquaSpy® soil moisture sensors. A set of five gypsum block soil moisture sensors were installed at 1, 2, 3, 4 and 5 feet and an AquaSpy® soil moisture probe down to five feet in the root zone at one location to monitor soil water levels in the 200-12 field. Another set of the same type of sensors were installed in the Control field. Both sensors were installed in close proximity to each other in the field. Gypsum blocks were installed in the 200-12 field prior to planting. Gypsum blocks were installed in the Control field and the AquaSpy® probe in each field following crop emergence. An additional Envirosmart soil moisture probe was installed in the 200-12 field to learn the function and use of other water management tools available to growers. Following this paragraph, a series of graphs and tables shows weekly gypsum block readings for the season; growing season water, including rainfall, irrigation, and soil moisture at various growth stages; and the order of irrigation and rainfall events for each field. Finally a form describes the protocols for each field. "Total Water," as shown on the graph for growing season water, is the sum of seasonal irrigation, rainfall and net soil water. Graphs and tables for the 200-12 field are shown first, followed by the illustrations for the Control field.

Graph – Gypsum Block Readings for Harold Grall 200-12



Graph – Growing Season Water Tracking for Harold Grall 200-12

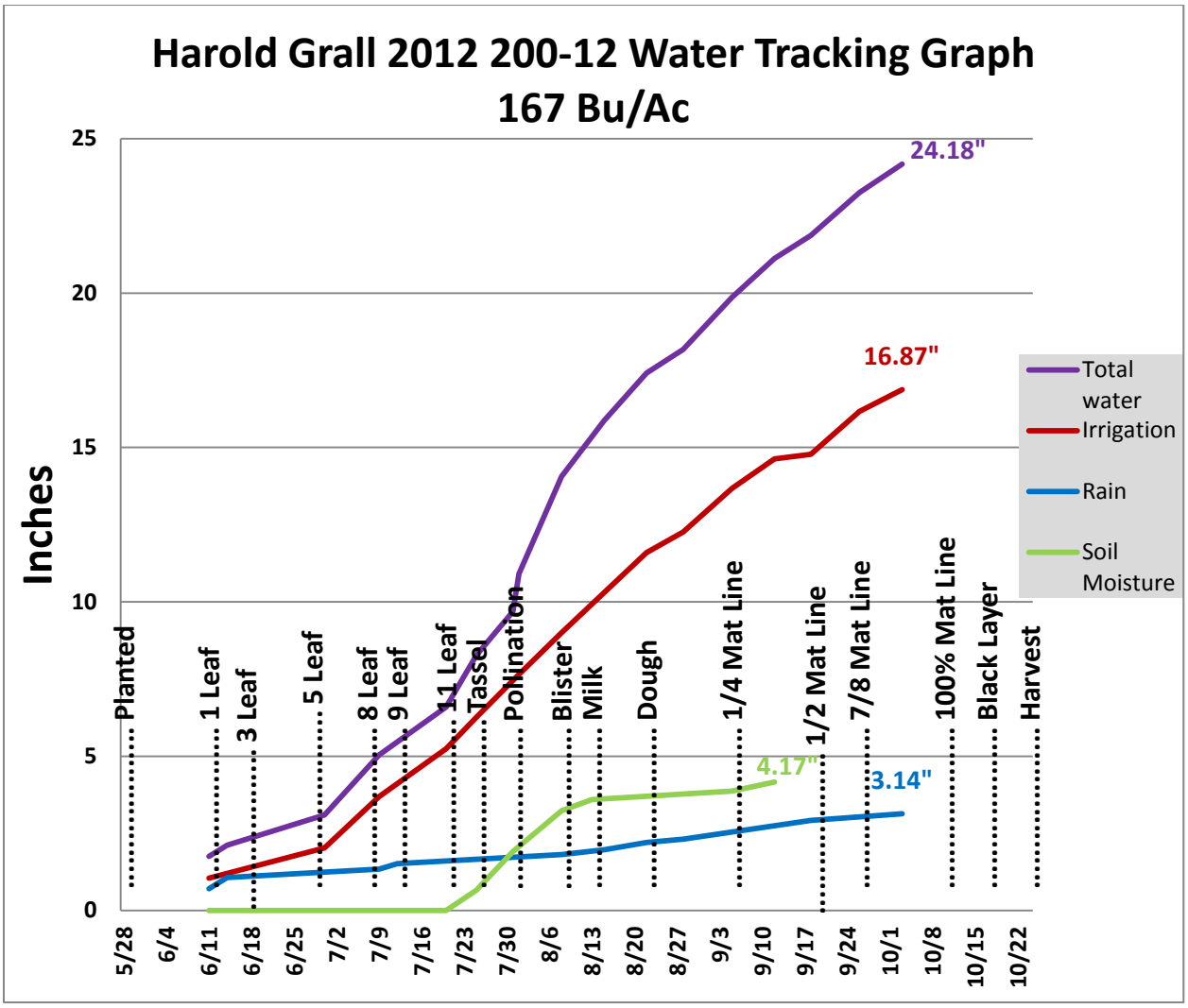


Table- Demonstration Field Data Harold Grall 200-12

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
3/26			965819		12.1	95.9	42.0	76.2	79.1			
3/29					12.1	95.9	42.0	76.2	79.1			
4/19	2.00		965819		97.1	97.2	97.5	91.4	92.6		N	
4/23			965819		97.3	96.5	96.7	91.0	92.4		204 N	
4/26			965819		97.4	96.4	96.5	90.8	92.2		204 N	
5/1	0.25		965819		97.4	96.4	96.4	90.8	92.3		204 N	
5/8			965819		97.9	96.8	96.6	91.2	92.8		204 N	
5/17			965819		97.3	28.6	96.0	90.8	92.3		195 N	
5/24			965819		97.1	5.5	95.7	91.4	92.2		180 N	
5/31			978274		97.6	98.0	96.2	93.2	92.7		240 Y	492
6/11	0.71	1.05	209	1 leaf	97.4	97.0	96.7	96.1	96.6	200-12	165 N	
6/14	0.36		209	3 leaf	98%	97.5	97.2	96.6	97.7		165 N	
6/22			209	3 leaf	99.1	98.5	98.2	97.5	98.2		149 N	
6/28			20238	5 leaf	98.5	98.1	97.6	97.0	97.6		35 Y	
6/30		0.98	32203	5 leaf	98.5	98.1	97.6	97.0	97.6	200-12	80 Y	460 Y
7/7			77019	8 leaf							167 Y cw	443
7/9	0.28	1.67	86628	8 leaf	0	97.3	96.6	96.1	96.7	200-12	244 N	
7/12	0.17		88044	9 leaf	52.0	97.7	96.3	96.3	96.9		257 Y cw	473
7/20		1.54	138326	11 leaf	92.8	96.2	90.8	96.4	97.1	200-12	344 Y cw	438
7/25		1.02	171796	Tassel	31.0	68.0	73.6	96.2	97.1	200-12	279 Y cw	447
7/31				Pollination	0	33.4	30.9	97.2	98.2			
8/1		1.39	216991	Pollination	1.9	34.6	30.7	96.3	97.4	200-12	318 Y cw	450
8/8	0.30	1.35	261070	Blister	91.1	7.7	24.0	95.4	96.5	200-12	345 Y cw	422
8/13				Milk	38.4	25.2	16.5	95.7	97.6		260 Y cw	
8/15	0.15	1.30	303573	Milk	26.2	18.4	33.4	95.4	96.0	200-12	15 Y cw	475
8/22	0.24	1.30	346087	Dough	8.2	27.3	20.8	92.0	96.4	200-12	240 Y cw	420
8/28	0.11	0.66	367737	Dough	33.7	28.8	21.7	86.7	94.2	200-12	227 Y cw	415
9/5		1.41	413683	1/4 Mat Ln	7.4	28.6	18.6	58.0	79.5	200-12	290 Y cw	400
9/12		0.96	445146	1/2 Mat Ln	6.3	96.7	16.4	39.6	60.3	200-12	213 Y cw	400
9/18	0.60	0.15	450118	1/2 Mat Ln	21.3	44.1	16.2	46.7	63.4	200-12	77 Y cw	398

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
9/26		1.39	495598	7/8 Mat Ln	94.6	28.9	23.0	45.0	60.0	200-12	318 Y cw	403
10/3	0.22	0.70	518475	7/8 Mat Ln	97.7	96.2	87.5	50.7	64.0	200-12	180 N	
10/10			518475	1.0 Mat Ln	97.5	76.2	59.0	45.1	65.3		180 N	
10/17			518474	Blk Layer	97.0	55.8	56.4	56.5	66.7		180 N	
10/24			518475	Harvest	97.5	48.8	47.4	58.6	68.0		180 N	
Total	3.14	16.87			0	1.12	1.14	1.01	0.90			
Net Soil Water Is 4.17												
Irrigation, Rain, Net Soil Water is 24.18"												

- Numbers in red are not counted in total

NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

200-12

Year: *2012* **County:** *Moore* **Grower:** *Harold Grall*

No. Acres: *120* **Variety/Hyb:** *P1151HR* **Soil Type:** *Sherm Clay Loam*

Meter Type: *McCrometer*

Meter Mult: *Gallons x 100* **Tillage:** *Strip Till*

Fertilizer: *159-64-2* **Seeding:** *28,000*

Planted: *May 28, 2012* **Harvest:** *October 24, 2012*

Herbicide: *Basis, Atrazine, Rifle, Medal, Powermax* **Insecticide:** *None*

Yield: *167 Bu/Acre* **Prev. crop:** *Corn* **Row width:** *30 Inch*

Irrigation method: *Center Pivot* **Prewater:** *None* **Well GPM:** *2.6*

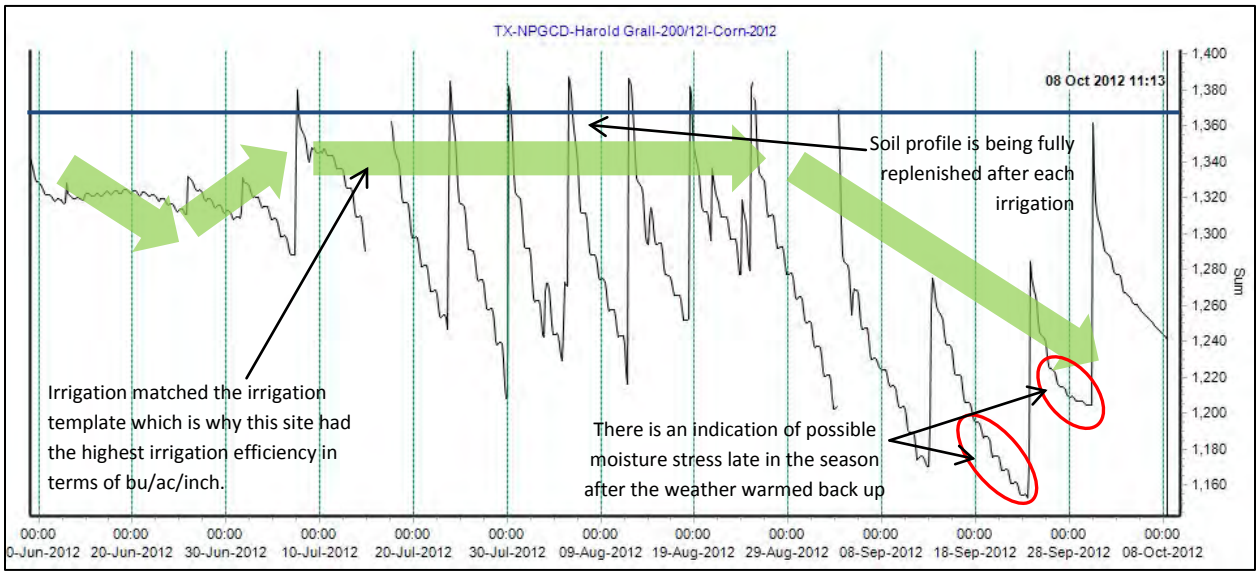
Distance between drops: *60”* **Distance from nozzle to ground:** *16”*

Application pattern: *LEPA Bubbler* **Crop row direction :** *Straight*

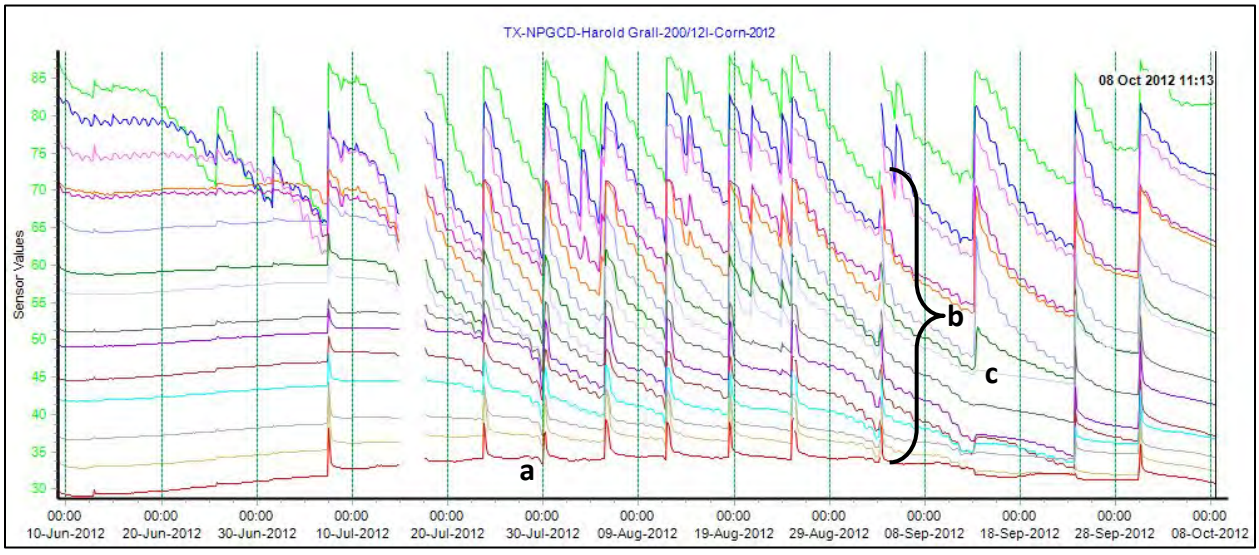
GPS Location: Latitude: *35.978813*

Longitude: *-102.181096*

Harold Grall: AquaSpy 200-12 Site (167 bu/ac; 16.9” irrigation)



Irrigation was able to fully re-wet the soil profile after each pass and the roots were active over the entire root zone each irrigation interval. This allowed the irrigation to keep up with plant water requirements and not cause moisture stress during the critical period. It would appear that the plant population was in balance with the water availability and irrigation was able to follow the desired template resulting in good yield and excellent water use efficiency.



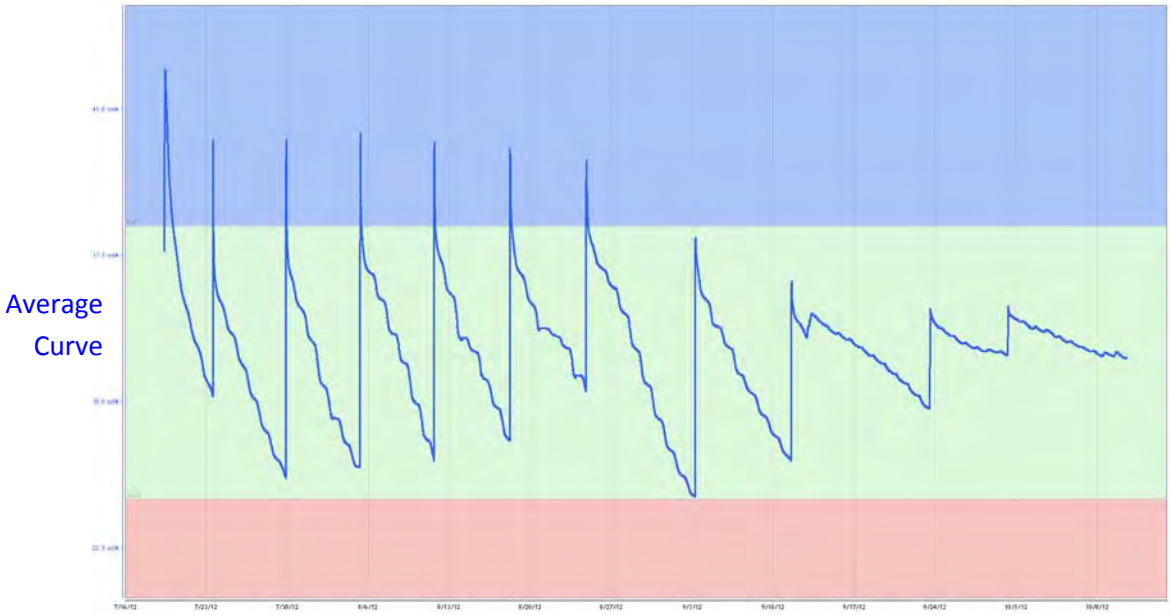
(a) Active roots to 60” by the end of July. Irrigation is penetrating to 60” after every pass.

(b) Roots are active over the entire 60” root zone during every irrigation interval

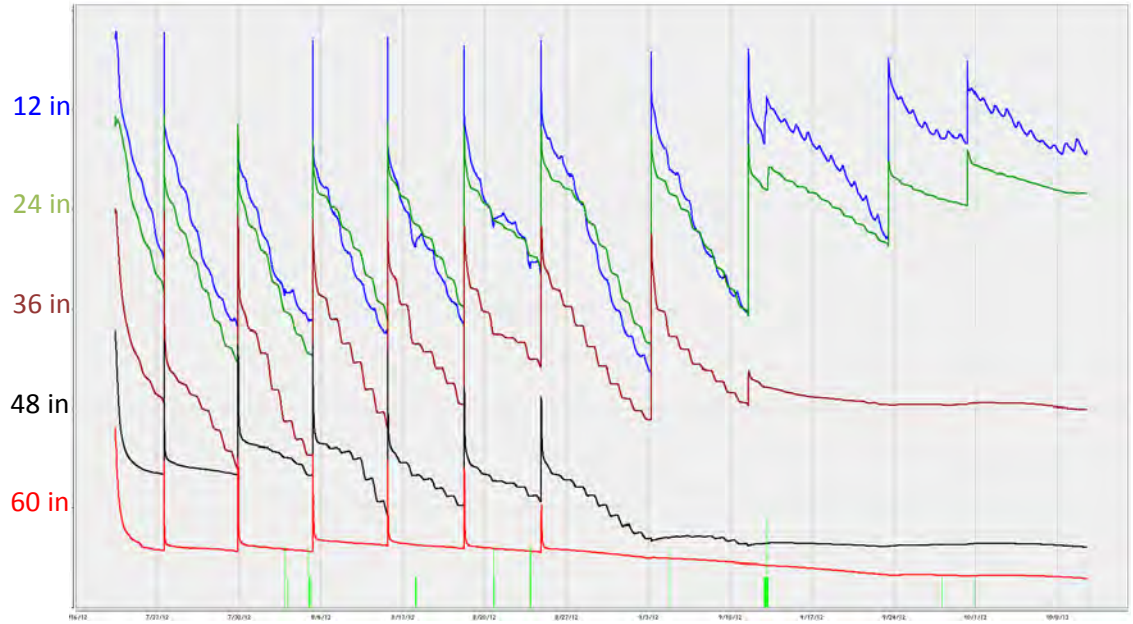
(c) The irrigation interval was stretched out at the end of the season and moisture may have been a little limited during the warmer conditions experienced during late grain fill.

Summary Seasonal Soil Water Report for Grall 200-12 by McCrometer (Raw Data)

Summary Average Soil Profile Curve

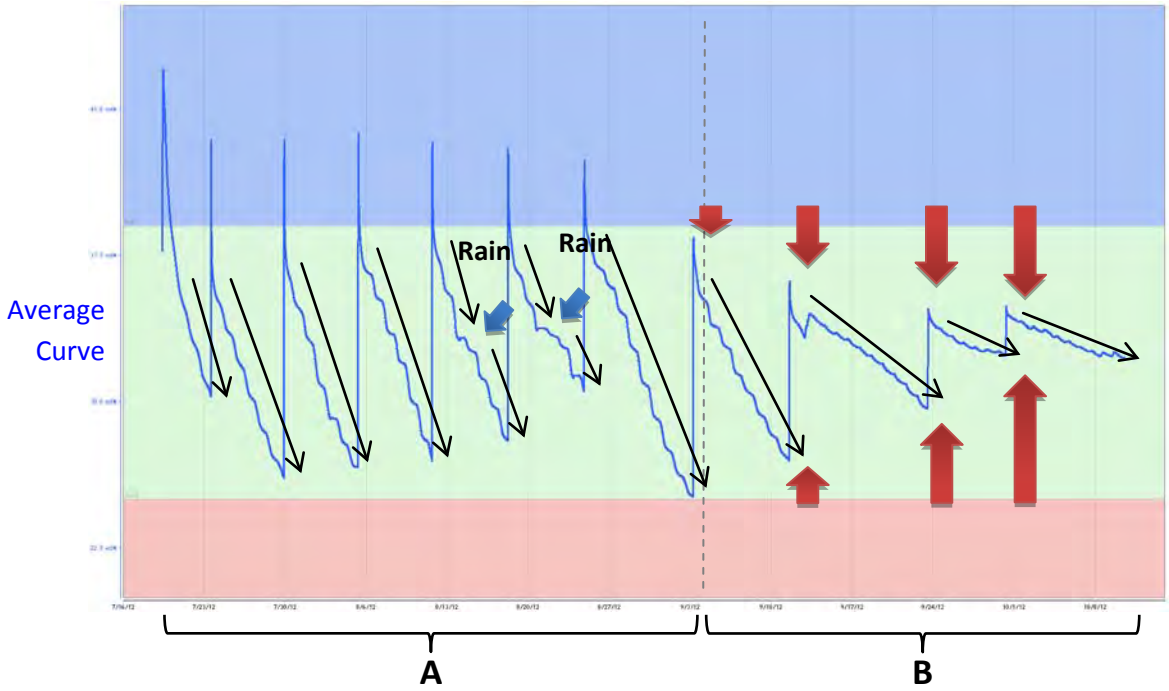


Separate Sensor Soil Profile View



Summary Seasonal Soil Water Data Analysis for Grall 200-12 by McCrometer

Summary Average Curve

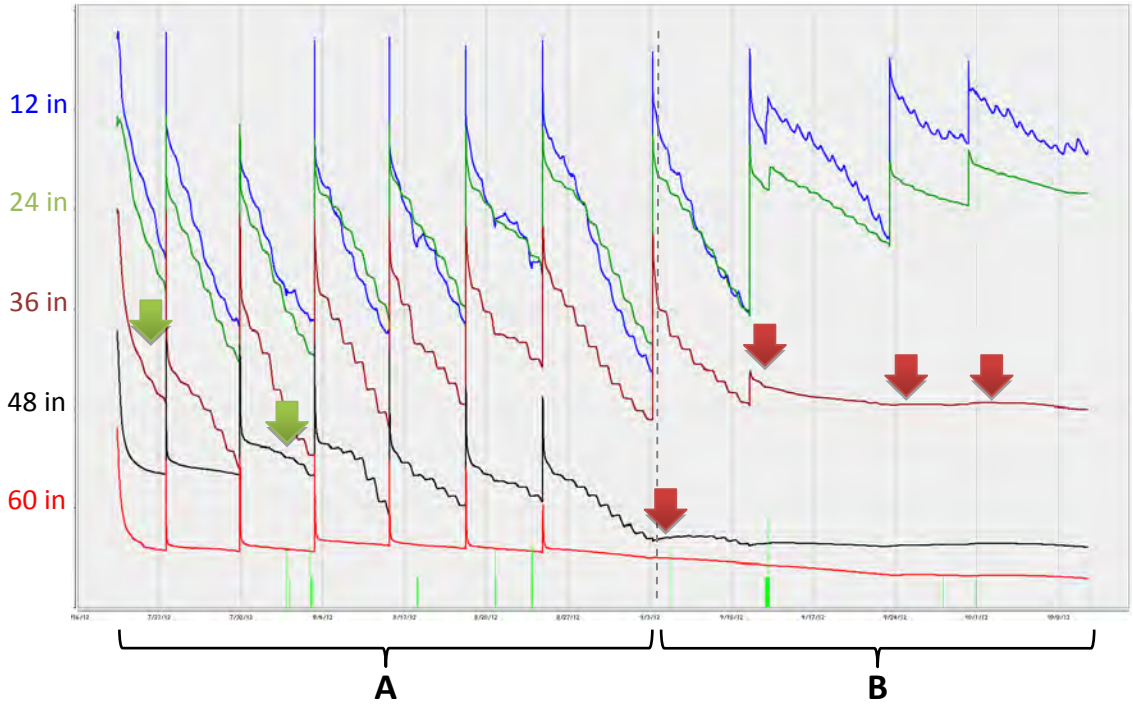


A. Average curve (an average of sensors from all five depths) shows a healthy balance of crop water use and irrigation during Period A (7/16 to 9/3)
    1. Slope of crop water use (approximated by lines above) is consistent
    2. No signs of significant water stress during this period
    3. Rain events in August supplemented moisture – potential for additional savings by extending time between irrigations after rainfall
    4. Irrigation beyond saturation (full) point – potential overwatering (see full profile view below)

B. Average curve shows significant compression (lower max, higher min) and flatter slope during Period B (9/3 to 10/8)
    1. Significant loss in water capacity from wells required re-nozzle of pivot, reducing the application rate for Period B
    2. Compression of max/min may indicate irrigations are not reaching full root depth (see full profile view below)
    3. Change in slope may indicate a combination of a) moisture stress and b) change in crop water use late in the season as crop approaches maturity

Separate Sensor Seasonal Soil Water Data Analysis for Grall 200-12 by McCrometer

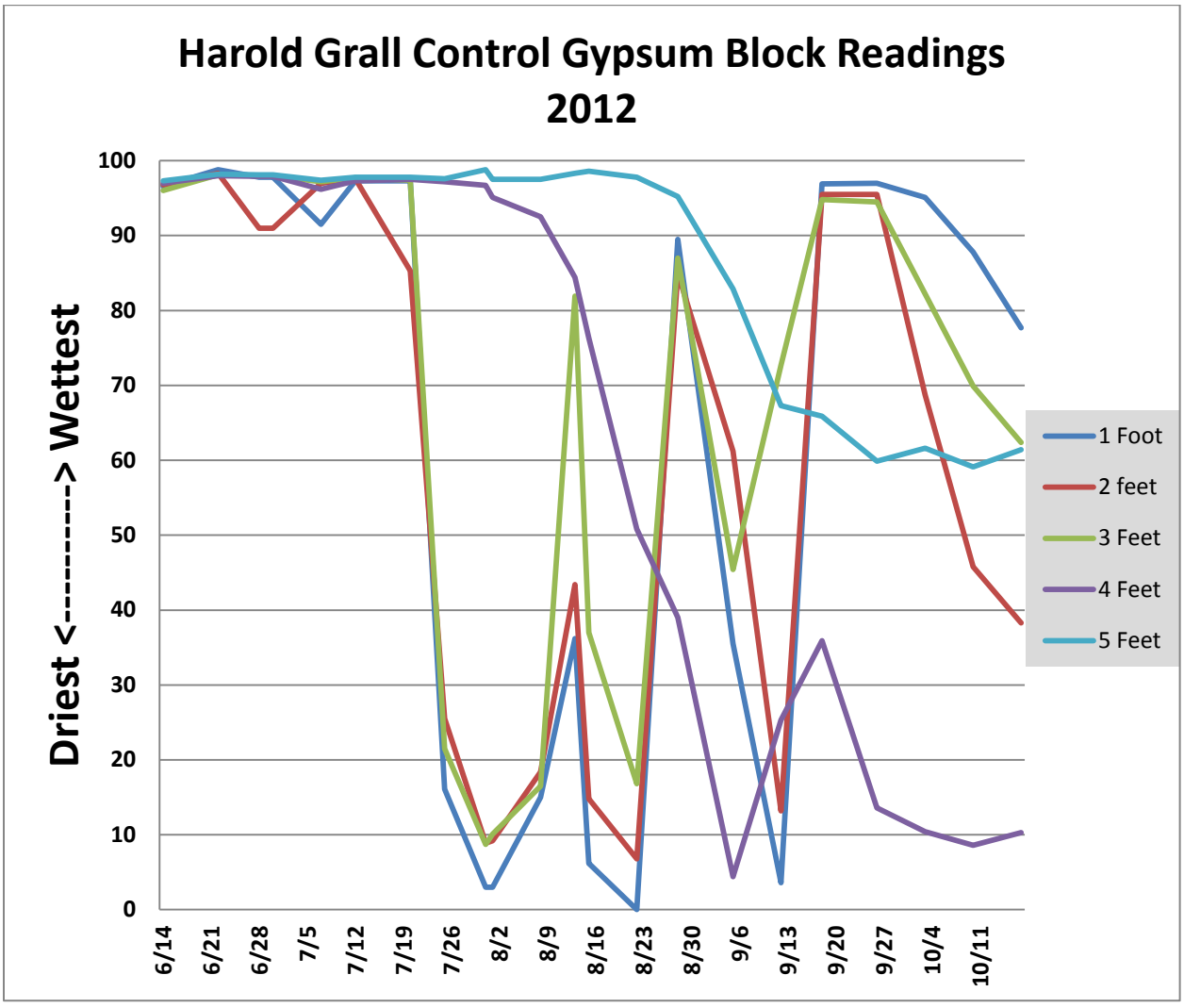
Profile View



A. Individual curves at each depth, arranged like a soil profile, provide additional detail to the average curve for Period A (7/16 to 9/3) shown in the previous section
    1. Slope of crop water use is consistent at each depth during this period
    2. Root development and activity extending to 36 in. and later 48 in. (green arrows)
    3. Little/no root activity at 60 in., but irrigations during Period A pushed water to this depth beyond the roots. Each “spike” at 60 in. represents water that saturated and quickly drained from this depth (potential savings)

B. Profile view confirms reduced application during Period B (9/3 to 10/8)
    1. Beginning with the irrigation about 9/3, water did not adequately reach 48 in.
    2. The next cycle of irrigation (about 9/12) and subsequent irrigations did not adequately reach 36 in.
    3. Some stress likely occurred during this period, as only the upper soil profile had adequate available water
    4. Crop water use at 12 and 24 in. slowed significantly late in the season, indicating that water required by the crop as it approached maturity was dropping off and damage from inadequate water at 36 and 48 in. may not have been as significant

Graph – Gypsum Block Readings for Harold Grall Control



Graph – Growing Season Water Tracking for Harold Grall Control

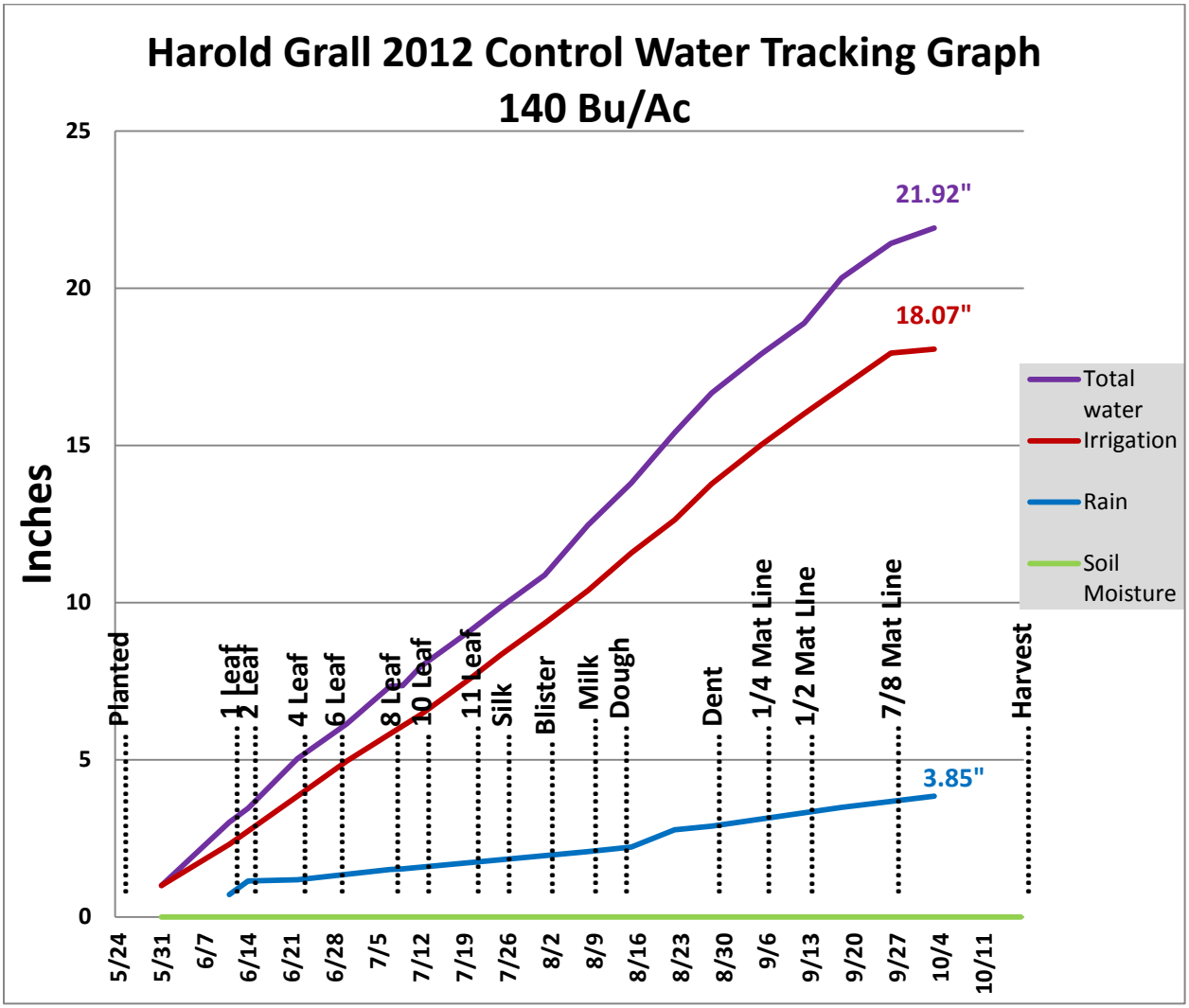


Table- Demonstration Field Data Harold Grall Control

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
5/1	2.0		.02 AF									
5/31		1.00	10.11							Control		
6/11	0.71	1.31	23.19	1 leaf						Control	90 Y	358
6/14	0.44		27.25	2 leaf	96.6	96.8	96.0	97.0	97.3		240 Y	298
6/22	0.04	1.54	38.61	4 leaf	98.8	98.3	98.1	98.0	98.2	Control	243 Y	312
6/28			47.25	6 leaf	97.8	91.0	98.0	97.9	98.1		135 Y	318
6/30		1.11	49.76	6 leaf	97.8	91.0	98.0	97.9	98.1	Control	180 Y	307
7/7	0.32	0.87	58.52	8 leaf	91.5	97.0	97.2	96.2	97.4	Control	182 Y cw	284
7/9	0.02		60.82								250 N	273
7/12		0.62	64.75	10 leaf	97.3	97.6	97.7	97.3	97.8	Control	34 Y cw	345
7/20		1.14	76.20	11 leaf	97.3	85.3	97.4	97.5	97.8	Control	12 Y cw	333
7/25		0.76	83.86	Silk	16.1	25.5	21.5	97.2	97.6	Control	304 Y cw	325
7/31			92.46	Silk	3.0	8.9	8.7	96.7	98.8		244 Y cw	325
8/1		1.00	93.82	Blister	3.0	9.2	10.1	95.1	97.5	Control	288 Y cw	326
8/8	0.55	1.04	104.24	Milk	15.0	18.4	16.5	92.5	97.5	Control	273 Y cw	329
8/13				Dough	36.2	43.4	81.9	84.4	98.3		160 Y cw	
8/15	0.15	1.19	116.12	Dough	6.2	14.8	37.0	76.3	98.6	Control	263 Y cw	326
8/22	0.55	1.05	126.64	Dough	0.0	6.8	16.8	50.8	97.8	Control	240 Y cw	315
8/28	0.11	1.15	138.13	Dent	89.5	85.0	87.0	39.0	95.2	Control	175 Y cw	235
9/5		1.24	150.57	1/4 Mat Ln	35.5	61.2	45.4	4.4	82.9	Control	204 Y cw	324
9/12		0.99	160.47	1/2 Mat Ln	3.6	13.2	72.7	25.3	67.3	Control	159 Y cw	311
9/18	0.60	0.83	168.74	1/2 Mat Ln	96.9	95.5	94.8	35.9	65.9	Control	257 Y cw	308
9/26		1.10	179.78	7/8 Mat Ln	97.0	95.5	94.5	13.6	59.9	Control	107 Y cw	315
10/3	0.36	0.13	181.14	1.0 Mat Ln	95.1	68.7	82.2	10.4	61.6	Control	355 N	
10/10			181.16	1.0 Mat Ln	87.8	45.8	69.9	8.6	59.1		355 N	
10/17			181.16	Harvested	77.7	38.3	62.4	10.3	61.4		355 N	
Total	3.85	18.07			0	0	0	0	0			
Irrigation, Rain, Net Soil Water is 21.92"												

- Numbers in red are not counted in total

NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

Control

Year: *2012* **County:** *Hartley* **Grower:** *Harold Grall*

No. Acres: *120* **Variety/Hyb:** *P1151HR* **Soil Type:** *Sherm Clay Loam*

Meter Type: *Seametrics*

Meter Mult: *Ac Ft x 1* **Tillage:** *Strip Till*

Fertilizer: *162-55-2* **Seeding:** *26,000*

Planted: *May 24, 2012* **Harvest:** *October 16, 2012*

Herbicide: *Basis, Atrazine, Rifle, Medal, Powermax* **Insecticide:** *None*

Yield: *140 Bu/Acre* **Prev. crop:** *Corn* **Row width:** *30 Inch*

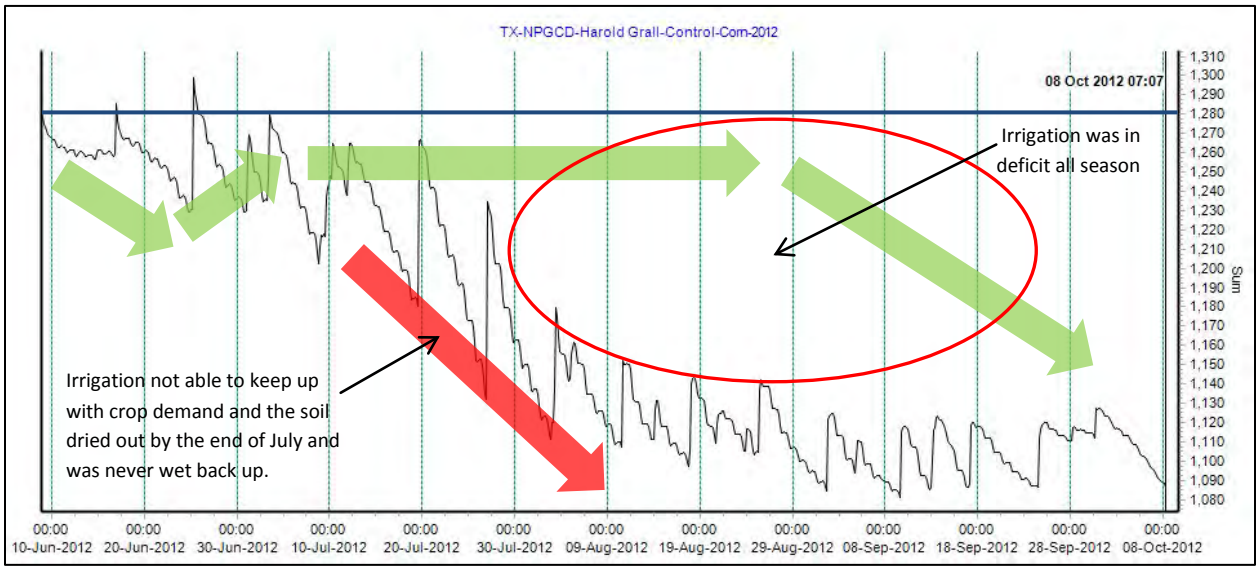
Irrigation method: *Center Pivot* **Prewater:** *None* **Well GPM:** *3.3*

Distance between drops: *60”* **Distance from nozzle to ground:** *16”*

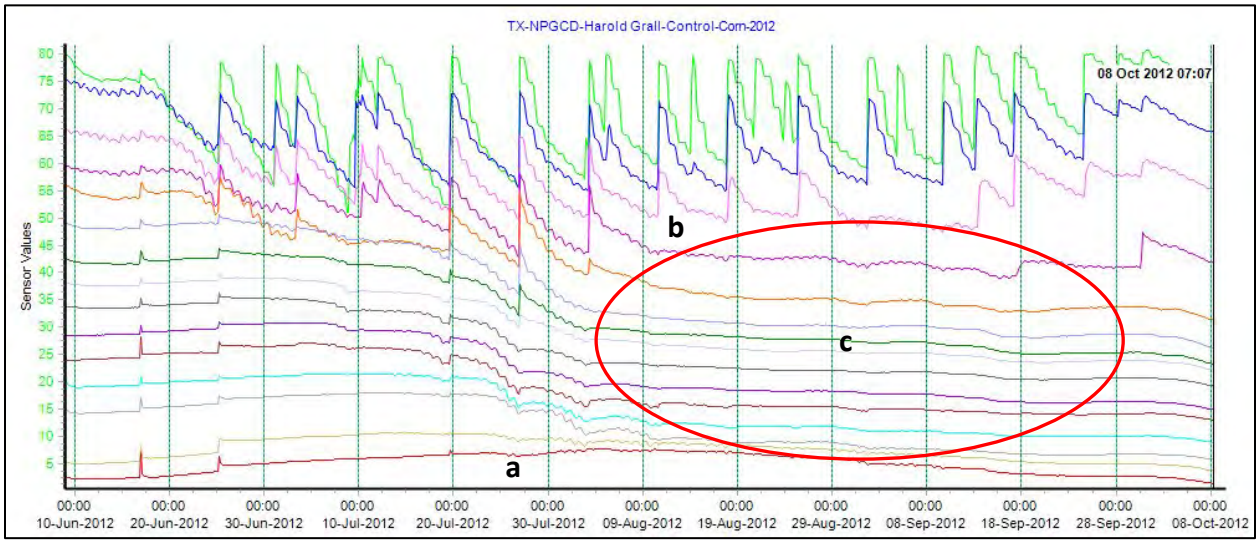
Application pattern: *LEPA Bubbler* **Crop row direction :** *Straight*

GPS Location: Latitude: *35.981297*
Longitude: *-102.18055*

Harold Grall: AquaSpy Control Site (140 bu/ac; 18.1" irrigation)



Irrigation was not able to keep up with crop demand. The soil profile was full at the start of the season and the soil gave up considerable soil moisture but this was not enough to stop severe moisture stress during August and reduced yield. The crop can be seen "chasing moisture" from greater and greater depths in the soil at the end of each irrigation cycle, indicating moisture stress from late July onwards.



(a) Root activity reached 60" by late July
(b) Irrigation only reaching 12"
(c) Sub-soil moisture was largely depleted by the beginning of August and was never replenished

Harvest Results -The 200-12 field produced a 167 bushel per acre corn yield. Irrigation totaled 16.87 inches. Production in the control field was 140 bushels per acre, where seasonal irrigation was 18.07. There was no pre-water in either field. In comparison, the 200-12 field produced 27 more bushels per acre than the control with 1.20 less inches of irrigation. Corn production was 9.90 bushels (554lbs) per inch of irrigation in the 200-12 field compared to 7.75 bushels (434lbs) in the control. Production from each inch of irrigation, rainfall and net soil water that totaled 24.18 inches was 6.90 bushels (387lbs) per acre in the 200-12 field. Irrigation, rainfall and net soil water totaled 21.92 inches in the control field where production was 6.38 bushels (357lbs) per inch. Crop production costs were $14.27 per acre more for the 200-12 field than for the control from increased seed, fertilizer and harvest expenses. At $6.59 per bushel, the additional 27 bushel per acre corn yield in the 200-12 field amounts to $177.93 more per acre . The 200-12 field's net gain was $163.66 per acre with 1.20 inches less irrigation used compared to production from the control field. A summary of the demonstration results are shown in the following table.

Table – 2012 Demonstration Results for Harold Grall 200-12 & Control

Irrigation		Irrig/Rain/Soil	PRODUCTION		CROP VALUE @ $6.59/Bu		
field	Inches	Inches	Bu/Ac	Bu/Ac-In Irrigation	Per Acre	Acre-In of Irrigation	Ac-In of Irrig/Rain/Soil
200-12	16.87	*24.18	167	9.90	$1100.53	$65.23	$45.51
Control	18.07	+21.92	140	7.34	$922.60	$51.05	$42.09

***Includes 4.17 inches of water removed from five feet of soil, plus rainfall, and irrigation.**
+Includes 0 inches of soil water removed from five feet of soil, plus rainfall and irrigation.

Additional Hybrid and Plant Population Harvest Results- All growers are searching for the best corn hybrid, seeding rate, planting date and other information to help maintain profitable corn production levels with less irrigation and rainfall. Below are results of ten Pioneer, NK and Triumph hybrids and two additional seeding rates from within Grall's 200-12 field. Yields are at 15.0 percent moisture and rounded to the nearest number. Irrigation and rain are the same as that reported for the 200-12 field.

Table – 2012 Corn Yields from Different Corn Hybrids and seeding rates

Hybrid	Seeding Rate	Bushels/Acre
NK N79S	28,000	202
NK N72Q	28,000	201
NK N72D	28,000	198
P1151HR	32,000	193
P1151HR	28,000	190
TR 7514S	32,000	190
NK N68B	28,000	188
TR 1217S	28,000	187
P1564HR	32,000	184
P1564HR	28,000	183
P0876HR	32,000	181
P0876HR	28,000	176
P1151XR	28,000	172

Hybrid	Seeding Rate	Bushels/Acre
P1151XR	32,000	166
TR 7514S	28,000	165
TR 1217S	32,000	163

Variable Rate Irrigation-VRI At Grall Control Field – Programmed Variable center pivot speed control was used in Grall's Control field using a prescription written from field and soil information obtained from a preseason EM 38 soil survey. The VRI prescription was written by NPGCD personnel using Crop Metrics Virtual Agronomist software. The prescription was based on an eight day revolution and 300 gpm that applies 1.0 inch of irrigation. Speed of the center travel rate varies in sixty six degree increments to apply different amounts of irrigation as selected in writing the prescription. The prescription is written to apply more irrigation on the southwest portion of the circle. Actual irrigation varied from 0.85 inches to 1.17 inches in selected areas of the field. A map of the prescription follows. Center pivot variable speed control was accomplished by Pivotrac using the VRI prescription. VRI was initiated on July 18, which was late. A copy of Grall's harvest monitor yield map of the control field follows in this report. Grall's control field is one of three initiated by NPGCD during the 2012 growing season to learn the VRI process.

Harold Grall's Variable Rate Irrigation (VRI)

Map-Variable Rate Irrigation Prescription for Grall Control Field

1

Virtual Agronomist
Base Management Program

Grower Harold Grall
Farm Grall Farms
Field 417 44

Pivot VRI by Sector Report

Base Application Depth: 1.00 in
Base Walk Rate: 10.00 (%)
Total Area: 121.85 ac **Total Time:** 8d 0hr 56min
Total Flat Rate Water Amount: 3,308,820.5 gal
Total VRI Water Amount: 3,324,634.9gal (1.00in/ac)

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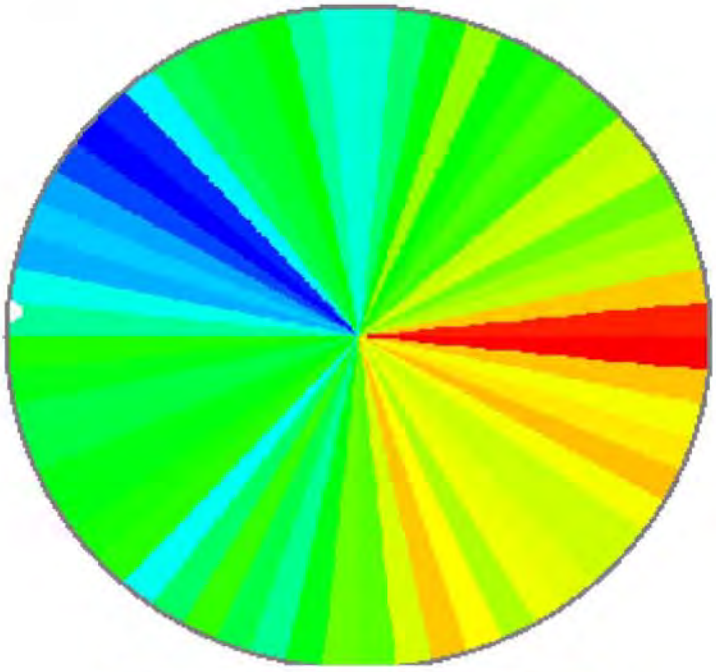

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Table- Variable Rate Irrigation by Six Degree Sectors for Grall Control Field

Virtual Agronomist™ Base Management Program

Grower Harold Grall

Farm Grall Farms

Field 417 44

Pivot VRI by Sector Report

Start Angle	Stop Angle	Area (ac)	Application (in)	Speed (%)
0	6	1.91	1.08	9.29
6	12	2.01	1.04	9.57
12	18	2.02	1.01	9.87
18	24	2.02	0.97	10.34
24	30	2.02	1.01	9.89
30	36	2.01	1.00	9.99
36	42	2.02	0.99	10.12
42	48	2.02	0.99	10.06
48	54	2.02	0.95	10.49
54	60	2.02	0.95	10.55
60	66	2.02	0.98	10.23
66	72	2.02	0.96	10.40
72	78	2.03	0.95	10.51
78	84	2.03	0.92	10.92
84	90	2.02	0.86	11.61
90	96	2.02	0.85	11.75
96	102	2.03	0.91	10.95
102	108	2.03	0.94	10.69
108	114	2.03	0.93	10.80
114	120	2.04	0.91	10.97
120	126	2.04	0.93	10.70
126	132	2.04	0.95	10.55
132	138	2.04	0.95	10.56
138	144	2.04	0.94	10.62
144	150	2.04	0.94	10.66
150	156	2.05	0.96	10.45
156	162	2.05	0.93	10.74
162	168	2.05	0.91	10.93
168	174	2.05	0.95	10.58
174	180	1.94	0.98	10.15
180	186	2.14	0.98	10.19
186	192	2.05	1.02	9.83
192	198	2.05	1.06	9.46
198	204	2.05	1.03	9.68
204	210	2.05	1.00	10.03
210	216	2.04	1.04	9.59
216	222	2.05	1.09	9.20
222	228	2.04	1.00	9.99
228	234	2.05	1.01	9.94
234	240	2.04	1.02	9.85
240	246	2.04	1.02	9.83
246	252	2.03	1.03	9.71
252	258	2.04	1.03	9.68
258	264	2.04	1.02	9.82
264	270	2.04	1.00	9.95
270	276	1.96	1.06	9.44
276	282	2.03	1.09	9.21
282	288	2.03	1.13	8.95
288	294	2.03	1.11	9.02
294	300	2.03	1.12	8.94
300	306	2.03	1.15	8.70
306	312	2.02	1.17	8.54
312	318	2.02	1.16	8.62
318	324	2.02	1.10	9.12
324	330	2.02	1.04	9.62
330	336	2.02	1.03	9.73
336	342	2.02	1.02	9.76
342	348	2.03	1.01	9.89
348	354	2.05	1.06	9.44
354	360	2.14	1.08	9.27

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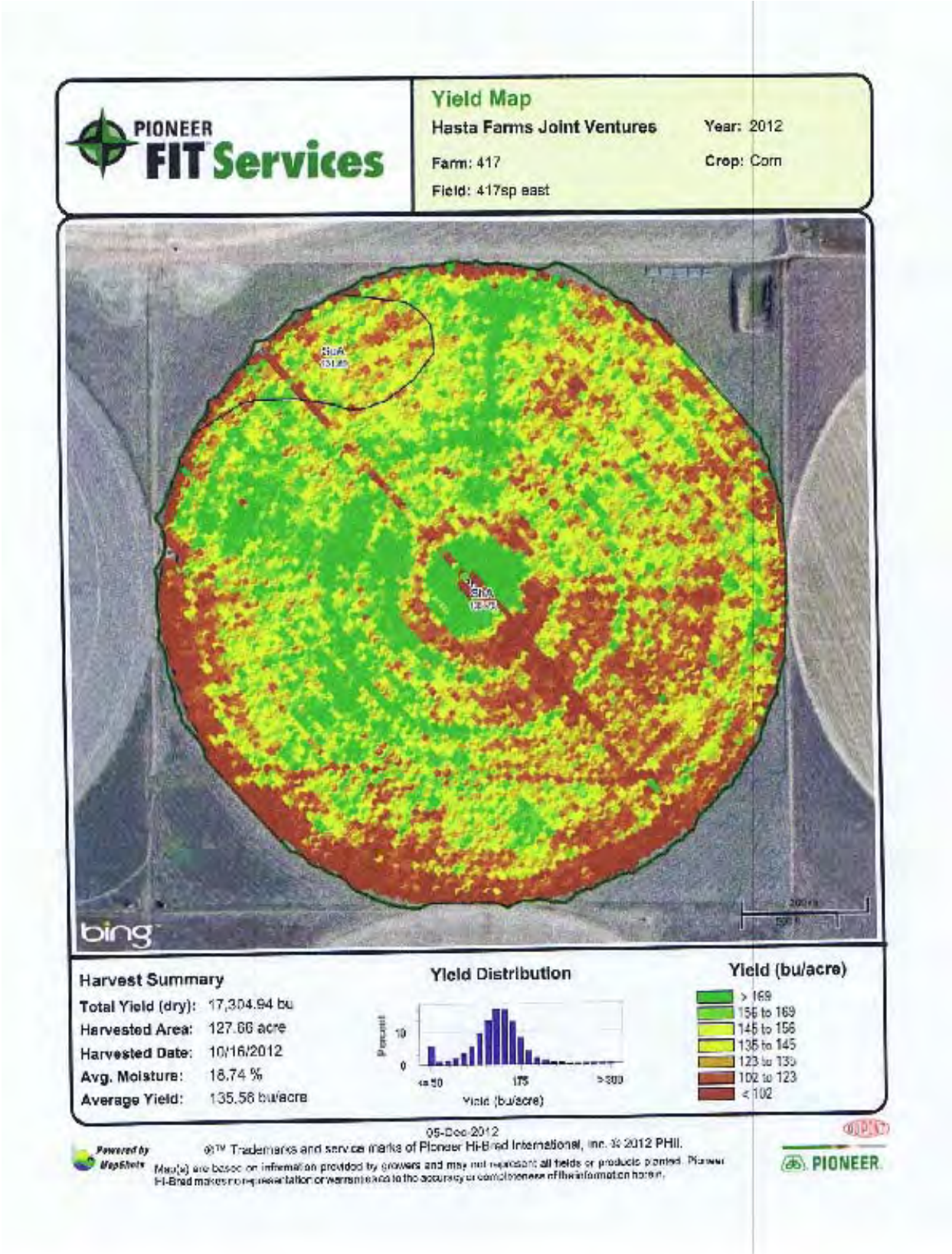
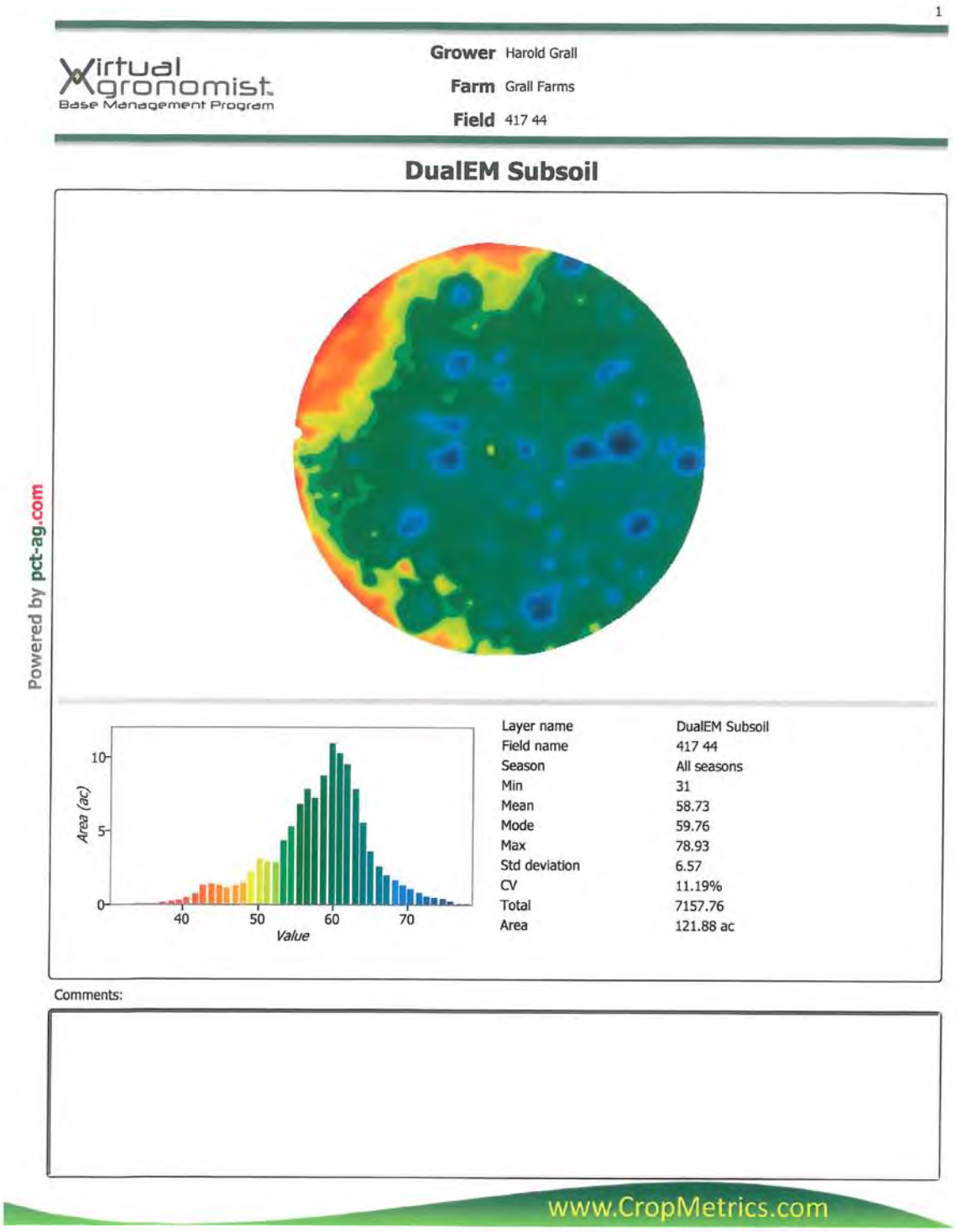
Map-Harvest Monitor Yield Map for Grall Control Field



Map-Dual Em Subsoil Map for Grall Control Field



Tommy Laubhan-Lipscomb County Demonstration, 2012

Planting and Crop Information – For his demonstration, Tommy Laubhan strip tilled and planted 60 acres of corn in the southwest quarter of the southwest half of section 1139, for his "200-12" field, "Laubhan 200-12". Laubhan planted the southwest quarter of the circle with Pioneer 1498HR at a seeding rate of 31,000 seeds/acre. He planted the northwest quarter 60 acres, also strip tilled, to Pioneer 1498HR at 31,000 seeds/acre for his "control" field, "Laubhan Control". Both the southwest quarter 200-12 and northwest quarter control fields were irrigated using the same center pivot. Seasonal water meter readings averaged 1125 gpm and delivered an average of 1.35 inch of irrigation in a 5.6 day revolution. Planting and crop information for "Laubhan 200-12" and "Laubhan Control" are shown in the table below. Each is the same unless specified and by colors.

Table – Planting and Crop Information for Laubhan

Planted:	May 4	**Fertilizer:**	240-70-0-40s-5zn
Hybrid:	P1498HR	**Tillage:**	Strip Till
Seeding Rate:	31,000	**Herbicide:**	Cinch ATZ, Round Up, Require Q
Soil Type:	Quannah Soils	**Insecticide:**	none
Row Width:	30 Inches	**No. Acres:**	61 each
GPM Per Acre:	4.5	**Harvested:**	October 15
Irrig/Rain/SoilWater: 200-12	24.39"	**Irrig/Rain/SoilWater:** Control	26.86"

Beginning Soil Water Profile and Growing Season Rainfall

"200-12": Weekly gypsum block readings show soil water was good at 1, 2, 3, 4, and 5 feet in the profile following planting and early season irrigation. Additional readings and the AquaSpy® soil probe show the crop used most water from 1 and 2 feet plus irrigation in late July and August, and about 50 percent from 3 feet. Soil water sensors indicate limited plant root activity at 4 and 5 feet during the growing season. The gypsum blocks were installed in June following early season irrigation.

"Control": Soil water was good except at 2 feet prior to planting. Weekly gypsum block readings show the profile was refilled following June rainfall and continuous irrigation. Additional readings show soil water was quickly depleted at 1 and 2 feet during July when plant water use was high. Only limited water was used from 3 and 4 feet.

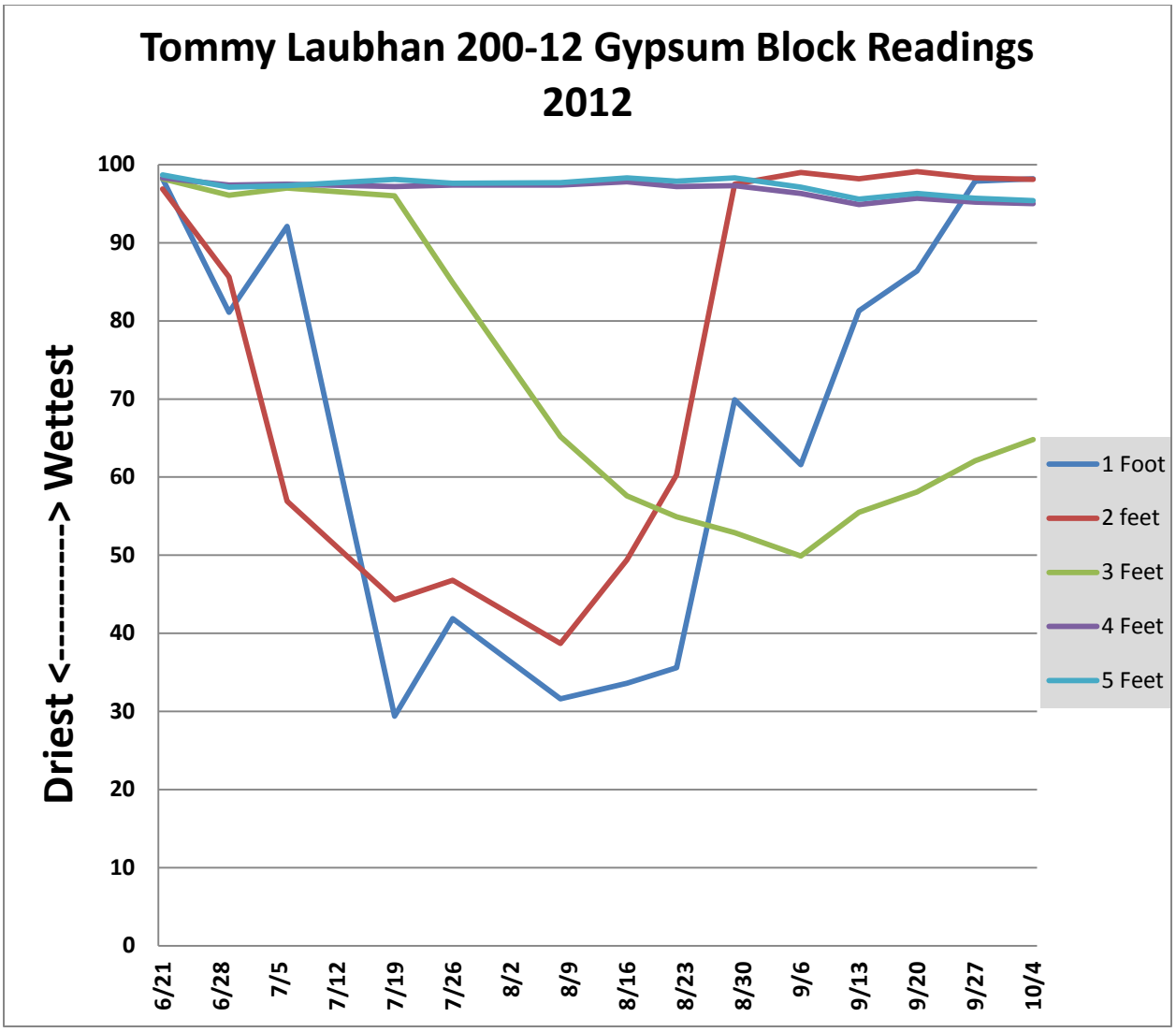
Both: Seasonal rainfall totaled 4.08 inches. Timely single rainfall events contributed to production, but the total is less than needed. The following table shows monthly rainfall as recorded by a district rain gauge located at the edge of the two fields.

Table – Monthly Rainfall Data for Laubhan "200-12" & "Control"

May- .03" June- 1.69" July- 1.01" August- 1.35" Sept- 0" Total: 4.08"

Growing Season Water Tracking – The district tracked crop total water throughout the growing season using rain gauges, water meters and both gypsum blocks and AquaSpy® soil moisture sensors. A set of five gypsum block soil moisture sensors was installed at 1, 2, 3, 4 and 5 feet and an AquaSpy® soil moisture probe was installed down to five feet in the root zone at one location to monitor soil water levels in the 200-12 field. Another set of the same type of sensors were installed in the Control field. Both sensors were installed in close proximity to each other in the field. Gypsum blocks were installed in the Control field prior to planting. Gypsum blocks and the AquaSpy® probe were installed in the 200-12 field following crop emergence. Following this paragraph, a series of graphs and tables shows weekly gypsum block readings for the season; growing season water, including rainfall, irrigation, and soil moisture at various growth stages; and the order of irrigation and rainfall events for each field. Finally a form describes the protocols for each field. "Total Water," as shown on the graph for growing season water, is the sum of seasonal irrigation, rainfall and net soil water. Graphs and tables for the 200-12 field are shown first, followed by the illustrations for the Control field.

Graph – Gypsum Block Readings for Tommy Laubhan 200-12



Graph – Growing Season Water Tracking for Tommy Laubhan 200-12

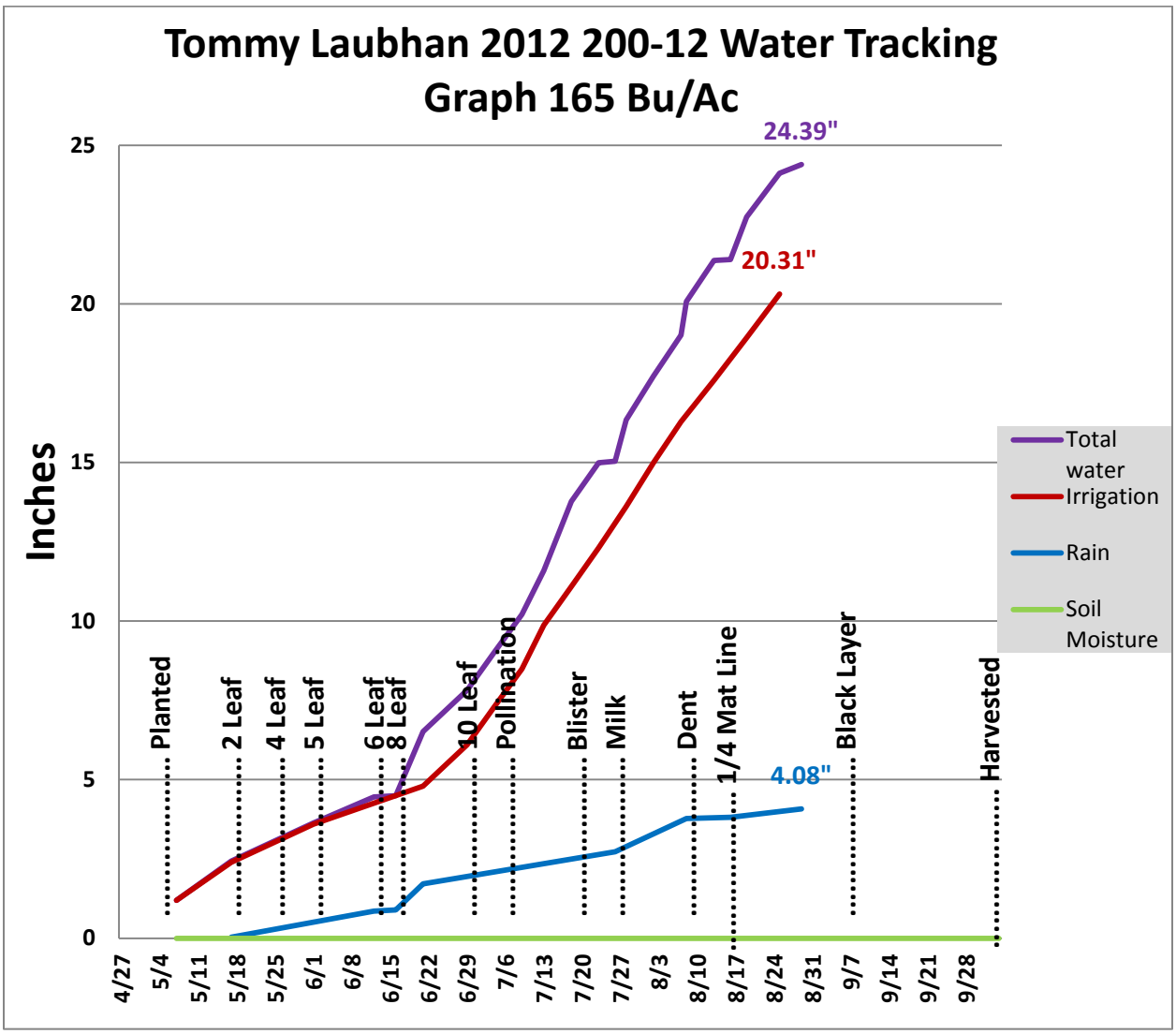


Table- Demonstration Field Data Tommy Laubhan 200-12

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
4/27	0.05		421932							Wheat	30 Y	
5/2	0.78		422641							Wheat	330 Y	
5/4										Planted		
5/7		1.20	422830							200-12	285 Y	1100
5/12										200-12	195 Y	1100
5/17	0.03	1.20	434410	2 leaf						200-12	195 Y	1100
5/25			444363	4 leaf						Stop	335 N	
6/1		1.20	444880	5 leaf						200-12	180 Y	1100
6/12	0.83		455311	6 leaf						Control	240 N	
6/16	0.03		456932	8 leaf						Control	243 Y	1100
6/21	0.83	1.20	463004	8 leaf	98.2	96.9	98.2	98.3	98.7	200-12	225 Y cw	1100
6/29		1.30	475996	10 leaf	81.1	85.6	96.1	97.4	97.1	200-12	210 Y	1123
7/4		1.20	Pivot							200-12	182 Y cw	1100
7/6			487657	12 leaf	92.1	56.9	97.0	97.5	97.3	East	350 Y cw	1077
7/9		1.19	Pivotrac							200-12	178 Y cw	1100
7/13		1.38	Pivotrac							200-12	157 Y cw	1100
	0.96		497675	Pollination	97.2	91.1	97.0	96.6	96.5	Control	235 Y cw	1098
7/18		1.22	Pivotrac							200-12	234 Y cw	1100
7/19			508024	Blister	29.4	44.3	96.0	97.2	98.1	Control	315 Y cw	1084
7/23		1.22	Pivotrac							200-12	234 Y cw	1100
7/26	0.05		519796	Milk	41.9	46.8	84.9	97.4	97.6	East Half	118 Y cw	1079
7/28		1.30	Pivotrac							200-12	234 Y cw	1100
8/2		1.38	Pivotrac							200-12	234 Y cw	1100
			531694	Dent	27.6	32.0	60.8	97.5	97.8	Control	238 Y cw	1088
8/7		1.30	Pivotrac							200-12	324 Y cw	1100
8/8	1.05		542935	1/4 Mat Ln	31.6	38.7	65.2	97.4	97.7	Split	324 Y cw	1150

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
8/13		1.30	Pivotrac							200-12	234 Y cw	1100
8/16	0.03		554234	1/3 Mat Ln	33.6	49.4	57.6	97.8	98.3	East Half	58 Y cw	1220
8/19		1.34	Pivotrac							20012	234 Y cw	1100
8/22			563900	1/2 Mat Ln	35.6	60.3	54.9	97.2	97.9	East Half	90 Y cw	1136
8/25		1.38	Pivotrac							200-12	234 Y cw	1100
8/29	0.27		571843	1.0 Mat Ln	69.9	97.5	52.9	97.3	98.3	East Half	58 Y cw	1267
9/6	1.18		582091	Blk Layer	61.6	99.0	49.9	96.3	97.1	East Half	125 N	
9/13	0.50		590102	Blk Layer	81.3	98.2	55.5	94.9	95.6	East Half	114 Y	
9/20			599531	Blk Layer	86.4	99.1	58.1	95.7	96.3	East Half	114 N	
9/27	1.63		599531	Beg Harvest	97.9	98.3	62.1	95.2	95.7		114 N	
10/4	0.07		599531	harvested	98.2	98.1	64.8	95.0	95.4		114 N	
Total	4.08	20.31			0	0	0	0	0			
Cannot identify soil water separate from irrigation & rain												
Irrigation, Rain, Net Soil Water is 24.39 inches												

- Numbers in red are not counted in total

NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

200-12

Year: *2012* **County:** *Lipscomb* **Grower:** *Tommy Laubhan*

No. Acres: *60* **Variety/Hyb:** *P1498HR* **Soil Type:** *Quannah Soils*

Meter Type: *McCrometer*

Meter Mult: *Gallons x 1000* **Tillage:** *Strip Till*

Fertilizer: *240-70-0-40s-5zn* **Seeding:** *31,000*

Planted: *May 4, 2012* **Harvest:** *October 4, 2012*

Herbicide: *Cinch ATZ, Round Up, Require Q* **Insecticide:** *None*

Yield: *165 Bu/Acre* **Prev. crop:** **Row width:** *30 Inch*

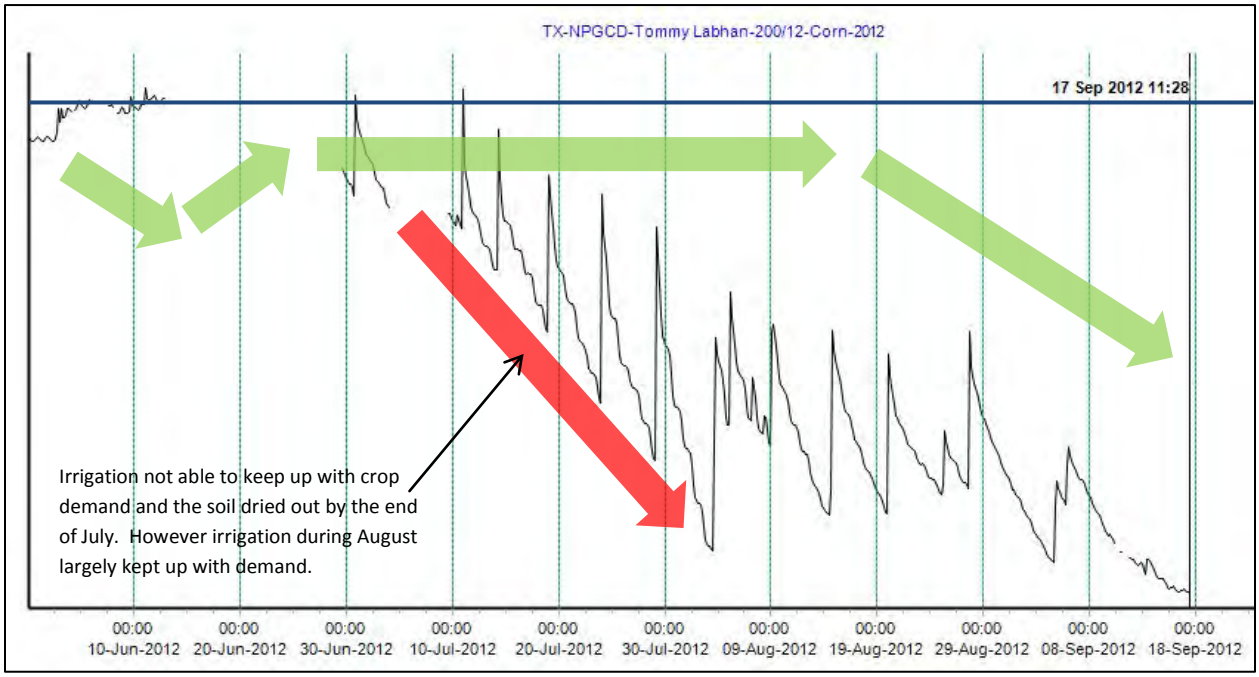
Irrigation method: *Center Pivot* **Prewater:** *None* **Well GPM:** *1125*

Distance between drops: *60”* **Distance from nozzle to ground:** *16”*

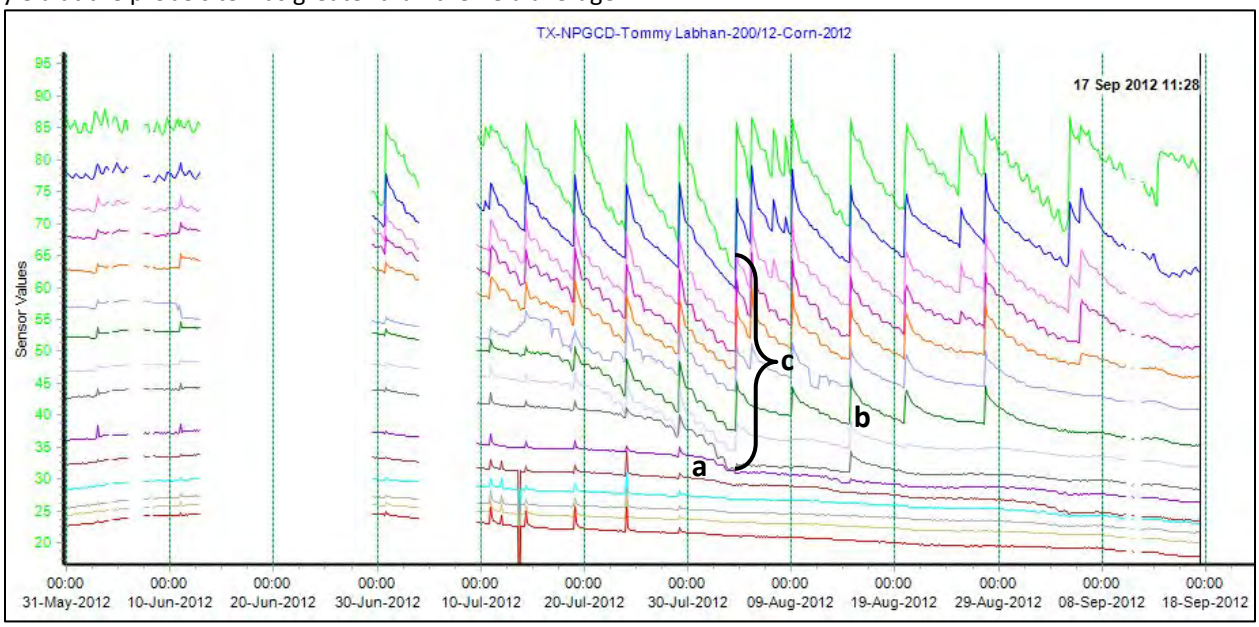
Application pattern: *Spray* **Crop row direction :** *Circle*

GPS Location: Latitude: *36.407858*
Longitude: *-100.112097*

Tommy Laubhan: AquaSpy 200-12 Site (165 bu/ac; 20.3” irrigation)

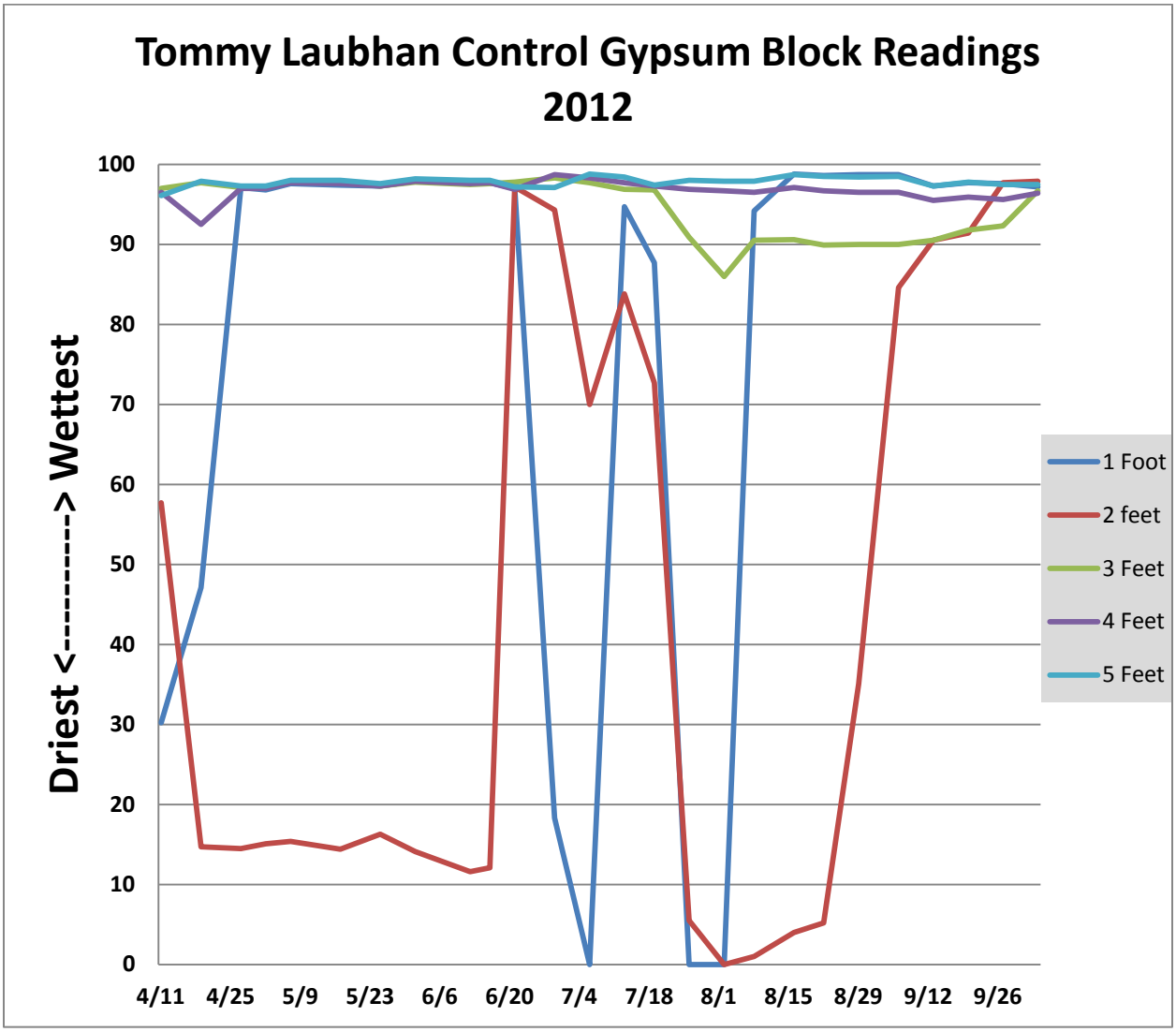


Irrigation was not able to keep up with peak moisture demand through July; however, since the site began with a full soil profile, the crop was able to draw upon stored soil moisture to keep up with demand. Irrigation was not able to re-wet the soil past 28” during August and the late season water use was reduced. While it is possible that the crop tipped-back and suffered some yield loss, it is hard to say if usage was reduced through moisture stress or some other factor such as mites. The field had a lot of variation and it is possible that the yield at the probe site was greater than the field average.



(a) Root activity to 44” by early August
(b) Irrigation penetrated to at least 28” every irrigation, with many irrigations to 36”.
(c) Excellent water uptake down to 36”

Graph – Gypsum Block Readings for Tommy Laubhan Control



Graph – Growing Season Water Tracking for Tommy Laubhan Control

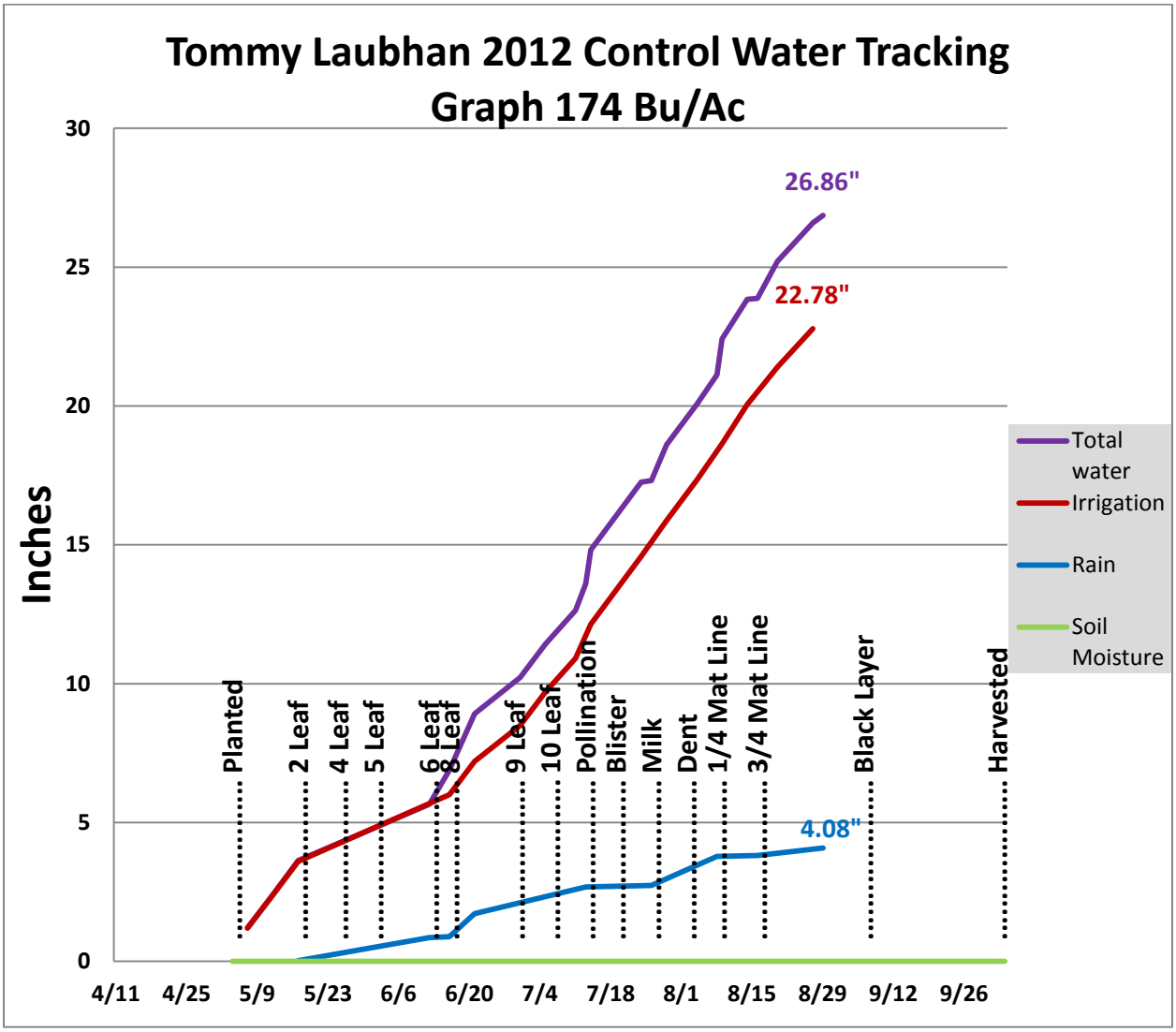


Table- Demonstration Field Data Tommy Laubhan Control

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
4/11				Install	30.2	57.7	97.0	96.5	96.1			
4/19					47.1	14.7	97.7	92.5	97.9		N	
4/27	0.05		421932		97.1	14.5	97.1	97.0	97.3	wheat	30 Y	
5/2	0.78		422641		96.8	15.1	97.2	97.0	97.3	wheat	330 Y	
5/4										planted		
5/7		1.20	422830		97.6	15.4	97.9	97.7	98.0	control	285 Y	1100
5/12		1.20								control		1100
5/17	0.03	1.20	434410	2 leaf	97.4	14.4	97.7	97.6	98.0	200-12	195 Y	1100
5/25			444363	4 leaf	97.3	16.3	97.3	97.3	97.6	stop	335 N	
6/1			444880	5 leaf	97.9	14.1	97.8	97.9	98.2	200-12	180 Y	1034
		1.20								control		
6/12	0.83		455311	6 leaf	97.7	11.6	97.5	97.6	98.0	control	240 N	
6/16	0.03	1.20	456931	8 leaf	97.7	12.1	97.6	97.7	98.0	control	243 Y	1100
6/21	0.83	1.20	463004	8 leaf	97.0	97.2	97.8	96.9	97.2	200-12	225 Y	1068
6/29			475996	9 leaf	18.3	94.3	98.3	98.7	97.1	200-12	210 Y	1123
6/30		1.30	Pivotrac							control	200 Y cw	1100
7/5		1.20	Pivotrac								248 Y cw	1100
7/6			487657	10 leaf	0	70.0	97.7	98.3	98.8	east	350 Y cw	1077
7/11		1.22	Pivotrac							control	320 Y cw	1100
7/13	0.96		497675	Pollination	94.7	83.8	96.9	97.7	98.4	control	235 Y cw	1098
7/14		1.22	Pivotrac							control	324 Y cw	1100
7/19			508024	Blister	87.7	72.7	96.8	97.3	97.4	control	315 Y cw	1084
		1.22	Pivotrac							control	324 Y cw	1100
7/24		1.22	Pivotrac							control	324 Y cw	1100
7/26	0.05		519798	Milk	0	5.5	90.9	96.9	98.0	east half	118 Y cw	1079
7/29		1.30	Pivotrac							control	324 Y cw	1100
8/2			531694	Dent	0	0	86.0	96.7	97.9	control	238 Y cw	1088
8/4		1.46	Pivotrac							control	324 Y cw	1100

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
8/8	1.05		542935	1/4 Mat Ln	94.2	1.0	90.5	96.5	97.9	split	324 Y cw	1150
8/9		1.30	Pivotrac							control	324 Y cw	1100
8/14		1.42	Pivotrac							control	324 Y cw	1100
8/16	0.03		554234	3/4 Mat Ln	98.8	4.0	90.6	97.1	98.7	east half	58 Y cw	1220
8/20		1.34	Pivotrac							control	324 Y cw	1100
8/22			563900	7/8 Mat Ln	98.6	5.2	89.9	96.7	98.5	east half	90 Y cw	1136
8/27		1.38	Pivotrac							control	324 Y cw	1100
8/29	0.27		571843	1.0 Mat Ln	98.7	35.1	90.0	96.5	98.4	east half	58 Y cw	1267
9/6	1.18		582091	Blk Layer	98.7	84.6	90.0	96.5	98.5		125 N	
9/13	0.50		590102	Blk Layer	97.3	90.5	90.5	95.5	97.3	east half	114 Y	
9/20			599531	Blk Layer	97.7	91.4	91.8	95.9	97.8		114 N	
9/27	1.63		599531	Blk Layer	97.6	97.7	92.3	95.6	97.5		114 N	
10/4	0.07		599531	Harvest	97.2	97.9	96.7	96.4	97.5		114 N	
Total	4.08	22.78			0	0	0	0	0			
Cannot identify soil water separate from irrigation & rainfall												
Irrigation, Rain, Net Soil Water is 26.86 inches												

- Numbers in red are not counted in total

NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

Control

Year: *2012* **County:** *Lipscomb* **Grower:** *Tommy Laubhan*

No. Acres: *60* **Variety/Hyb:** *P1498HR* **Soil Type:** *Quannah Soils*

Meter Type: *McCrometer*

Meter Mult: *Gallons x 1000* **Tillage:** *Strip Till*

Fertilizer: *240-70-0-40s-5zn* **Seeding:** *31,000*

Planted: *May 4, 2012* **Harvest:** *October 4, 2012*

Herbicide: *Cinch ATZ, Round Up, Require Q* **Insecticide:** *None*

Yield: *174 Bu/Acre* **Prev. crop:** **Row width:** *30 Inch*

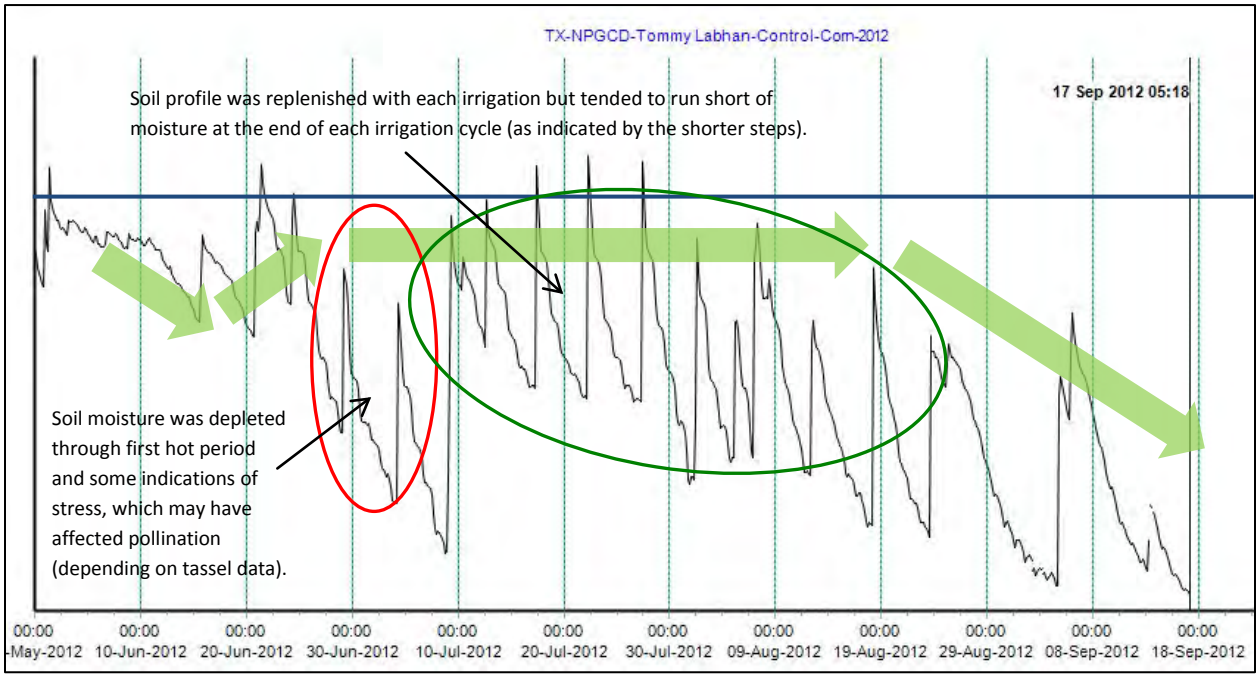
Irrigation method: *Center Pivot* **Prewater:** *None* **Well GPM:** *1125*

Distance between drops: *60”* **Distance from nozzle to ground:** *16”*

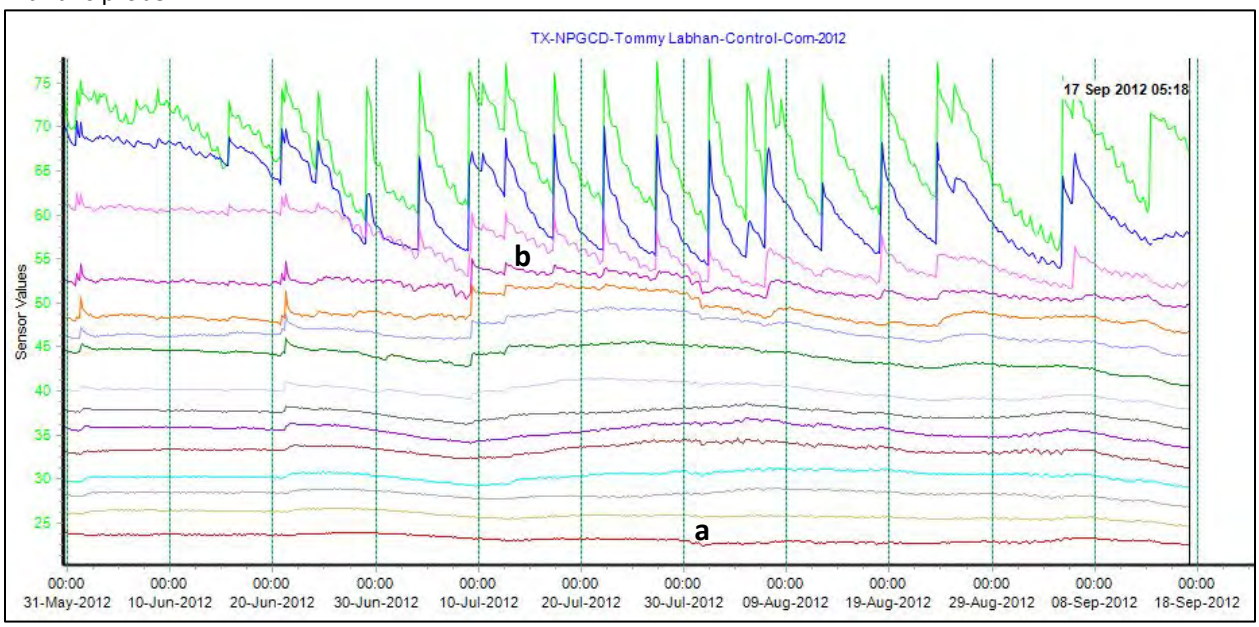
Application pattern: *Spray* **Crop row direction :** *Circle*

GPS Location: Latitude: *36.407858*
Longitude: *-100.112097*

Tommy Laubhan: AquaSpy Control Site (174 bu/ac; 22.8" irrigation)



The crop began with a full soil profile but suffered a little through the first hot spell at the end of June/beginning of July. The profile was then refilled and irrigation appeared to keep up with crop demand for much of the rest of the season. It is curious however, that the separate layer graph does not show a deep or aggressive root system (which could be indicative of some soil structural issue). It also seems to have a lower water holding capacity compared to the 200/12 site. It is possible that there were installation or setting issues with this probe.



(a) While deep root activity is not strong, there is evidence that the roots were active at 60" by the end of July.

(b) Most irrigations penetrated to 16" but root activity was not strong below 12"

Harvest Results - The 200-12 field produced a 165 bushel per acre corn yield. Irrigation totaled 20.31 inches. Production in the control field was 174 bushels per acre. Seasonal irrigation totaled 22.78 inches. There was no pre-season irrigation. The control field produced nine more bushels per acre than the 200-12 and irrigation was 2.47 inches more. Corn production was 8.12 bushels (455lbs) per inch of irrigation in the 200-12 field compared to 7.63 (428lbs) in the control. *Production* from each inch of irrigation, rainfall and net soil water that totaled 24.39 inches was 6.76 bushels (379lbs) per acre in the 200-12 field. Irrigation, rainfall and net soil water totaled 26.86 inches in the control field where production was 6.48 bushels (363lbs) per inch. Crop production costs were $14.91 per acre less for the 200-12 field than for the control from reduced irrigation and harvest expenses. At $6.59 per bushel, the nine bushel per acre increased corn yield in the control field amounts to $59.31 more per acre. The control field's net gain was $44.40 per acre with 2.47 inches additional irrigation used compared to production from the 200-12 field. A summary of the demonstration results are shown in the following table.

Table – 2012 Demonstration Results for Laubhan 200-12 & Control

Irrigation		Irrig/Rain/Soil	PRODUCTION		CROP VALUE @ $6.59/Bu		
field	Inches	Inches	Bu/Ac	Bu/Ac-In Irrigation	Per Acre	Acre-In of Irrigation	Ac-In of Irrig/Rain/Soil
200-12	20.31	*24.39	165	8.12	$1087.35	$53.53	$44.58
Control	22.78	+26.86	174	7.64	$1146.66	$50.33	$42.69

***Includes 0 inches of water removed from five feet of soil, plus rainfall, and irrigation.**
+Includes 0 inches of soil water removed from five feet of soil, plus rainfall and irrigation.

Hartley Feeders-Hartley County Demonstration, 2012

Planting and Crop Information - For their demonstration, Hartley Feeders strip tilled and planted 60 acres of corn in the north half of the northwest quarter of section 2, for their "200-12" field, "Hartley Feeders 200-12". They planted the field with Pioneer 1498HR at seeding rate of 28,000 seeds/acre. Hartley Feeders planted 120 acres, also strip tilled, in the northeast quarter of section 3 to Pioneer 1498HR at 28,000 seeds/acre for their "control" field, "Hartley Feeders Control". The 200-12 field was irrigated using a center pivot where seasonal water meter readings average 450 gpm and delivered an average of 1.30 inches of irrigation in a 6.5 day revolution. The center pivot also irrigated wheat in the south half of the circle. Water meter readings averaged 500 gpm for the center pivot that irrigated the control field and delivered 1.44 inches in a 6.5 day revolution. Planting and crop information for "Hartley Feeders 200-12" and "Hartley Feeders Control" are shown in the table below. Each is the same unless specified. Dennis Buss is Farm Manager for Hartley Feeders.

Table – Planting and Crop Information for Hartley Feeders

200-12		*Control*	
Planted:	May 20	**Planted:**	May 20
Fertilizer:	7 tons manure+80-0-0	**Fertilizer:**	Effluent +110-100-58
Hybrid:	Pioneer 1498HR	**Hybrid:**	Pioneer 1498HR
Seeding Rate:	28,000:	**Herbicide:**	Harness, Grounded, Roundup, Hell Fire
Soil Type:	Sherm Clay Loam	**Soil Type:**	Dumas Clay Loam
Row Width:	30 Inches	**Tillage:**	Strip Till
No Acres:	60	**No. Acres:**	120
GPM Per Acre:	3.75	**GPM Per Acre:**	4.16
Harvested:	October 10	**Insecticide:**	Comite, Dimethoate, Intrepid, Vision
Irrig/Rain/SoilWater:	26.64"	**Irrig/Rain/SoilWater:**	27.50"

Beginning Soil Water Profile and Growing Season Rainfall

"200-12": There was no preseason soil water at 2, 3 and 4 feet when gypsum blocks were installed in April. The one foot level had good soil water and 5 feet was about one half. Soil water levels at 2 and 3 feet were filled by early June rainfall and irrigation following planting. Weekly gypsum block readings show only limited to no changes in soil water levels at 4 and 5 feet during the growing season. Sherm clay loam soil holds approximately 2.0 inches of available water per foot for potential crop use. The gypsum blocks were installed in mid-April prior to planting to obtain advanced soil water conditions.

"Control": Soil moisture sensing gypsum blocks were installed on June 22 following planting and good rainfall on June 11 and 13. Not as timely as needed. Weekly gypsum block readings following installation show beginning good soil water levels at 1, 2, 3, 4, and 5 feet. Plants used water extensively from 1, 2 and 3 feet during the growing season and from 4 and

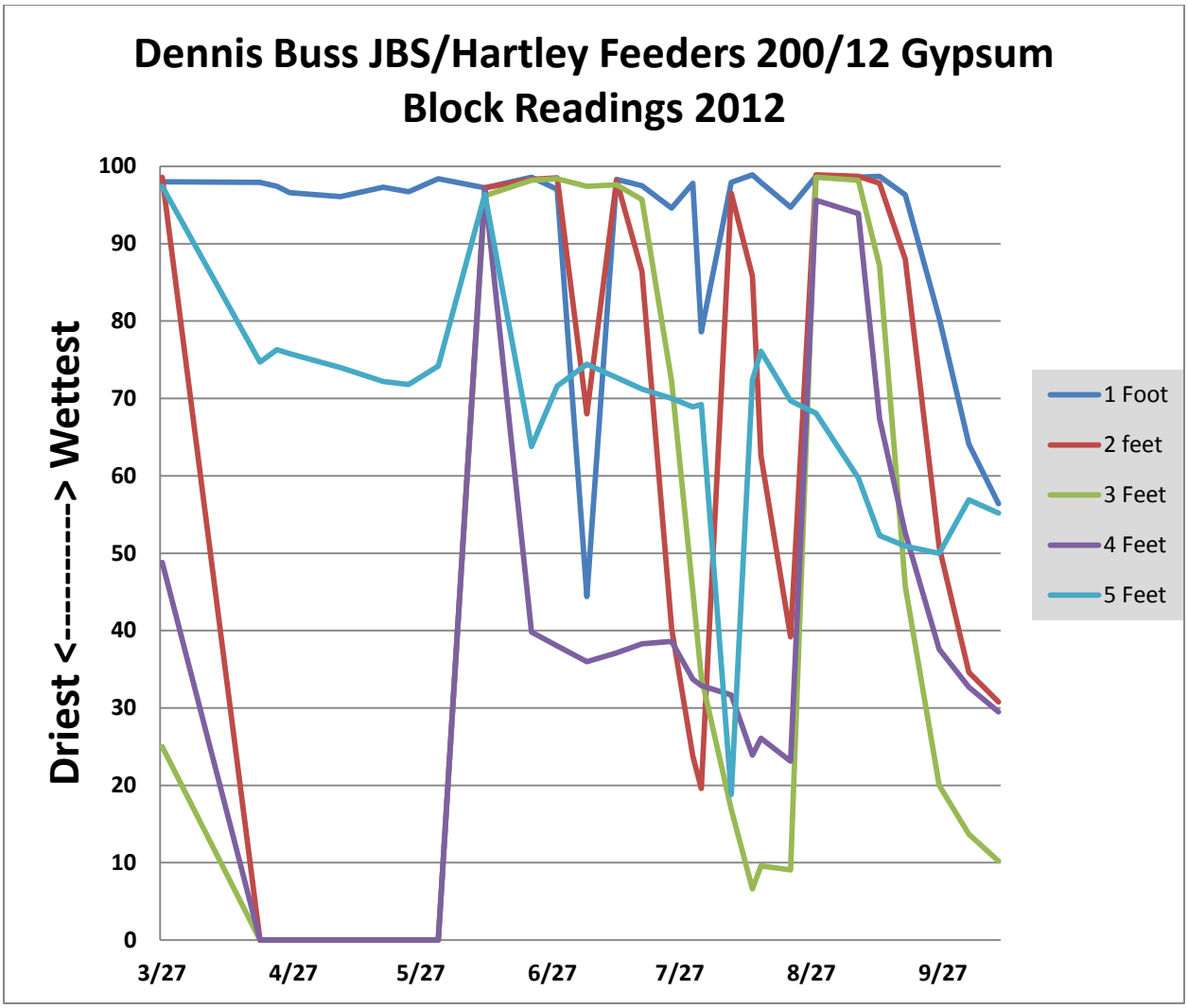
5 feet finishing the crop in September. Dumas clay loam soil holds approximately 1.85 inches of available water per foot for potential crop use.
Both: Seasonal rainfall totaled 5.96 inches. The crop was in the pollinating to blister growth stages during the more extreme heat in late July and early August. The following table shows monthly rainfall as recorded by a district rain gauge located at the two fields.

Table – Monthly Rainfall Data for Hartley Feeders "200-1 two 2" & "Control"

May- 0" June- 1.71" July- 2.31" August- 1.05" Sept- .89" Total: 5.96"

Growing Season Water Tracking – The district tracked crop total water throughout the growing season using rain gauges, water meters and both gypsum block and AquaSpy® soil moisture sensors. A set of five gypsum block soil moisture sensors was installed at 1, 2, 3, 4 and 5 feet and an AquaSpy® soil moisture probe was installed down to five feet in the root zone at one location to monitor soil water levels in the 200-12 field. Another set of the same type of sensors was installed in the Control field. Both sensors were installed in close proximity to each other in the field. Gypsum blocks were installed in each 200-12 field prior to planting. Gypsum blocks were installed in the Control field and the AquaSpy® probe in each field following crop emergence. Following this paragraph, a series of graphs and tables shows weekly gypsum block readings for the season; growing season water, including rainfall, irrigation, and soil moisture at various growth stages; and the order of irrigation and rainfall events for each field. Finally a form describes the protocols for each field. "Total Water," as shown on the graph for growing season water, is the sum of seasonal irrigation, rainfall and net soil water. Graphs and tables for the 200-12 field are shown first, followed by the illustrations for the Control field.

Graph – Gypsum Block Readings for Dennis Buss 200-12



Graph – Growing Season Water Tracking for Dennis Buss 200-12

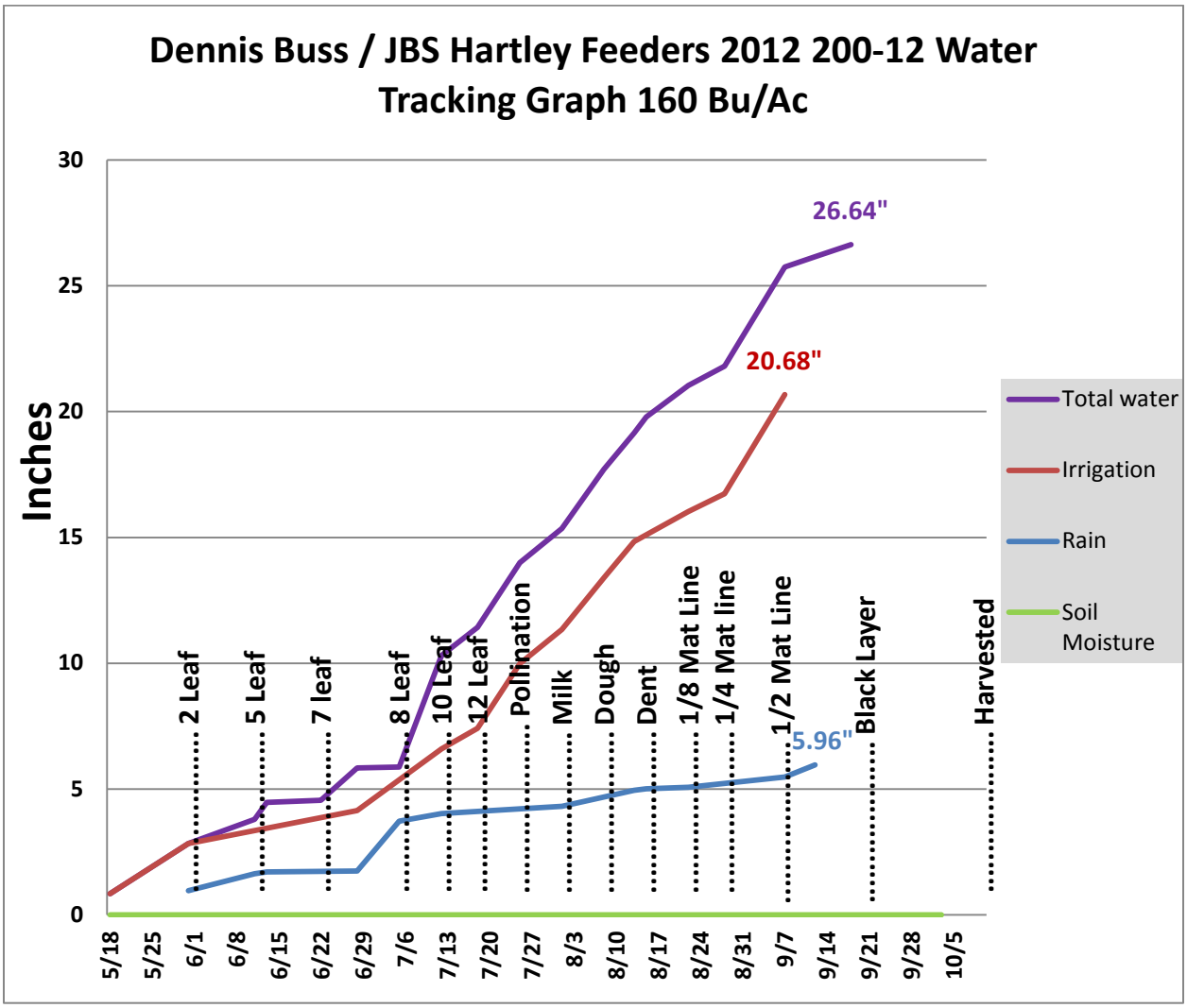


Table- Demonstration Field Data Hartley Feeders 200-12

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
3/27			none		98.0	98.6	25.0	48.8	97.4			
4/19	3.46											
4/19			10.34		97.9	0	0	0	74.7		N	
4/23	0.32		13.34		97.4	0	0	0	76.3	Wheat		515
4/26			17.23		96.6	0	0	0	75.8	Wheat	105 Y	
5/8			29.04		96.1	0	0	0	74.0		270 N	
5/18	0.45	0.84	33.24		97.3	0	0	0	72.2	Prewater	280 N	
5/24			33.24		96.7	0	0	0	71.8		270 N	
5/31		2.00	43.22	2 leaf	98.4	0	0	0	74.2		330 N	
6/11	0.96		43.22	5 leaf	97.2	97.2	96.2	96.9	96.4		330 N	
6/13	0.67											
6/22	0.08		43.57	7 leaf	98.6	98.3	98.2	39.8	63.8	Corn	280 N	448
6/28		1.30	49.74	7 leaf	97.0	98.5	98.4	38.0	71.6	Corn	85N	
7/5	0.03		60.04	8 leaf	44.4	68.0	97.4	36.0	74.4	Corn	17 Y cw	504
7/12	1.98	2.45	61.99	10 leaf	98.3	98.2	97.6	37.1	72.7		87 N	
7/18	0.30	0.82	66.10	12 leaf	97.5	86.4	95.7	38.3	71.2		0 Y cw	421
7/25		2.57	78.96	Pollination	94.6	40.3	72.2	38.6	70.0		70 N	
7/30			83.94	Blister	97.8	23.8	45.1	33.7	68.9		271 N	
8/1		1.36	85.77	Milk	78.6	19.6	34.0	32.9	69.2		333 Y cw	389
8/8	0.29	2.06	96.08	Dough	97.9	96.5	16.9	31.7	18.8		287 Y ccw	454
8/13		1.44	103.31	Dough	98.9	85.8	6.6	23.9	72.4		68 N	
8/15	0.64		103.31	Dent	97.9	62.6	9.6	26.1	76.1		68 N	
8/22	0.06	1.19	109.25	1/8 Mat Ln	94.7	39.2	9.1	23.1	69.7		268 N	
8/28	0.06	0.71	112.74	1/4 Mat Ln	98.7	98.9	98.6	95.6	68.1		350 N	
9/7		3.94	132.44	1/2 Mat Ln	98.6	98.7	98.2	93.9	59.7		302 Y	560
9/12	0.41		132.58	3/4 Mat Ln	98.7	97.8	87.1	67.4	52.3		298 N	
9/18	0.48		132.60	Blk Layer	96.3	88.0	45.7	52.6	50.9		272 N	
9/26			144.48	Blk Layer	80.4	50.8	20.0	37.6	50.0	Wheat	270 N	
10/3			144.48	Blk Layer	64.1	34.6	13.7	32.7	56.9		270 N	
10/10			151.19	Harvested	56.4	30.8	10.2	29.5	55.2	Wheat	88 N	
Total	5.96	20.68			0	0	0	0	0			
Irrigation, Rain, Net Soil Water is 26.64 Inches												

- Numbers in red are not counted in total

NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

200-12

Year: *2012* **County:** *Hartley* **Grower:** *Dennis Buss*

No. Acres: *60* **Variety/Hyb:** *P1498HR* **Soil Type:** *Sherm Clay Loam*

Meter Type: *Seametrics*

Meter Mult: *Ac Ft x 1* **Tillage:** *Conventional*

Fertilizer: *7 ton manure+80-0-0* **Seeding:** *28,000*

Planted: *May 20, 2012* **Harvest:** *October 10, 2012*

Herbicide: *Harness, Grounded, Roundup, Hell Fire* **Insecticide:** *Comite, Demethoate, Intrepid, Vision*

Yield: *160 Bu/Acre* **Prev. crop:** **Row width:** *30 Inch*

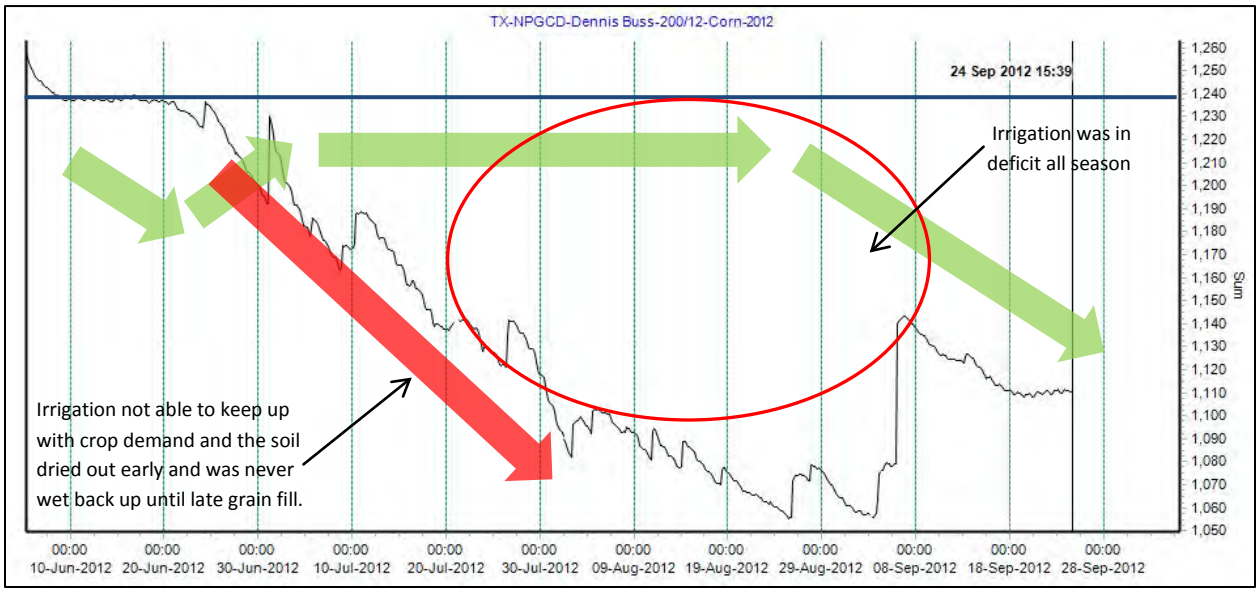
Irrigation method: *Center Pivot* **Prewater:** *Yes* **Well GPM:** *450*

Distance between drops: *60”* **Distance from nozzle to ground:** *16”*

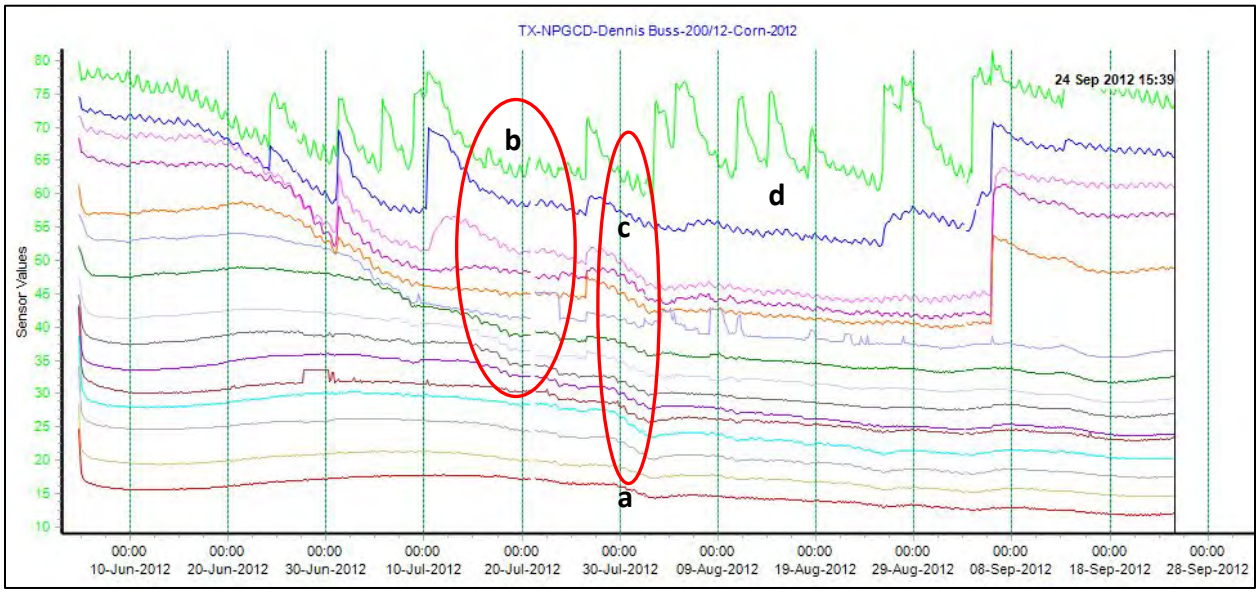
Application pattern: *Spray* **Crop row direction :** *Straight*

GPS Location: Latitude: *35.889773*
Longitude: *-102.45235*

Hartley Feeders: AquaSpy 200-12 Site (160 bu/ac; 19.8" irrigation)

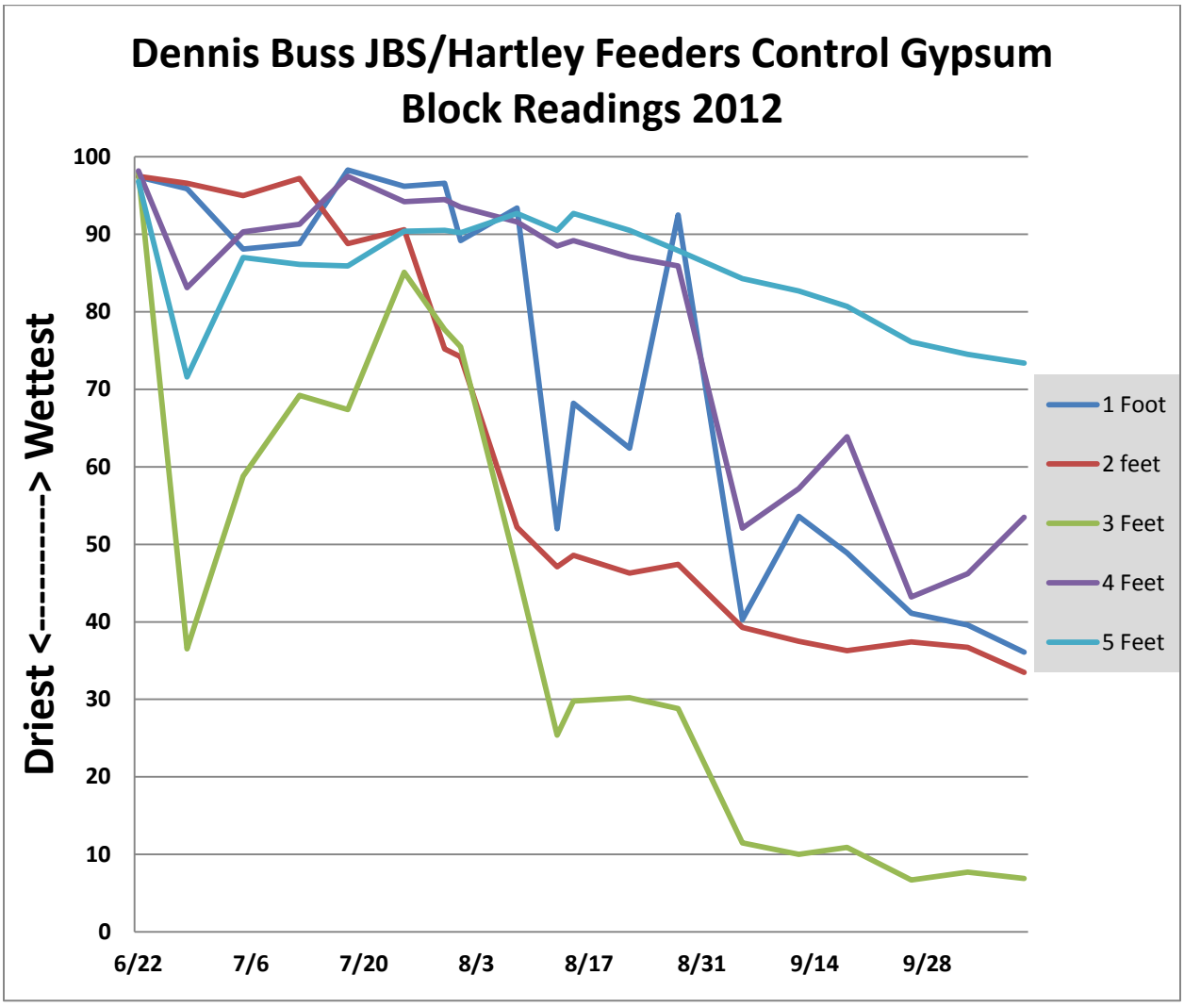


Irrigation was in deficit all season and the soil moisture continued to dry out until September where a late wetting event re-wet the top 20" of soil. The yield was better than the probe data suggests, which might indicate the probe was placed in a drier part of the field that yielded lower than the field average. It might also suggest that water may have been following old root channels in the previous crop line (inter-row space) – or the sprinklers were running in bubble mode (creating wetter and drier strips).



- **(a)** Roots grew to 60" relatively early in the season which indicates the crop was under moisture stress and looking for moisture from an early stage.
- **(b)** There were two irrigations that hardly even registered at 4" in mid-July and root growth and soil moisture depletion accelerated during this period.
- **(c)** The crop was forced to draw on stored soil moisture during the second hot spell in late July/early Aug. This indicates quite severe moisture stress.
- **(d)** Late irrigation was ineffective at penetrating past 4" and the subsoil was completely dry.

Graph – Gypsum Block Readings for Dennis Buss Control



Graph – Growing Season Water Tracking for Dennis Buss Control

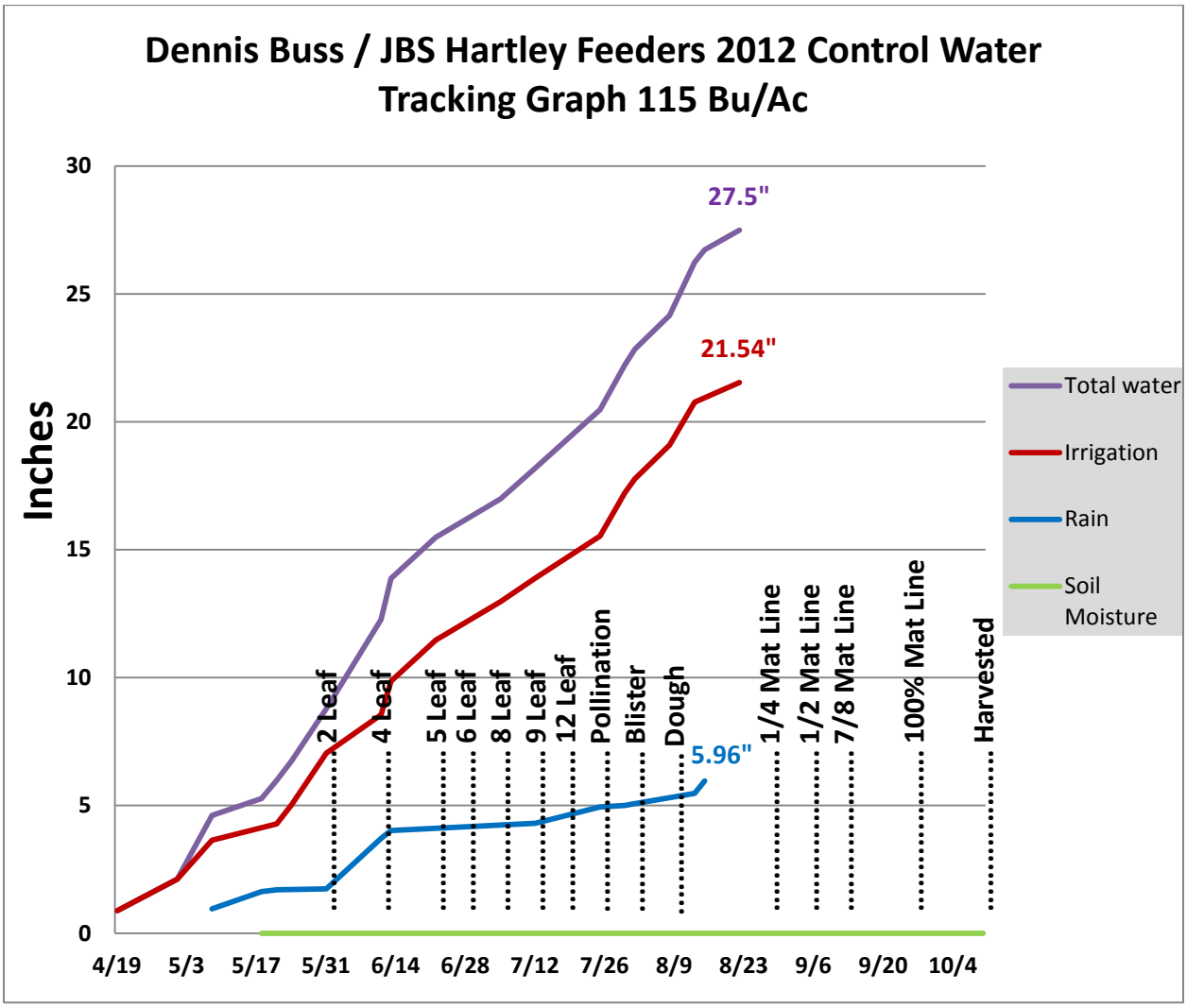


Table- Demonstration Field Data Hartley Feeders Control

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
4/19	3.46											
4/23	0.32		.03 AF									
4/26			0.03									
5/1												
5/8			0.03									
5/18	0.45	0.89	8.86							Prewater		
5/24			8.86									
5/31		1.23	21.12	2 leaf							60 Y	467
6/11	0.96	1.53	36.41	5 leaf							8 Y	
6/13	0.67											
6/22	0.08	0.63	42.75	4 leaf	97.4	97.5	97.9	98.2	96.8		45 N	
6/28		1.02	52.95	6 leaf	95.9	96.6	36.5	83.1	71.6		115 Y	
7/5	0.03	1.75	70.37	8 leaf	88.1	95.0	58.8	90.3	87.0		4 Y cw	500
7/12	1.98	1.50	85.35	9 leaf	88.8	97.2	69.2	91.3	86.1		24 Y cw	507
7/18	0.30	1.31	98.38	12 leaf	98.3	88.8	67.4	97.5	85.9		330 Y cw	349
7/25		1.61	114.47	Pollination	96.2	90.6	85.1	94.2	90.4		54 Y cw	466
7/30			126.06	Pollination	96.6	75.2	77.7	94.5	90.5		29 Y cw	470
8/1		1.50	129.47	Blister	89.2	74.2	75.5	93.5	90.2		137 Y cw	455
8/8	0.29	0.92	138.63	Dough	93.4	52.2	46.7	91.6	92.7		348 Y cw	571
8/13				Dough	52.0	47.1	25.4	88.5	90.5		250 Y cw	
8/15	0.64	1.64	155.06	Dough	68.2	48.6	29.8	89.2	92.7		308 Y cw	467
8/22	0.06	1.69	171.97	1/8 Mat Ln	62.4	46.3	30.2	87.1	90.5	120 Acres	261 Y cw	629
8/28	0.06	0.55	174.71	1/4 Mat Ln	92.5	47.4	28.8	85.9	87.9	60 Acres	306 Y cw	479
9/5		1.32	181.31	1/2 Mat Ln	40.3	39.3	11.5	52.1	84.3	Corn	289 Y	557
9/6		1.68	189.73							Corn		
9/9			193.76							Wheat		
9/12	0.41	0.77	197.60	7/8 Mat Ln	53.6	37.5	10.0	57.2	82.7		267 N	
9/18	0.48		197.60	7/8 Mat Ln	48.9	36.3	10.9	63.9	80.7		267 N	
9/26			201.37	1.0 Mat Ln	41.1	37.4	6.7	43.2	76.1	Wheat	104 Y	536
10/3			201.66	Blk Layer	39.6	36.7	7.7	46.2	74.5		90 N	
10/10			214.95	Harvest	36.1	33.5	6.9	53.5	73.4	Wheat	138 N	
Total	5.96	21.54			0	0	0	0	0			
Irrigation, Rainfall, Net Soil water is 27.50 Inches												

- Numbers in red are not counted in total

NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

Control

Year: *2012* **County:** *Hartley* **Grower:** *Dennis Buss*

No. Acres: *120* **Variety/Hyb:** *P1498HR* **Soil Type:** *Dumas Clay Loam*

Meter Type: *Seametrics*

Meter Mult: *Ac Ft x 1* **Tillage:** *Strip Till*

Fertilizer: *Effluent+110-100-58* **Seeding:** *28,000*

Planted: *May 20, 2012* **Harvest:** *October 10, 2012*

Herbicide: *Harness, Grounded, Roundup, Hell Fire* **Insecticide:** *Comite, Demethoate, Intrepid, Vision*

Yield: *115 Bu/Acre* **Prev. crop:** **Row width:** *30 Inch*

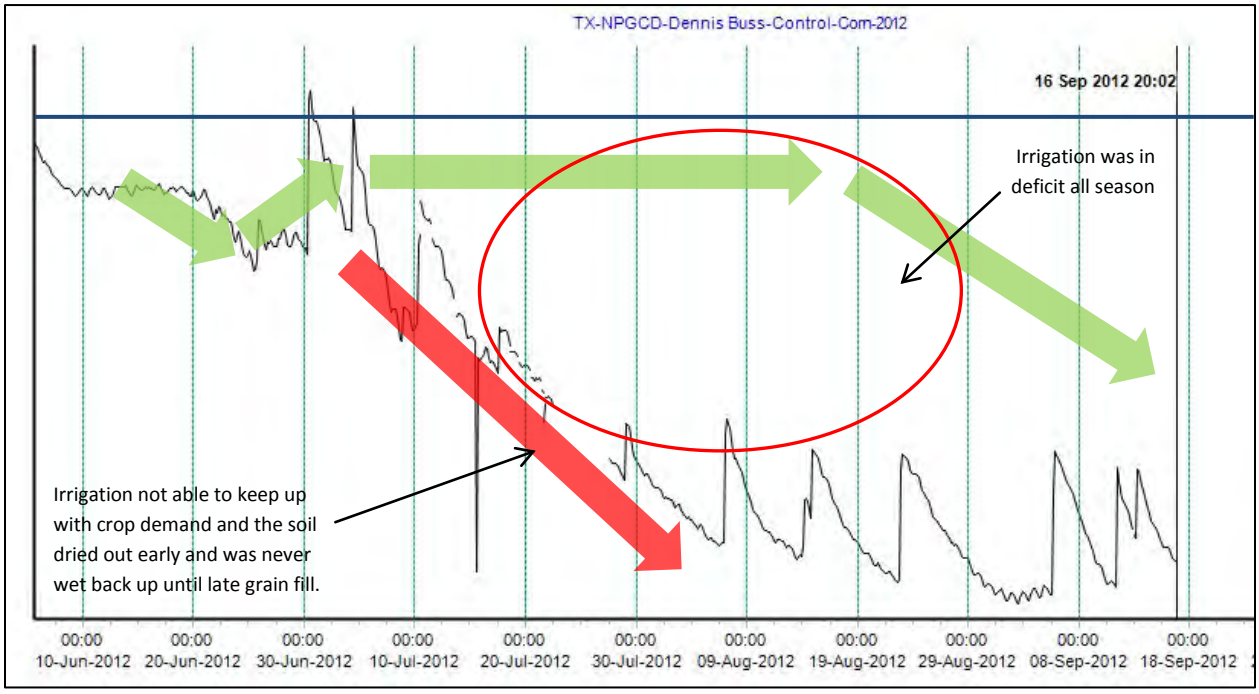
Irrigation method: *Center Pivot* **Prewater:** *Yes* **Well GPM:** *500*

Distance between drops: *60”* **Distance from nozzle to ground:** *16”*

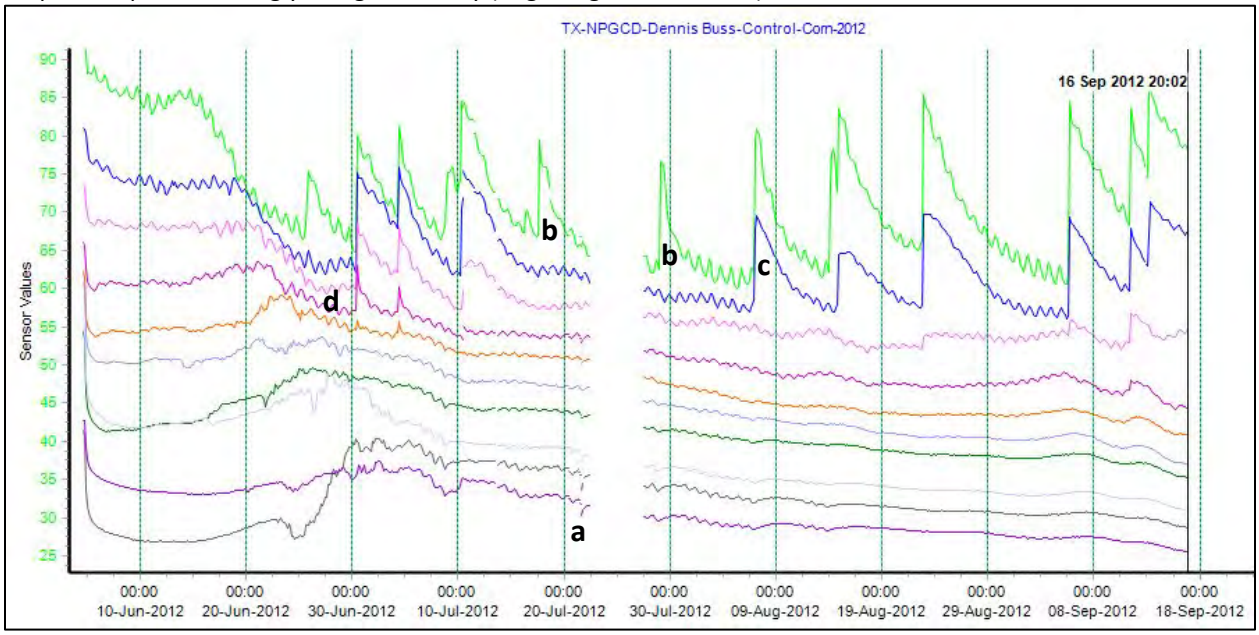
Application pattern: *Spray* **Crop row direction :** *Straight*

GPS Location: Latitude: *35.888398*
Longitude: *-102.46786*

Hartley Feeders: AquaSpy Control Site (115 bu/ac; 20.7" irrigation)



The crop suffered from deficit irrigation and moisture stress all season. The sub-soil (below 12") dried out after the first hot spell at the end of June and was never re-wet. Irrigation was not effective at penetrating to depth, despite the pivot seemingly being run slowly (large irrigation intervals).



(a) Roots active to 60" by 20th July (data not shown)
(b) Irrigation only penetrating to 4"
(c) Irrigation penetrating to 8" but not 12"
(d) Subsoil below 12" dried out from late June (i.e. the first hot spell) and was never effectively re-wet for the rest of the season.

Harvest Results - The 200-12 field produced a 160 bushel per acre corn yield. Irrigation totaled 20.68 inches. Production in the control field was 115 bushels per acre, where seasonal irrigation totaled 21.54 inches. Pre -season irrigation was 0.84 inches for the 200-12 field and 0.89 inches for the control. Both are included in the total irrigation. In comparison, the 200-12 field produced 45 more bushels per acre than the control with 0.86 inches less irrigation. Corn production was 7.73 bushels (433lbs) per inch of irrigation in the 200-12 field compared to 5.33 (312lbs) in the control. Production from each inch of irrigation, rainfall and net soil water that totaled 26.64 inches was 6.00 bushels (336lbs) per acre in the 200-12 field. Irrigation, rainfall and net soil water totaled 27.50 inches in the control field where production was 4.18 bushels (234lbs) per inch. Crop production costs were $11.17 per acre more for the 200-12 field than for the control from reduced irrigation but primarily from increased harvest expenses. At $6.59 per bushel, the additional corn yield amounts to $296.55 more per acre. The 200-12 field's net gain was $285.38 per acre with 0.86 inches less irrigation used compared to production from the control field. Dennis Buss thinks the primary reason for the lower yield from the control field is that the field was not strip tilled when 3.45 inch rain fell in April. Cattle were grazing wheat on the control field. The 200-12 field was already strip tilled and stored more of the early rainfall. A summary of the demonstration results are shown in the following table.

Table – 2012 Demonstration Results for Hartley Feeders 200-12 & Control

Irrigation		Irrig/Rain/Soil	PRODUCTION		CROP VALUE @ $6.59/Bu		
field	Inches	Inches	Bu/Ac	Bu/Ac-In Irrigation	Per Acre	Acre-In of Irrigation	Ac-In of Irrig/Rain/Soil
200-12	20.68	*26.64	160	7.73	$1054.40	$50.98	$39.58
Control	21.54	+27.50	115	5.34	$757.85	$35.18	$27.56

***Includes 0 inches of water removed from five feet of soil, plus rainfall, and irrigation.**
+Includes 0 inches of soil water removed from five feet of soil, plus rainfall and irrigation.

Corn Grain vs. Corn Silage in Hartley Feeders Control Field – Hartley Feeders chose to harvest the south half of the control circle as corn silage on August 28. Silage production was 19.72 tons per acre. Irrigation totaled 19.09 inches. Silage production was 1.03 tons per inch of irrigation. Production was 0.82 tons from each inch of irrigation and rainfall. At $6.59 per bushel and $50.00 per ton, silage corn amounts to $228.15 more per acre. However, production costs for silage was $97.07 more per acre due to additional harvest costs. In comparison, Net gain from silage corn was $131.11 per acre more with 2.45 inches less irrigation. Dennis Buss said a late season spider mite problem after the silage was harvested likely limited grain production on the north half of the circle. A summary of the results are in the table below.

Table – 2012 Demonstration Results for Hartley Feeders Corn Silage vs. Grain

Irrigation		Irrig/Rain/Soil	PRODUCTION		CROP VALUE @ $50.00/Ton & $6.59/Bu		
field	Inches	Inches	T&bu/A	T&Bu/Ac-In Irrigation	Per Acre	Acre-In of Irrigation	Ac-In of Irrig/Rain/Soil
Silage	19.09	*24.16	19.72 T	1.03 T	$986.00	$51.65	$40.81
Grain	21.54	+27.50	115 bu	5.34 bu	$757.85	$35.18	$27.56

***Includes 0 inches of water removed from five feet of soil, plus rainfall, and irrigation.**
+Includes 0 inches of soil water removed from five feet of soil, plus rainfall and irrigation

Brent Clark-Hartley County Demonstration, 2012

Planting and Crop Information - For his demonstration, Brent Clark strip tilled and planted 120 acres of corn in the southeast quarter of section 206, for his "200-12" field, "Clark 200-12". Clark planted the field with Pioneer 1151HR at a seeding rate of 27,000 seeds/acre. Clark planted 120 acres, also strip tilled, in the northeast quarter of section 206 to DK 6328 at 32,000 seeds/acre for his "control" field, "Clark Control". The 200-12 field was irrigated using a center pivot where seasonal water meter readings average 620 gpm and delivered an average of 1.25 inches of irrigation in a 4.5 day revolution. Water meter readings averaged 600 gpm for the center pivot that irrigated the control field and delivered 1.20 inches in a 4.5 day revolution. Planting and crop information for "Clark 200-12" and "Clark Control" are shown in the table below. Each is the same unless specified. Hail damage on June 14 was significant in both fields.

Table – Planting and Crop Information for Clark

200-12		*Control*	
Planted:	April 23	**Fertilizer:**	150-60-0
Hybrid:	Pioneer 1151HR	**Hybrid:**	DK 6328
Seeding Rate:	26,000	**Seeding Rate**:	32,000
Soil Type:	Dumas Loam	**Soil Type:**	Sherm Clay Loam
Row Width:	30 Inches	**Tillage:**	Strip Till
Harvested:	September 12	**No. Acres:**	120
GPM Per Acre:	5.1	**Herbicide:**	Balance, Roundup,
Insecticide:	none	**GPM Per Acre:**	5.0
Irrig/Rain/SoilWater:	22.36"	**Irrig/Rain/SoilWater:**	27.69"

Beginning Soil Water Profile and Growing Season Rainfall

"200-12": Soil water was good at 1 and 2 feet at planting, but low at 3 feet. One irrigation in May following planting plus rainfall rewet the third foot soil profile by the end of May. Soil water was good at 4 and 5 feet in the beginning of the season. Dumas loam soil holds approximately 1.85 inches of available water per foot for crop use. Weekly gypsum block readings and the AquaSpy® soil probe show adequate to good soil water levels throughout the growing season. The gypsum blocks were installed in late March prior to planting to obtain advanced soil water conditions.

"Control": Soil water was good to five feet when the soil moisture sensing gypsum blocks were installed in early May following planting. Weekly gypsum block readings and the AquaSpy® soil probe show good soil water levels throughout the growing season. Sherm clay loam soil holds approximately two inches of available water per foot for potential crop use.

Both: Seasonal rainfall totaled 7.56 inches. More than half of the rainfall was in June. Hail on June 14 at the nine leaf stage caused significant plant damage. Existing leaves were severely shredded leaving plants in poor condition. Additional leaves developed to produce a partial

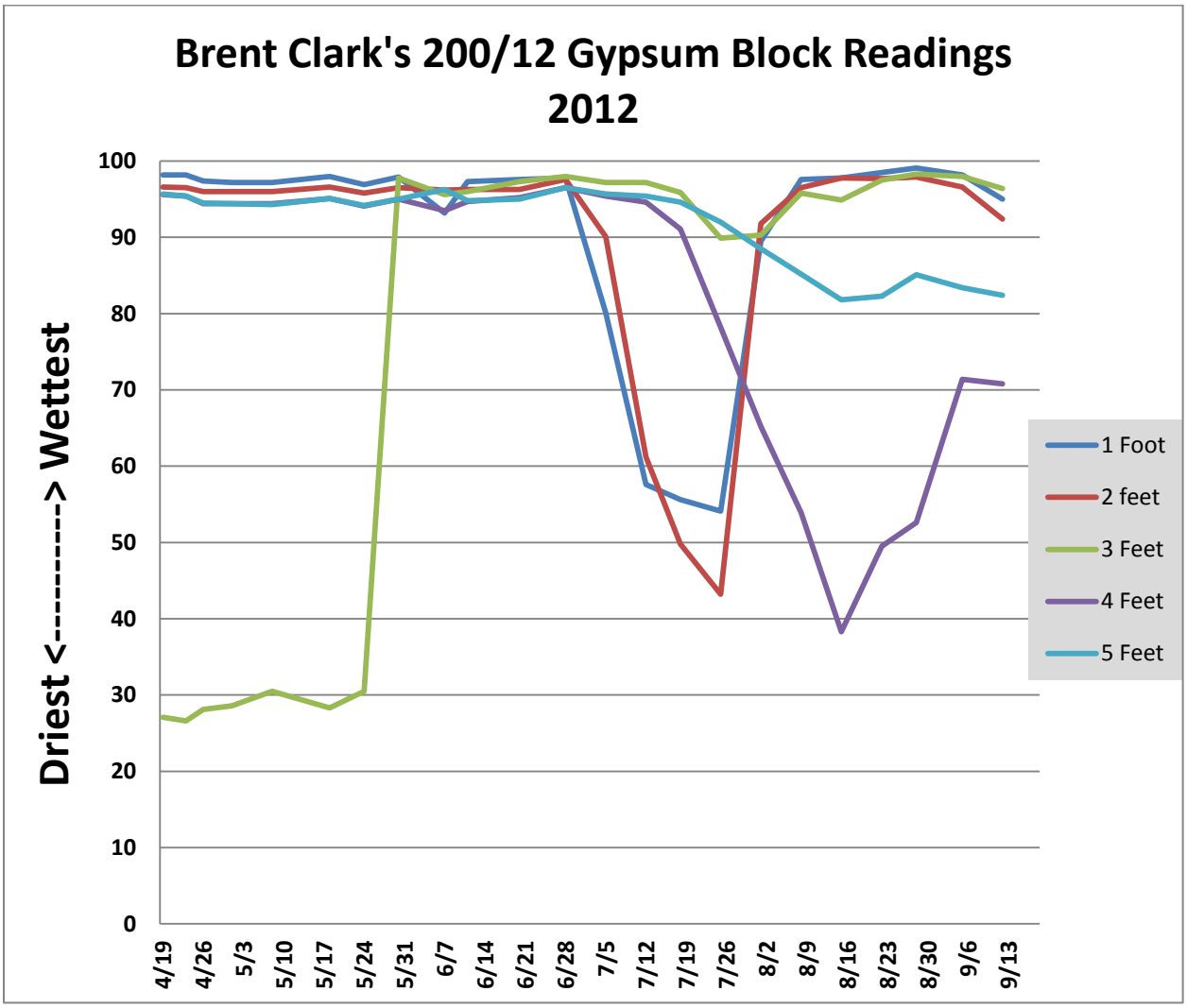
crop. The crop was in the milk to early dough stage during the more extreme heat in late July and early August. The following table shows monthly rainfall as recorded by a district rain gauge located at the field.

Table – Monthly Rainfall Data for Clark "200-12" & "Control"

May- .67" June- 4.15" July- .85" August- 1.89" Sept-0" Total: 7.56"

Growing Season Water Tracking – The district tracked crop total water throughout the growing season using rain gauges, water meters and both gypsum block and AquaSpy® soil moisture sensors. A set of five gypsum block soil moisture sensors was installed at 1, 2, 3, 4 and 5 feet and an AquaSpy® soil moisture probe was installed down to five feet in the root zone at one location to monitor soil water levels in the 200-12 field. Another set of the same type of sensors was installed in the Control field. Both sensors were installed in close proximity to each other in the field. Gypsum blocks were installed in each 200-12 field prior to planting. Gypsum blocks were installed in the Control field and the AquaSpy® probe in each field following crop emergence. Following this paragraph, a series of graphs and tables shows weekly gypsum block readings for the season; growing season water, including rainfall, irrigation, and soil moisture at various growth stages; and the order of irrigation and rainfall events for each field. Finally a form describes the protocols for each field. "Total Water," as shown on the graph for growing season water, is the sum of seasonal irrigation, rainfall and net soil water. Graphs and tables for the 200-12 field are shown first, followed by the illustrations for the Control field.

Graph – Gypsum Block Readings for Brent Clark's 200-12



Graph – Growing Season Water Tracking for Brent Clark's 200-12

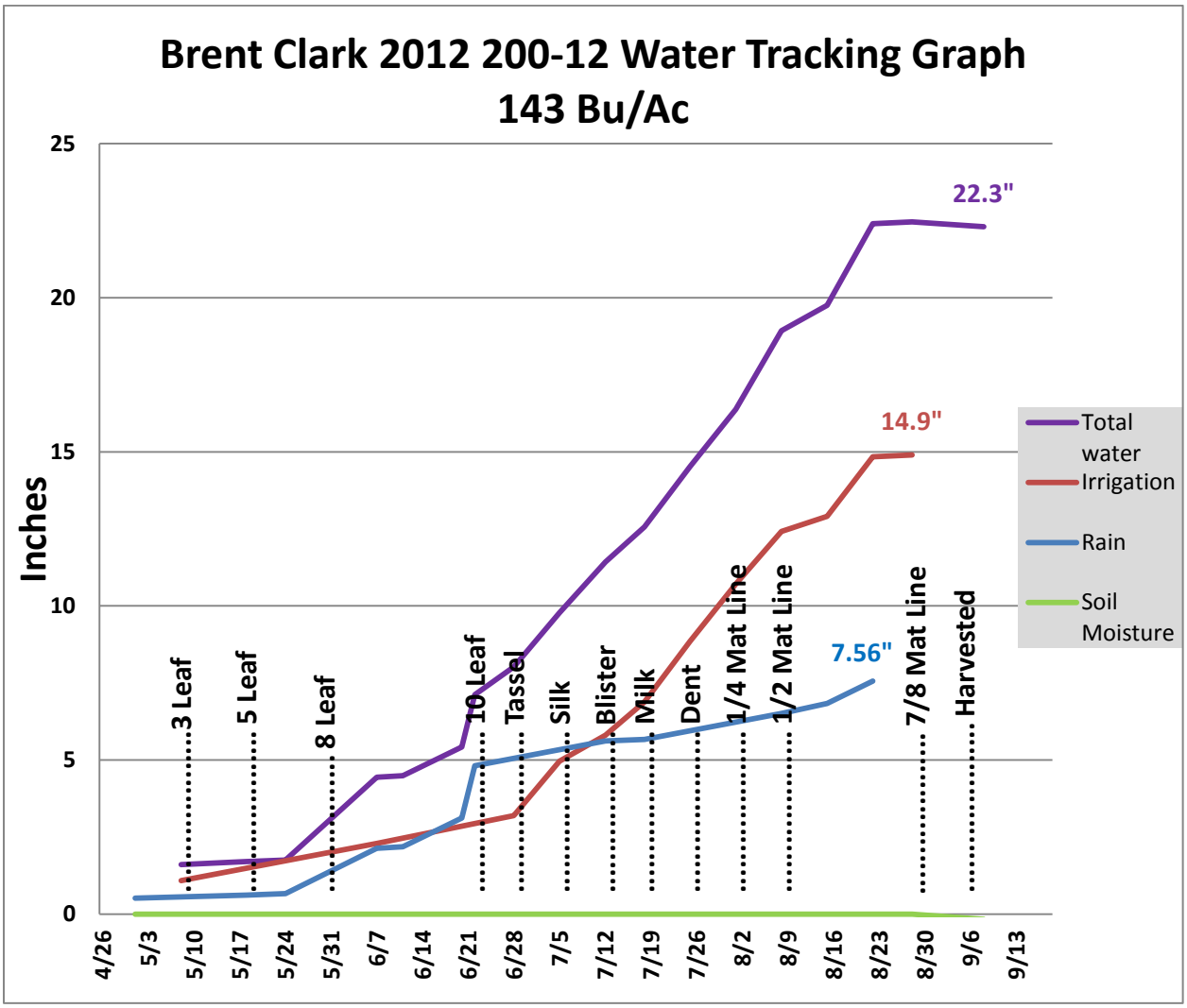


Table- Demonstration Field Data Brent Clark's 200-12

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
3/26			.03AF									
4/19	0.61				98.2	96.6	27.1	95.6	95.7		N	
4/23			.08AF		98.2	96.5	26.6	95.4	95.4	Planted	N	
4/26			3.44		97.4	96.0	28.1	94.4	94.5		300 N	
5/1	0.52		10.87		97.2	96.0	28.6	94.4	94.4		180 N	
5/8		1.09	10.92		97.2	96.0	30.5	94.4	94.3	200-12	180 N	
5/18	0.10		10.97	3 leaf	98.0	96.6	28.3	95.1	95.1		180 N	
5/24	0.05		15.95	5 leaf	96.9	95.8	30.5	94.1	94.2		0 Y	587
5/30			22.95	5 leaf	97.9	96.5	97.8	95.0	95.0		195 N	
6/7	1.47	1.21	23.03	8 leaf	93.2	96.2	95.6	93.5	96.3	200-12	15 N	
6/11	0.05		23.03	8 leaf	97.3	96.3	96.0	94.7	94.8		15 N	
6/20	0.93		25.98	8 leaf	97.6	96.3	97.3	95.2	95.0	Hail	270 Y	606
6/22	1.70											
6/28		0.90	31.97	10 leaf	97.8	97.6	98.0	96.5	96.5	200-12	75 Y	656
7/5		1.76	49.52	Tassel	80.1	90.1	97.2	95.4	95.7	200-12	195 N	
7/12	0.80	0.85	58.00	Silk	57.6	61.2	97.2	94.6	95.4	200-12	65 Y cw	650
7/18	0.05	1.08	68.70	Blister	55.6	49.8	95.9	91.1	94.6	200-12	20 Y cw	636
7/25		1.97	88.28	Milk	54.1	43.2	89.9	78.2	92.0	200-12	226 Y cw	635
8/1		1.85	106.67	Dent	89.5	91.8	90.3	65.2	88.5	200-12	75 N	
8/8	0.84	1.71	123.79	1/4 Mat Ln	97.6	96.5	95.8	53.9	85.2	200-12	194 N	
8/15	0.33	0.49	128.71	1/2 Mat Ln	97.8	97.8	94.9	38.3	81.8	200-12	337 Y cw	600
8/22	0.72	1.93	147.95	1/2 Mat Ln	98.5	97.7	97.5	49.5	82.3	200-12	186 Y cw	599
8/28		0.06	148.48	7/8 Mat Ln	99.1	97.9	98.3	52.6	85.1	200-12	198 N	
9/5			148.43	1.0 Mat Ln	98.2	96.6	98.0	71.4	83.4		198 N	
9/12			148.44	Harvest	95.0	92.4	96.4	70.8	82.4		198 N	
9/18			148.44									
Total	7.56	14.90			0	0	-1.42	0.72"	0.54"			
Net Soil Water is Minus .16"												
Irrig/Rain/Net Soil Water is 22.30"												

- Numbers in red are not counted in total

NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

200-12

Year: *2012* **County:** *Hartley* **Grower:** *Brent Clark*

No. Acres: *120* **Variety/Hyb:** *P1151HR* **Soil Type:** *Dumas Loam*

Meter Type: *Seametrics*

Meter Mult: *Ac Ft x 1* **Tillage:** *Strip Till*

Fertilizer: *150-60-0* **Seeding:** *26,000*

Planted: *April 23, 2012* **Harvest:** *September 12, 2012*

Herbicide: *Balance, Roundup* **Insecticide:** *None*

Yield: *143 Bu/Acre* **Prev. crop:** **Row width:** *30 Inch*

Irrigation method: *Center Pivot* **Prewater:** *None* **Well GPM:** *620*

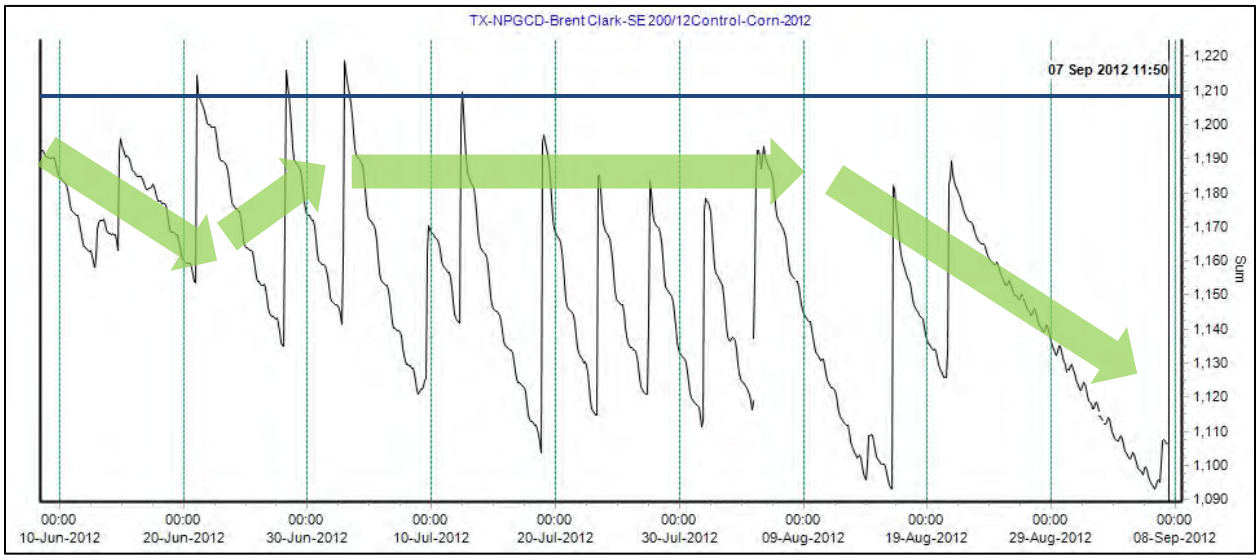
Distance between drops: *60”* **Distance from nozzle to ground:** *16”*

Application pattern: *Spray* **Crop row direction :** *Straight*

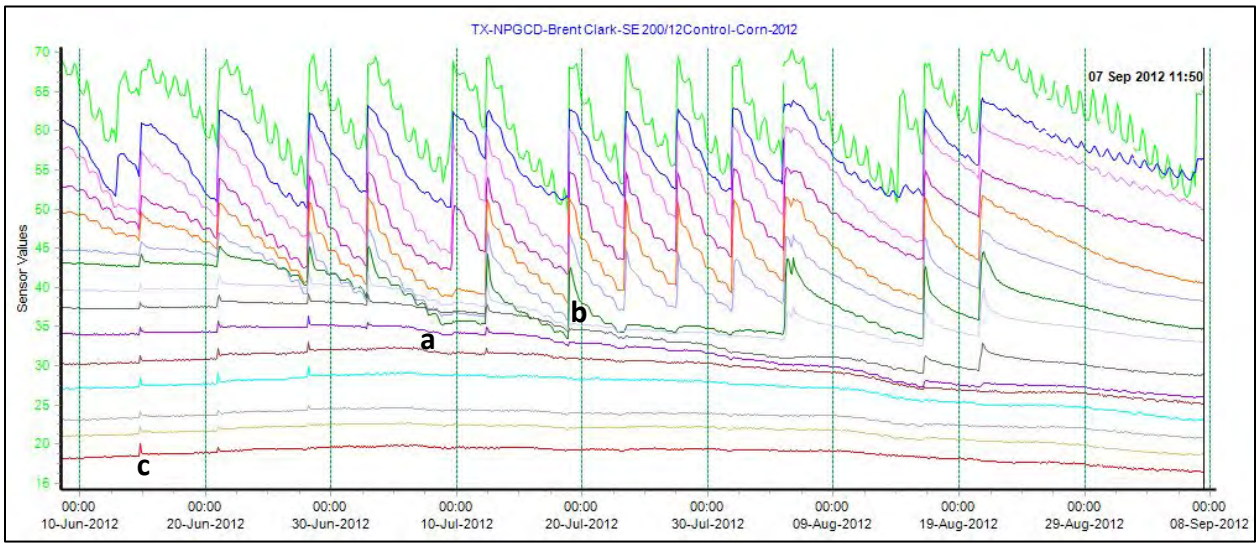
GPS Location: Latitude: *35.825289*

Longitude: *-102.167828*

Brent Clark: AquaSpy 200-12 Site (143 bu/ac; 14.9" irrigation)



Irrigation and water use seemed to be pretty good. The severe hail on 6/22 must have significantly reduced yield potential or it is possible that the yield at the probe site was greater than the field average



- **(a)** Roots active down to 40"
- **(b)** Irrigation effective down to 24"-28" and water uptake was active over this range during each irrigation interval.
- **(c)** Some evidence of water movement to 60" indicates sub-soil had adequate moisture.

Brent Clark's Variable Rate Irrigation (VRI)

Map-Variable Rate Irrigation Prescription for Clark 200-12 Field

Virtual Agronomist
Base Management Program

Grower Brent Clark
Farm Clark Farms
Field 1201 South

Pivot VRI by Sector Report

Base Application Depth: 1.25 in
Base Walk Rate: 17.00 (%)
Total Area: 122.58 ac **Total Time:** 4d 14hr 0min
Total Flat Rate Water Amount: 4,160,818.9 gal
Total VRI Water Amount: 4,159,913.1gal (1.25in/ac)

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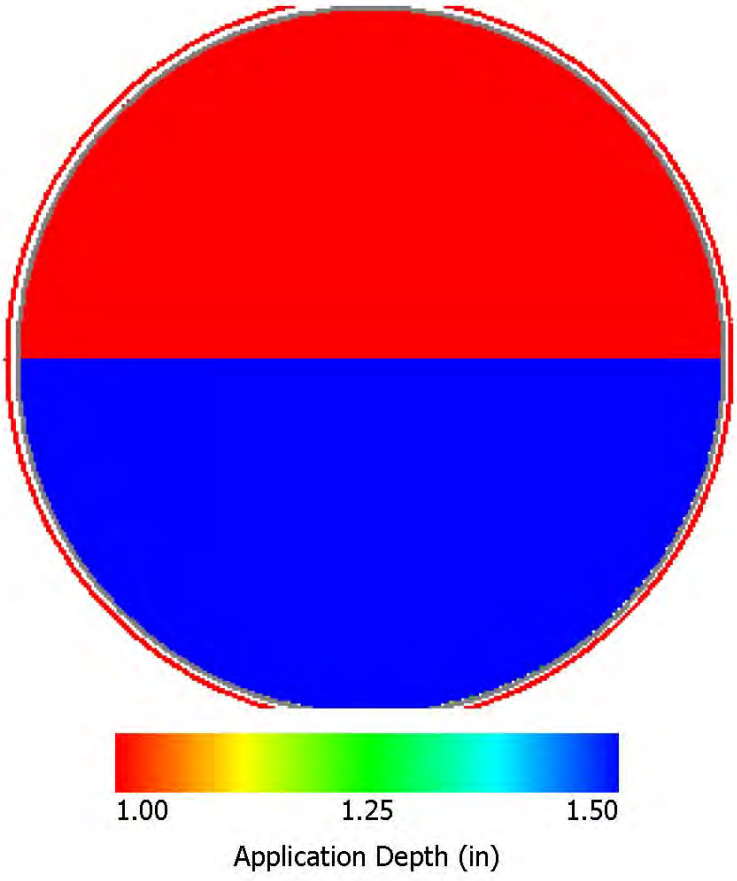

Table-Variable Rate Irrigation by 180 Degree Sectors for Clark 200-12 Field

Virtual Agronomist
Base Management Program

Grower Brent Clark
Farm Clark Farms
Field 1201 South

Pivot VRI by Sector Report

Start Angle	Stop Angle	Area (ac)	Application (in)	Speed (%)
0	6	2.05	1.000	21.25
6	12	2.05	1.000	21.25
12	18	2.05	1.000	21.25
18	24	2.05	1.000	21.25
24	30	2.04	1.000	21.25
30	36	2.05	1.000	21.25
36	42	2.04	1.000	21.25
42	48	2.05	1.000	21.25
48	54	2.04	1.000	21.25
54	60	2.05	1.000	21.25
60	66	2.04	1.000	21.25
66	72	2.04	1.000	21.25
72	78	2.04	1.000	21.25
78	84	2.04	1.000	21.25
84	90	2.04	1.000	21.25
90	96	2.05	0.750	14.17
96	102	2.04	0.750	14.17
102	108	2.04	0.750	14.17
108	114	2.04	0.750	14.17
114	120	2.04	0.750	14.17
120	126	2.04	0.750	14.17
126	132	2.03	0.750	14.17
132	138	2.05	0.750	14.17
138	144	2.04	0.750	14.17
144	150	2.04	0.750	14.17
150	156	2.04	0.750	14.17
156	162	2.04	0.750	14.17
162	168	2.04	0.750	14.17
168	174	2.04	0.750	14.17
174	180	2.04	0.750	14.17
180	186	2.04	0.750	14.17
186	192	2.04	0.750	14.17
192	198	2.04	0.750	14.17
198	204	2.04	0.750	14.17
204	210	2.04	0.750	14.17
210	216	2.04	0.750	14.17
216	222	2.04	0.750	14.17
222	228	2.04	0.750	14.17
228	234	2.04	0.750	14.17
234	240	2.04	0.750	14.17
240	246	2.04	0.750	14.17
246	252	2.05	0.750	14.17
252	258	2.05	0.750	14.17
258	264	2.05	0.750	14.17
264	270	2.05	0.750	14.17
270	276	2.04	1.000	21.25
276	282	2.04	1.000	21.25
282	288	2.04	1.000	21.25
288	294	2.05	1.000	21.25
294	300	2.05	1.000	21.25
300	306	2.05	1.000	21.25
306	312	2.04	1.000	21.25
312	318	2.05	1.000	21.25
318	324	2.04	1.000	21.25
324	330	2.05	1.000	21.25
330	336	2.05	1.000	21.25
336	342	2.05	1.000	21.25
342	348	2.04	1.000	21.25
348	354	2.05	1.000	21.25
354	360	2.05	1.000	21.25

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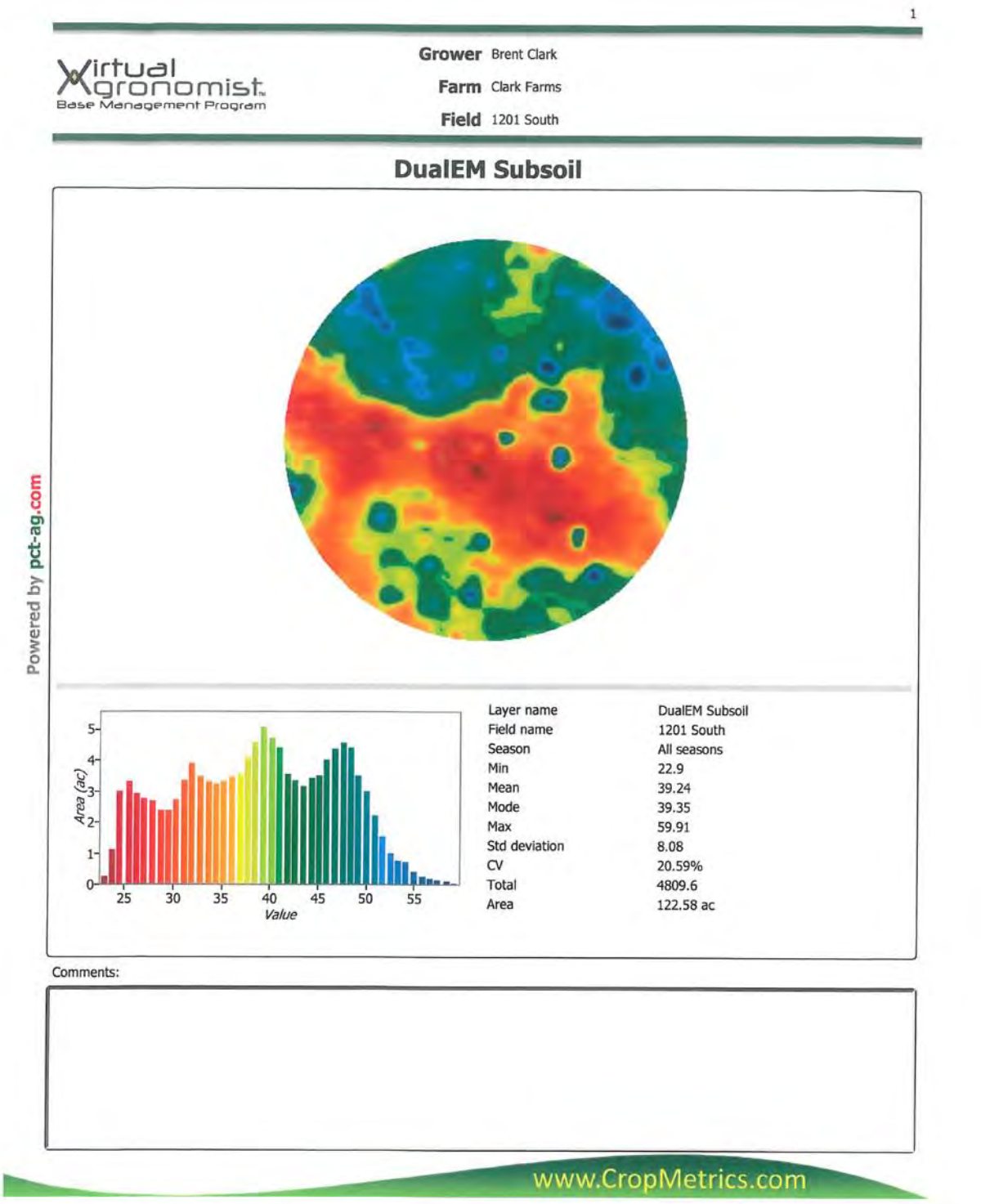
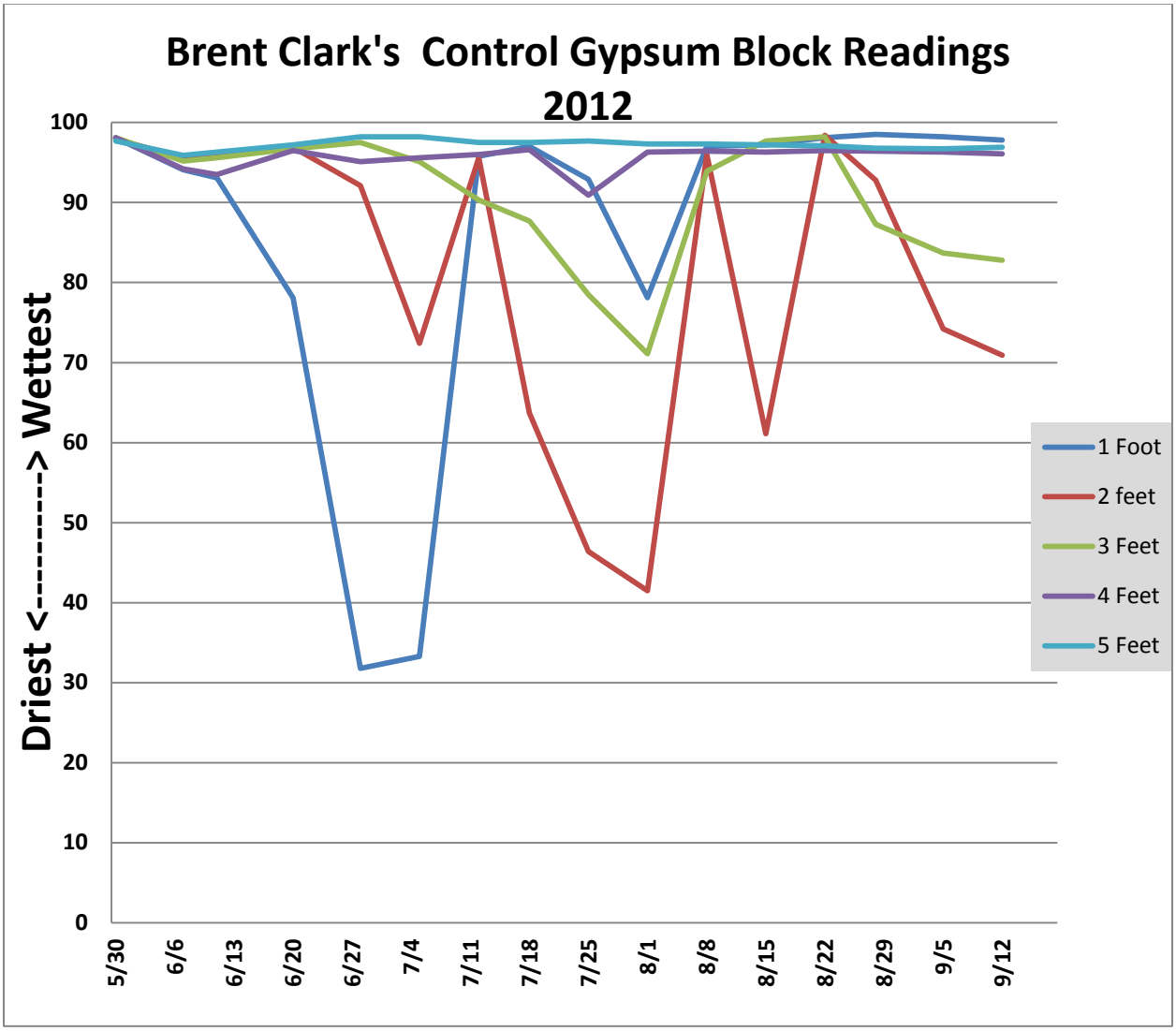
Map-Dual Em Subsoil Map for Clark 200-12 Field



Graph – Gypsum Block Readings for Brent Clark's Control



Graph – Growing Season Water Tracking for Brent Clark's Control

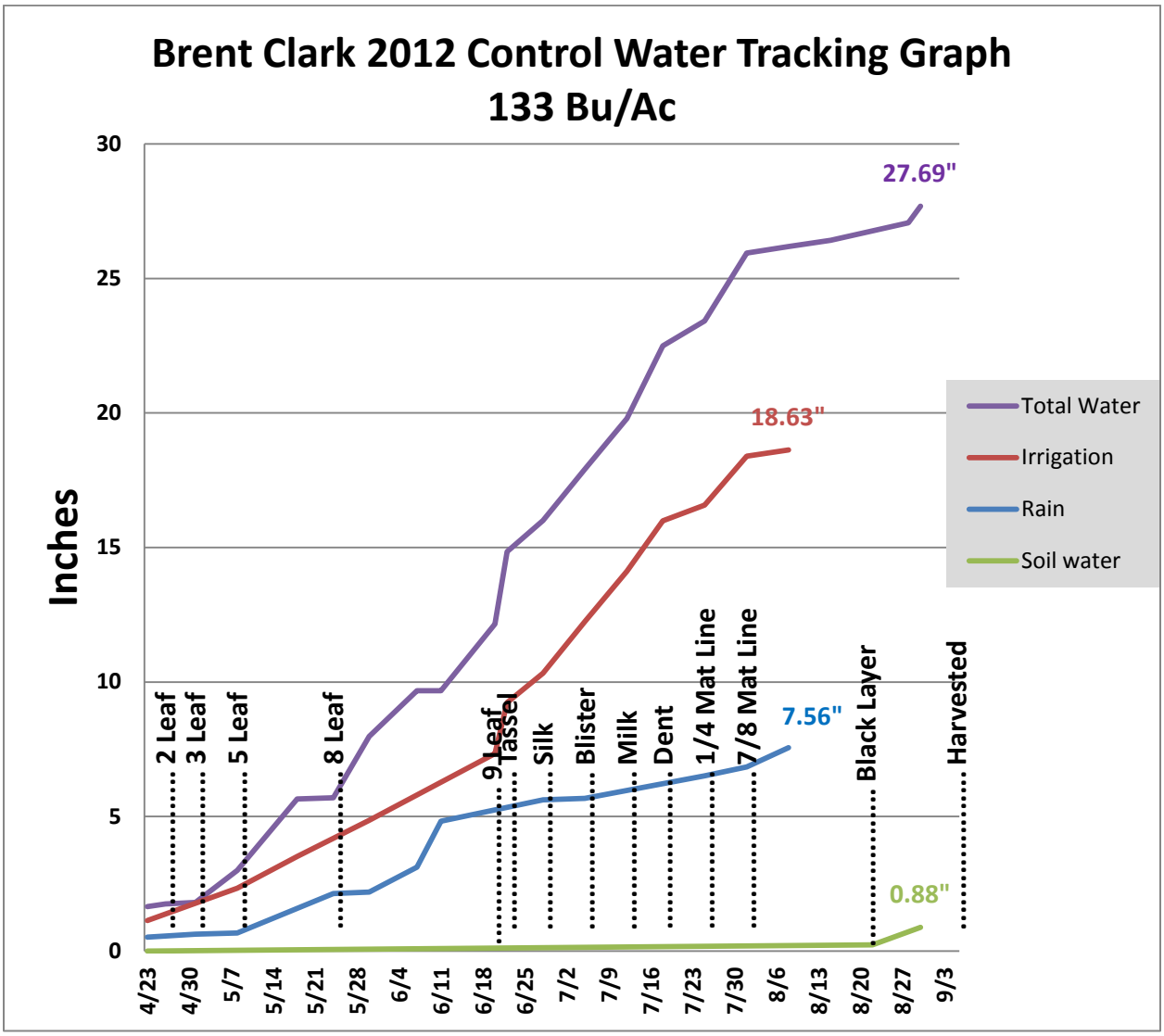


Table- Demonstration Field Data Brent Clark's Control

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
3/26			.02									
4/19	0.61											
4/23			.26							Planted		
4/26			3.99									
5/1	0.52		11.33									
5/8		1.13	11.33	2 leaf						Control		
5/18	0.10		11.33	3 leaf							0 N	
5/24	0.05		16.31	5 leaf							345 Y	626
5/30		1.20	23.33	5 leaf	98.1	97.9	98.1	98.1	97.7	Control	30 N	571
6/7	1.47	1.18	35.02	8 leaf	94.1	95.6	95.2	94.2	95.9	Control	30 N	
6/11	0.05		35.15	8 leaf	93.1	96.2	95.6	93.5	96.3		15 Y	559
6/20	0.93	1.35	48.59	8 leaf	78.1	96.9	96.7	96.5	97.2	Hail	90 Y	637
6/22	1.70											
6/28			54.56	9 leaf	31.8	92.1	97.5	95.1	98.2	Control	270 Y	613
7/5		2.48	73.40	Tassel	33.3	72.4	95.1	95.6	98.2	Control	109 Y cw	625
7/12	0.80	1.89	92.32	Silk	95.8	95.6	90.3	96.0	97.5	Control	287 Y cw	591
7/18	0.05	1.10	103.32	Blister	97.0	63.7	87.7	96.6	97.5	Control	208 Y cw	613
7/25		1.91	122.34	Milk	92.9	46.4	78.5	90.9	97.7	Control	12 Y cw	606
8/1		1.88	141.09	Dent	78.1	41.5	71.1	96.3	97.3	Control	184 Y cw	629
8/8	0.84	1.87	159.78	1/4 Mat Ln	97.0	96.0	93.9	96.4	97.3	Control	344 Ycw	589
8/15	0.33	0.59	165.60	7/8 Mat Ln	97.2	61.1	97.7	96.3	97.2	Control	147 Y cw	599
8/22	0.72	1.81	183.69	1.0 Mat Ln	98.1	98.4	98.2	96.5	97.1	Control	302 Y cw	599
8/28		0.24	185.99	Blk Layer	98.5	92.8	87.3	96.4	96.8	Control	18 N	
9/5			186.01	Blk Layer	98.2	74.2	83.7	96.3	96.7		18 N	
9/12			186.04	Harvest	97.8	70.9	82.8	96.1	96.9		0 N	
9/18			186.04								N	
Total	7.56	18.63			0	0.84"	0.66"	0	0			
Net Soil Water is 1.50"												
Irrigation, Rain, Net Soil Water is 27.69"												

- Numbers in red are not counted in total

NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

Control

Year: *2012* **County:** *Hartley* **Grower:** *Brent Clark*

No. Acres: *120* **Variety/Hyb:** *DK 6348* **Soil Type:** *Sherm Clay Loam*

Meter Type: *Seametrics*

Meter Mult: *Ac Ft x 1* **Tillage:** *Strip Till*

Fertilizer: *150-60-0* **Seeding:** *32,000*

Planted: *April 23, 2012* **Harvest:** *September 12, 2012*

Herbicide: *Balance, Roundup* **Insecticide:** *None*

Yield: *133 Bu/Acre* **Prev. crop:** **Row width:** *30 Inch*

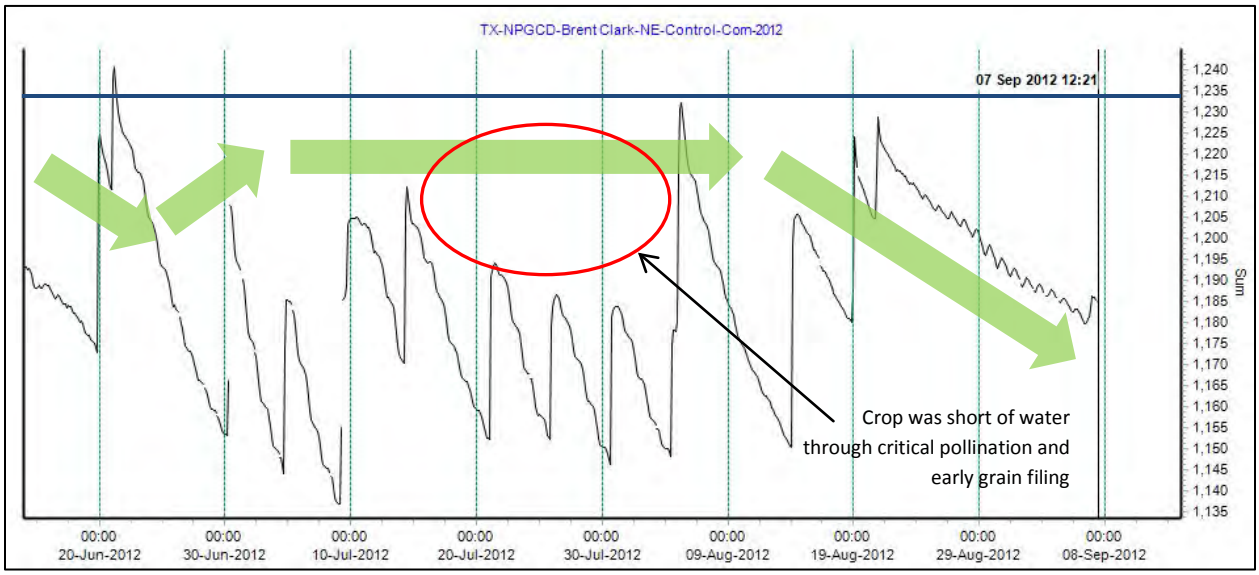
Irrigation method: *Center Pivot* **Prewater:** *None* **Well GPM:** *600*

Distance between drops: *60”* **Distance from nozzle to ground:** *16”*

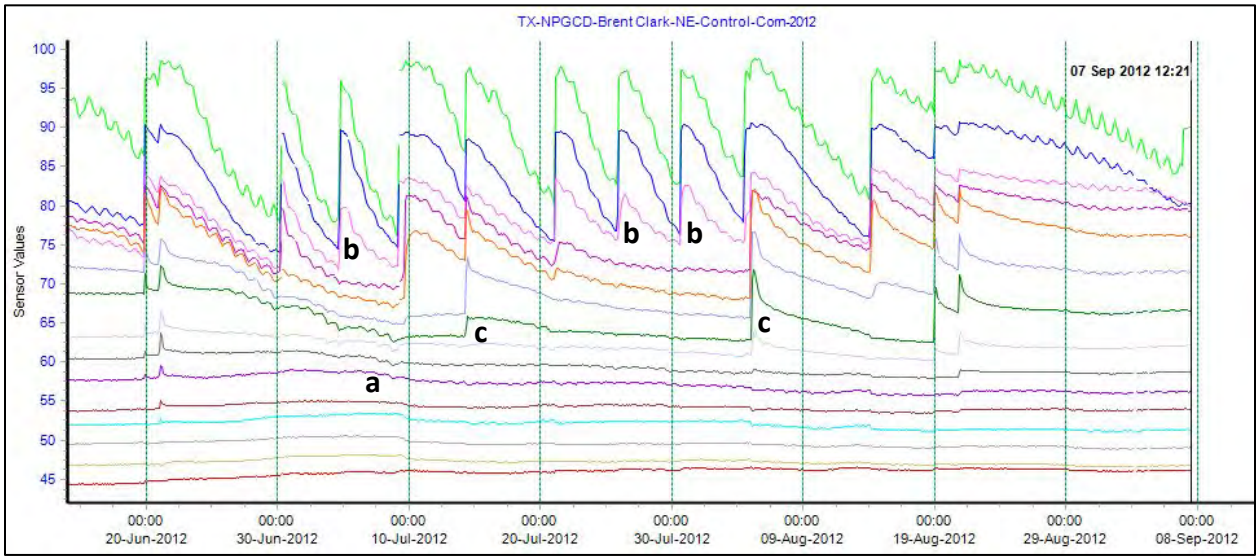
Application pattern: *Spray* **Crop row direction :** *Straight*

GPS Location: Latitude: *35.835393*
Longitude: *-102.16186*

Brent Clark: AquaSpy Control Site (133 bu/ac; 18.6" irrigation)



The crop suffered moisture stress during mid-late July due to irrigation only penetrating to 12". Sensor values indicated that the subsoil was dry below 44" and that moisture availability was limited for much of the season.



- **(a)** Root activity to 40"
- **(b)** Irrigation only penetrated to 12" – subsoil not being re-wetted
- **(c)** Some irrigations were more effective and penetrated to 28"

Irrigation seemed variable in the amount and depth. This may be due to changes in application rate or environmental conditions affecting the irrigation efficiency.

Harvest Results - The 200-12 field produced a 143 bushel per acre corn yield. Irrigation totaled 14.90 inches. The crop was affected by significant hail damage but recovered to produce a partial crop. Production in the control field was 133 bushels per acre, where seasonal irrigation totaled 18.63 inches. The control field received similar hail damage. No pre-season irrigation was applied in either field. In comparison, the 200-12 field produced ten more bushels per acre than the control with 3.73 inches less irrigation. Corn production was 9.6 bushels (537lbs) per inch of irrigation in the 200-12 field compared to 7.14 (400lbs) in the control. Production from each inch of irrigation, rainfall and net soil water that totaled 22.30 inches was 6.41 bushels (358lbs) per acre in the 200-12 field. Irrigation, rainfall and net soil water totaled 27.69 inches in the control field where production was 4.80 bushels (269lbs) per inch. Crop production costs were $54.50 per acre less for the 200-12 field than for the control from reduced seed, fertilizer, irrigation and increased harvest expenses. At $6.59 per bushel, the additional corn yield amounts to $65.90 more per acre. The 200-12 field's net gain was $120.40 per acre with 3.75 inches less irrigation used compared to production from the control field. A summary of the demonstration results are shown in the following table.

Table – 2011 Demonstration Results for Clark 200-12 & Control

Irrigation		Irrig/Rain/Soil	PRODUCTION		CROP VALUE @ $6.59/Bu		
field	Inches	Inches	Bu/Ac	Bu/Ac-In Irrigation	Per Acre	Acre-In of Irrigation	Ac-In of Irrig/Rain/Soil
200-12	14.90	*22.30	143	9.60	$942.37	$63.25	$42.26
Control	18.63	+27.69	133	7.14	$876.47	$47.05	$31.65

***Includes -0.16 inches of water removed from five feet of soil, plus rainfall, and irrigation.**
+Includes 1.50 inches of soil water removed from five feet of soil, plus rainfall and irrigation.

Variable Rate Irrigation-VRI At Clark 200-12 Field – Programmed Variable center pivot speed control was used in Clark's 200-12 field using a prescription written from field and soil information obtained from a preseason EM 38 soil survey. The VRI prescription was written by NPWD personnel using Crop Metrics Virtual Agronomist software. Actual center pivot variable speed control was accomplished by Pivotrac using the VRI prescription. In the VRI process, one inch of irrigation was applied to the north half of the 200-12 field and 1.5 inches on the south half each pass beginning July 25, which was late. Clark did not harvest the two half circles separately. He stated, according to his harvest yield monitor, the north side of the 200-12 field was equal to the south side where 2 ½ inches less irrigation water was applied. Clark's 200-12 field is one of three initiated by NPGCD during the 2012 growing season to learn the VRI process.

Richard Schad - Hansford County Demonstration, 2012

Planting and Crop Information - For his demonstration, Richard Schad strip tilled and planted 41 acres of corn in the west half circle of the northwest quarter of section 157 for his "200-12" field, "Schad 200-12". He planted the field with Channel 208-48vt3 at a seeding rate of 24,000 seeds/acre. Schad planted 123 acres, also strip tilled, in the southwest quarter of section 157 to Channel 216-49vt2 at 32,500 seeds/acre for his control" field, "Schad Control". The 200-12 field was irrigated using a center pivot where seasonal water meter readings average 700 gpm and delivered an average of 1.25 inches of irrigation in a 2.7 day revolution. Water meter readings averaged 780 gpm for the center pivot that irrigated the control field and delivered 1.20 inches in a 3.5 day revolution. The two wells also irrigated another 255 acres of cotton and corn that stretched available water, especially with very little rainfall. Planting and crop information for "Schad 200-12" and "Schad Control" are shown in the table below. Each is the same unless specified.

Table – Planting and Crop Information for Richard Schad

200-12		*Control*	
Planted:	May 11	***Planted:***	*May 1*
Fertilizer:	204-56-5-4s-0.7zn	**Fertilizer:**	172-64-5-4s-0.7zn
Hybrid:	Ch208-48vt3	**Hybrid:**	Ch216-49vt3
Seeding Rate:	24,000	**Seeding Rate**;	32,500
Soil Type:	Olso silty clay loam	**Insecticide:**	None
Row Width:	30 Inches	**Tillage:**	**S**trip Till
No Acres:	41	**No. Acres:**	123
Herbicide:	Aatrex, Basis, Brimstone, Laudis, Detonate, Round Up, Powermax		
GPM per Acre:	3.25	**GPM Per Acre:**	3.25
Irrig/Rain/SoilWater:	26.75"	**Irrig/Rain/SoilWater:**	25.39"
Harvested:	September 27	**Harvested:**	September 19

Beginning Soil Water Profile and Growing Season Rainfall

"200-12": Preseason irrigation had been applied prior to the gypsum blocks being installed on April 18. Readings that followed show good soil water at 1, 2, 3, 4, and 5 feet. Weekly readings show the crop depleted soil water at 1, 2, 3, and 4 feet during July when daily water use was high. The crop could have used more irrigation during this period, but water was being stretched to all planted acres. The crop was in the milk to early dough growth stage during the hottest days. Plants used water from 5 feet in August. The gypsum blocks were

installed in Olso silty clay loam soil which holds approximately 2.0 inches of available water per foot for potential crop use. The gypsum blocks were installed in mid-April prior to planting to obtain advanced soil water conditions.

"Control": Soil moisture sensing gypsum blocks were installed in mid-June following planting. The soil profile was full from 5.11 inches of pre-water and irrigation following planting. Weekly gypsum block readings show the crop depleted available soil water at 1, 2, and 3 feet during late July and early August when crop water use was high. The crop was in the dough growth stage during the hot days. The crop used water from 4 feet and some from 5 feet later in the growing season. Gypsum blocks were installed in Olso silty clay loam that holds approximately 2.0 inches of available water per foot for potential crop use.

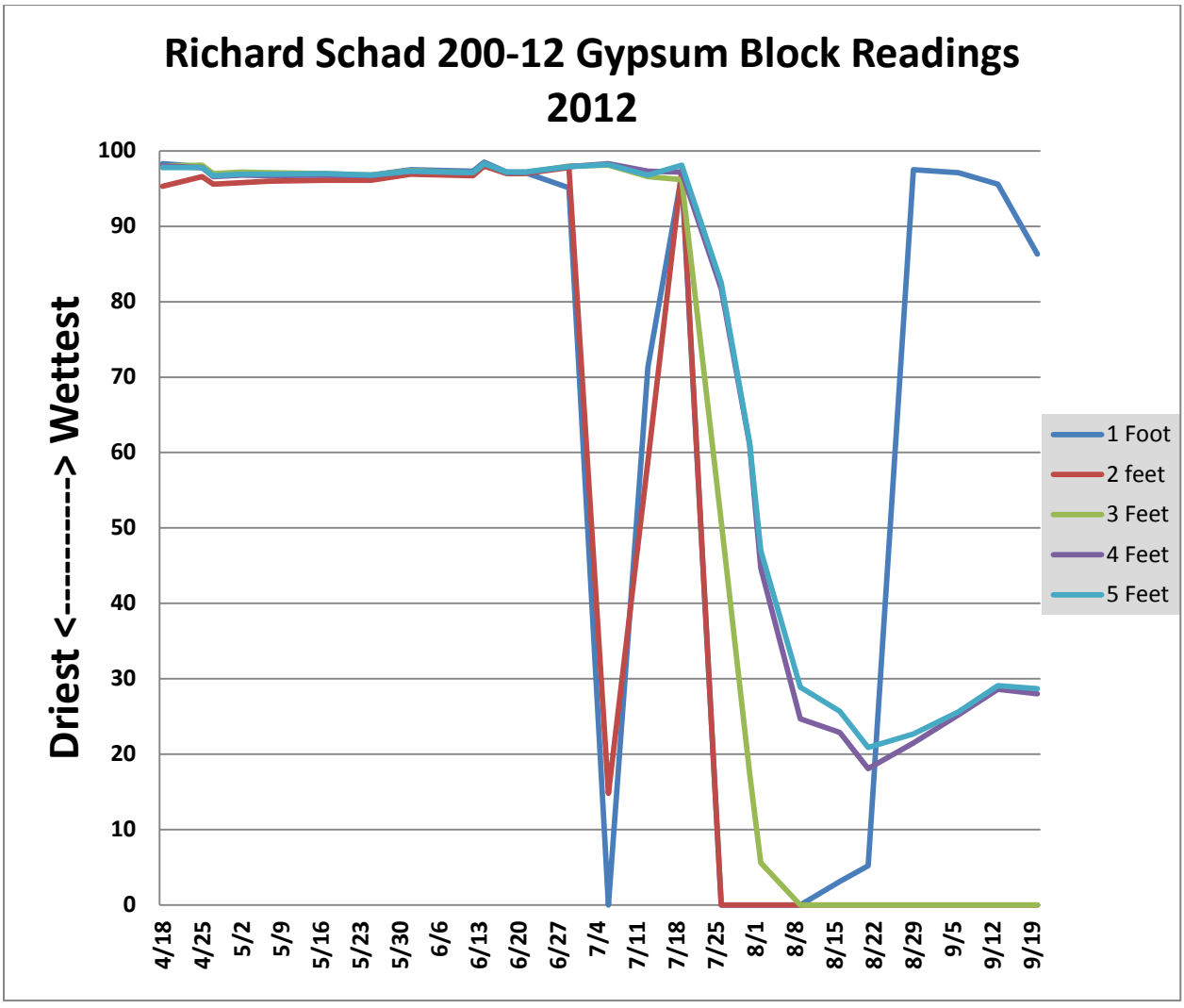
Both: Seasonal rainfall totaled 4.64 inches for the 200-12 field and 3.37 for the control. The following table shows monthly rainfall as recorded by a district rain gauge located at the two fields.

Table – Monthly Rainfall Data for Richard Schad"200-1 two 2" & "Control"

200-12	May- 0"	June- 1.80"	July- 1.05"	August- .22"	Sept- 1.57"	Total: 4.64"
Control	May- .30"	June- 1.80"	July- 1.05"	August- .22"	Sept.- 0"	Total: 3.37"

Growing Season Water Tracking – The district tracked crop total water throughout the growing season using rain gauges, water meters and both gypsum block and John Deere Water soil moisture sensors. A set of five gypsum block soil moisture sensors was installed at 1, 2, 3, 4 and 5 feet and a John Deere Water soil moisture probe was installed down to five feet in the root zone at one location to monitor soil water levels in the 200-12 field. Another set of the same type of sensors was installed in the Control field. Both sensors were installed in close proximity to each other in the field. Gypsum blocks were installed in the 200-12 field prior to planting. Gypsum blocks were installed in the Control field and the John Deere Water probe in each field following crop emergence. Following this paragraph, a series of graphs and tables shows weekly gypsum block readings for the season; growing season water, including rainfall, irrigation, and soil moisture at various growth stages; and the order of irrigation and rainfall events for each field. Finally a form describes the protocols for each field. "Total Water," as shown on the graph for growing season water, is the sum of seasonal irrigation, rainfall and net soil water. Graphs and tables for the 200-12 field are shown first, followed by the illustrations for the Control field.

Graph – Gypsum Block Readings for Richard Schad 200-12



Graph – Growing Season Water Tracking for Richard Schad 200-12

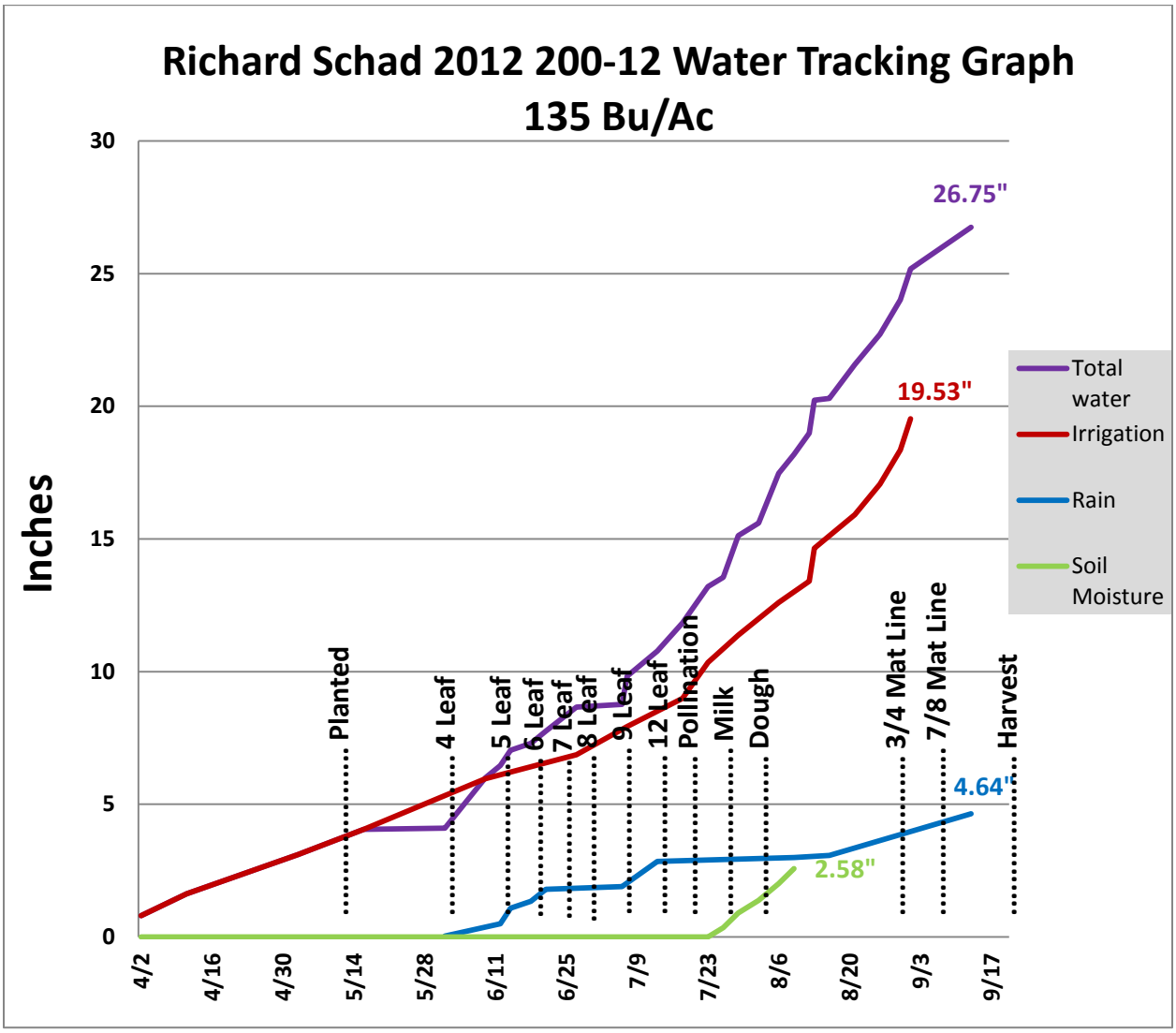


Table- Demonstration Field Data Richard Schad's 200-12

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
4/2		0.80	21 hrs							Prewater		700
4/11		0.83	22 hrs							Prewater		700
4/25			No Meter		97.9	96.6	98.1	97.8	97.8	Sorghum	45 Y	
4/27			No Meter		96.8	95.6	97.0	96.6	96.7		185 N	
5/2	0.30		No Meter		97.0	95.8	97.2	96.8	96.9		210 N	
5/3		1.48	39 hrs							Pewater		
5/7			No Meter		96.9	96.0	97.1	96.7	96.9		270 N	
5/11										Planted		
5/16		0.95	25 hrs							Corn		
5/17			3.42		96.8	96.1	97.0	96.8	97.0		185 N	
5/25			3.42		96.8	96.1	96.8	96.7	96.8		180 N	
6/1	0.04		7.39	4 leaf	97.5	96.9	97.4	97.3	97.3	Sorghum	30 N	
6/9		1.90	50 hrs							Corn		700
6/12	0.46		21.33	5 leaf	97.3	96.7	97.1	97.1	97.1		60 N	
6/14	0.58		21.54	5 leaf	98.5	98	98.3	98.3	98.3		37 N	
6/18	0.26		21.80	6 leaf	97.2	97	97.1	97.1	97.2		37 N	
6/21	0.46		21.80	7 leaf	97.2	97	97.1	97.1	97.2		37 N	
6/27		0.91	24 hrs							Corn		700
6/29			29.40	8 leaf	95.1	97.8	98.0	97.9	97.9		310 N	
7/6	0.10		29.99	9 leaf	0	14.8	98.1	98.3	98.2		308 Y ccw	400
7/7		1.06	28 hrs							Corn		700
7/13	0.95		42.20	12 leaf	71.4	58.9	96.6	97.3	96.8	Sorghum	175 Y cw	763
7/18		1.06	28 hrs							Corn		700
7/19			46.31	Pollination	96.8	97.4	96.2	97.2	98.1		309 N	
7/23		1.36	36 hrs							Corn		700
7/26			54.98	Milk	0	0	50.8	81.7	82.5		48 N	
7/29		1.02	27 hrs							Corn		700
7/31			59.34	Milk	0	0	17.5	61.1	61.3		309 N	
8/2			60.66	Dough	0	0	5.6	44.7	47.0		280 Y	

											cw	
8/6		1.24	32.8 hrs							Corn		700
8/9	0.15		69.59	Dough	0	0	0	24.7	28.9		48 N	
Date	**Inches**	**Inches**	**Water**	**Growth**	**Soil Moisture**					**Crop**	**Pivot**	**Well**
mm/dd	**Rain**	**Irrigation**	**Meter**	**Stage**	**1 Foot**	**2 feet**	**3 Feet**	**4 Feet**	**5 Feet**	**Status**	**Position**	**Gpm**
8/12		0.80	21 hrs							Corn		700
8/13		1.24	32.8 hrs							Corn		700
8/16	0.07		82.43	Dent	3.1	0	0	22.9	25.7		48 N	
8/21		1.27	33.5 hrs							Corn		700
8/21			93.57	1/2 Mat Ln	5.2	0	0	18.1	20.9		292 N	
8/26		1.15	30.5 hrs							Corn		700
8/29			109.31	3/4 Mat Ln	97.5	0	0	21.5	22.7	Sorghum	109 Y	
8/30		1.29	34 hrs							Corn		700
9/1		1.17	31 hrs							Corn		700
9/6			125.69	7/8 Mat Ln	97.1	0	0	25.2	25.6	Sorghum	125 Y	757
9/13	1.57		126.79	1.0 Mat Ln	95.6	0	0	28.6	29.1	Sorghum	169 N	
9/20	4.64		126.79	Harvest	86.3	0	0	28.0	28.7		169 N	
9/27	0.06		126.79	Harvest	59.4	0	0	29.9	29.2		168 N	
10/4	1.28		126.79		97.0	0	0	94.3	84.5		168 N	
10/11			126.79		96.4	0	0	28.0	29.4		168 N	
Total	4.64	19.53			0	0	0	1.30	1.28			
Net Soil Water is 2.58"												
Irrigation, Rain, Soil Water is 26.75"												

- Numbers in red are not counted in total

NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

200-12

Year: *2012* **County:** *Hansford* **Grower:** *Richard Schad*

No. Acres: *41* **Variety/Hyb:** *CH208-48VT3* **Soil Type:** *Olso Silty Clay Loam*

Meter Type: *Seametrics*

Meter Mult: *Ac Ft x 1* **Tillage:** *Strip Till*

Fertilizer: *204-56-5-4s-0.7zn* **Seeding:** *24,000*

Planted: *May 11, 2012* **Harvest:** *September 27, 2012*

Herbicide: *Aatrex, Basis, Brimstone, Laudis, Detonate, Round Up, Powermax* **Insecticide:** *None*

Yield: *135 Bu/Acre* **Prev. crop:** **Row width:** *30 Inch*

Irrigation method: *Center Pivot* **Prewater:** *Yes* **Well GPM:** *700*

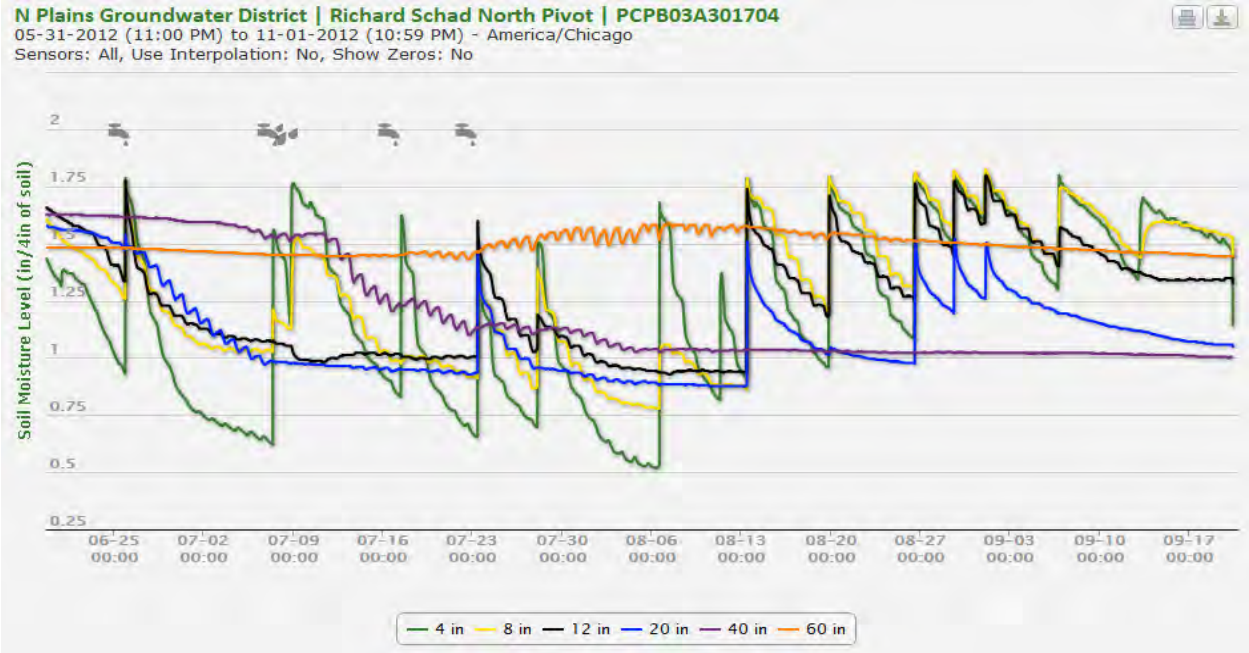
Distance between drops: *60”* **Distance from nozzle to ground:** *16”*

Application pattern: *Spray* **Crop row direction :** *Straight*

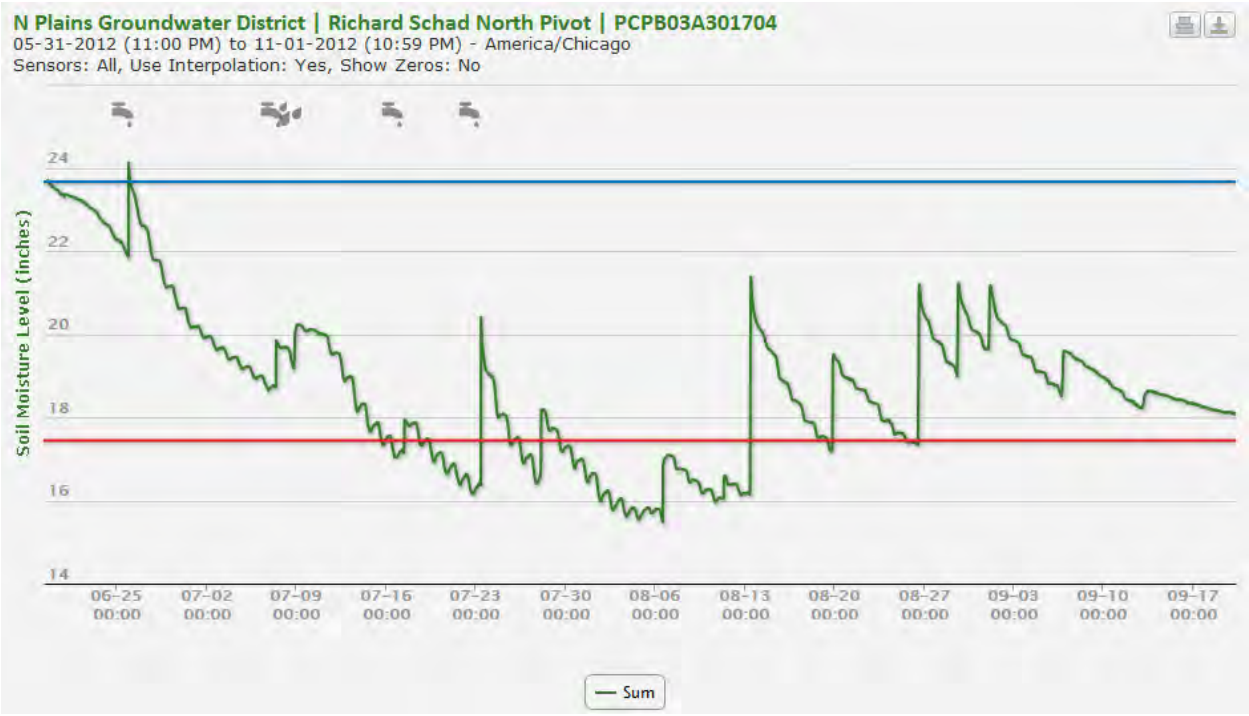
GPS Location: Latitude: *36.3079*
Longitude: *-101.54655*

John Deere Water Report for Richard Schad 200-12 Field

200-12 Field Separate Graph

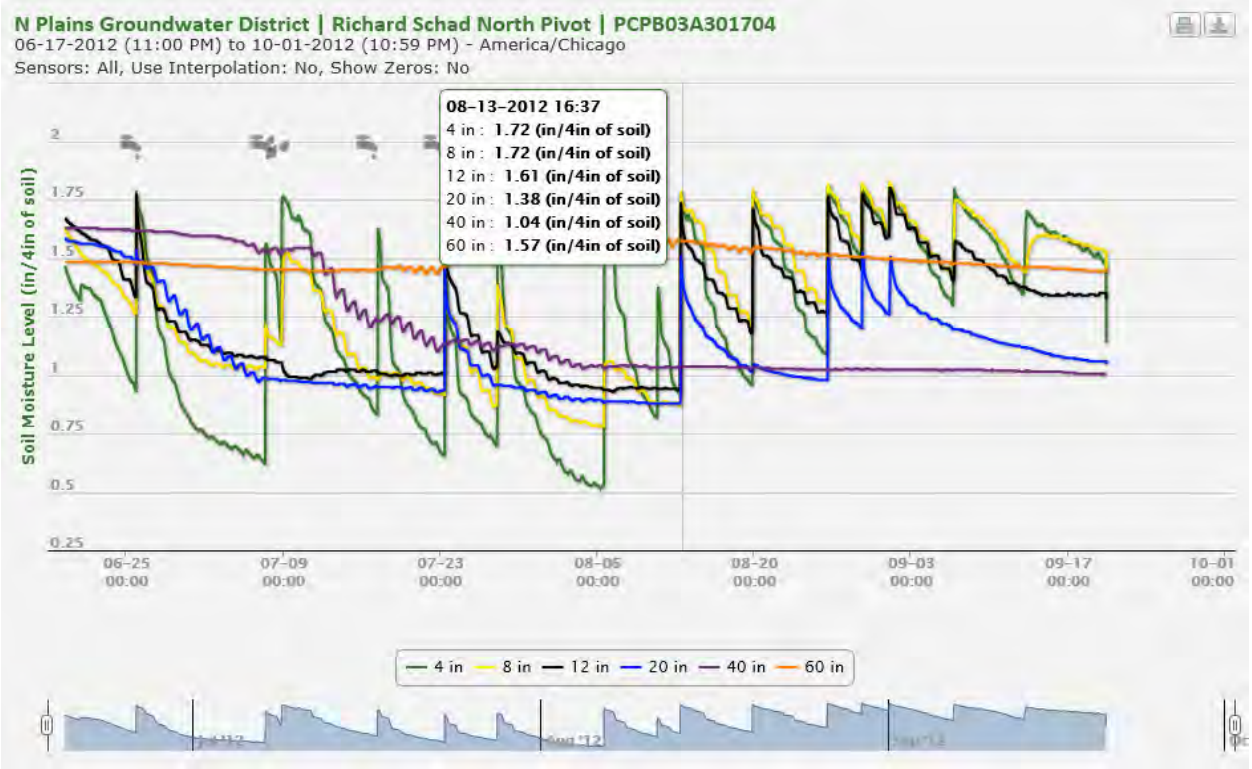


200-12 Field Summary Graph

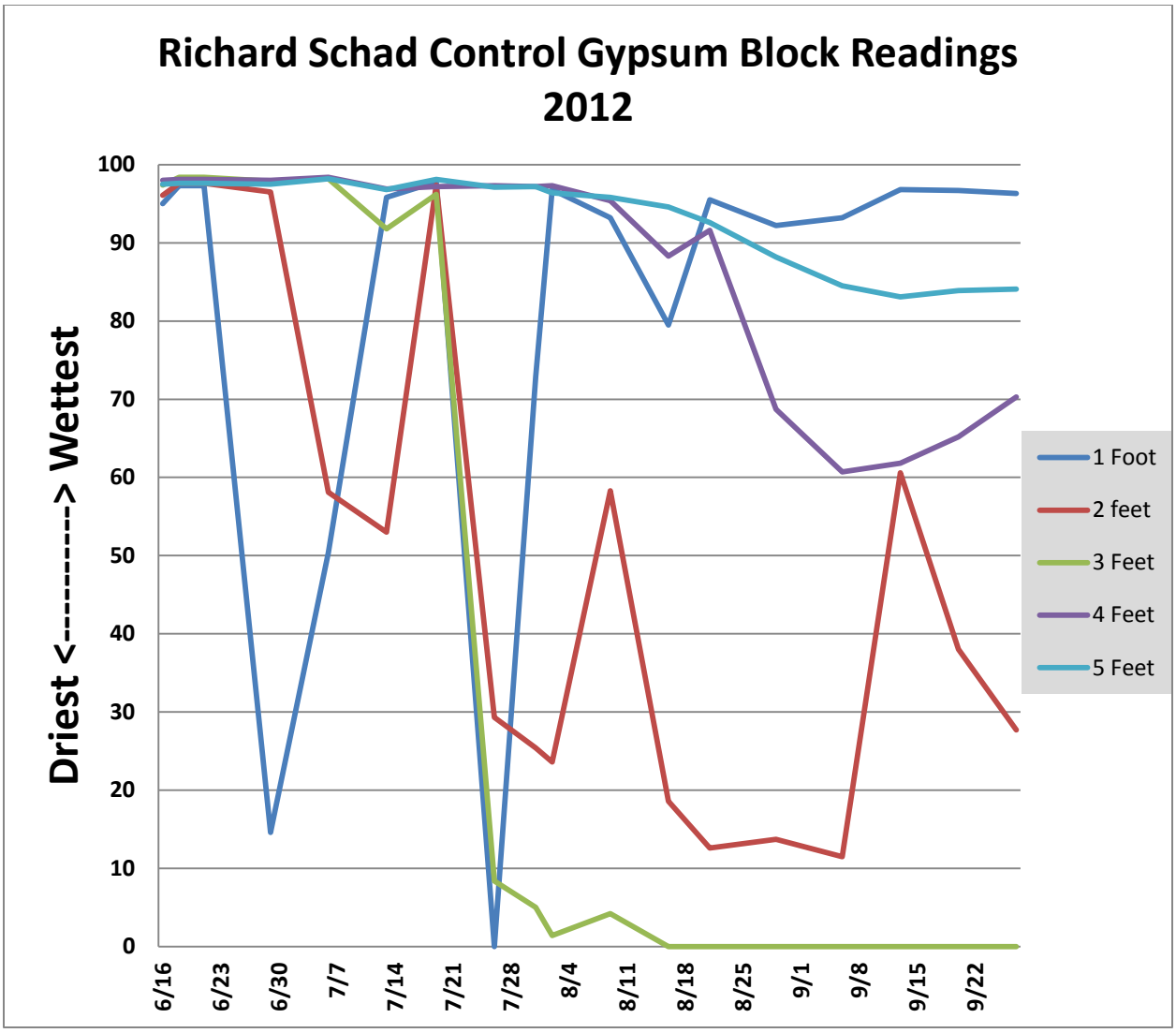


Schad 200-12: Sensor data indicates root activity past the 40” level but none at 60”. irrigation patterns vary from 5-12 days in season. Affective depths range from 8-20” depths. Sum and Line graphs indicates 3 days of stress first week of August when water uptake diminishes and line graph sensors flat line at 4, 8, 12, 20 and 40” depths. Irrigation and rainfall events after that period rebuild profile moisture to the 20” depth by season end.

Graph-Soil Water Sum on August 13 by JDW Soil Probe for Schad 200-12 Field



Graph – Gypsum Block Readings for Richard Schad Control



Graph – Growing Season Water Tracking for Richard Schad Control

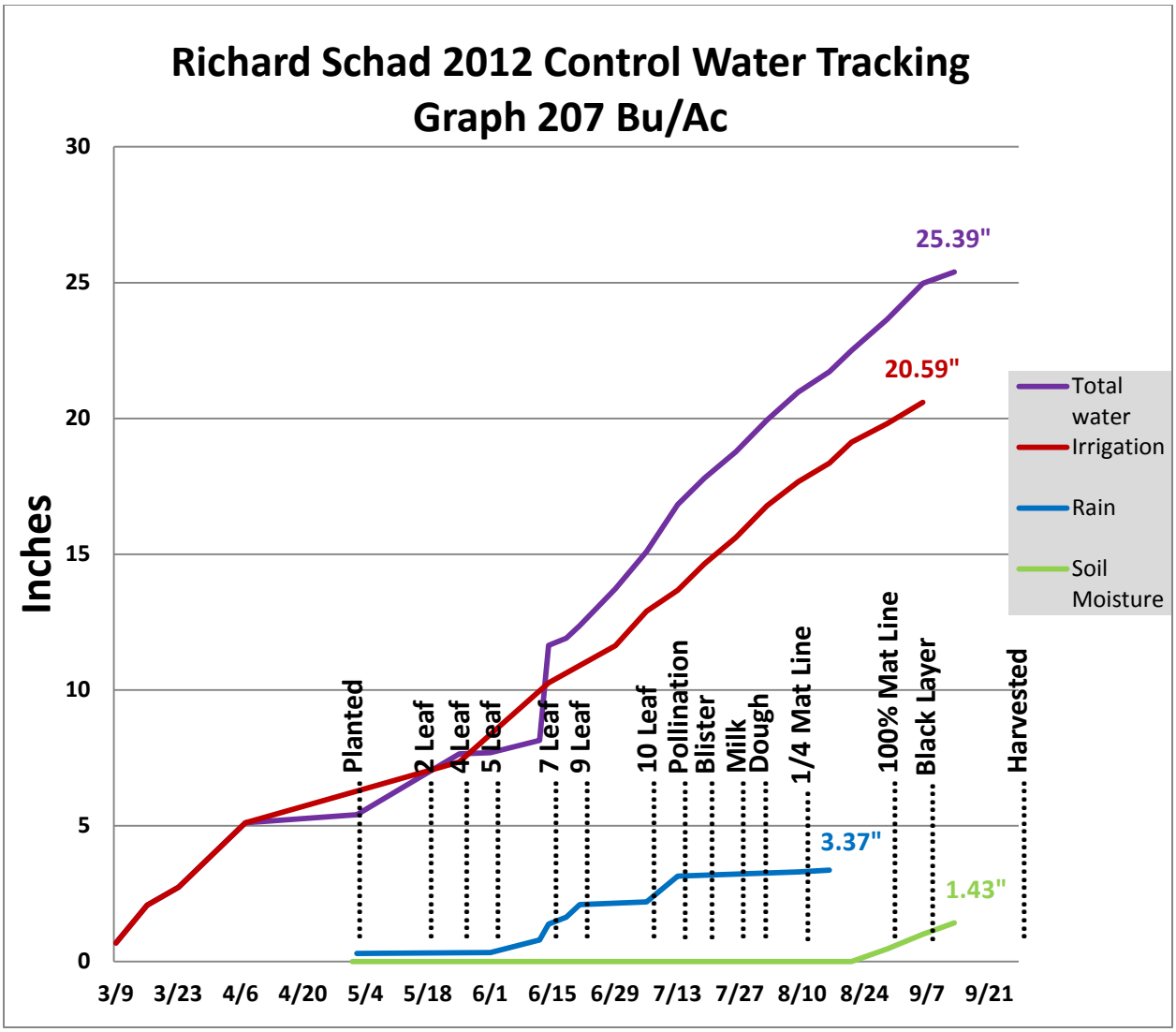

Richard Schad 2012 Control Water Tracking
Graph 207 Bu/Ac
Inches
30
25
20
15
10
5
0
3/9
3/23
4/6
4/20
5/4
5/18
6/1
6/15
6/29
7/13
7/27
8/10
8/24
9/7
9/21
25.39"
20.59"
3.37"
1.43"
Planted
2 Leaf
4 Leaf
5 Leaf
7 Leaf
9 Leaf
10 Leaf
Pollination
Blister
Milk
Dough
1/4 Mat Line
100% Mat Line
Black Layer
Harvested
Total water
Irrigation
Rain
Soil Moisture

Table- Demonstration Field Data Richard Schad's Control

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
3/9		0.69	48 hrs							Prewater	20 N	800
3/16		1.39	96 hrs							Prewater	35 N	800
3/23		0.66	46 hrs							Prewater	12 N	800
4/7		2.37	164 hrs							Prewater	20 N	800
4/25			12 AF								339 N	
4/27			12 AF								185 N	
5/2	0.30		12									
5/17				2 leaf								
5/25		2.24	35	4 leaf							270 Y	757
6/1	0.04		43	5 leaf							60 Y	793
6/12	0.46		62	6 leaf							185 Y	742
6/14	0.58	2.92	65	7 leaf							20 N	
6/16			65	7 leaf	95.0	96.1	97.4	98.0	97.5		20 N	
6/18	0.26		65	8 leaf	97.3	97.6	98.4	98.1	97.6		20 N	
6/21	0.46		67	9 leaf	97.3	97.6	98.4	98.1	97.6		150 Y	775
6/29		1.36	79	9 leaf	14.6	96.5	97.9	98.0	97.5		178 N	
7/6	0.10	1.27	92	10 leaf	50.4	58.1	98.2	98.4	98.2		309 N	
7/13	0.95	0.78	100	pollin	95.8	53	91.8	96.9	96.8		40 N	
7/19		0.97	110	blister	97.8	97.4	96.2	97.2	98.1		230 Y cw	795
7/26		0.97	120	milk	0	29.3	8.4	97.3	97.1		53 Y cw	786
7/31			129	dough	72.9	25.4	5.0	97.2	97.2		153 Y cw	785
8/2		1.17	132	dough	96.8	23.6	1.4	97.3	96.4		316 Y cw	797
8/9	0.15	0.88	141	1/4mat ln	93.2	58.3	4.2	95.4	95.8		21 N	
8/16	0.07	0.68	148	1/2mat ln	79.5	18.6	0	88.3	94.6		34 Y cw	797
8/21		0.78	156	7/8mat ln	95.5	12.6	0	91.6	92.6		49 N	
8/29	3.37	0.68	163	1.0mat ln	92.2	13.7	0	68.7	88.2		39 N	
9/6		0.78	171	blk layer	93.2	11.5	0	60.7	84.5		43 N	
9/13	1.57		171	blk layer	96.8	60.6	0	61.8	83.1		43 N	
9/20			171	harvest	96.7	38.0	0	65.2	83.9		7 N	
9/27			171	harvest	96.3	27.7	0	70.3	84.1		7 N	
Total	3.37	20.59			0	0	0	0.85	0.58			
Net Soil Water is 1.43"					Irrigation, Rain, Soil Water is 25.39"							

- Numbers in red are not counted in total

NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

Control

Year: *2012* **County:** *Hansford* **Grower:** *Richard Schad*

No. Acres: *123* **Variety/Hyb:** *CH216-49VT* **Soil Type:** *Olso Silty Clay Loam*

Meter Type: *Senninger*

Meter Mult: *Ac Ft x 1* **Tillage:** *Strip Till*

Fertilizer: *172-64-5-4s-0.7zn* **Seeding:** *32500*

Planted: *May 1, 2012* **Harvest:** *September 19, 2012*

Herbicide: *Aatrex, Basis, Brimstone, Laudis, Detonate, Round Up, Powermax* **Insecticide:** *None*

Yield: *207 Bu/Acre* **Prev. crop:** **Row width:** *30 Inch*

Irrigation method: *Center Pivot* **Prewater:** *Yes* **Well GPM:** *780*

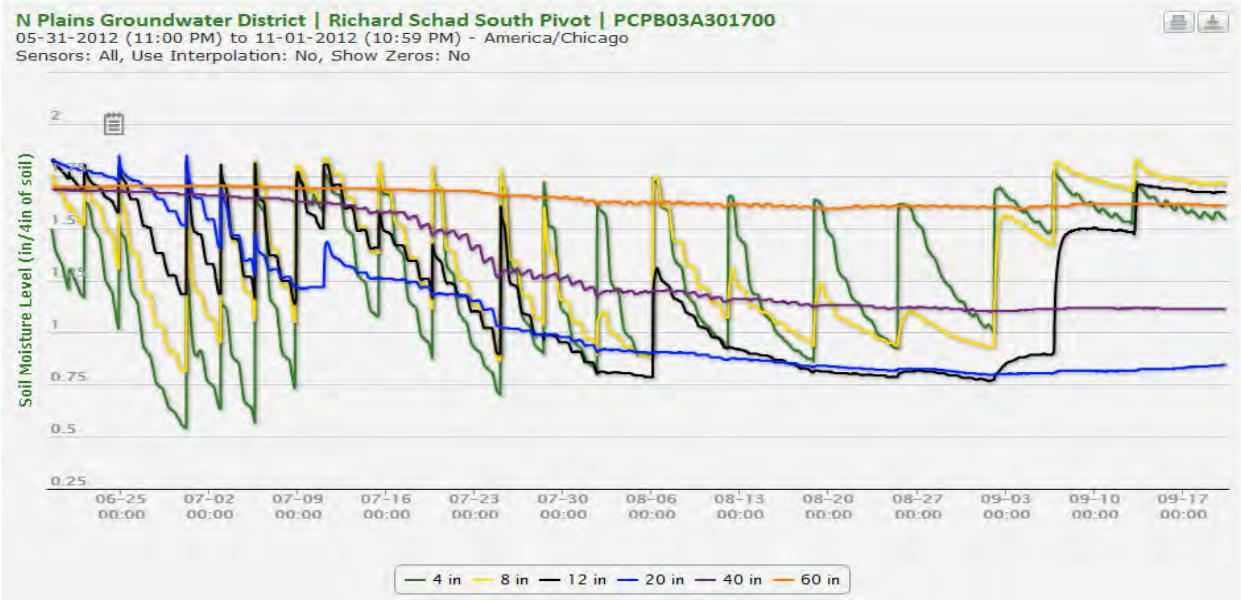
Distance between drops: *60”* **Distance from nozzle to ground:** *16”*

Application pattern: *Spray* **Crop row direction :** *Straight*

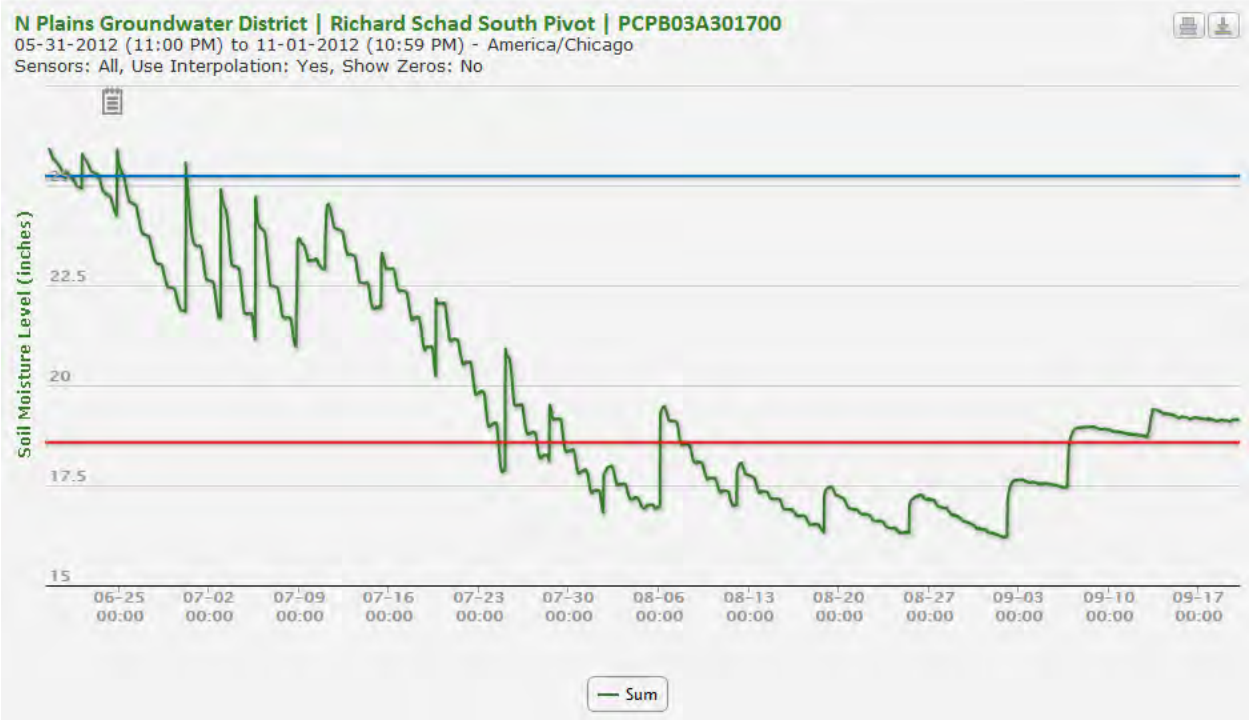
GPS Location: *Latitude:* *36.30215*
Longitude: *-101.54981*

John Deere Water Report for Richard Schad Control Field

Control Field Separate Sensor Graph



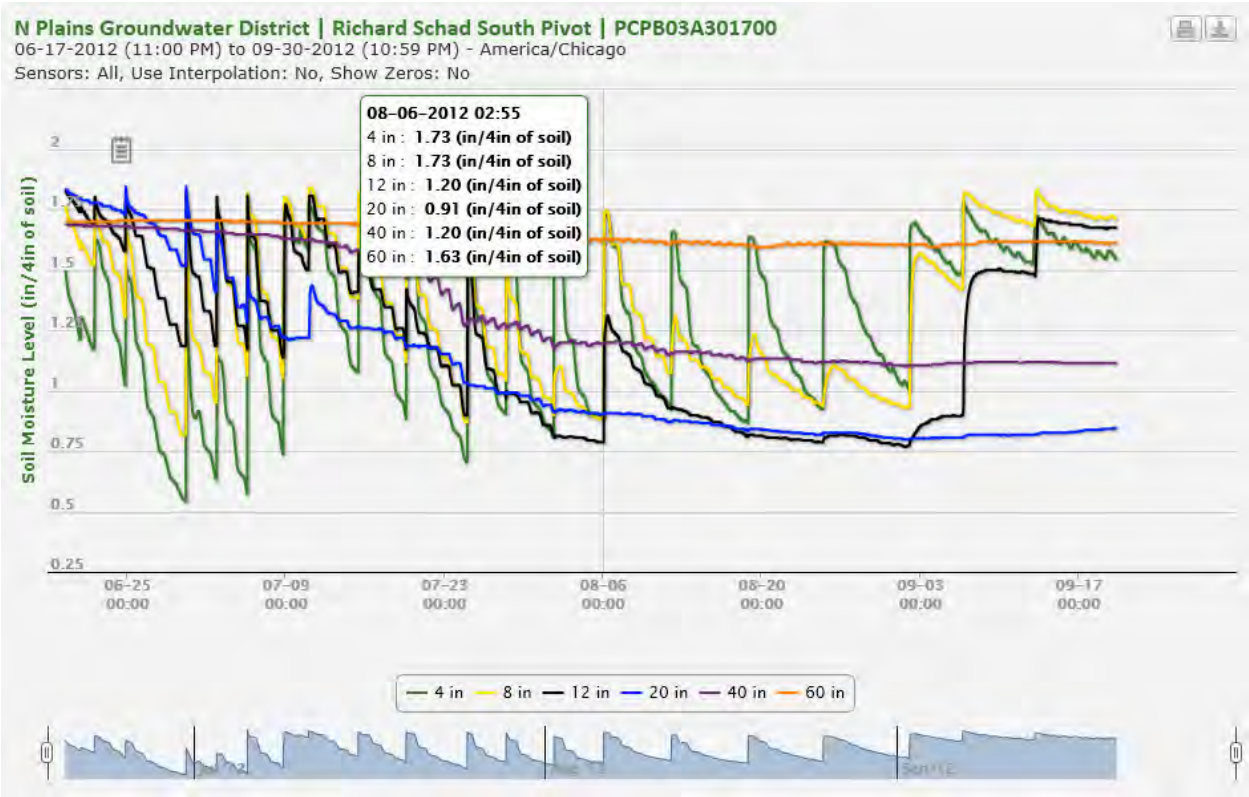
Control Field Summary Graph



Schad Control: This pivot shows early season pattern of 3 day revolutions which pushed water to the 20" depth. By second week of July affective depth dropped to the 12" depth, by 2nd week of August affective depth dropped further to only 8" depth. Slowing the pivot to 6 day revolutions in August did not increase soil moisture until first week in September when crop water use decreased and net ain in profile moisture occurs. Rooting activity seen to the 40" depth, no activity seen at the 60" depth.

Graph-Soil Water Sum on July 24 by John Deere Water Soil Probe for Schad Control Field

Graph-Separate Soil Water on August 6 by Sensor Depth by JDW Probe for Schad Control Field



Harvest Results -The 200-12 field produced a 135 bushel per acre corn yield. Irrigation totaled 19.53 inches. Production in the control field was 205 bushels per acre, where irrigation was 20.59 inches. Pre -season irrigation was 3.11 inches for the 200-12 field and 5.11 for the control. Pre-season irrigation is included in total irrigation. In comparison, the control field produced 72 more bushels per acre than the 200-12 with 1.06 additional inches of irrigation. Corn production was 6.91 bushels (387lbs) per inch of irrigation in the 200-12 field compared to 10.05 bushels (563lbs) in the control. Production from each inch of irrigation, rainfall and net soil water that totaled 26.75 inches was 5.04 bushels (283lbs) per acre in the 200-12 field. Irrigation, rainfall and net soil water totaled 25.39 inches in the control field where production was 8.15 bushels (456lbs) per inch. Crop production costs were $97.97 per acre more for the control field than for the 200-12 from increased seed, fertilizer, irrigation and harvest expenses. At $6.59 per bushel, the additional 72 bushel per acre corn yield amounts to $474.48 more per acre. The control field's net gain was $376.51 per acre with 1.06 inches more irrigation used compared to production from the 200-12 field. Schad stated, "We were really stretched for water to irrigate the fields, since rain didn't occur. We had two new center pivots and another one moved to previous dry land acres. There were delays getting the irrigation systems ready and the crops planted. I thought we had lost too much of the crops in July when it didn't rain again. However, crop yields were much better than expected earlier in the season." A summary of the demonstration results are shown in the following table.

Table – 2012 Demonstration Results for Richard Schad 200-12 & Control

Irrigation		Irrig/Rain/Soil	PRODUCTION		CROP VALUE @ $6.59/Bu		
field	Inches	Inches	Bu/Ac	Bu/Ac-In Irrigation	Per Acre	Acre-In of Irrigation	Ac-In of Irrig/Rain/Soil
200-12	19.53	*26.75	135	6.91	$889.65	$45.55	$33.25
Control	20.59	+25.39	207	10.05	$1364.13	$66.25	$53.72

***Includes 2.58 inches of water removed from five feet of soil, plus rainfall, and irrigation.**
+Includes 1.43 inches of soil water removed from five feet of soil, plus rainfall and irrigation.

Additional Hybrid and Plant Population Harvest Results- All growers are searching for the best corn hybrid, seeding rate, planting date and other information to help maintain profitable corn production levels with less irrigation and rainfall. Below are corn yields of three seeding rates from three Channel hybrids within Schad's 200-12 field. Irrigation and rain are the same as that reported for the 200-12 field.

Table – 2012 Corn Yields from Three Channel Corn Hybrids and Three Seeding Rates

Hybrid	Seeding Rate	Bushels/Acre
Ch208-48vt3p	28,000	170
Ch208-48vt3p	24,000	167
Ch214-14vt3p	24,000	166
Ch208-48vt3p	26,000	153
Ch214-14vt3p	28,000	151
Ch211-99vt3p	24,000	144
Ch214-14vt3p	28,000	144

Krienke-Ochiltree County Demonstration, 2012

Planting and Crop Information – For his demonstration, Danny Krienke strip tilled and planted 60 acres of corn in the southwest quarter of the south half of section 47, for his "200-12" field, "Krienke 200-12". Krienke planted the southwest quarter of the circle with Pioneer 33B54 at a seeding rate of 27,000 seeds/acre. He planted the southeast quarter 60 acres, also strip tilled, to Pioneer 33B54 at 27,000 seeds/acre for his "control" field, "Krienke Control". Both the southwest quarter 200-12 and southeast quarter control fields were irrigated using the same center pivot. Seasonal water meter readings averaged 525 gpm and delivered an average of 1.0 inch of irrigation in a 9 day revolution. Planting and crop information for "Krienke 200-12" and "Krienke Control" are shown in the table below. Each is the same unless specified.

Table – Planting and Crop Information for Krienke

Planted:	May 21	**Fertilizer:**	125-25-0
Hybrid:	P33B54	**Tillage:**	Strip Till
Seeding Rate:	27,000	**Herbicide:**	Cinch ATZ, Round Up
Soil Type: 200-12	Lazbuddie clay	**Soil Type**: **control**	Sherm clay loam
Row Width:	30 Inches	**Insecticide:**	none
Harvested:	October 15	N**o. Acres:**	60 each
GPM Per Acre:	4.4	**GPM Per Acre:**	4.4
Irrig/Rain/SoilWater: 200-12	29.56"	**Irrig/Rain/SoilWater: Control**	32.68"

Beginning Soil Water Profile and Growing Season Rainfall

"200-12": Preseason soil water was good at 1 and 2 feet, about 50 percent at 3 feet and 40 percent at 4 feet in April. Weekly gypsum block readings that followed show soil water was good at 1, 2 and 3 feet following planting and early season irrigation, but still lacking at 4 and 5 feet in the profile. Additional readings indicate and the AquaSpy® soil probe show the crop used all water from 1, 2 and 3 feet plus irrigation in late July and August, and limited water from 4 and 5 feet in September finishing the crop. Lazbuddie clay loam soil holds approximately 2.0 inches of available water per foot for crop use. The gypsum blocks were installed in late April prior to planting to obtain advanced soil water conditions.

"Control": Soil water was good at 1, 2, and 4 feet but none at 3 and 5 feet prior to planting. Weekly gypsum block readings and the AquaSpy® soil probe show improved soil water levels in June following irrigation and rainfall, except at 5 feet. Additional readings show soil water was quickly depleted at 1, 2, and 3 feet during July when plant water use was high. Only limited water was used from 4 feet. There was no soil water at 5 feet during the growing season. Sherm clay loam soil holds approximately 2.0 inches per foot for potential crop use. .

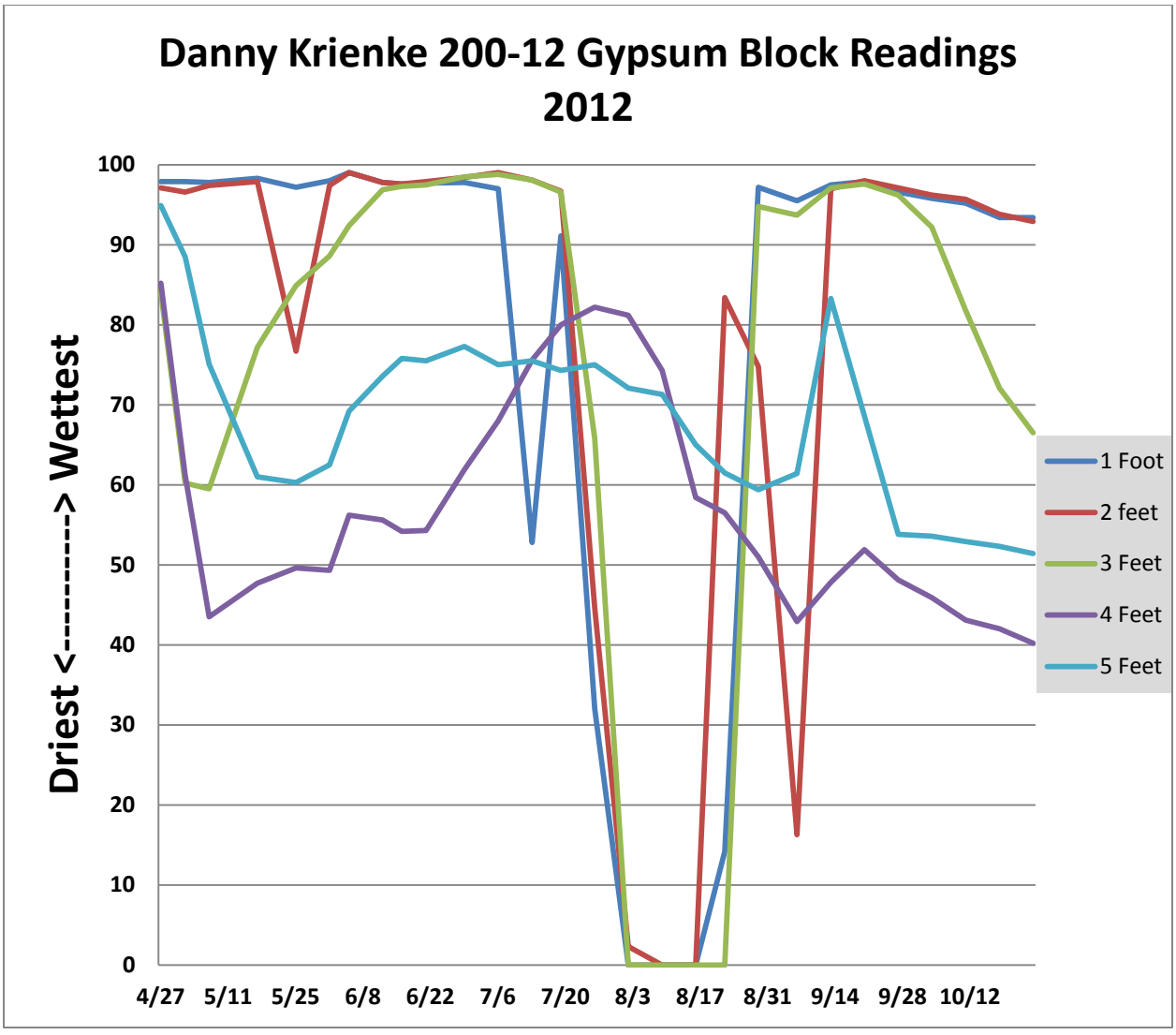
Both: Seasonal rainfall totaled 4.44 inches. Rainfall totaled only 1.02 inches in July and August when it was needed. The following table shows monthly rainfall as recorded by a district rain gauge located at the edge of the two fields.

Table – Monthly Rainfall Data for Krienke "200-12" & "Control"

May- 0" June- 1.74" July- .35" August- .67" Sept- 1.68" Total: 4.44"

Growing Season Water Tracking – The district tracked crop total water throughout the growing season using rain gauges, water meters and both gypsum block and AquaSpy® soil moisture sensors. A set of five gypsum block soil moisture sensors was installed at 1, 2, 3, 4 and 5 feet and an AquaSpy® soil moisture probe was installed down to five feet in the root zone at one location to monitor soil water levels in the 200-12 field. Another set of the same type of sensors was installed in the Control field. Both sensors were installed in close proximity to each other in the field. Gypsum blocks were installed in the 200-12 and control fields prior to planting. The AquaSpy® probe was installed in each field following crop emergence. Following this paragraph, a series of graphs and tables shows weekly gypsum block readings for the season; growing season water, including rainfall, irrigation, and soil moisture at various growth stages; and the order of irrigation and rainfall events for each field. Finally a form describes the protocols for each field. "Total Water," as shown on the graph for growing season water, is the sum of seasonal irrigation, rainfall and net soil water. Graphs and tables for the 200-12 field are shown first, followed by the illustrations for the Control field.

Graph – Gypsum Block Readings for Danny Krienke 200-12



Graph – Growing Season Water Tracking for Danny Krienke 200-12

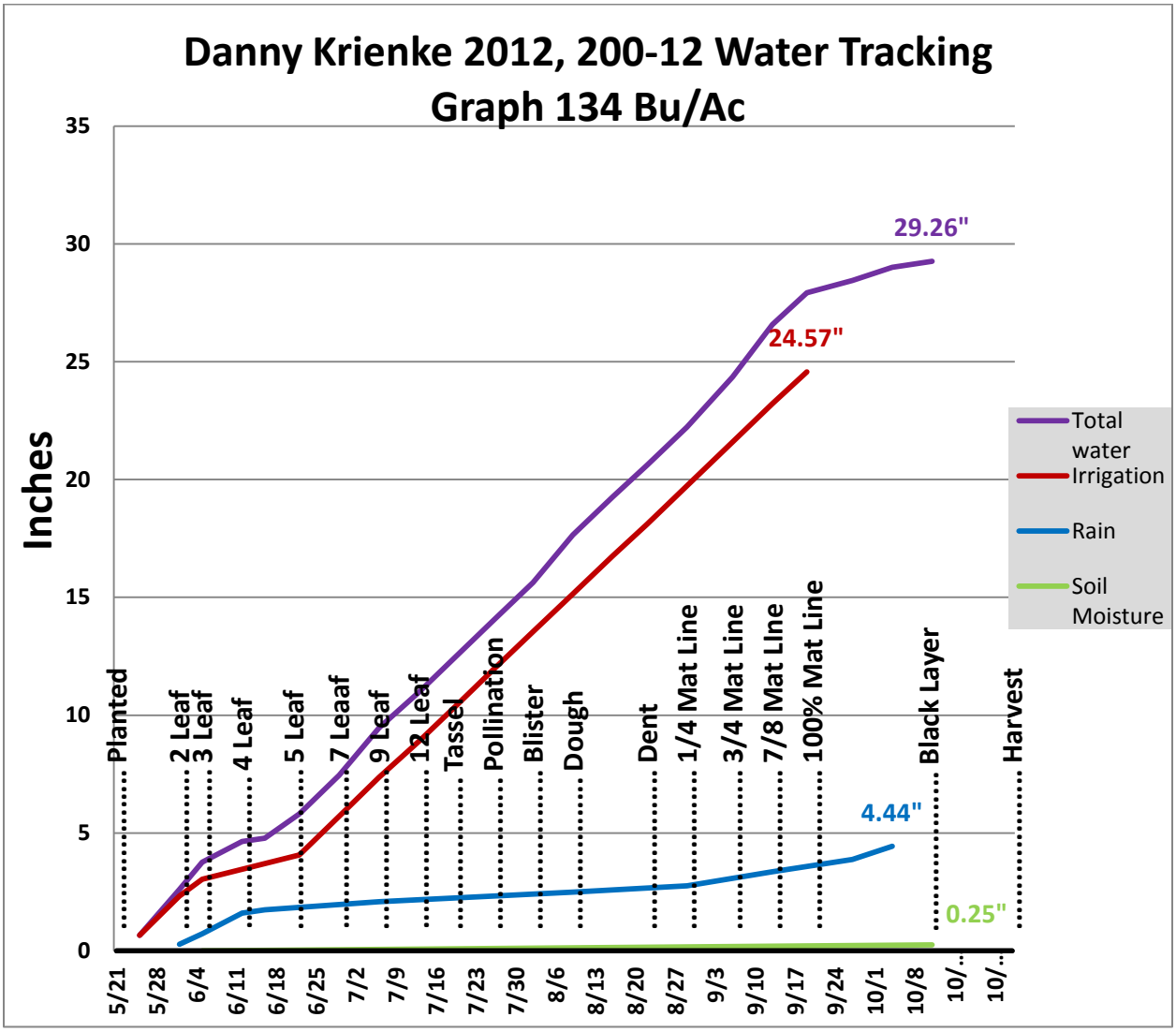


Table- Demonstration Field Data Danny Krienke's 200-12

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
4/27	0.48		203122		97.9	97.1	84.0	85.2	94.9	Wheat	60 Y	
5/2	0.33		207090		97.9	96.6	60.2	61.2	88.5	Wheat	0 Y	
5/7			211008		97.8	97.4	59.5	43.5	75.1	Wheat	315 Y	
5/17			218876		98.3	97.9	77.2	47.7	61.0	Wheat	275 Y	
5/21			222901	Planted						Planted		
5/25		0.66	225063		97.2	76.7	84.9	49.6	60.3	Corn	153	
6/1	0.28	1.67	230505	2 leaf	98.0	97.4	88.6	49.3	62.5	Split	180 Y	
6/5	0.45	0.71	232808	3 leaf	99.0	99.0	92.4	56.2	69.2	Stop	201 N	
6/12	0.87		232808	4 leaf	97.8	97.8	96.9	55.6	73.6	Stop	201 N	
6/16	0.14		232808	4 leaf	97.6	97.6	97.3	54.2	75.8	Stop	201 N	
6/21			235193	5 leaf	97.7	97.9	97.5	54.3	75.5	Control	135 Y	551
6/22		1.03	236174							Control	90 Y rev	
6/29		1.64	241513	7 leaf	97.8	98.4	98.5	61.9	77.3	Control	150 Y	524
7/6	0.35	1.66	246928	9 leaf	97.0	99.0	98.8	68.0	75.0	200-12	232 Y ccw	546
7/13		1.52	251885	12 leaf	52.8	98.1	98.1	75.6	75.5	200-12	221 Y cw	566
7/19		1.39	256431	Tassel	91.1	96.7	96.6	80.0	74.3	Control	97 Y cw	497
7/26		1.65	261825	Pollination	32.0	44.6	65.8	82.2	75.0	Control	168 Y ccw	525
8/2		1.61	267071	Blister	0	2.3	0	81.2	72.1	200-12	252 Y ccw	532
8/9	0.41	1.61	272309	Dough	0	0	0	74.3	71.3	Control	216 Y cw	495
8/16		1.61	277542	Dough	0	0	0	58.4	65.0	Control	146 Y cw	530
8/22		1.35	281935	Dent	14.2	83.4	0	56.5	61.5	Control	10 Y ccw	532
8/29	0.26	1.62	287228	1/4 Mat Ln	97.2	74.8	94.8	51.0	59.4	200-12	222 Y cw	527
9/6		1.86	293309	3/4 Mat Ln	95.5	16.3	93.7	42.9	61.4	200-12	255 Y	528
9/13	0.60	1.63	298636	7/8 Mat Ln	97.5	97.0	97.1	47.8	83.3	200-12	213 Y	531
9/19		1.35	303043							Control	90 Y rev	
9/20			303925	1.0 Mat Ln	97.9	98.0	97.6	51.9	68.6	Control	138 Y cw	500
9/27	0.52		306378	1.0 Mat Ln	96.6	97.1	96.2	48.1	53.8	Control	122 N	
10/4	0.56		306378	1.0 Mat Ln	95.8	96.2	92.2	45.9	53.6		122 N	
10/11			306378	Blk Layer	95.2	95.7	81.8	43.1	52.9		122 N	

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
10/18			306378	Blk Layer	93.4	93.8	72.1	42.0	52.3		90 N	
10/25			306378	Harvest	93.4	92.9	66.5	40.2	51.4		90 N	
Total	4.44	24.57			0	0	0.25	0	0			
Net soil water is 0.25 inches												
Total Irrigation, Rainfall, and Net Soil water is 29.56 inches												

- Numbers in red are not counted in total

NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

200-12

Year: *2012* **County:** *Ochiltree* **Grower:** *Danny Krienke*

No. Acres: *60* **Variety/Hyb:** *33B54* **Soil Type:** *Sherm Clay Loam*

Meter Type: *McCrometer*

Meter Mult: *Gallons X 1000* **Tillage:** *Strip Till*

Fertilizer: *125-25-0* **Seeding:** *27,000*

Planted: *May 21, 2012* **Harvest:** *October 25, 2012*

Herbicide: *Cinch ATZ, Round Up* **Insecticide:** *None*

Yield: *134 Bu/Acre* **Prev. crop:** *Wheat* **Row width:** *30"*

Irrigation method: *Center Pivot* **Prewater:** *None* **Well GPM:** *525*

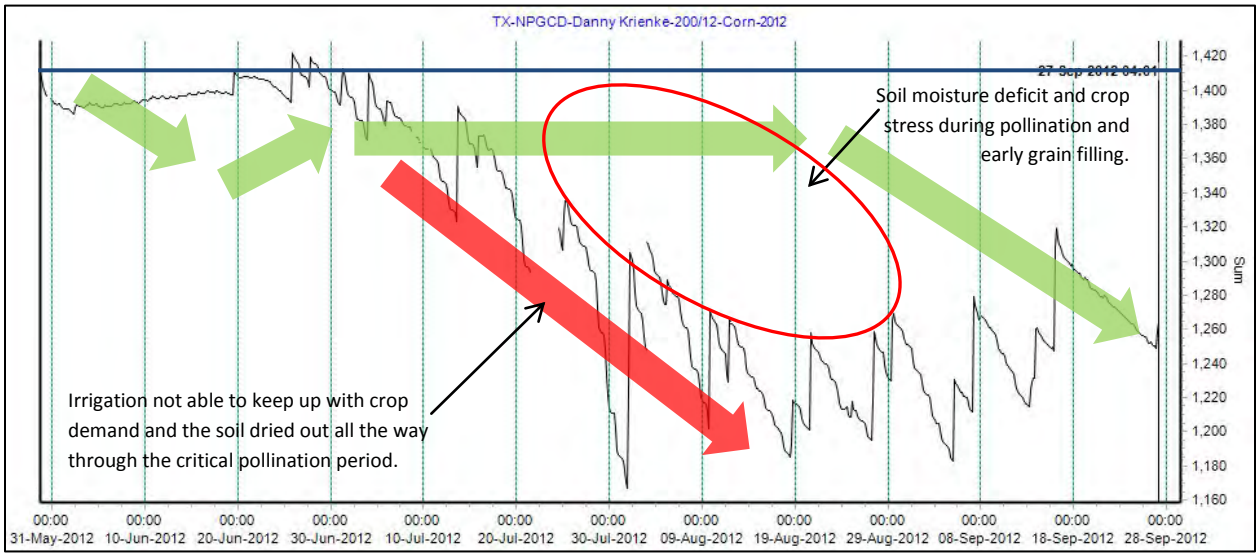
Distance between drops: *60"* **Distance from nozzle to ground:** *16"*

Application pattern: *Spray* **Crop row direction :** *Straight*

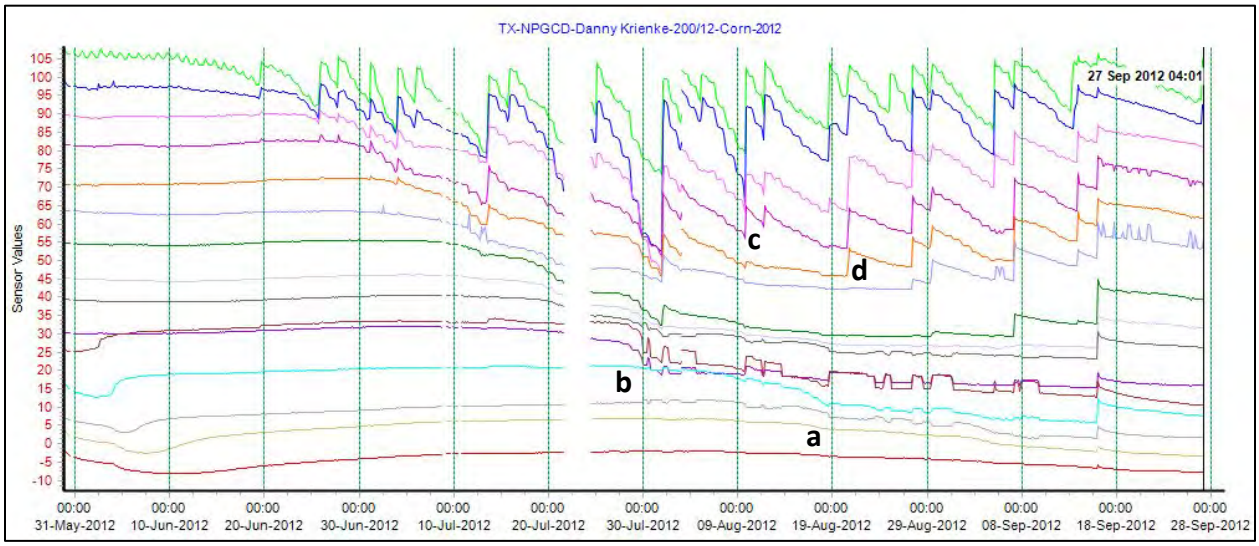
Elevation: *2940 Feet* **GPS Location:** Latitude: *36.400173*

Longitude: *-100.854732*

Danny Krienke: AquaSpy® 200-12 Site (134 bu/ac; 24.6" irrigation)



The field began with a full soil moisture profile, however irrigation was not able to keep up with crop demand and the crop essentially ran low on water. The moisture deficit during peak demand resulted in a yield reduction at this site.



(a) Evidence of root activity all the way to 56"

(b) Crop went looking for deep moisture during hot spell in late July. Moisture seeking activity is indicative of moisture stress during this time.

(c) Irrigation during peak water use only able to penetrate to 16"

(d) Late irrigations penetrated deeper (20-24" range) as the crop demand decreased. Windshield-wipe irrigations more effective at deep penetration on second pass due to soil being wet from first pass.

Danny Krienke's Variable Rate Irrigation (VRI)

Map-Variable Rate Irrigation Prescription for Krienke 200-12 Field

Virtual Agronomist
Base Management Program

Grower Danny Krienke
Farm Krienke Farms
Field 47 11

Pivot VRI by Sector Report

Base Application Depth: 1.00 in
Base Walk Rate: 7.00 (%)
Total Area: 61.42 ac **Total Time:** 2d 0hr 0min
Total Flat Rate Water Amount: 1,667,937.5 gal
Total VRI Water Amount: 1,667,937.5gal (1.00in/ac)

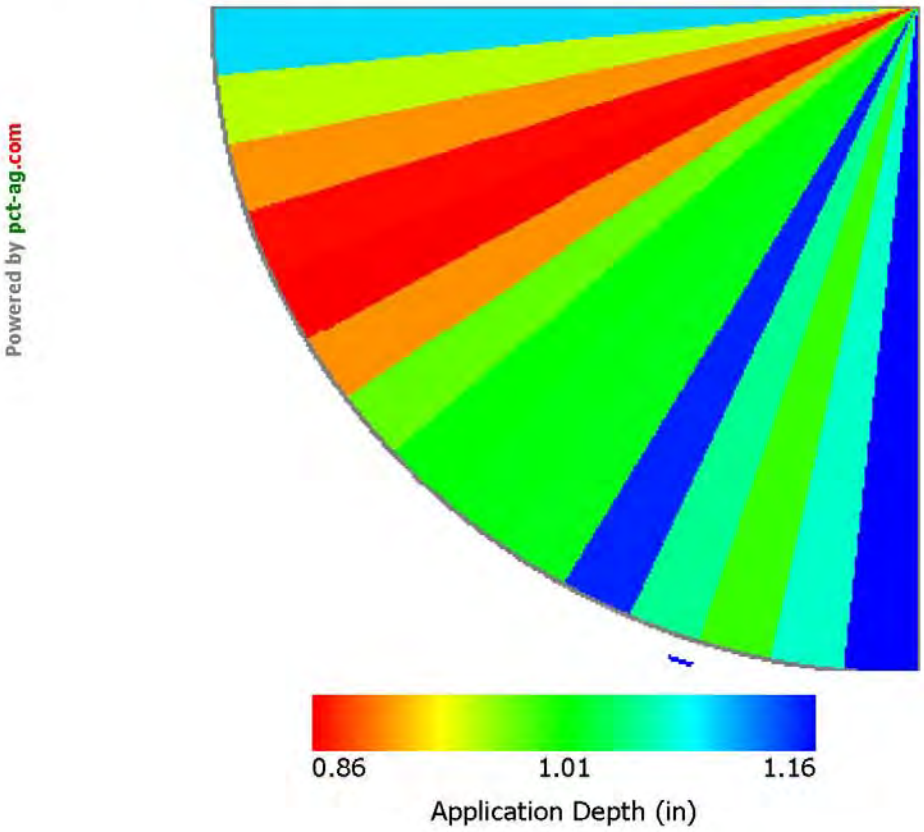


Table-Variable Rate Irrigation by Six Degree Sectors for Krienke 200-12 Field

Virtual Agronomist
Base Management Program

Grower Danny Krienke
Farm Krienke Farms
Field 47 11

Pivot VRI by Sector Report

Start Angle	Stop Angle	Area (ac)	Application (in)	Speed (%)
180	186	4.12	1.16	6.05
186	192	4.10	1.07	6.56
192	198	4.10	0.99	7.06
198	204	4.10	1.05	6.66
204	210	4.10	1.15	6.10
210	216	4.10	1.01	6.90
216	222	4.10	1.01	6.92
222	228	4.10	1.01	6.94
228	234	4.10	0.98	7.14
234	240	4.10	0.90	7.76
240	246	4.10	0.86	8.15
246	252	4.10	0.86	8.13
252	258	4.10	0.90	7.76
258	264	4.10	0.95	7.34
264	270	4.01	1.09	6.40

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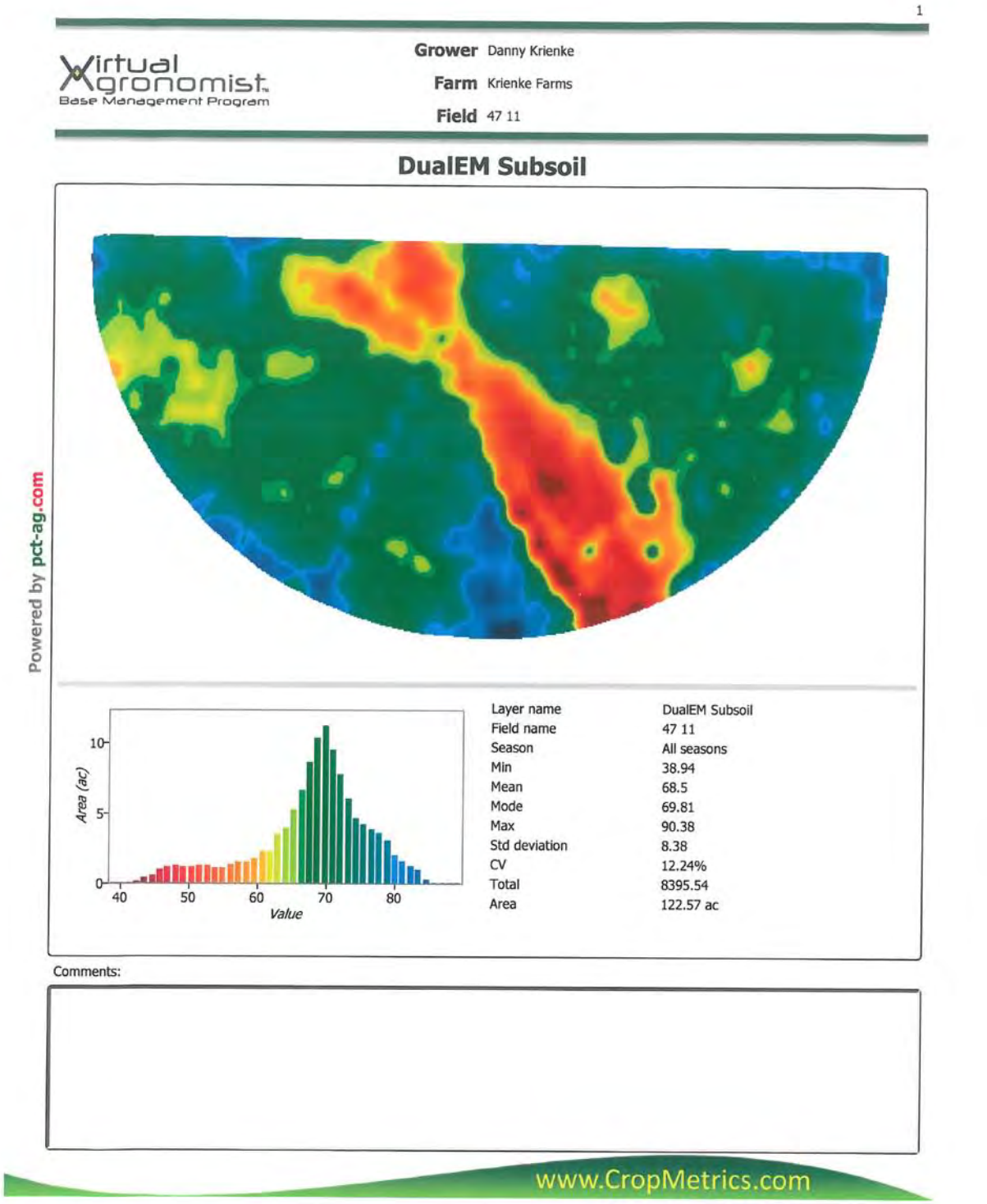
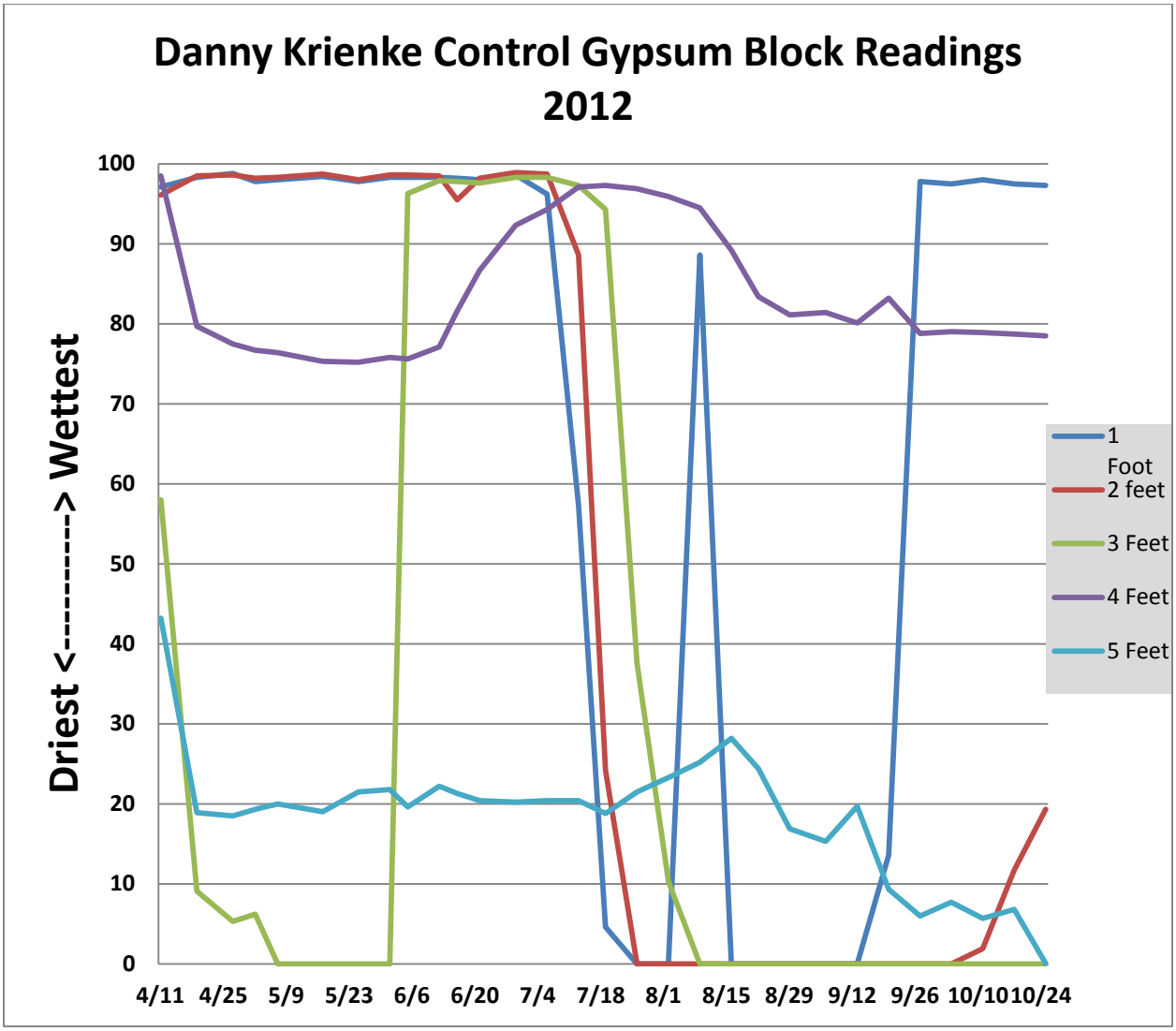
Map-Dual Em Subsoil Map for Krienke 200-12 and Control Field's



Graph – Gypsum Block Readings for Danny Krienke Control



Graph – Growing Season Water Tracking for Danny Krienke Control

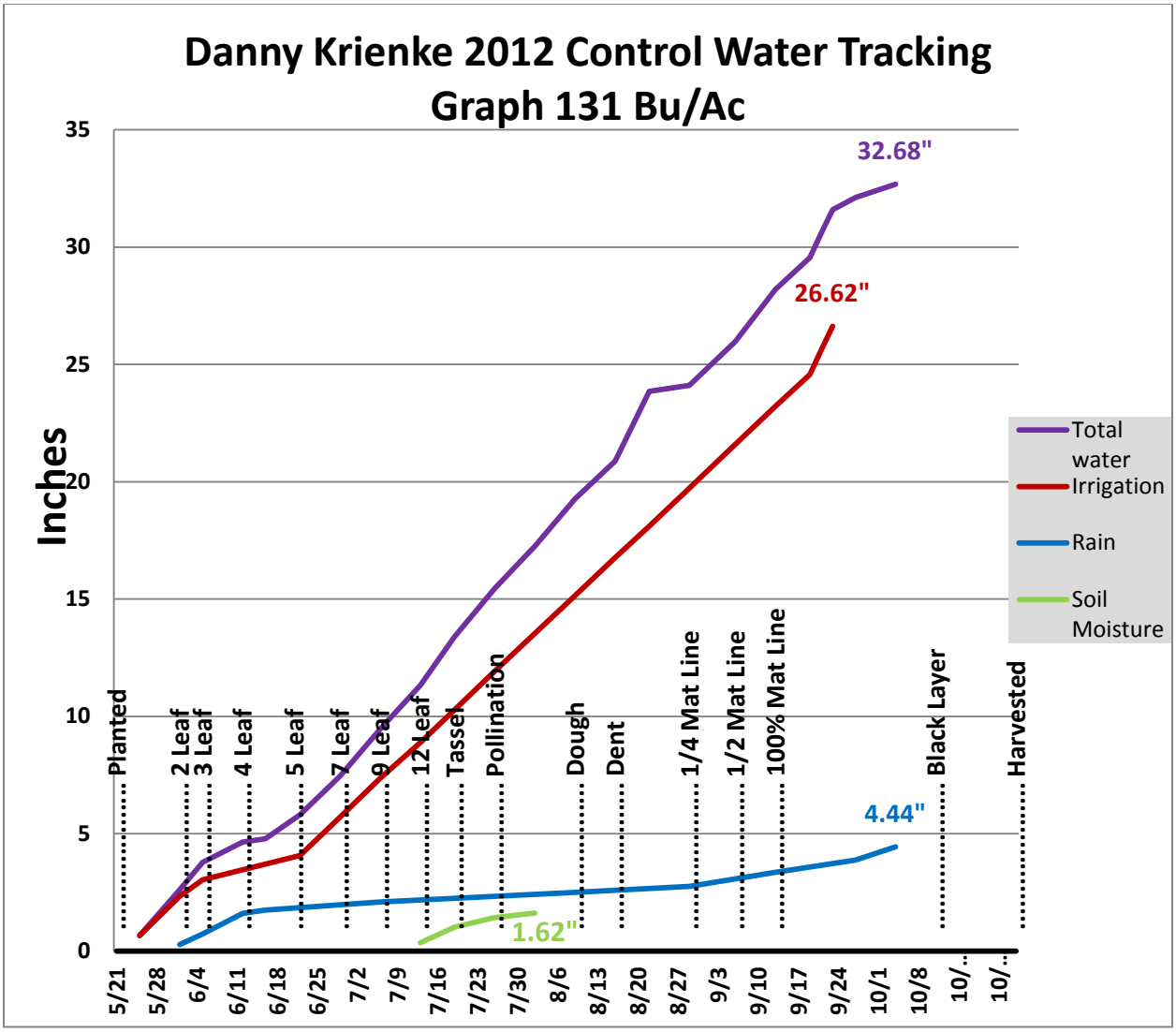


Table- Demonstration Field Data Danny Krienke's Control

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
4/11					97.1	96.1	58.0	98.5	43.2			
4/19	0.75		199249		98.3	98.5	9.1	79.7	18.9	Wheat	Y	
4/27	0.48		203122		98.8	98.6	5.3	77.5	18.5	Wheat	60 Y	
5/2	0.33		207090		97.8	98.2	6.2	76.7	19.3	Wheat	0 Y	
5/7			211008		98.0	98.3	0	76.4	20.0	Wheat	315 Y	
5/17			218876		98.4	98.7	0	75.3	19.0	Wheat	275 Y	
5/21										Planted		
5/22			222901							Corn	90 Y cw	
5/25		0.66	225063		97.8	98.0	0	75.2	21.5	Corn	153 Y	
6/1	0.28	1.67	230505	2 leaf	98.3	98.6	0	75.8	21.8	Corn	180 Y	
6/5	0.45	0.71	232808	3 leaf	98.3	98.6	96.3	75.6	19.6	Stop	201 N	
6/12	0.87		232808	4 leaf	98.3	98.5	97.9	77.1	22.2	Stop	201 N	
6/16	0.14		232808	4 leaf	98.2	95.5	97.8	81.6	21.3	Stop	201 N	
6/21			235193	5 leaf	98.0	98.2	97.6	86.7	20.4	Control	135 Y	551
6/22		1.03	236174							Control	90 Y rev	
6/29		1.64	241513	7 leaf	98.6	98.9	98.3	92.3	20.2	Control	150 Y	524
7/6	0.35	1.66	246928	9 leaf	96.2	98.7	98.3	94.3	20.4	200-12	232 Y ccw	546
7/13		1.52	251885	12 leaf	57.3	88.6	97.3	97.1	20.4	200-12	221 Y cw	566
7/19		1.39	256431	Tassel	4.6	24.2	94.3	97.3	18.8	Control	97 Y cw	497
7/26		1.65	261825	Pollination	0	0	37.6	96.9	21.5	Control	168 Y ccw	525
8/2		1.61	267071	Blister	0	0	10.3	95.9	23.3	200-12	252 Y ccw	532
8/9	0.41	1.61	272309	Dough	88.6	0	0	94.5	25.2	Control	216 Y cw	495
8/16		1.61	277542	Dent	0	0	0	89.2	28.2	Control	146 Y cw	530
8/22		1.35	281935	Dent	0	0	0	83.4	24.4	Control	150 Y ccw	532
8/29	0.26	1.62	287228	1/4 Mat Ln	0	0	0	81.1	16.9	200-12	222 Y cw	527
9/6		1.86	293309	1/2 Mat Ln	0	0	0	81.4	15.3	200-12	255 Y	528
9/13	0.60	1.63	298636	1.0 Mat Ln	0	0	0	80.1	19.7	200-12	213 Y	531
9/19		1.35	303043							Control	90 Y rev	
9/20			303925	1.0 Mat Ln	13.6	0	0	83.2	9.3	Control	138 Y cw	500
9/21		1.05	304753							Split	180	

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
9/23		1.00	306378							Control	90 Y rev	
9/23			306378							Stop	93 N	
9/27	0.52		306378	1.0mat ln	97.8	0	0	78.8	6.0	Control	122 N	
10/4	0.56		306378	1.0mat ln	97.5	0	0	79.0	7.7		122 N	
10/11			306378	blk layer	98.0	1.9	0	78.9	5.7		122 N	
10/18			306378	blk layer	97.5	11.7	0	78.7	6.8		122 N	
10/25			306376	harvest	97.3	19.3	0	78.5	0.08		90 N	
Total	4.44	26.62			0	1.62	0	0	0			
Net Soil Water is 1.62"												
Irrigation, rainfall plus Net Soil Water is 32.68 inches												

- Numbers in red are not counted in total

NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

Control

Year: *2012* **County:** *Ochiltree* **Grower:** *Danny Krienke*

No. Acres: *60* **Variety/Hyb:** *33B54* **Soil Type:** *Sherm Clay Loam*

Meter Type: *McCrometer*

Meter Mult: *Gallons X 1000* **Tillage:** *Strip Till*

Fertilizer: *125-25-0* **Seeding:** *27,000*

Planted: *May 21, 2012* **Harvest:** *October 25, 2012*

Herbicide: *Cinch ATZ, Round Up* **Insecticide:** *None*

Yield: *131 Bu/Acre* **Prev. crop:** *Wheat* **Row width:** *30"*

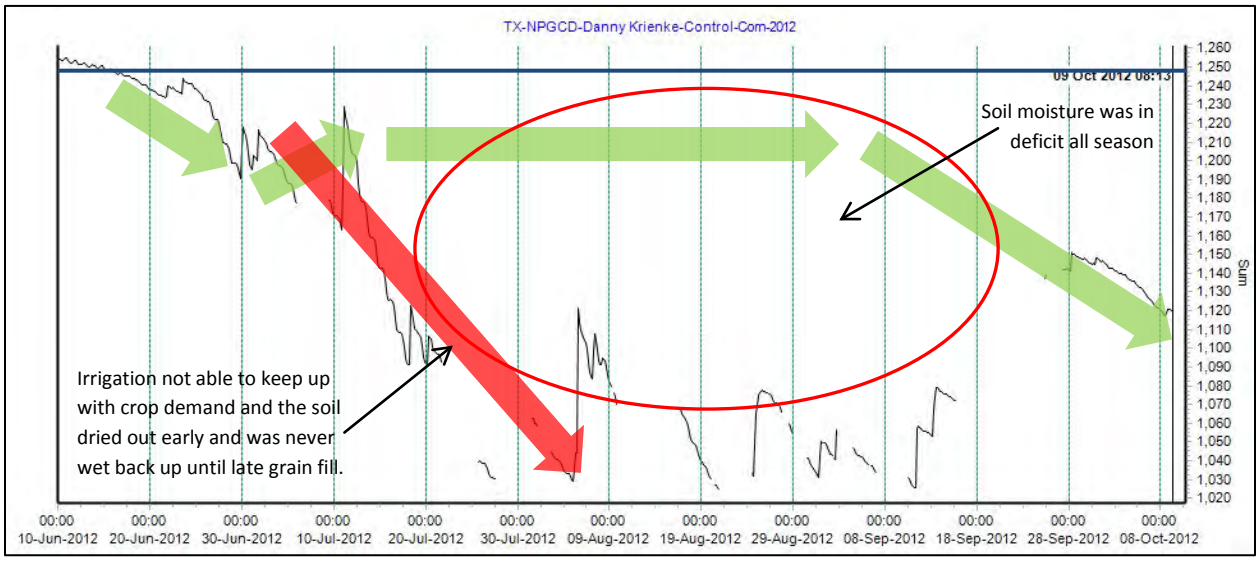
Irrigation method: *Center Pivot* **Prewater:** *None* **Well GPM:** *525*

Distance between drops: *60"* **Distance from nozzle to ground:** *16"*

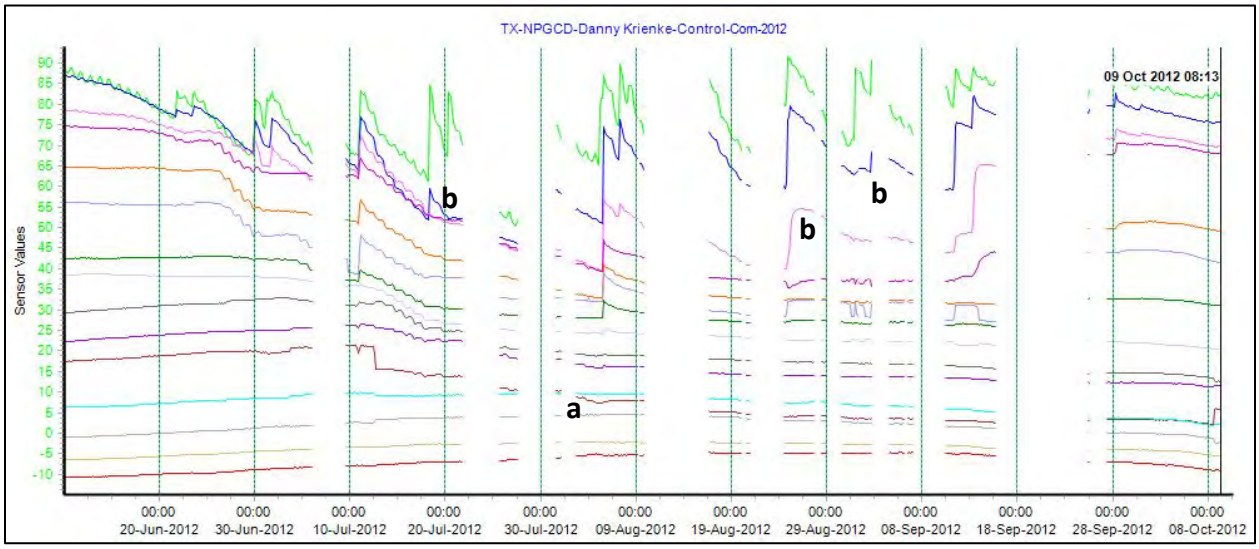
Application pattern: *Spray* **Crop row direction :** *Straight*

Elevation: *2940 Feet* **GPS Location:** Latitude: *36.400173* - Longitude: *100.854732*

Danny Krienke: AquaSpy Control Site (131 bu/ac; 26.6" irrigation)



Indications were that this side of the pivot did not have as much deep stored soil moisture as the 200/12 side of the pivot and the active roots were therefore not quite as deep. Irrigation was not able to keep up with crop demand and the lower initial stored soil moisture was probably the difference with this site achieving lower yield than the 200/12 side, despite have 2" more water applied.



(a) Roots active to 44"

(b) Irrigation only reaching 8-12". This resulted in the sub-soil drying out and not being re-wet during most of the season. The crop ran at a severe moisture deficit.

Harvest Results - The 200-12 field produced a 134 bushel per acre corn yield. Irrigation totaled 24.57 inches. Production in the control field was 131 bushels per acre. Seasonal irrigation totaled 26.62 inches. There was no pre-season irrigation. The 200-12 field produced three more bushels per acre than the control and irrigation was 2.10 inches less. Corn production was 5.45 bushels (305lbs) per inch of irrigation in the 200-12 field compared to 4.92 (275lbs) in the control. *Production* from each inch of irrigation, rainfall and net soil water that totaled 29.56 inches was 4.53 bushels (254lbs) per acre in the 200-12 field. Irrigation, rainfall and net soil water totaled 32.68 inches in the control field where production was 4.01 bushels (224lbs) per inch. Crop production costs were $8.82 per acre less for the 200-12 field than for the control from reduced irrigation and increased harvest expenses. At $6.59 per bushel, the three bushel per acre increased corn yield in the 200-12 field amounts to $19.77 more per acre. The 200-12 field's net gain was $28.59 per acre with 2.10 inches less irrigation used compared to production from the control field. A summary of the demonstration results are shown in the following table.

Table – 2012 Demonstration Results for Krienke 200-12 & Control

Irrigation		Irrig/Rain/Soil	PRODUCTION		CROP VALUE @ $6.59/Bu		
field	Inches	Inches	Bu/Ac	Bu/Ac-In Irrigation	Per Acre	Acre-In of Irrigation	Ac-In of Irrig/Rain/Soil
200-12	24.57	*29.56	134	5.45	$883.06	$35.94	$29.87
Control	26.62	+32.68	131	4.92	$863.29	$32.43	$26.41

***Includes 0.25 inches of water removed from five feet of soil, plus rainfall, and irrigation.**
+Includes 1.62 inches of soil water removed from five feet of soil, plus rainfall and irrigation.

Variable Rate Irrigation-VRI At Krienke's 200-12 Field – Programmed variable center pivot speed control was used in Krienke's 200-12 field using a prescription written from field and soil information obtained from a preseason EM 38 soil survey. The VRI prescription was written by NPGCD personnel using Crop Metrics Virtual Agronomist software, based on a nine day revolution and 525 gpm applying 1.0 inch of irrigation. Speed of the center travel rate varies in fifteen six degree increments to apply different amounts of irrigation as selected in writing the prescription. The prescription is written to apply more irrigation on what the EM 38 survey showed to be the most productive soil in the 200-12 portion of the circle. Actual irrigation varied from 0.86 inches to 1.16 inches in selected areas of the field. A map of the prescription follows. Center pivot variable speed control was accomplished by Pivotrac using the VRI prescription. VRI was initiated in July, which was late. Krienke's 200-12 field is one of three VRI demonstrations conducted by NPGCD during the 2012 growing season to learn the VRI process.

Phil Haaland-Hartley County Demonstration, 2012

Planting and Crop Information - For his demonstration, Phil Haaland strip tilled and planted 15 acres of corn in the northwest quarter of the 120 acre circle located in the northeast quarter of section 44, for his "200-12" field, "Haaland 200-12". Haaland planted the 15 acres with Pioneer 1151HR at a seeding rate of 26,000 seed/acre. He planted the remaining 105 acres of the circle, also strip tilled, to P1151HR at 30,000 seeds/acre for his "control" field, "Haaland Control". Both the 200-12 15 acre field and 105 acre control field were irrigated by the same center pivot. Seasonal water meter readings averaged 475 gpm and delivered an average of 1.35 inches of irrigation in a normal 6.5 day revolution. Planting and crop information for "Haaland 200-12" and "Haaland Control" are shown in the table below. Each is the same unless specified.

Table – Planting and Crop Information for Phil Haaland

200-12		*Control*	
Planted:	May 24	**Fertilizer:**	220-70-0
Hybrid:	Pioneer 1151HR	**Herbicide:**	Balance, Atrazine, Banvel, round-up
Seeding Rate:	26,000	**Seeding Rate**:	30,000
Soil Type:	Sherm Clay Loam	**Soil Type:**	Gruver Loam
Row Width:	30 Inches	**Insecticide:**	Comite
No. Acres:	200-12 15	**No. Acres:**	105
GPM Per Acre:	4.0	**Harvested**:	October 23
Irrig/Rain/SoilWater:	29.49"	**Irrig/Rain/SoilWater:**	33.10"
Tillage:	strip till	**Tillage:**	strip till

Beginning Soil Water Profile and Growing Season Rainfall

"200-12": Preseason irrigation totaled 3.33 inches in March prior to the gypsum blocks being installed. Weekly readings following planting show soil water was good at 1, 2, 3, 4, and 5 feet. Gypsum block soil moisture sensors show good soil water levels at all sensing depths until mid-July when the crop used all water from 1 and 2 feet plus irrigation and rainfall. The crop then used water stored at 3 and 4 feet in the soil profile. For the demonstration, Phil chose to periodically skip irrigations on the 200-12 15 acres. Irrigations were skipped on June 30 and July 11 creating plant stress. Additional irrigations were not applied on July 24. Not applying the irrigation on July 25 when the extreme heat followed creating high plant water use limited corn yield more than anticipated. However, reduced irrigation with promising corn hybrids, planting dates and other management strategies is the purpose of the NPGCD's 200-12 project. Sherm clay loam soil holds approximately 2.0 inches of available water per foot for potential crop use. Weekly gypsum block readings and the John Deere Water soil probe show limited to inadequate available soil water levels at 1, 2 and 3 feet, beginning in mid-July during pollination. The gypsum blocks were installed on June 15 in Sherm clay loam soil.

"Control": Soil water was good at 1, 2, 3, 4 and 5 feet in the profile after the gypsum blocks were installed on March 28. Weekly gypsum block readings generally show adequate soil water during the growing season. Plant water use exceeded irrigation and rainfall in late July and early August when the profile was partially depleted at 1 and 2 feet and later at 3 and 4 feet. Gypsum blocks were installed in Gruver loam that holds about 2.0 inches of available water per foot.

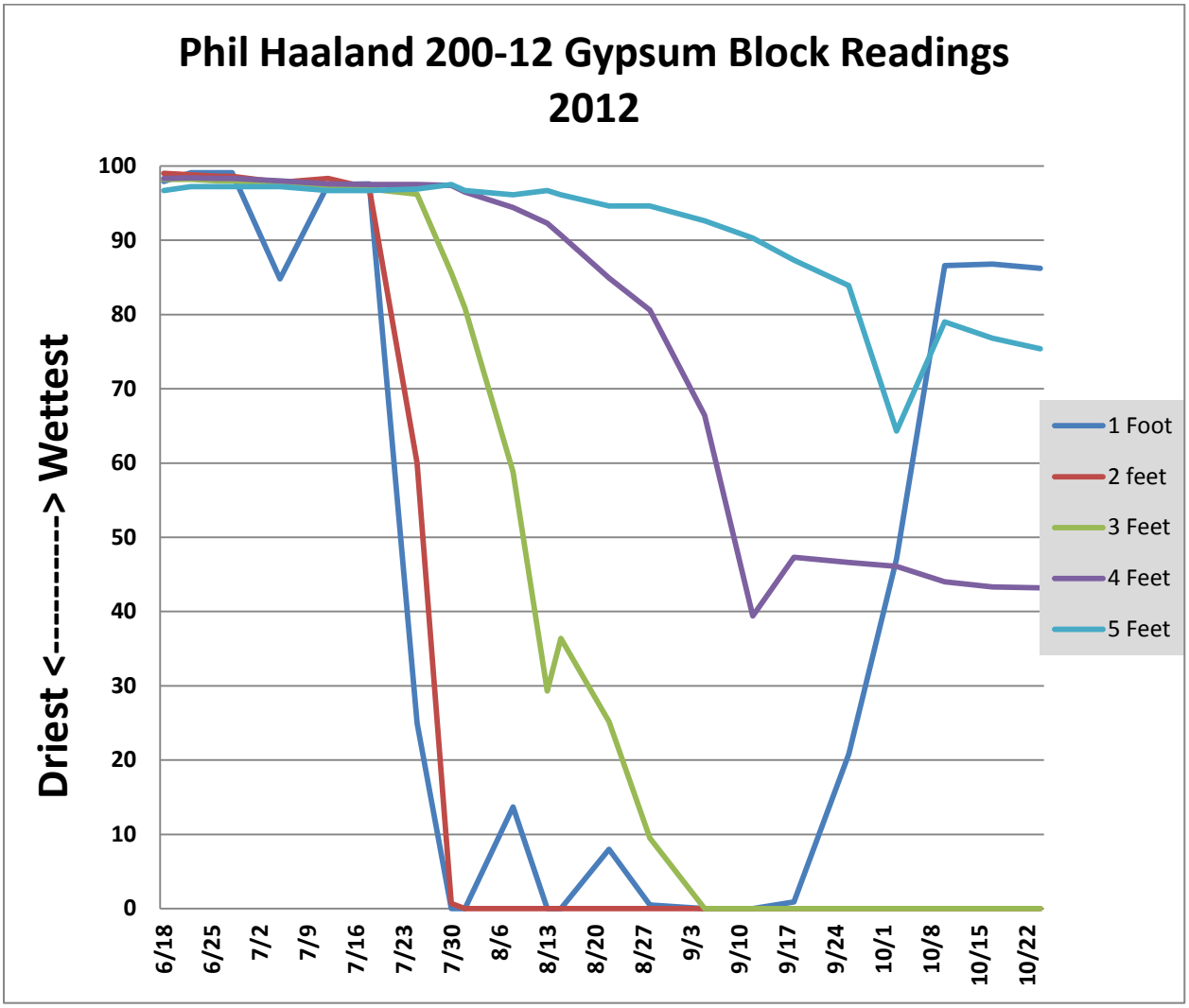
Both: Seasonal rainfall following planting until harvest totaled 5.02 inches. The following table shows monthly rainfall as recorded by a district rain gauge located at the edge of the field.

Table – Monthly Rainfall Data for Haaland "200-12" & "Control"

May- .10" June- 1.02" July- 1.94" August- 1.35" Sept- .61" Total: 5.02"

Growing Season Water Tracking – The district tracked crop total water throughout the growing season using rain gauges, water meters and both gypsum block and John Deere Water soil moisture sensors. A set of five gypsum block soil moisture sensors was installed at 1, 2, 3, 4 and 5 feet and a John Deere Water soil moisture probe was installed down to five feet in the root zone at one location to monitor soil water levels in the 200-12 field. Another set of the same type of sensors were installed in the Control field. Both sensors were installed in close proximity to each other in the field. Gypsum blocks were installed in the control field prior to planting. Gypsum blocks were installed in the 200-12 field and the John Deere Water probe in each field following crop emergence. Following this paragraph, a series of graphs and tables shows weekly gypsum block readings for the season; growing season water, including rainfall, irrigation, and soil moisture at various growth stages; and the order of irrigation and rainfall events for each field. Finally a form describes the protocols for each field. "Total Water," as shown on the graph for growing season water, is the sum of seasonal irrigation, rainfall and net soil water. Graphs and tables for the 200-12 field are shown first, followed by the illustrations for the Control field.

Graph – Gypsum Block Readings for Phil Haaland's 200-12



Graph – Growing Season Water Tracking for Phil Haaland's 200-12

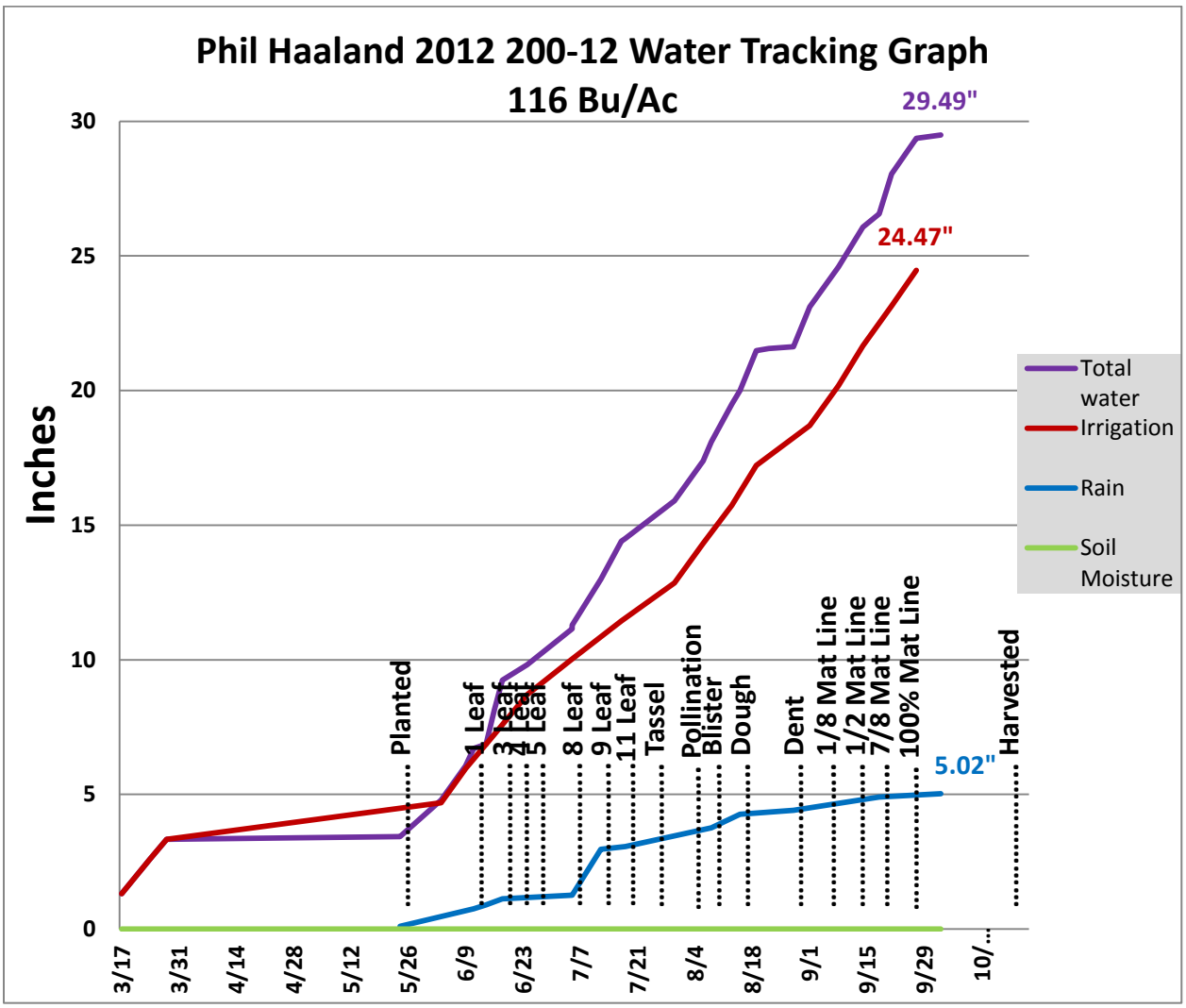


Table- Demonstration Field Data Phil Haaland's 200-12

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
3/17		1.31	Pivotrac							prewtr		
3/24		1.30	Pivotrac							prewtr	4 N	
3/28		0.72	Pivotrac							prewtr	4N	
5/4	0.33		no meter								4 N	
5/8	0.04		no meter								0 N	
5/16	0.16										0 N	
5/24	0.10									Planted		
6/3		1.36	Pivotrac									443
6/9		1.27	Pivotrac									
6/11	0.65		14.60	1 leaf								425
6/14	0.15		21.24	1 leaf								512
6/15												
6/16		1.26	Pivotrac									
6/18	0.22		25.23	3 leaf	97.9	99.0	98.2	98.3	96.7		161 N	
6/22			27.83	4 leaf	99.1	98.8	98.2	98.4	97.2	control	18 Y	517
6/24		1.48	Pivotrac							200-12		475
6/26			40.54	5 leaf	99.1	98.6	98.0	98.3	97.2	control	60 Y	484
6/28			40.54	5 leaf	99.1	98.6	98.0	98.3	97.2	control	60 Y	484
7/5		1.33	Pivotrac							200-12		
7/5	0.14		53.09	8 leaf	84.8	97.8	97.4	98	97.2	200-12	288 Y cw	493
7/11			Pivotrac							200-12		
7/12	1.70		70.78	9 leaf	97.5	98.3	97.2	97.6	96.7	control	18 Y cw	490
7/17		1.41								200-12		500
7/18	0.10		83.22	11 leaf	97.6	97.0	96.9	97.5	96.7	control	340 Y cw	487
7/25			97.91	tassel	25.0	60.0	96.2	97.5	96.9	control	42 Y cw	449
7/30			108.21	silk	0	0.70	85.6	97.4	97.5	control	318 Y cw	453
7/30		1.41	Pivotrac							200-12		
8/1			112.12	pollin	0	0	80.9	96.5	96.7	control	58 Y cw	401
8/6		1.48	Pivotrac							200-12		
8/8	0.70		127.00	blister	13.7	0	58.8	94.4	96.1	control	67 Y cw	484
8/13		1.41	Pivotrac	blister	0	0	29.3	92.3	96.7	control	340 Y cw	
8/15	0.50		139.50	dough	0	0	36.4	90.7	96.1	control	82 Y cw	439

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
8/19		1.48	Pivotrac							200-12		
8/22	0.08		153.56	dough	8.0	0	25.2	84.9	94.6	control	97 Y cw	481
8/28	0.07		166.08	dent	0.5	0	9.5	80.6	94.6	control	105 Y cw	472
9/1		1.48	Pivotrac							200-12		
9/5			181.38	1/8mat ln	0	0	0	66.4	92.6	control	172 Y cw	469
9/8		1.48	Pivotrac							200-12		
9/12			195.52	1/2mat ln	0	0	0	39.4	90.3	control	183 Y cw	469
9/14		1.48	Pivotrac							200-12		
9/18	0.49		206.42	7/8mat ln	0.90	0	0	47.3	87.3	control	139 Y	444
9/21		1.48	Pivotrac							200-12		
9/26			222.09	1.0mat ln	20.8	0	0	46.6	83.9	control	204 Y cw	438
9/27		1.33	Pivotrac							200-12		
10/3	0.12		225.89	1.0mat ln	47.1	0	0	46.1	64.3	stop	300 N	
10/10			225.89	blk layer	86.6	0	0	44.0	79.0	stop	300 N	
10/17			225.89	blk layer	86.8	0	0	43.3	76.8	stop	300 N	
10/24			225.89	harvest	86.2	0	0	43.2	75.4	stop	N	
	5.02	24.47			0	0	0	0	0			
Irrigation, Rain, Net Soil Water is 29.49 inches												

- Numbers in red are not counted in total

NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

200-12

Year: *2012* **County:** *Hartley* **Grower:** *Phil Haaland*

No. Acres: *15* **Variety/Hyb:** *P1151HR* **Soil Type:** *Sherm Clay Loam*

Meter Type: *Seametrics*

Meter Mult: *Ac Ft x 1* **Tillage:** *Strip Till*

Fertilizer: *220-70-0* **Seeding:** *26,000*

Planted: *May 24, 2012* **Harvest:** *October 23, 2012*

Herbicide: *balance, atrazine, banvel, round-up* **Insecticide:** *Comite*

Yield: *116 Bu/Acre* **Prev. crop:** **Row width:** *30 Inch*

Irrigation method: *Center Pivot* **Prewater:** *Yes* **Well GPM:** *475*

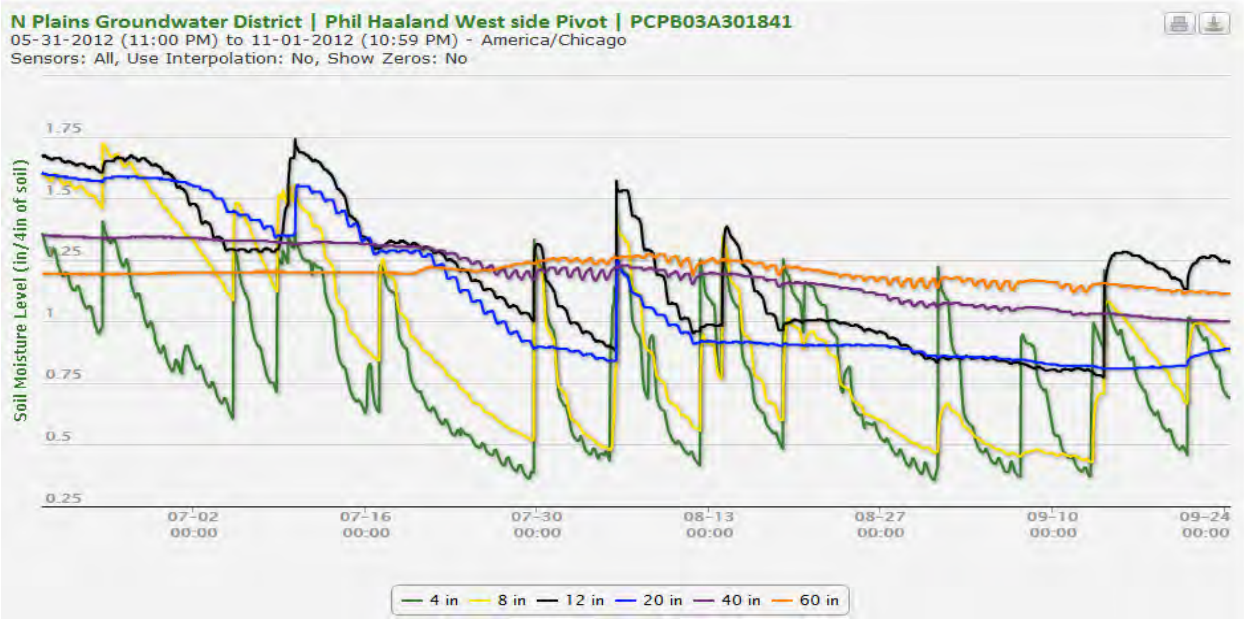
Distance between drops: *60”* **Distance from nozzle to ground:** *16”*

Application pattern: *Spray* **Crop row direction :** *Straight*

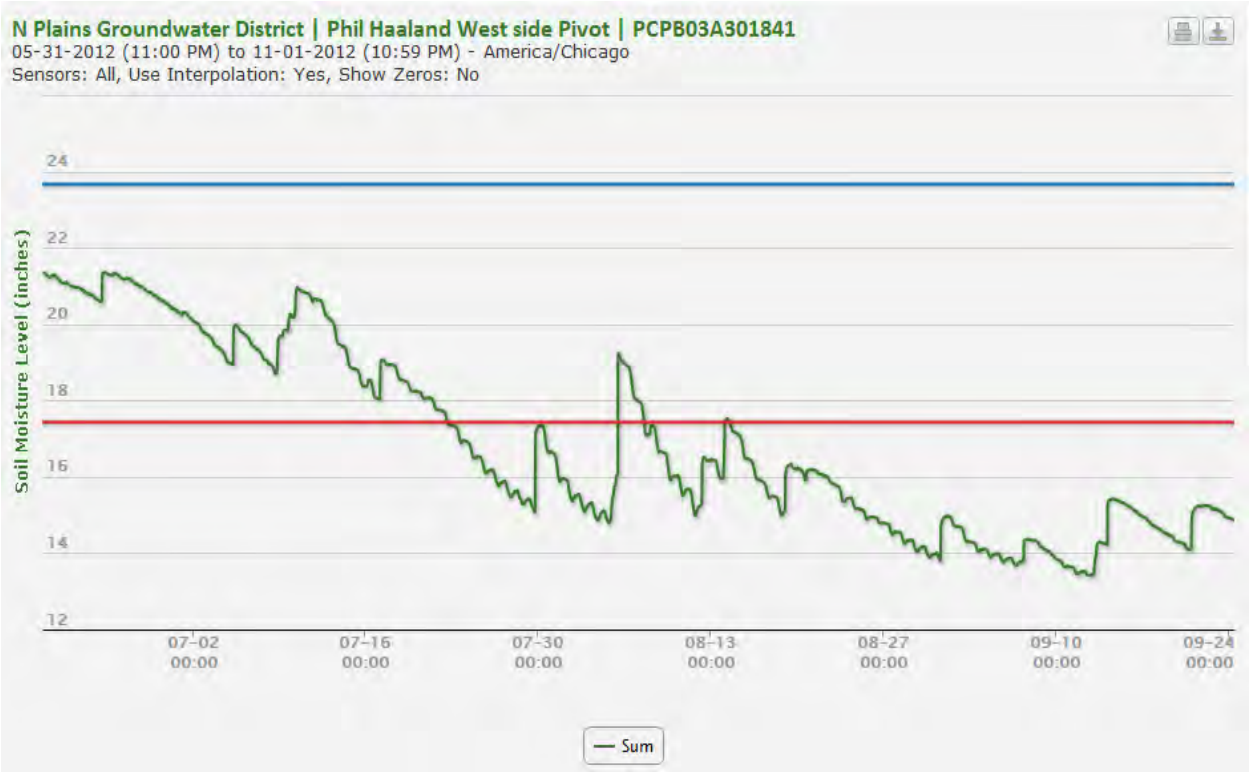
GPS Location: Latitude: *36.047075*
Longitude: *-102.424868*

John Deere Water Report for Phil Haaland 200-12 Field

200-12 Field Separate Graph



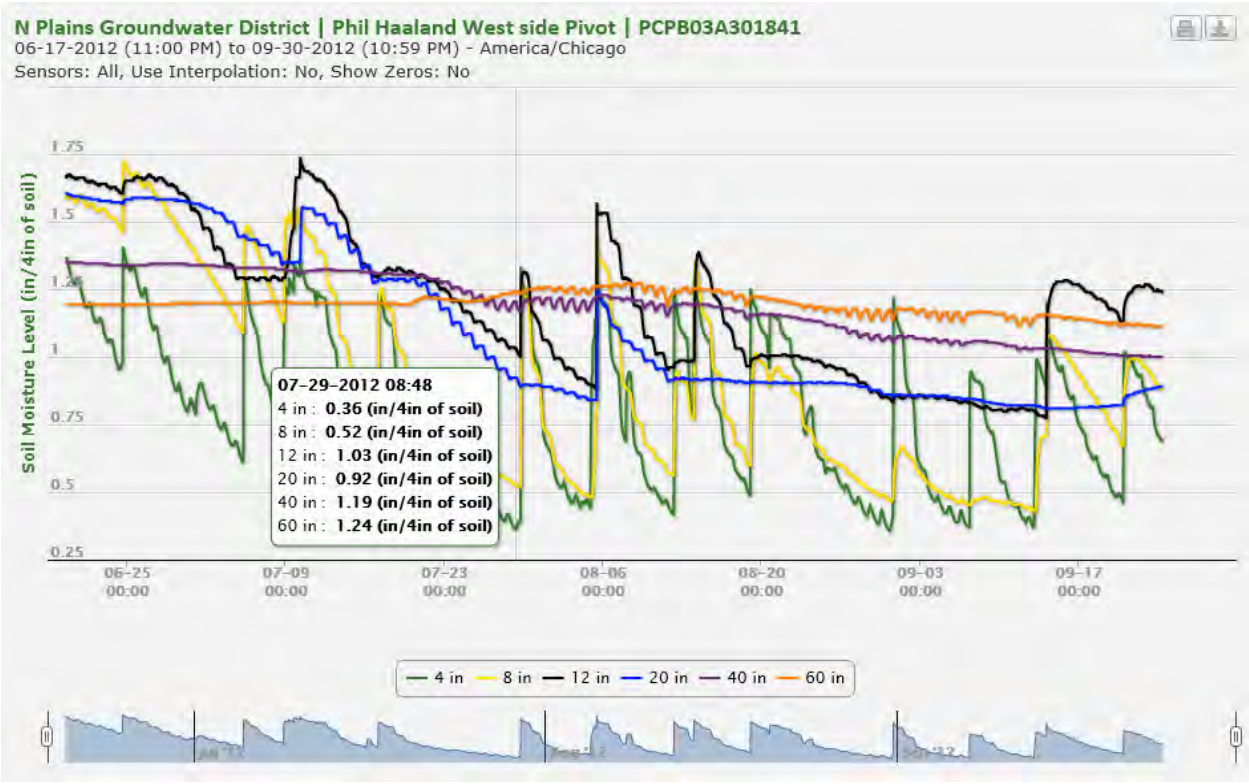
200-12 Field Summary Graph



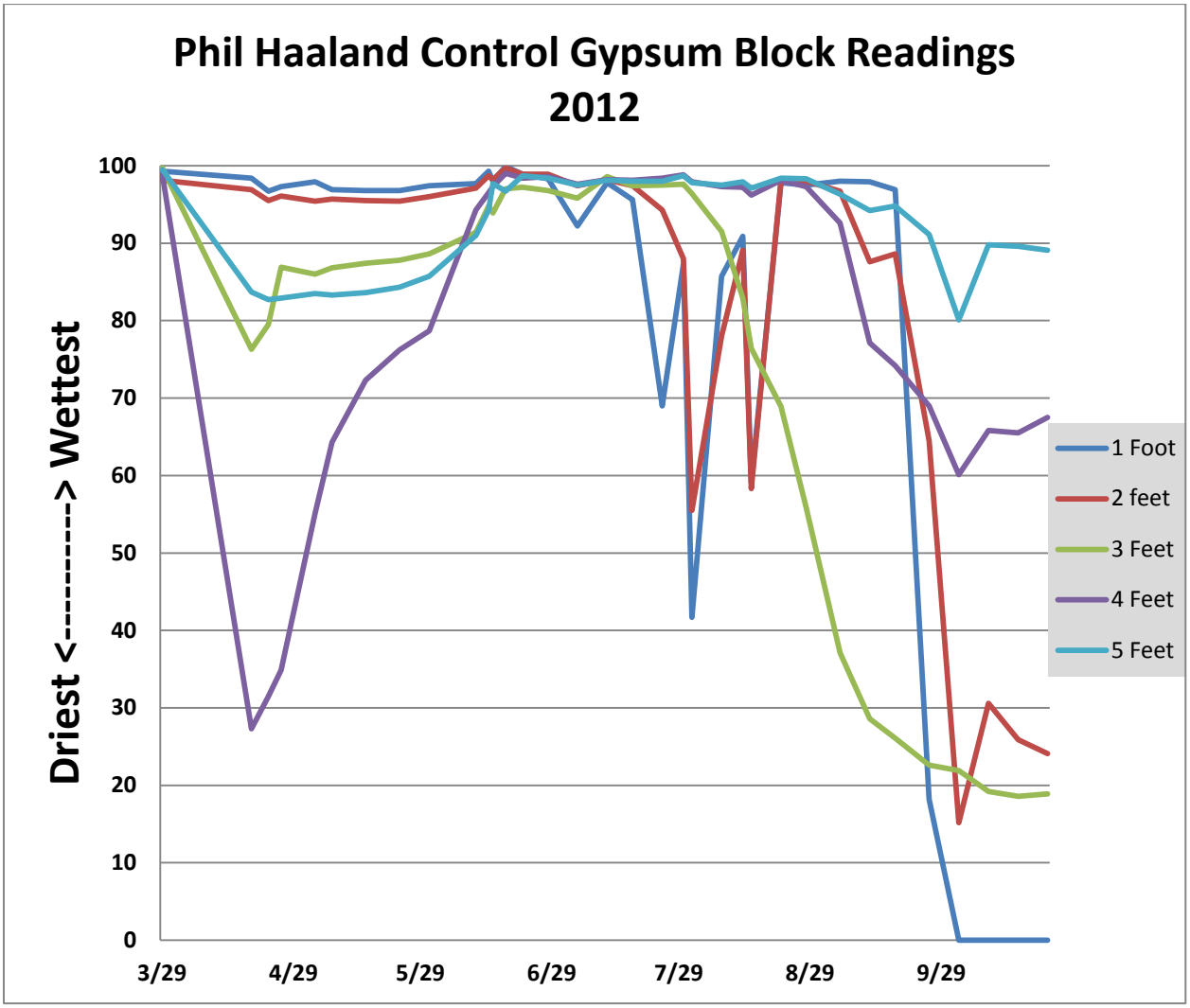
Haaland 200-12: Pivot shows root activity to the 20” level, no significant stepping is seen at the 40” and 60” levels. Irrigation patterns show 6 and 12 day periods between applications. Refill depths vary from 8 to 20 inch depths. Stress is indicated in the sum graph from end of July to September when reduced water uptake is seen in the daily stepping 5 times.

Graph-Soil Water Sum on July 29 by John Deere Water Probe for Haaland 200-12 Field

Graph-Soil Water by Sensor Depth on July 29 by JDW Probe for Haaland 200-12 Field



Graph – Gypsum Block Readings for Phil Haaland's Control



Graph – Growing Season Water Tracking for Phil Haaland's Control

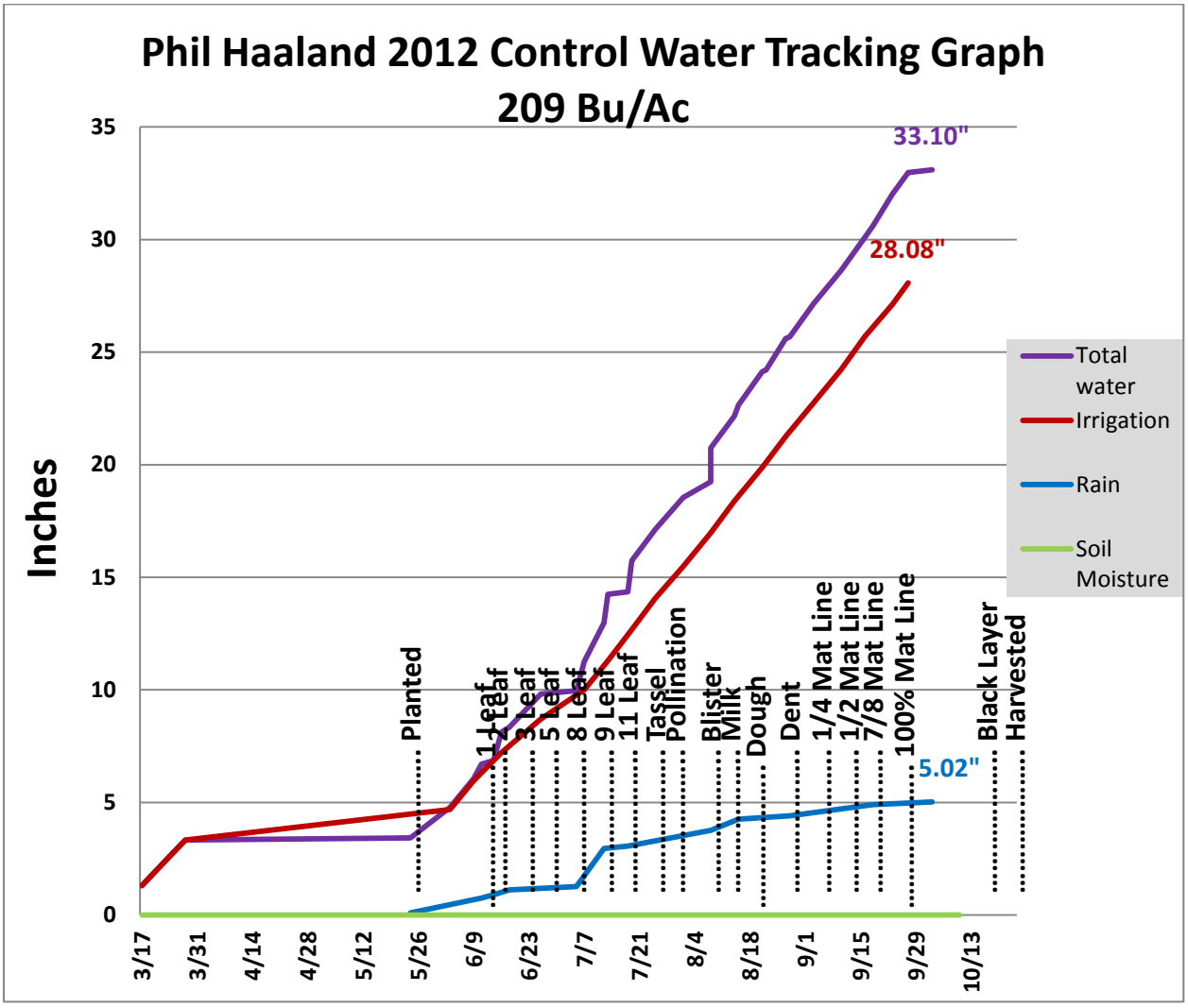


Table- Demonstration Field Data Phil Haaland's Control

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
3/17		1.31	Pivotrac							Prewater		
3/24		1.30	Pivotrac							Prewater		
3/28		0.72	No Meter							Prewater	4 N	
3/29			No Meter		99.3	98.1	99.7	98.8	99.5		4 N	
4/19					98.4	96.9	76.3	27.3	83.7		4 N	
4/23					96.7	95.5	79.5	31.5	82.7		4 N	
4/26					97.3	96.1	86.9	34.9	82.9		0 N	
5/4	0.33				97.9	95.4	86.0	55.1	83.5		0 N	
5/8	0.04				96.9	95.7	86.8	64.3	83.3		4 N	
5/16	0.16		No Meter		96.8	95.5	87.4	72.3	83.6		0 N	
5/24	0.10		No Meter		96.8	95.4	87.8	76.2	84.3	Planted	15 Y	
5/31			No Meter		97.4	96.0	88.6	78.7	85.7		315 Y	443
6/3		1.36	Pivotrac									
6/9		1.27	Pivotrac									
6/11	0.65		14.6	1 leaf	97.7	97.1	91.4	94.3	91.0		240 Y	425
6/14	0.15		21.24	1 leaf	99.3	98.7	94.8	96.5	94.3		47 Y	512
6/15				2 leaf	98.0	98.2	93.9	97.3	97.7		100 Y	
6/16		1.26	Pivotrac							Control		
6/18	0.22		25.23	2 leaf	99.9	99.7	97.0	99.0	96.7		161 N	
6/22			27.83	3 leaf	98.9	98.9	97.2	98.4	98.7	Control	18 Y	517
6/26		1.48	Pivotrac							Control		
6/28			40.54	5 leaf	98.3	98.9	96.8	98.6	98.4	Control	60 Y	484
7/5	0.14		53.09	8 leaf	92.2	97.4	95.8	97.6	97.5	200-12	288 Y cw	493
7/7		1.31	Pivotrac							Control		
7/12	1.70		70.78	9 leaf	97.8	98.2	98.6	98.2	98.1	Control	18 Y cw	490
7/13		1.28	Pivotrac							Control		
7/18	0.10		83.22	11 leaf	95.6	97.4	97.4	98.1	98.0	Control	340 Y cw	487
7/19		1.39	Pivotrac							Control		
7/25			97.91	Tassel	69.0	94.3	97.5	98.4	98.0	Control	42 Y cw	449
7/25		1.39	Pivotrac							Control		
7/30			108.21	Pollination	87.3	88.0	97.6	98.8	98.7	Control	318 Y cw	453
8/1			112.12	Pollination	41.7	55.5	96.4	97.9	97.8	Control	56 Y cw	401

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
8/1		1.41	Pivotrac							Control		
8/8	0.7		127.00	Blister	85.7	78.0	91.5	97.3	97.5	Control	67 Y cw	484
8/8		1.50	Pivotrac							Control		
8/13				Milk	90.9	89.1	82.9	97.2	97.9	Control	340 Y cw	
8/14		1.41	Pivotrac							Control		
8/15	0.50		139.50	Dough	59.1	58.3	76.4	96.2	97.1	Control	58 Y cw	439
8/21		1.48	Pivotrac							Control		
8/22	0.08		153.56	Dough	97.8	98.1	68.9	98.1	98.4	Control	97 Y cw	481
8/27		1.39	Pivotrac							Control		
8/28	0.07		166.08	Dent	97.5	98.0	55.9	97.3	98.3	Control	105 Y cw	472
9/3		1.48	Pivotrac							Control		
9/5			181.38	1/4 Mat Ln	98.0	96.7	37.1	92.6	96.3	Control	172 Y cw	469
9/10		1.48	Pivotrac							Control		
9/12			195.52	1/2 Mat Ln	97.9	87.6	28.6	77.1	94.2	Control	183 Y cw	469
9/16		1.48	Pivotrac							Control		
9/18	0.49		206.42	7/8 Mat Ln	96.9	88.6	26.1	74.2	94.8	Control	139 Y cw	444
9/23		1.42	Pivotrac							Control		
9/26			222.09	1.0 Mat Ln	18.2	64.5	22.6	69.0	91.1	Control	204 Y cw	438
9/27		0.96	Pivotrac							Control		
10/3	0.12		225.89	1.0 Mat Ln	0	15.2	21.9	60.1	80.1	Stop	300 N	
10/10			225.89	1.0 Mat Ln	0	30.6	19.2	65.8	89.8	Stop	300 N	
10/17			225.89	Blk Layer	0	25.9	18.6	65.5	89.6	Stop	300 N	
10/24			225.89	Harvest	0	24.1	18.9	67.5	89.1	Stop	N	
Total	5.02	28.08			0	0	0	0	0			
Irrigation, Rain, Net Soil Water is 33.10”												

- Numbers in red are not counted in total

NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

Control

Year: *2012* **County:** *Hartley* **Grower:** *Phil Haaland*

No. Acres: *105* **Variety/Hyb:** *P1151HR* **Soil Type:** *Gruver Loam*

Meter Type: *Seametrics*

Meter Mult: *Ac Ft x 1* **Tillage:** *Strip Till*

Fertilizer: *220-70-0* **Seeding:** *30,000*

Planted: *May 24, 2012* **Harvest:** *October 23, 2012*

Herbicide: *Balance, Atrazine, Banvel, Round-up* **Insecticide:** Comite

Yield: *209 Bu/Acre* **Prev. crop:** **Row width:** *30 inch*

Irrigation method: *Center Pivot* **Prewater:** *Yes* **Well GPM:** *475*

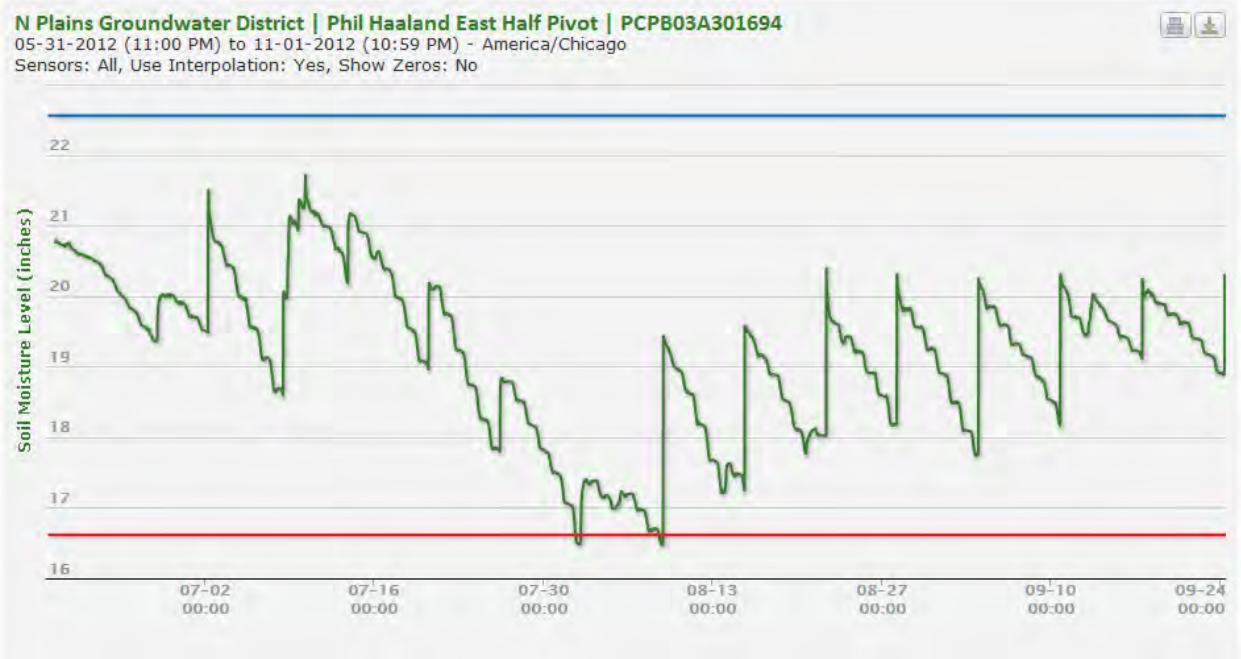
Distance between drops: *60”* **Distance from nozzle to ground:** *16”*

Application pattern: *Spray* **Crop row direction :** *Straight*

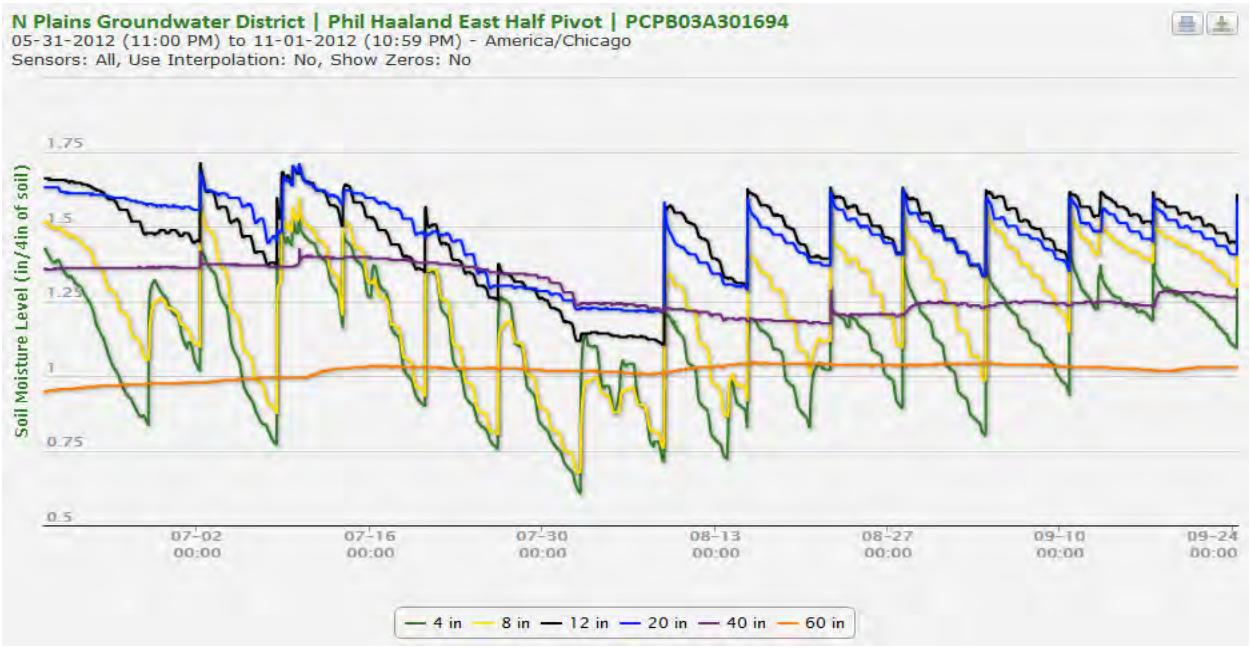
GPS Location: Latitude: *36.047075*
Longitude: *-102.424868*

John Deere Water Report for Phil Haaland Control Field

Control Field Summary Graph



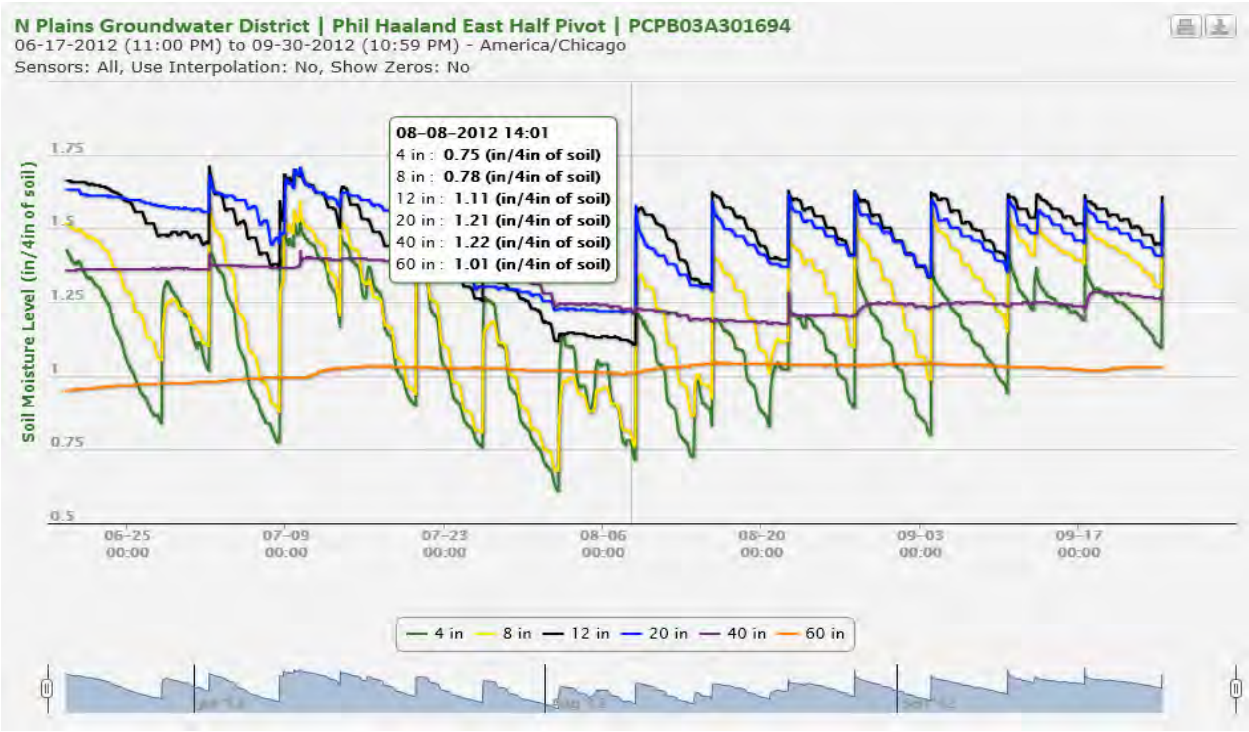
Control Field Separate Graph



Season Review: Haaland Control shows root activity down to 40” level with stepping shown towards end of July. No root activity is seen at 60” depth. Sprinkler was making approximately 6 day revolutions with refill seen down to the 20” level. No significant water movement is seen below 20”.

Graph- Soil Water Sum August 2 2012 by John Deere Water Probe for Haaland Control Field

Graph-Separate Soil Water by sensor Depth on August 8 2012 by John Deere Water Probe for Haaland Control Field



Harvest Results - The 200-12 field produced a 116 bushel per acre corn yield. Irrigation totaled 24.47 inches. Production in the control field was 209 bushels per acre. Seasonal irrigation totaled 28.08 inches. Pre-season irrigation was 3.33 inches in both fields and is included in the total irrigation listed above. In comparison, the 200-12 field produced 93 less bushels per acre than the control and irrigation was 3.61 inches less. Corn production was 4.74 bushels (265lbs) per inch of irrigation in the 200-12 field compared to 7.44 (417lbs) in the control. Production from each inch of irrigation, rainfall and net soil water that totaled 29.49 inches was 3.93 bushels (220lbs) per acre in the 200-12 field. Irrigation, rainfall and net soil water totaled 33.10 inches in the control field where production was 6.31 bushels (353lbs) per inch. Crop production costs were $58.55 per acre less for the 200-12 field than for the control from reduced seed, irrigation and harvest expenses. At $6.59 per bushel, the reduced corn yield in the 200-12 field amounts to $612.87 less per acre. The 200-12 field's net loss was $554.32 per acre with 3.61 inches less irrigation used compared to production from the control field. Haaland says the 2012 growing season was another unwanted challenge for growers to develop new management strategies. It was too long between irrigations for the 200-12 field in July. A one inch rain at that time would have really helped maintain yield potential. A summary of the demonstration results are shown in the following table.

Table – 2012 Demonstration Results for Haaland 200-12 & Control

Irrigation		Irrig/Rain/Soil	PRODUCTION		CROP VALUE @ $6.59/Bu		
field	Inches	Inches	Bu/Ac	Bu/Ac-In Irrigation	Per Acre	Acre-In of Irrigation	Ac-In of Irrig/Rain/Soil
200-12	24.47	*29.49	116	4.74	$764.44	$31.24	$25.92
Control	28.08	+33.10	209	7.44	$1377.31	$49.05	$41.61

***Includes 0 inches of water removed from five feet of soil, plus rainfall, and irrigation.**
+Includes 0 inches of soil water removed from five feet of soil, plus rainfall and irrigation.

Additional Plant Population Harvest Results- All growers are searching for the best corn hybrid, seeding rate, planting date and other information to help maintain corn production levels with less irrigation and rainfall. Below are results of three additional seeding rates from Pioneer 1151HR hybrids within Haaland's 200-12 15 acre field. Irrigation and rain are the same as reported for the 200-12 field.

Table – 2012 Corn Yields from Different seeding rates of P1151HR

Seeding Rate	Bushels/Acre
22,000	121
26,000	116 (200-12 yield)
18,000	106
30,000	101

Frische Brothers-Moore County Demonstration, 2012

Planting and Crop Information - For their demonstration, Frische Brothers strip tilled and planted 53 acres of corn in the west half circle of the northwest quarter of section 96, for their "200-12" field, "Frische 200-12". Frische planted the west half circle with Pioneer 1151HR at a seeding rate of 28,000 seeds/acre. They planted the east half 53 acres, also strip tilled, to P1151HR at 28,000 seeds/acre for their "control" field, "Frische Control". Both the west half circle 200-12 and east half control fields were irrigated using the same center pivot. Seasonal water meter readings averaged about 725 gpm and delivered an average of 1.0 inch of irrigation in a 65 hour revolution. An adjoining similar acreage of grain sorghum was irrigated separately with the same irrigation well. The well pumped air making exact gpm measurements difficult. Planting and crop information for "Frische 200-12" and "Frische Control" are shown in the table below. Each is the same unless specified. Both fields received hail damage in mid-June. Corn was at the seven leaf plant growth stage. Hail damage resulted in reduced plant population and plant canopy that limited production. Insurance adjustment for hail damage was 70 percent.

Table – Planting and Crop Information for Frische Brothers

Planted:	May 6	**Fertilizer:**	175-30-2-3s1zn
Hybrid:	Pioneer 1151HR	**Tillage:**	Strip Till
Seeding Rate:	28,000	**Herbicide:**	Sharpen, Succeed, Array**,** Atrazine,RU
Soil Type:	Sherm silty clay Loam	**Soil Type**:	Sherm & Sunray clay loam
Row Width:	30 Inches	**Insecticide:**	Onager**,** Intrepid**,**
Harvested:	October 15	N**o. Acres:**	53 each
GPM Per Acre:	3.4	**GPM Per Acre:**	3.4
Irrig/Rain/SoilWater:	17.34"	**Irrig/Rain/SoilWater:**	18.46"

Beginning Soil Water Profile and Growing Season Rainfall

"200-12": Preseason irrigation of 1.50 inches was applied prior to the gypsum blocks being installed on April 2. Weekly gypsum block readings that followed showed soil water was good at 1, 2 and 3 feet, but was low at 4 feet in the profile. Additional readings indicate the soil profile was filled to 4 feet and was about one half at 5 feet by the first of June, following irrigation and limited rainfall. Weekly gypsum block readings and the AquaSpy® soil probe show the crop used all water from 1, 2, 3, and 4 feet plus irrigation in July. Sherm silty clay loam soil holds approximately 2.0 inches of available water per foot for crop use. The gypsum blocks were installed in early April prior to planting to obtain advanced soil water conditions. The crop was damaged by hail in mid-June

"Control": Soil water was good in the profile when the gypsum blocks were installed on June 14. Gypsum blocks were installed in Sunray clay loam soil following planting. Weekly gypsum block readings and the AquaSpy® soil probe show good soil water levels in June but declining rapidly at 1, 2, and 3 feet during July when plant water use was high. Soil water from 4 feet was used during August and some from 5 feet finishing the crop. Basically, the crop used all

available water. Sunray clay loam holds approximately 2.0 inches per foot for potential crop use. .

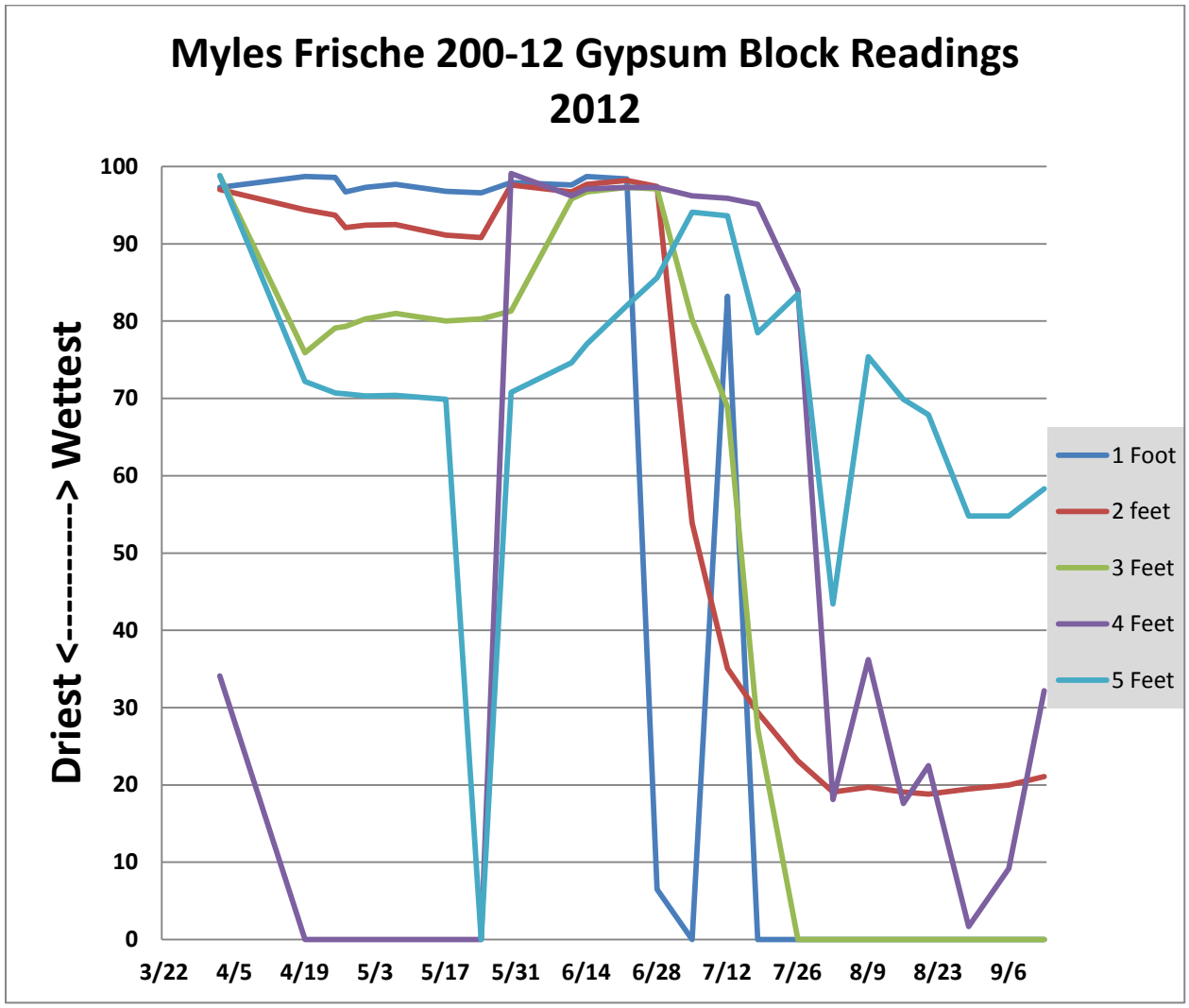
Both: Seasonal rainfall totaled 3.82 inches. More than half of the rainfall was in June. Hail in mid-June at the seven leaf growth stage caused significant plant damage. Myles Frische said the hail caused a reduction in plant population plus additional evapotranspiration due to less canopy. And, with hindsight, the crop likely should have been replanted. The following table shows monthly rainfall as recorded by a district rain gauge located at the edge of the two fields.

Table – Monthly Rainfall Data for Frische "200-12" & "Control"

May- .0" June- 2.15" July- .31" August- 1.36" Sept- 0" Total: 3.82"

Growing Season Water Tracking – The district tracked crop total water throughout the growing season using rain gauges, water meters and both gypsum block and AquaSpy® soil moisture sensors. A set of five gypsum block soil moisture sensors was installed at 1, 2, 3, 4 and 5 feet and an AquaSpy® soil moisture probe was installed down to five feet in the root zone at one location to monitor soil water levels in the 200-12 field. Another set of the same type of sensors were installed in the Control field. Both sensors were installed in close proximity to each other in the field. Gypsum blocks were installed in the 200-12 field prior to planting. Gypsum blocks were installed in the Control field and the AquaSpy® probes were installed in each field following crop emergence. Following this paragraph, a series of graphs and tables shows weekly gypsum block readings for the season; growing season water, including rainfall, irrigation, and soil moisture at various growth stages; and the order of irrigation and rainfall events for each field. Finally a form describes the protocols for each field. "Total Water," as shown on the graph for growing season water, is the sum of seasonal irrigation, rainfall and net soil water. Graphs and tables for the 200-12 field are shown first, followed by the illustrations for the Control field.

Graph – Gypsum Block Readings for Myles Frische 200-12



Graph – Growing Season Water Tracking for Myles Frische 200-12

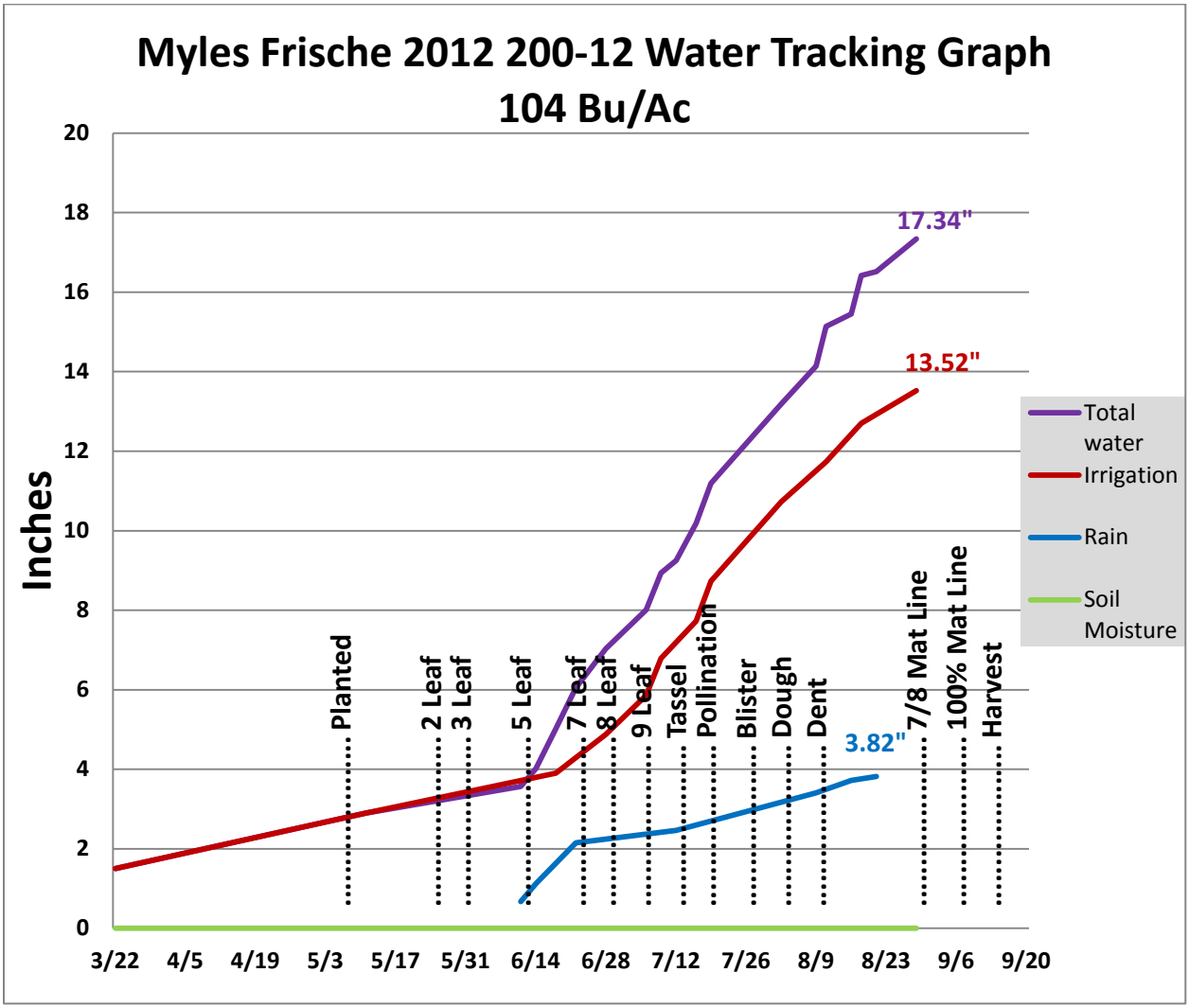


Table- Demonstration Field Data Myles Frische's 200-12

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
3/22		1.50	Pivotrac							Prewater		900
4/2			No Meter		97.3	97.0	98.8	34.1	98.8		0 N	
4/19	0.77		No Meter		98.7	94.4	75.9	0	72.2		0 N	
4/25			.02 AF		98.6	93.7	79.1	0	70.7		0 N	
4/27	0.06		0.02		96.7	92.1	79.3	0	70.6		0 N	
5/1	0.13		0.02		97.3	92.4	80.3	0	70.3		0 N	
5/6										Planted		
5/7			0.02		97.7	92.5	81.0	0	70.4		0 N	
5/11		1.40	Pivotrac							200-12		900
5/17			6.35		96.8	91.1	80.0	0	69.9		0 N	
5/24			13.03	2 leaf	96.6	90.8	80.3	0	0		0 N	
5/30			13.03	3 leaf	97.9	97.6	81.3	99.1	70.8		300 N	
6/11	0.67		23.04	5 leaf	97.6	96.7	95.8	96.2	74.6		300 N	
6/14	0.45		23.04	5 leaf	98.7	97.7	96.7	97.1	77.0		300 N	
6/18		1.00	Pivotrac							200-12		800
6/22	1.03		32.61	7 leaf	98.4	98.2	97.3	97.3	82.0	Hail	6 N	
6/28			40.08	8 leaf	6.5	97.4	97.1	97.3	85.6		152 Y	surging
6/28		0.98	Pivotrac									725
7/5			47.68	9 leaf	0	53.9	80.2	96.2	94.1	control	165 Y cw	725
7/6		0.98	Pivotrac							200-12		725
7/9		0.93	Pivotrac							200-12		725
7/12	0.31		69.56	Tassel	83.2	35.1	68.9	95.9	93.6		189 N	
7/16		0.94	Pivotrac							200-12		
7/18			82.27	Pollination	0	29.4	27.3	95.1	78.5	200-12	261 Y cw	surging
7/19		1.00	Pivotrac							200-12		725
7/26			94.89	Blister	0	23.1	0	84.0	83.5	200-12	340 Y cw	720
7/26		1.00	Pivotrac							200-12		725
7/27										Sorghum		725
8/2			103.66	Dough	0	19.1	0	18.1	43.4	200-12	280 Y cw	800
8/2		1.00	Pivotrac							200-12		725
8/9	0.95		114.71	Dent	0	19.7	0	36.2	75.4	200-12	181 Y cw	800
8/11		1.00	Pivotrac							200-12		725
8/16	0.31		119.79	Dent	0	19.1	0	17.6	69.9	Control	113 Y cw	650

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
8/18		0.97	Pivotrac							200-12		725
8/21	0.10		127.22	1/2 Mat Ln	0	18.8	0	22.5	67.9	Stop	15 N	
8/29			133.80	7/8 Mat Ln	0	19.5	0	1.70	54.8	200-12	313 Y cw	877
8/29		0.82	Pivotrac							200-12		750
9/6			135.30	1.0 Mat Ln	0	20	0	9.2	54.8		17 N	
9/13			135.30	Harvest	0	21.1	0	32.2	58.3		17 N	
9/20			135.30		0	19.1	0	43.9	57.4		N	
	3.82	13.52			0	0	0	0	0			
Cannot identify Net soil separate from irrigation & rainfall.												
Irrigation, Rain, Net Soil Water is 17.34"												

- Numbers in red are not counted in total

NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

200-12

Year: *2012* **County:** *Moore* **Grower:** *Myles Frische*

No. Acres: *60* **Variety/Hyb:** *P1151HR* **Soil Type:** *Sherm Silty Clay Loam*

Meter Type: *Seametrics*

Meter Mult: *Ac Ft x 1* **Tillage:** *Strip Till*

Fertilizer: *175-30-2-3s1zn* **Seeding:** *28,000*

Planted: *May 6, 2012* **Harvest:** *September 13, 2012*

Herbicide: *Sharpen, Succeed, Array, Atrazine, RU* **Insecticide:** *None*

Yield: *104 Bu/Acre* **Prev. crop:** **Row width:** *30 Inch*

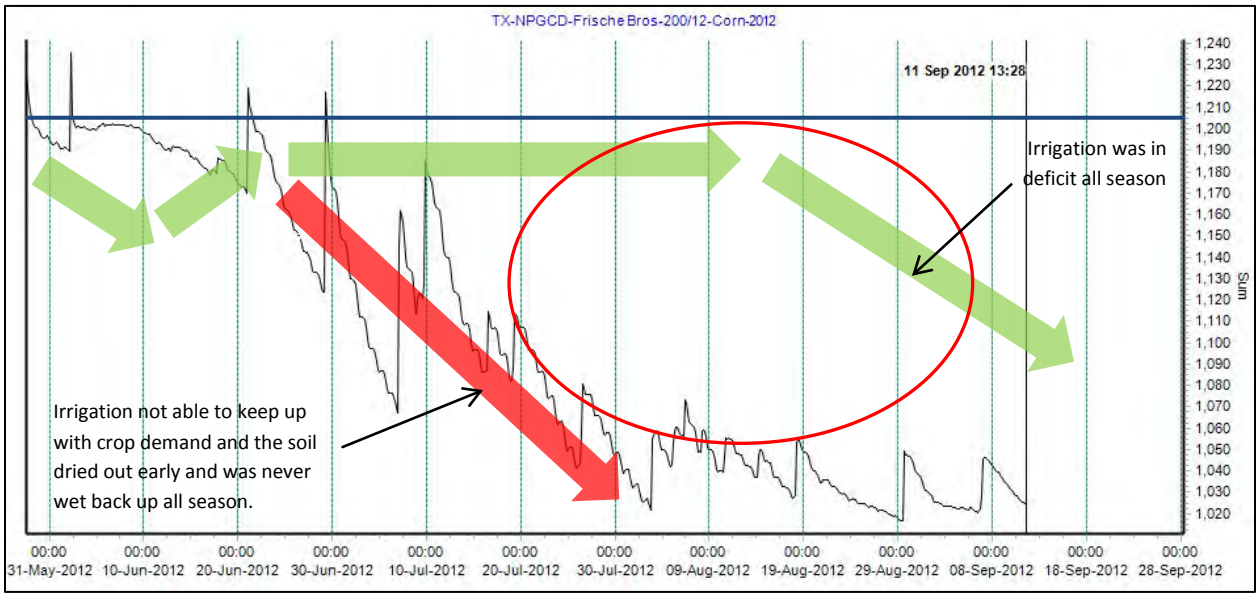
Irrigation method: *Center Pivot* **Prewater:** *Yes* **Well GPM:** *725*

Distance between drops: *60”* **Distance from nozzle to ground:** *16”*

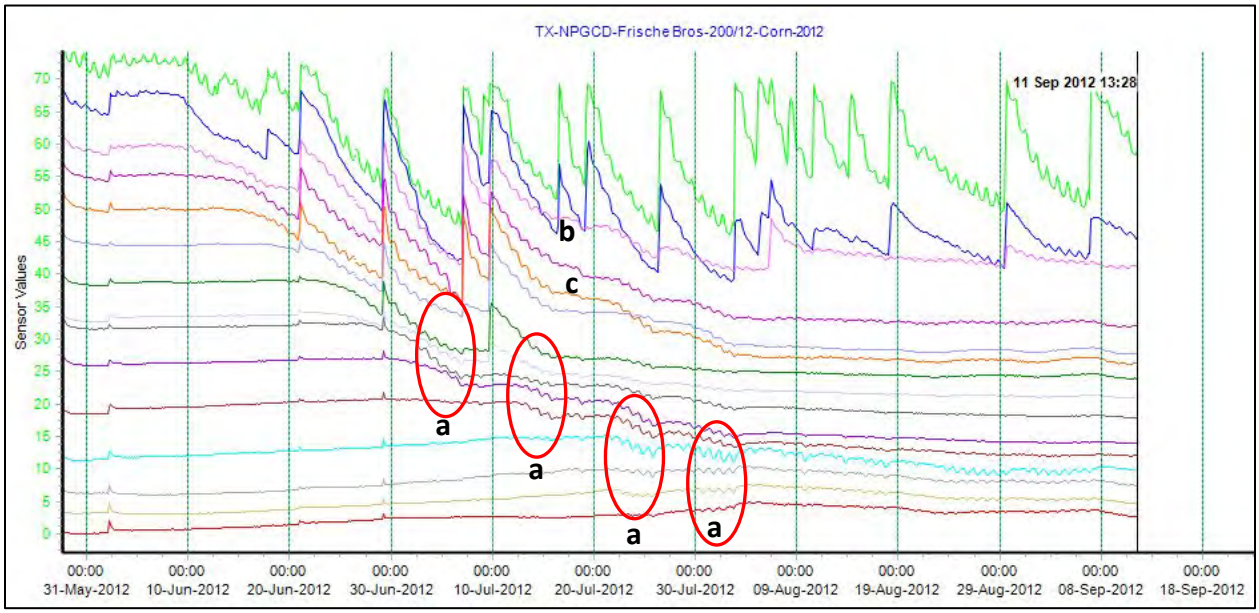
Application pattern: *Spray* **Crop row direction :** *Straight*

GPS Location: Latitude: *36.053615*
-
Longitude: *101.827005*

Frische Bros: AquaSpy 200-12 Site (104 bu/ac; 12.0” irrigation)



The soil moisture profile appeared to start out full but irrigation could not keep up with demand and the soil dried out from a very early crop stage. The crop was forced to continue seeking moisture from great and greater depths, indicating quite severe moisture stress. Moisture stress during the critical pollination stage would have caused the significant yield reduction experienced at this site. Severe moisture stress continued all the way to maturity.

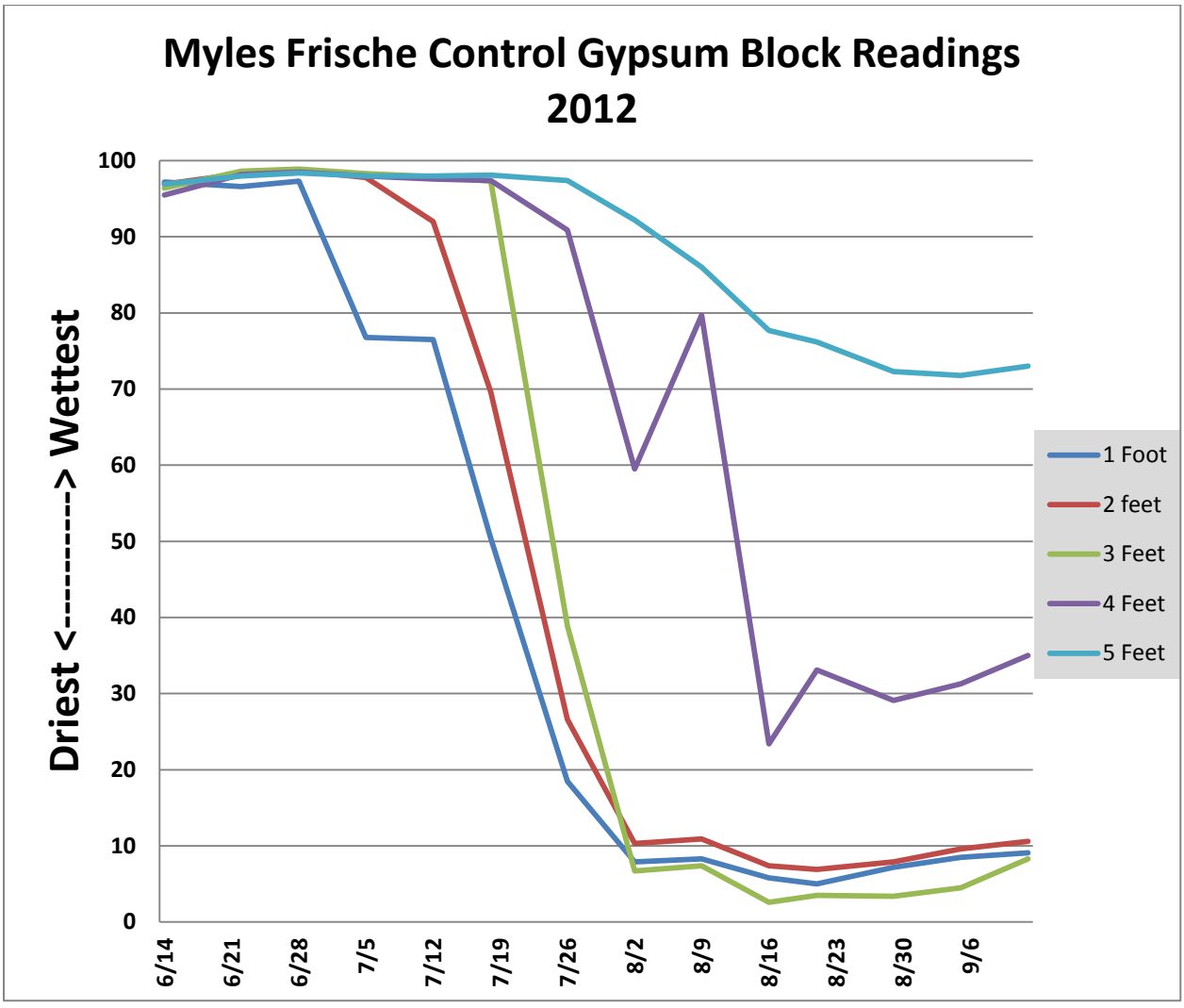


(a) The crop suffered severe moisture stress at the end of each irrigation cycle and the crop was forced to seek moisture from lower levels. The roots got to 60” in late July.

(b) Irrigation never made it to 12” during mid-July to early August.

(c) Irrigation never made it to 16” after July 10th

Graph – Gypsum Block Readings for Myles Frische Control



Graph – Growing Season Water Tracking for Myles Frische Control

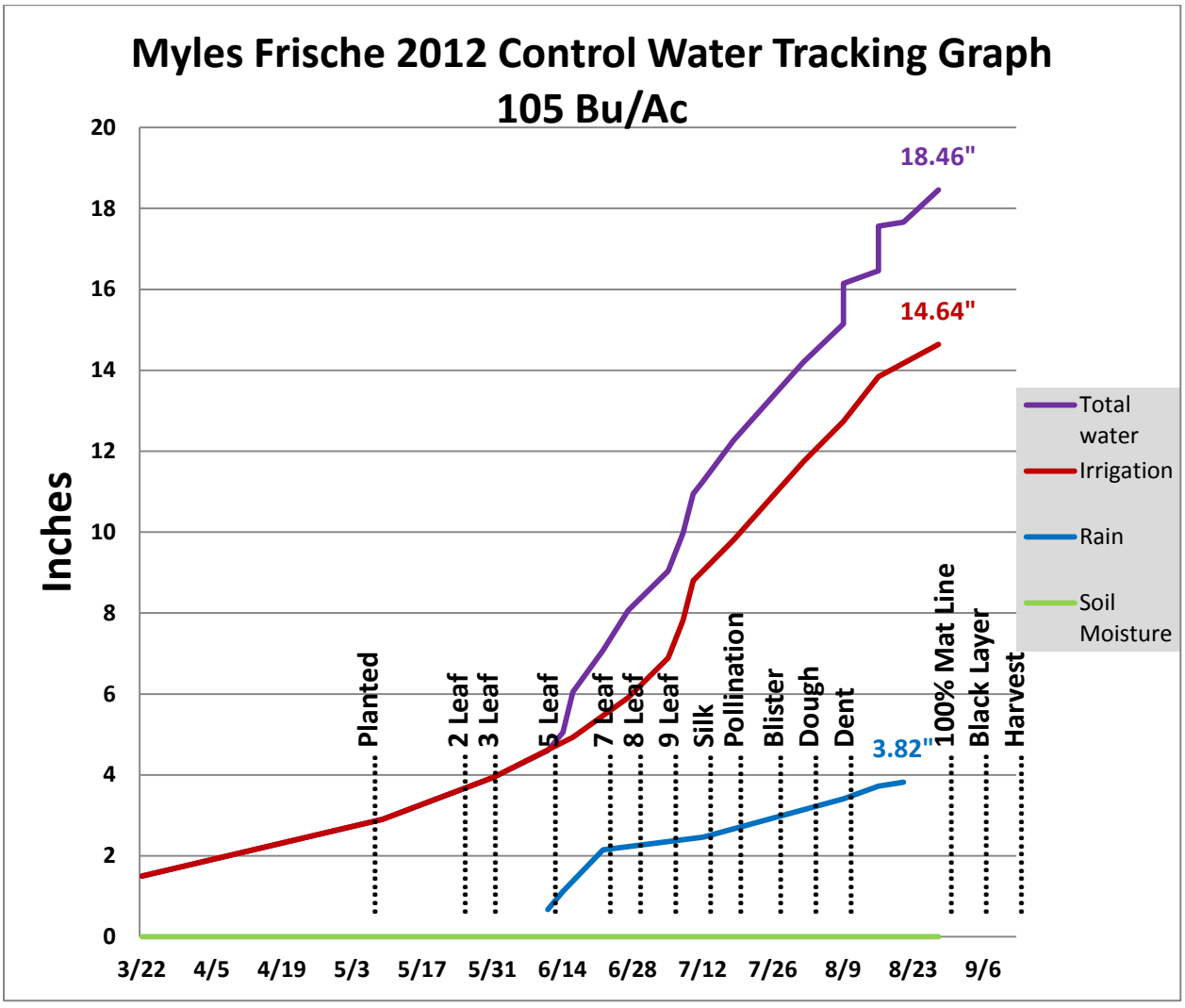


Table- Demonstration Field Data Myles Frische's Control

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
3/22		1.50	Pivotrac							Prewater	0 N	900
4/19	0.77										0 N	
4/25			.02 AF								0 N	
4/27	0.06										0 N	
5/1	0.13										0 N	
5/6										Planted		
5/9		1.40	Pivotrac							Control		900
5/17			6.35									
5/24			13.03	2 leaf								
5/30			13.03	3 leaf							300 N	
5/31		1.03	Pivotrac							Control		900
6/11	0.67		23.04	5 leaf							300 N	
6/14	0.45		23.04	5 leaf	97.2	96.9	96.4	95.5	96.9		300 N	
6/16		1.00	Pivotrac							Control		800
6/22	1.03		32.61	7 leaf	96.6	98.3	98.6	98.2	98.0	Hail	6 N	
6/27		0.98	Pivotrac							Control		725
6/28			40.08	8 leaf	97.3	98.7	98.9	98.5	98.4		152 Y	surging
7/5			47.68	9 leaf	76.8	97.8	98.3	98.0	98.0	Control	165 Y cw	700
7/5		0.98	Pivotrac							Control		725
7/8		0.93	Pivotrac							Control		725
7/10		0.98	Pivotrac							Control		725
7/12	0.31		69.56	Silk	76.5	92	97.9	97.6	98		189 N	
7/18			82.27	Pollination	50.4	69.6	97.3	97.4	98.1	200-12	261 Y cw	surging
7/18		1.00	Pivotrac							Control		
7/25		0.97	Pivotrac							Control		725
7/26			94.89	Blister	18.5	26.6	38.9	90.9	97.4	200-12	340 Y cw	720
8/1		0.97	Pivotrac							Control		725
8/2			103.66	Dough	7.9	10.3	6.7	59.5	92.2	20012	280 Y cw	800
8/9	0.95		114.71	Dent	8.3	10.9	7.4	79.7	86	200-12	181 Y cw	800
8/9		1.00	Pivotrac							Control		725
8/16	0.31		119.79	1/3 Mat Ln	5.8	7.4	2.6	23.4	77.7	Control	113 Y cw	650
8/16		1.10	Pivotrac							Control		725
8/21	0.10		127.22	5/8 Mat Ln	5	6.9	3.5	33.1	76.2	Stop	15 N	
8/28		0.80	Pivotrac							Control		750

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
8/29			133.80	1.0 Mat Ln	7.2	7.9	3.4	29.1	72.3	200-12	313 Y cw	877
9/5			135.30	Blk Layer	8.5	9.6	4.5	31.3	71.8		17 N	
9/12			135.30	Harvest	9.1	10.6	8.3	35.0	73.0		17 N	
9/20			135.30		6.3	7.4	7.3	36.6	74.1		N	
Total	3.82	14.64			0	0	0	0	0			
Cannot identify soil water separate from early season irrigation and rainfall												
Irrigation, Rain plus net soil water is 18.46 inches												

- Numbers in red are not counted in total

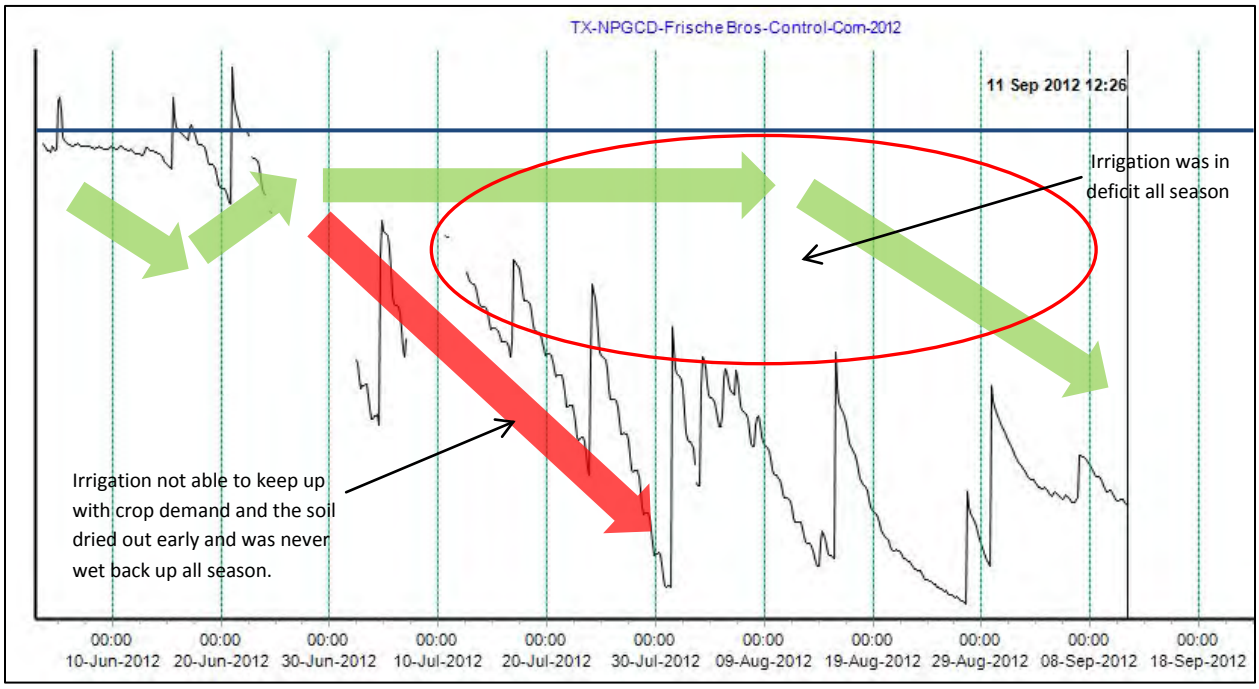
NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

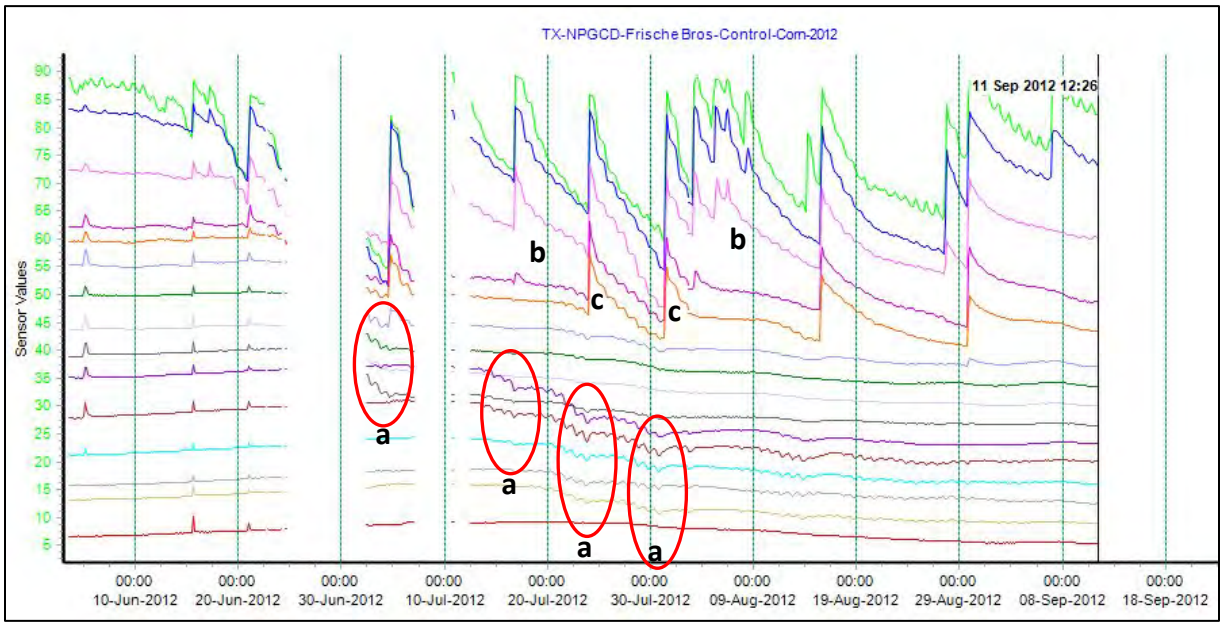
Control

	2012	**County:**	*Moore*	**Grower:**	*Myles Frische*
No. Acres:	*60*	**Variety/Hyb:**	*P1151HR*	**Soil Type:**	*Sherm & Sunray Clay Loam*
Meter Type:	*Seametrics*				
Meter Mult:	*Ac Ft x 1*	**Tillage:**	*Strip Till*		
Fertilizer:	*175-30-2-3s1zn*	**Seeding:**	*28,000*		
Planted:	*May 6, 2012*	**Harvest:**	*September 13, 2012*		
Herbicide:	*Sharpen, Succeed, Array, Atrazine, RU*			**Insecticide:**	*Onager, Intrepid*
Yield:	*105 Bu/Acre*	**Prev. crop:**		**Row width:**	*30 Inch*
Irrigation method:	*Center Pivot*	**Prewater:**	*Yes*	**Well GPM:**	*725*
Distance between drops:	*60”*	**Distance from nozzle to ground:**		*16”*	
Application pattern:	*Spray*	**Crop row direction :**		*Straight*	
		GPS Location:	Latitude:	*36.053615*	
			Longitude:	*-101.827005*	

Frische Bros: AquaSpy Control Site (105 bu/ac; 13.1" irrigation)



This crop ran out of water in a similar fashion to the 200/12 site. The crop was deficit irrigated from an early stage and was forced to rely on stored soil moisture. The stored soil moisture was depleted early and not replenished and so the crop suffered severe moisture stress and significant yield loss.



(a) The crop suffered severe moisture stress at the end of each irrigation cycle and the crop was forced to seek moisture from lower levels. The roots got to 60" in late July.

(b) Irrigation penetrated to 12" only.

(c) Irrigation was able to penetrate to 20" but sub soil remained dry.

Harvest Results - The 200-12 field produced a 104 bushel per acre corn yield. Irrigation totaled 13.52 inches. The crop was affected by significant hail damage but recovered to produce a partial crop. Production in the control field 105 bushels per acre. Seasonal irrigation totaled 14.64 inches. Pre-season irrigation was 1.50 inches in both fields and is included in the total irrigation listed above. In comparison, the 200-12 field produced 0ne less bushels per acre than the control and irrigation was 1.12 inches less. Corn production was 7.69 bushels (430lbs) per inch of irrigation in the 200-12 field compared to 7.17 (401lbs) in the control. Production from each inch of irrigation, rainfall and net soil water that totaled 17.34 inches was 6.00 bushels (336lbs) per acre in the 200-12 field. Irrigation, rainfall and net soil water totaled 18.46 inches in the control field where production was 5.69 bushels (318lbs) per inch. Crop production costs were $5.72 per acre less for the 200-12 field than for the control from reduced irrigation and harvest expenses. At $6.59 per bushel, the one bushel per acre reduced corn yield in the 200-12 field amounts to $6.59 less per acre. The 200-12 field's net loss was $0.87 per acre with 1.12 inches less irrigation used compared to production from the control field. Frische says the 2012 demonstration was not a good comparison due to the hail damage. A summary of the demonstration results are shown in the following table.

Table – 2012 Demonstration Results for Frische Brothers 200-12 & Control

Irrigation		Irrig/Rain/Soil	PRODUCTION		CROP VALUE @ $6.59/Bu		
field	Inches	Inches	Bu/Ac	Bu/Ac-In Irrigation	Per Acre	Acre-In of Irrigation	Ac-In of Irrig/Rain/Soil
200-12	13.52	*17.34	104	7.69	$685.36	$50.61	$39.52
Control	14.64	+18.46	105	7.17	$691.95	$47.26	$37.48

***Includes 0 inches of water removed from five feet of soil, plus rainfall, and irrigation.**
+Includes 0 inches of soil water removed from five feet of soil, plus rainfall and irrigation.

David Ford-Hartley County Demonstration, 2012

Planting and Crop Information - For his demonstration, David Ford strip tilled and planted 60 acres of corn in the south half circle of the southwest quarter of section 206, for his "200-12" field, "Ford 200-12". Ford planted the south half circle with Pioneer 1151HR at a seeding rate of 28,000 seeds/acre. He planted the north half 60 acres, also strip tilled, in the southwest quarter of section 206 to P1151HR at 32,000 seeds/acre for his "control" field, "Ford Control". Both the 200-12 south half circle field and north control field were irrigated using the same center pivot. Seasonal water meter readings averaged 490 gpm and delivered an average of 1.0 inch of irrigation in a 4.5 day revolution. Planting and crop information for "Ford 200-12" and "Ford Control" are shown in the table below. Each is the same unless specified. Both fields received hail damage in mid-June. Corn was at the five to six leaf plant growth stage. Insurance adjustment was 38.4 percent for the hail damage.

Table – Planting and Crop Information for Ford

200-12		*Control*	
Planted:	May 15	**Fertilizer:**	130-45-0
Hybrid:	Pioneer 1151HR	**Hybrid:**	P1151HR
Seeding Rate:	28,000	**Seeding Rate**:	32,000
Soil Type:	Dumas & Sunray Loam	**Tillage:**	Strip Till
Row Width:	30 Inches	**Insecticide:**	Onager**,** Intrepid**,** Stratego fung
Harvested:	October 15	**No. Acres:**	60 each
GPM Per Acre:	4.0	**Herbicide:**	Balance, Banvel**,** Atrazine, Roundup
Irrig/Rain/SoilWater:	15.61"	**Irrig/Rain/SoilWater:**	20.64"

Beginning Soil Water Profile and Growing Season Rainfall

"200-12": Preseason gypsum block readings showed soil water was good at only the one foot level in the profile. Additional readings indicated very limited to no soil water was available at 2, 3, 4, nor 5 feet. Ford chose to apply 2.60 inches of pre-water to the full circle prior to planting. The gypsum block soil moisture sensors show that 3, 4 and 5 feet in the soil profile were not wet until following the 2.63 inches of rain the third week in June. Dumas clay loam soil holds approximately 1.85 inches of available water per foot for crop use. Sunray clay loam holds about 2.0 inches per foot. Approximately equal amounts of each soil type are present in the 200-12 field. Weekly gypsum block readings and the AquaSpy® soil probe show limited to inadequate available soil water levels at 2 and 3 feet, especially beginning in early August during grain maturing. The gypsum blocks were installed in late March in Dumas clay loam soil prior to planting to obtain advanced soil water conditions.

"Control": Soil water was good in the profile following the mid-June rainfall. Gypsum blocks were installed in late May in Dumas clay loam soil following planting. Weekly gypsum block readings and the AquaSpy® soil probe show good soil water levels in June but declining rapidly at 1, 2, and 3 feet during July when plant water use was high. Approximately equal

amounts of Dumas clay loam and Sunray clay loam are in the north half circle control field. Dumas clay loam holds about 1.85 inches of available water per foot. Sunray clay loam holds approximately 2.0 inches per foot for potential crop use.

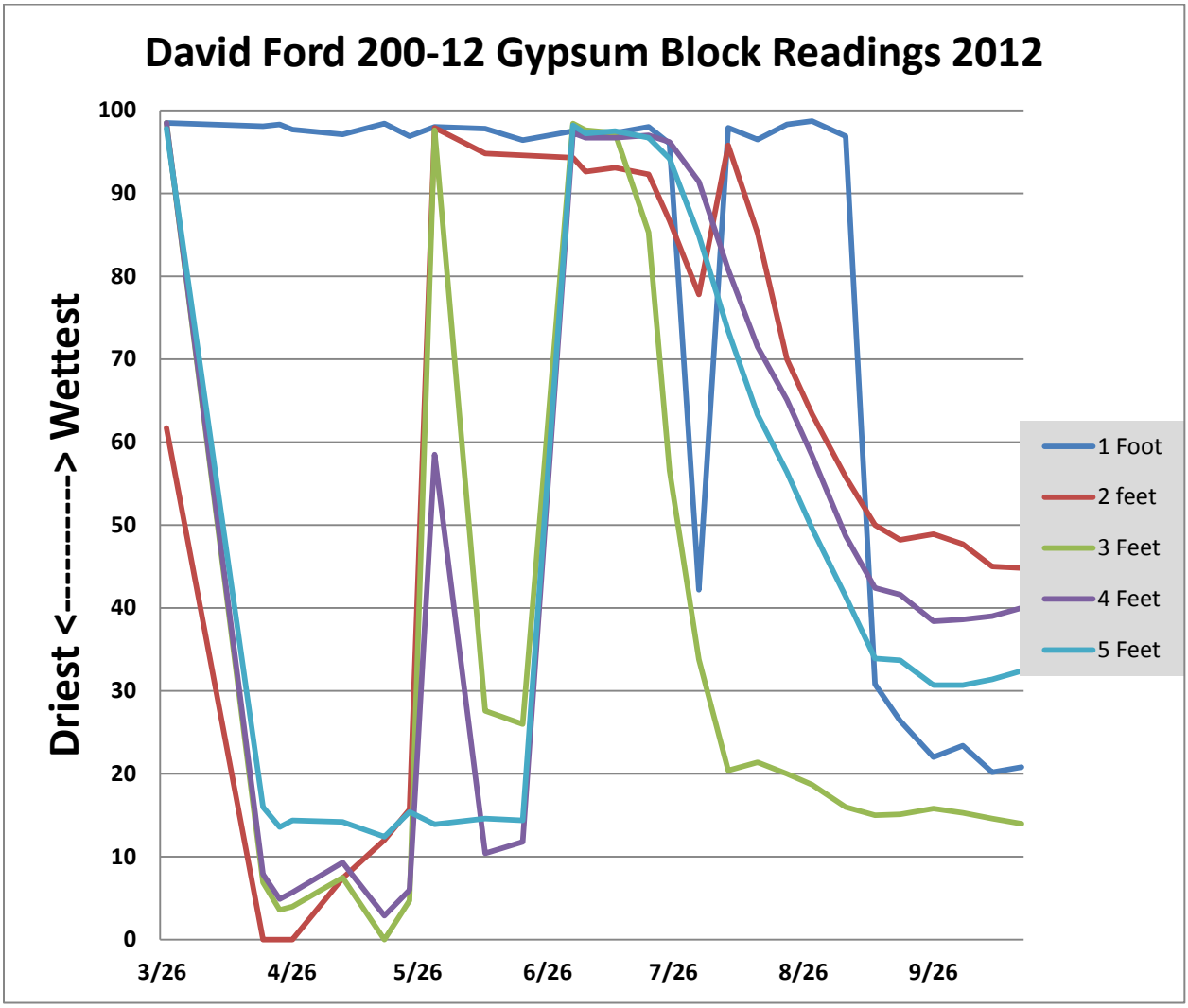
Both: Seasonal rainfall totaled 8.40 inches. More than half of the rainfall was in June. Hail in mid-June at the 5 to 6 leaf stage caused significant plant damage. Existing leaves were severely shredded leaving plants in poor condition. Additional leaves developed to produce a partial crop. Insurance adjustment was 38.4 percent for hail damage. Damage may have been more in the south 200-12 field. The following table shows monthly rainfall as recorded by a district rain gauge located at the edge of the two fields.

Table – Monthly Rainfall Data for Ford "200-12" & "Control"

May- .15" June- 4.15" July- .85" August- 1.89" Sept-.1.36" Total: 8.40"

Growing Season Water Tracking – The district tracked crop total water throughout the growing season using rain gauges, water meters and both gypsum block and AquaSpy® soil moisture sensors. A set of five gypsum block soil moisture sensors was installed at 1, 2, 3, 4 and 5 feet and an AquaSpy® soil moisture probe was installed down to five feet in the root zone at one location to monitor soil water levels in the 200-12 field. Another set of the same type of sensors was installed in the Control field. Both sensors were installed in close proximity to each other in the field. Gypsum blocks were installed in each 200-12 field prior to planting. Gypsum blocks were installed in the Control field and the AquaSpy® probes were installed in each field following crop emergence. Following this paragraph, a series of graphs and tables shows weekly gypsum block readings for the season; growing season water, including rainfall, irrigation, and soil moisture at various growth stages; and the order of irrigation and rainfall events for each field. Finally a form describes the protocols for each field. "Total Water," as shown on the graph for growing season water, is the sum of seasonal irrigation, rainfall and net soil water. Graphs and tables for the 200-12 field are shown first, followed by the illustrations for the Control field.

Graph – Gypsum Block Readings for David Ford 200-12



Graph – Growing Season Water Tracking for David Ford 200-12

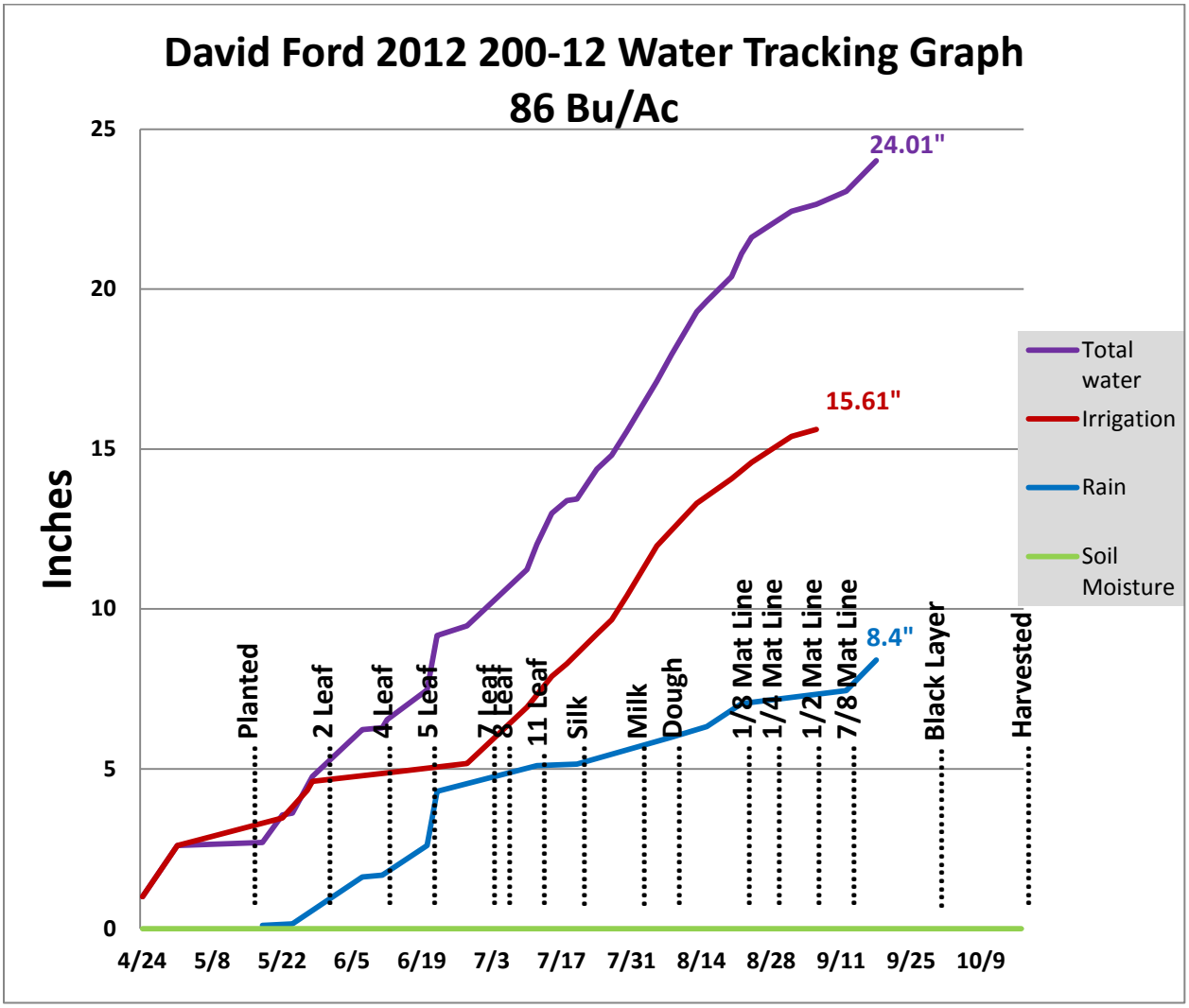


Table- Demonstration Field Data David Ford's 200-12

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
3/26			.03 Ac Ft									
3/27					98.5	61.7	98.5	98.5	97.8			
4/19	0.61				98.1	0	6.9	7.9	16.0		N	
4/23			9.79		98.3	0	3.6	4.9	13.6	Prewater	170 Y	476
4/24		1.00	Pivotrac							Prewater	146 Y ccw	475
4/26			15.46		97.7	0	4.0	5.7	14.4		300 Y	
5/1		1.60	Pivotrac							Prewater	153 N	475
	0.52		Too Wet		97.2	0	4.1	5.8	15.0		150 Y	
5/8			24.19		97.1	7.4	7.5	9.3	14.2		45 N	
5/15				Planted								
5/18	0.10		24.47		98.4	12.0	0	2.9	12.4		315 N	
5/22		0.86	Pivotrac							200-12	327 Y cw	475
5/24	0.05		37.43		96.9	15.7	4.7	6.0	15.4	200-12	105 Y	507
5/27		0.86	Pivotrac							200-12	327 Y cw	475
5/28		0.29	Pivotrac							200-12	150 N	475
5/30			47.49	2 leaf	98.0	97.9	97.6	58.5	13.9		150 N	
6/7	1.47											
6/11	0.05		48.27	4 leaf	97.8	94.8	27.6	10.4	14.6		140 N	
6/12		0.26	Pivotrac							200-12	107 Y ccw	
6/20	0.93		51.48	5 leaf	96.4	94.6	26.0	11.8	14.4	Hail	0 Y dry	
6/22	1.70									Hail		
6/28		0.30	Pivotrac							200-12	90 Y ccw	475
7/2			61.89	7 leaf	97.5	94.3	98.4	97.3	98.2	Split	270 Y	474
		0.81	Pivotrac							200-12	270 Y cw	475
7/5			67.82	8 leaf	97.1	92.6	97.6	96.7	97.2	Control	76 Y ccw	439
7/10		0.95	Pivotrac							200-12	270 Y cw	475
7/12	0.80		82.33	11 leaf	97.3	93.1	97.3	96.7	97.5	Control	39 Y cw	481
7/15		0.96	Pivotrac							200-12	270 Y cw	475
7/18		0.40	Pivotrac							200-12	90 Y rev	475
7/20	0.05		99.16	Silk	98.0	92.3	85.3	97	96.7	Control	342 Y cw	466
7/24		0.93	Pivotrac							200-12	270 Y cw	475
7/25			109.74	Silk	96.0	86.7	56.6	96.2	94.2	Control	24 Y cw	475
7/27		0.44	Pivotrac							200-12	115 Y rev	475
7/30		0.75	Pivotrac							200-12	90 Y ccw	475
8/1			124.61	Milk	42.2	77.8	33.8	91.4	84.9	Control	324 Y	487

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
8/5		1.56	Pivotrac							200-12	90 Y ccw	475
8/8	0.84		139.57	Dough	97.9	95.8	20.4	80.8	73.4	Control	343 Y cw	485
8/13		1.33	Pivotrac							200-12	90 Y ccw	475
8/15	0.33		153.72	Dough	96.5	85.2	21.4	71.5	63.3	Control	334 Y cw	509
8/20		0.77	Pivotrac							200-12	90 Y ccw	475
8/22	0.72		163.71	1/8 Mat Ln	98.3	70.0	20.0	65.1	56.4	Control	322 Y cw	509
8/24		0.51	Pivotrac							200-12	173 N	475
8/28			170.14	1/4 Mat Ln	98.7	63.4	18.7	58.4	49.6	200-12	112 Y cw	565
9/1		0.81	Pivotrac							200-12	90 stop	475
9/5			180.74	1/2 Mat Ln	96.9	55.8	16.0	48.7	41.4	Split	90 N	
9/6		0.22	Pivotrac							200-12	164 N	475
9/12	0.41		184.10	7/8 Mat Ln	30.8	50	15.0	42.4	33.9		164 N	
9/18	0.95		184.10	1.0 Mat Ln	26.4	48.2	15.1	41.6	33.7		164 N	
9/26			184.10	Blk Layer	22.0	48.9	15.8	38.4	30.7		164 N	
10/3			184.54	Blk Layer	23.4	47.7	15.3	38.6	30.7		164 N	
10/10			184.54	Moist Test	20.2	45.0	14.6	39.0	31.4		164 N	
10/17			184.54	Harvested	20.8	44.8	14.0	40.0	32.4		164 N	
Total	8.40	15.61			0	0	0	0	0			
Irrigation, rainfall, net soil water is 24.01 inches												

- Numbers in red are not counted in total

NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

200-12

Year: *2012* **County:** *Hartley* **Grower:** *David Ford*

No. Acres: *60* **Variety/Hyb:** *P1151HR* **Soil Type:** *Dumas & Sunray Loam*

Meter Type: *Seametrics*

Meter Mult: *Ac/Ft x 1* **Tillage:** *Strip Till*

Fertilizer: *130-45-0* **Seeding:** *28,000*

Planted: *May 15, 2012* **Harvest:** *October 15, 2012*

Herbicide: *Balance,Banvel,Atrzine,Roundup* **Insecticide:** *Onager,Intrepid,Stratego fung*

Yield: *86 Bu/Acre* **Prev. crop:** *Cotton* **Row width:** *30 Inch*

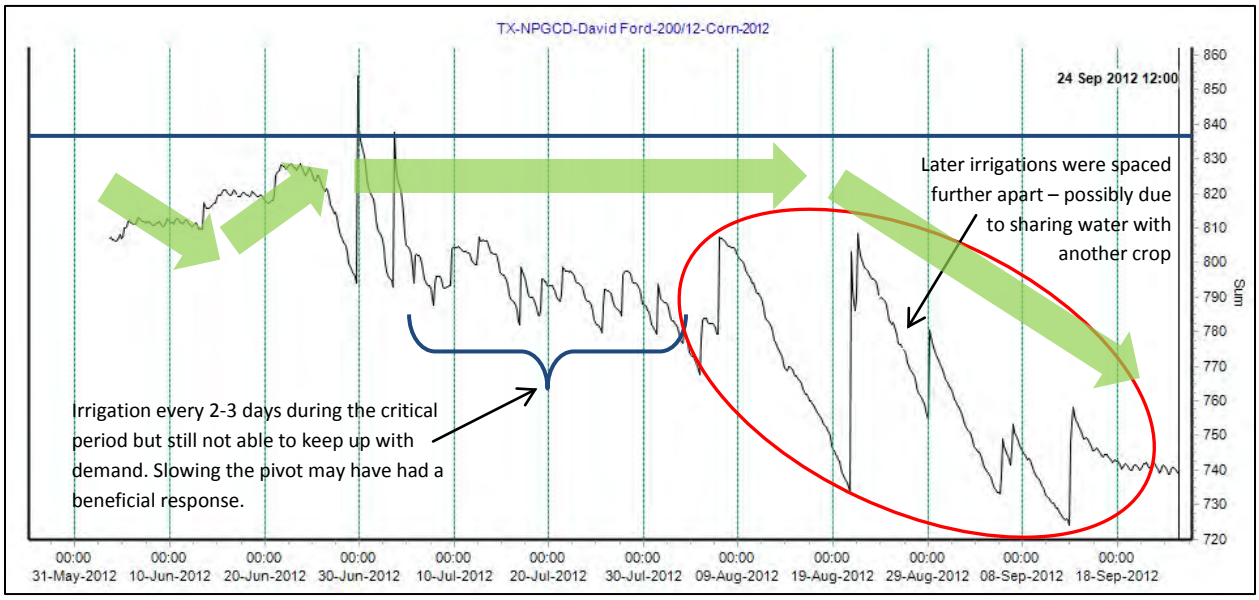
Irrigation method: *Center Pivot* **Prewater:** *Yes* **Well GPM:** *490*

Distance between drops: *60”* **Distance from nozzle to ground:** *16”*

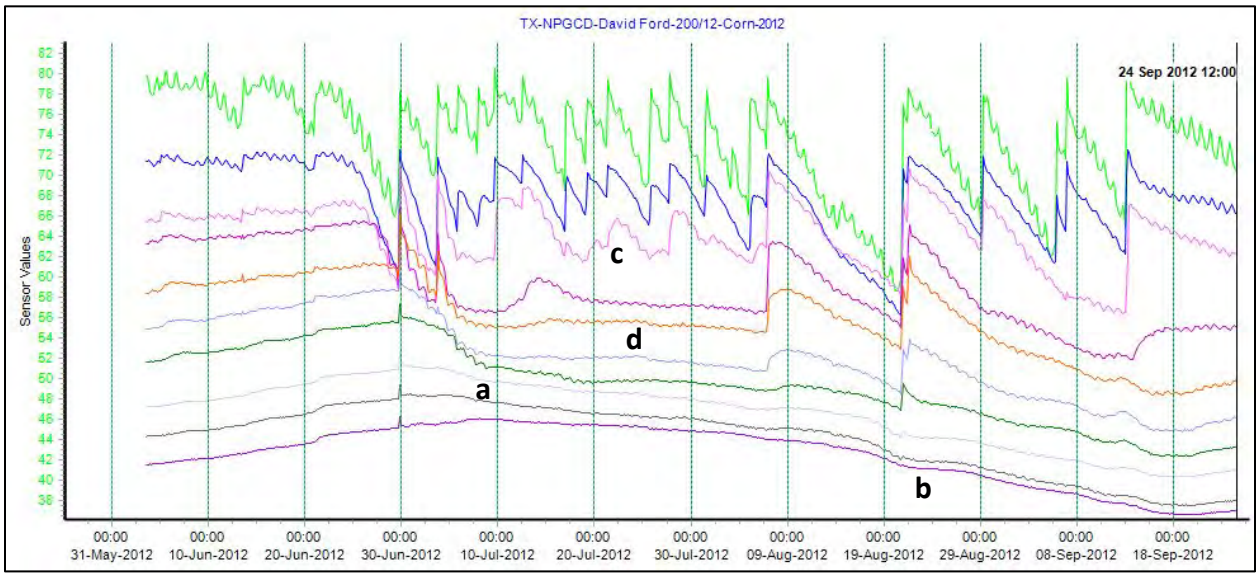
Application pattern: *Spray* **Crop row direction :** *Straight*

GPS Location: Latitude: *35.824802*
Longitude: *-102.170192*

David Ford: AquaSpy 200-12 Site (86 bu/ac; 13.0" irrigation)

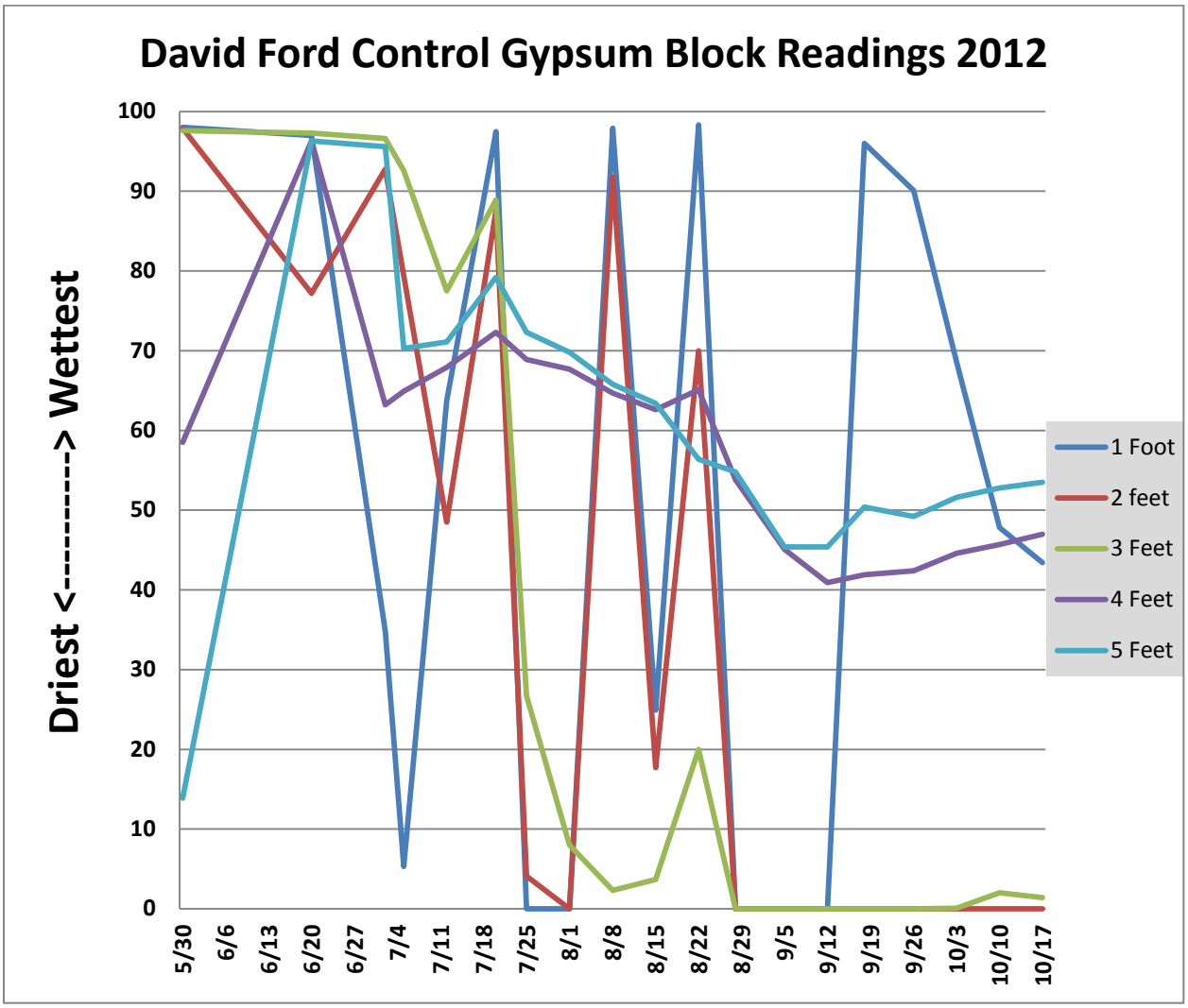


This site began with a good soil moisture profile but the roots were very active early and depleted the soil moisture below 12", which then stayed dry for the majority of the season. Irrigation was very frequent during this time and there is a good case for slowing the pivot down to increase penetration and water availability to the root zone.



(a) Roots growth very active to 36"early in the season
(b) Roots went all the way to 60" late in the season (data not shown)
(c) Irrigation only penetrating to 12" during critical pollination period.
(d) Soil from 16" and below was dry during peak demand.

Graph – Gypsum Block Readings for David Ford Control



Graph – Growing Season Water Tracking for David Ford Control

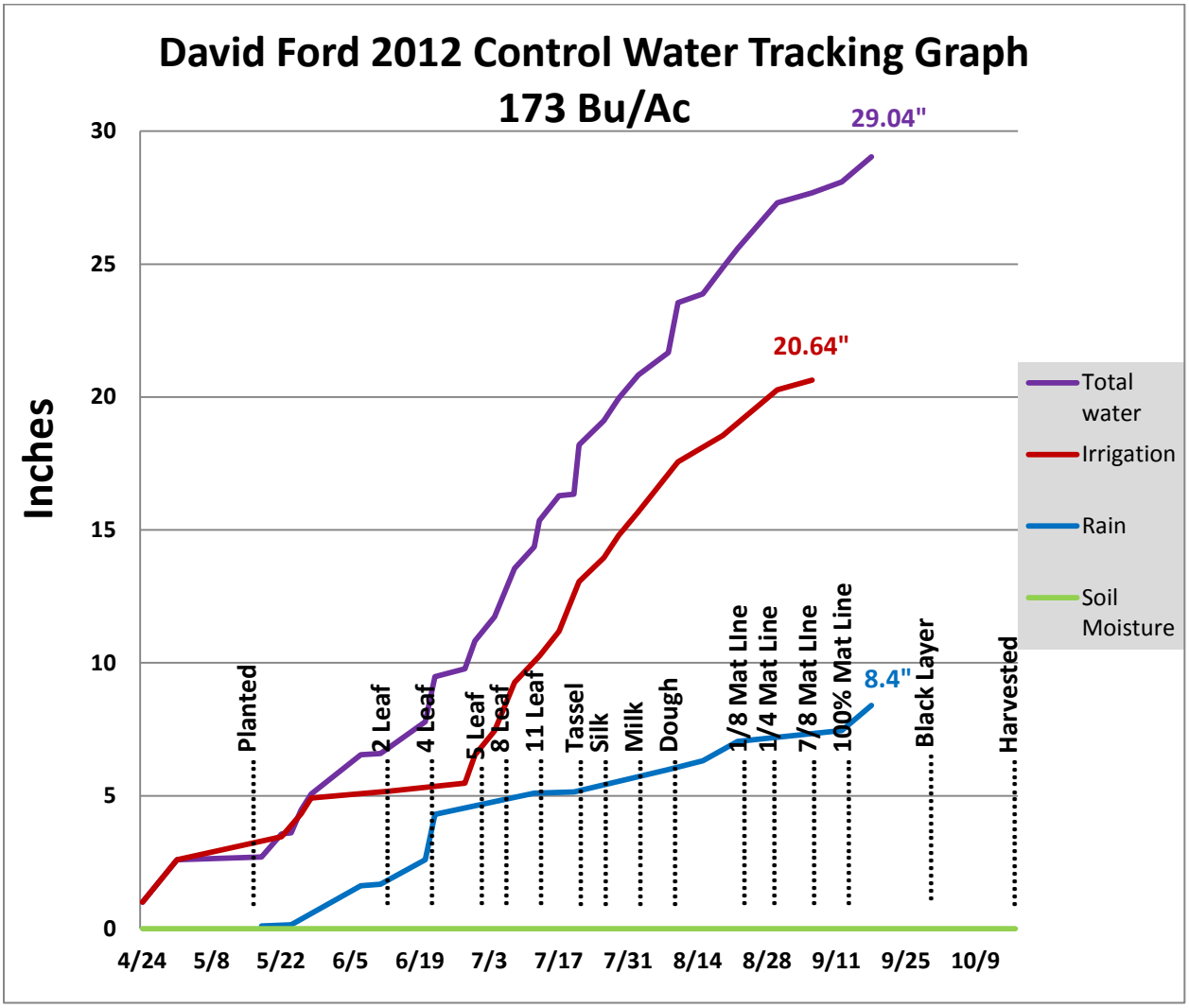


Table- Demonstration Field Data David Ford's Control

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
3/26			.03 Ac Ft									
4/19	0.61											
4/23			9.79 AF							Prewater	170 Y	476
4/24		1.00	Pivotrac							Prewater	146 Y ccw	475
4/26			15.46								300 Y	
5/1		1.60	Pivotrac							Prewater	153 N	475
5/1	0.52		too wet								150 Y	
5/8			24.19								45 N	
5/15				Planted						Planted		
5/18	0.10		24.47								315 N	
5/22		0.86	Pivotrac							Control	327 Y cw	475
5/24	0.05		37.43							200-12	105 Y	507
5/26		0.86	Pivotrac							Control	327 Y cw	475
5/28		0.60	Pivotrac							Control	81 Y cw	475
5/30			47.49	2 leaf	98.0	97.9	97.6	58.5	13.9		150 N	
6/7	1.47										N	
6/11	0.05		48.27	4 leaf							140 N	
6/13		0.26	Pivotrac							Control	63 Y ccw	475
6/20	0.93		51.48	5 leaf	97.0	77.2	97.3	96.3	96.3	Hail	0 Y dry	
6/22	1.70									Hail		
6/28		0.30	Pivotrac							Control	90 Y ccw	475
6/30		1.05	Pivotrac							Control	90 Y cw	475
7/2			61.89	7 leaf	34.8	92.8	96.6	63.2	95.6	Split	270 Y	474
7/4		0.91	Pivotrac							Control	90 Y cw	475
7/5			67.82	8 leaf	5.30	79.4	92.6	64.9	70.3	Control	76 Y ccw	439
7/6		0.91	Pivotrac							Control	270 Y rev	475
7/8		0.91	Pivotrac							Control	90 y cw	475
7/12	0.80		82.33	11 leaf	63.7	48.5	77.5	67.9	71.1	Control	39 Y cw	481
7/13		1.00	Pivotrac							Control	90 Y cw	475
7/17		0.93	Pivotrac							Control	90 Y cw	475
7/20	0.05		99.16	Tassel	97.5	87.6	88.9	72.3	79.2	Control	342 Y cw	466

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
		0.93	Pivotrac							Control	270 Y rev	475
7/21		0.93	Pivotrac							Control	90 Y cw	475
7/25			109.74	Silk	0	4.1	26.7	68.9	72.3	Control	24 Y cw	475
7/26		0.91	Pivotrac							Control	90 Y cw	475
7/29		0.84	Pivotrac							Control	270 Y ccw	475
8/1			124.61	Milk	0	0	8.0	67.7	69.8	Control	324 Y ccw	487
8/2		0.88	Pivotrac							Control	270 Y ccw	475
8/8	0.84		139.57	Dough	97.9	91.8	2.3	64.7	65.8	Control	343 Y cw	485
8/10		1.88	Pivotrac							Control	270 Y ccw	475
8/15	0.33		153.72	Dough	24.9	17.7	3.7	62.6	63.4	Control	334 Y cw	509
		0.83	Pivotrac							Control	309 N	475
8/19		0.16	Pivotrac							Control	270 Y ccw	475
8/22	0.72		163.71	1/8 Mat Ln	98.3	70.0	20.0	65.1	56.4	Control	322 Y cw	509
		0.88	Pivotrac							Control	270 Y ccw	475
8/28			170.14	1/4 Mat Ln	0	0	0	53.8	54.8	200-12	112 Y cw	565
8/30		0.84	Pivotrac							Control	270 Y ccw	475
9/5			180.74	7/8 Mat Ln	0	0	0	45.1	45.4	Split	90 N	
9/6		0.37	Pivotrac							Control	270 Y ccw	475
9/12	0.41		184.10	1.0 Mat Ln	0	0	0	40.9	45.4		164 N	
9/18	0.95		184.10	Blk Layer	96	0	0	41.9	50.4		164 N	
9/26			184.10	Blk Layer	90.1	0	0	42.4	49.2		164 N	
10/3			184.54	Blk Layer	68.6	0	0.1	44.6	51.6		164 N	
10/10			184.54	Blk Layer	47.8	0	2	45.7	52.8		164 N	
10/17			184.54	Harvested	43.4	0	1.4	47.0	53.5		164 N	
Total	8.40	20.64			0	0	0	0	0			
Irrigation, rainfall plus net soil water is 29.04 inches												

- Numbers in red are not counted in total

NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

Control

Year: *2012* **County:** *Hartley* **Grower:** *David Ford*

No. Acres: *60* **Variety/Hyb:** *P1151HR* **Soil Type:** *Dumas & Sunray Loam*

Meter Type: *Seametrics*

Meter Mult: *Ac Ft x 1* **Tillage:** *Strip Till*

Fertilizer: *130-45-0* **Seeding:** *32,000*

Planted: *May 15, 2012* **Harvest:** *October 15, 2012*

Herbicide: *Balance,Banvel,Atrzine,Roundup* **Insecticide:** *Onager,Intrepid,Stratego fung*

Yield: *86 Bu/Acre* **Prev. crop:** *Cotton* **Row width:** *30 Inch*

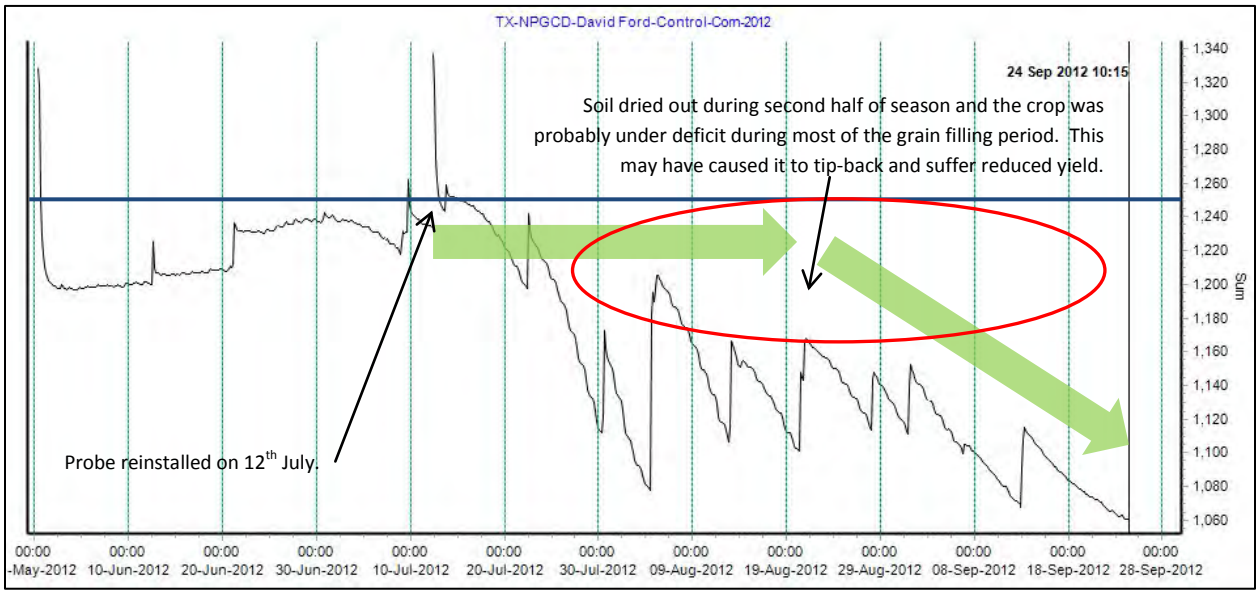
Irrigation method: *Center Pivot* **Prewater:** *Yes* **Well GPM:** *490*

Distance between drops: *60”* **Distance from nozzle to ground:** *16”*

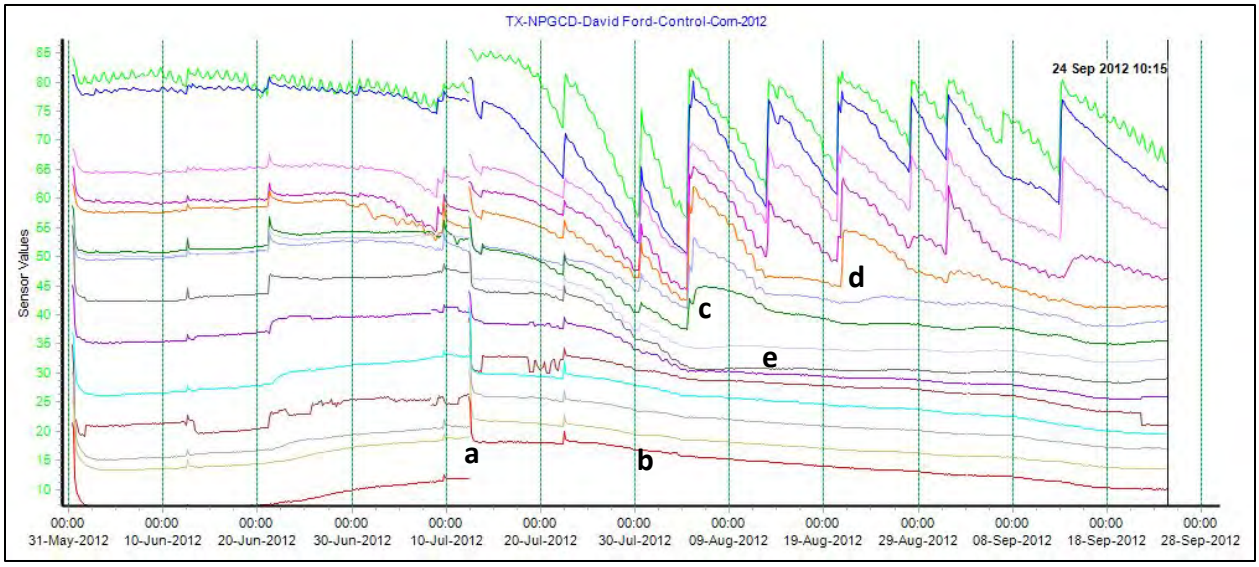
Application pattern: *Spray* **Crop row direction :** *Straight*

GPS Location: Latitude: *35.824802*
Longitude: *-102.170192*

David Ford: AquaSpy Control Site (173 bu/ac; 18.0" irrigation)



The probe was reinstalled on 12th July due to issues with the crop being replanted around the previously installed probe. Roots were already active to depth at the time of installation



- **(a)** Probe was re-installed on 12th July
- **(b)** Evidence of root activity at 60" indicates good initial stored soil moisture, which made a large contribution to yield.
- **(c)** Large irrigation event on 4th August wet the soil to depth and would have had a significant positive impact on yield.
- **(d)** Irrigation to 16-20" (which seemed to be more effective than on 200/12 circle).
- **(e)** Sub-soil dried out below 20" in August and was never re-wet for remainder of the season.

Harvest Results - The 200-12 field produced an 86 bushel per acre corn yield. Irrigation totaled 15.61 inches. The crop was affected by significant hail damage but recovered to produce a partial crop. Production in the control field, where hail damage may have been less, was 173 bushels per acre. Seasonal irrigation totaled 20.64 inches. Pre-season irrigation was 2.60 inches in both fields and is included in the total irrigation listed above. In comparison, the 200-12 field produced 87 less bushels per acre than the control and irrigation was 5.03 inches less. Corn production was 5.51 bushels (308lbs) per inch of irrigation in the 200-12 field compared to 8.38 (469lbs) in the control. Production from each inch of irrigation, rainfall and net soil water that totaled 24.01 inches was 3.58 bushels (200lbs) per acre in the 200-12 field. Irrigation, rainfall and net soil water totaled 29.04 inches in the control field where production was 5.96 bushels (333lbs) per inch. Crop production costs were $85.72 per acre less for the 200-12 field than for the control from reduced seed, fertilizer, irrigation and harvest expenses. At $6.59 per bushel, the reduced corn yield in the 200-12 field amounts to $573.33 less per acre. The 200-12 field's net loss was $487.61 per acre with 5.03 inches less irrigation used compared to production from the control field. Ford says the 2012 demonstration was not a good comparison due to the hail damage. And, that reduced corn irrigation following a previous cotton crop is not a good farming practice. A summary of the demonstration results are shown in the following table.

Table – 2012 Demonstration Results for Ford 200-12 & Control

Irrigation		Irrig/Rain/Soil	PRODUCTION		CROP VALUE @ $6.59/Bu		
field	Inches	Inches	Bu/Ac	Bu/Ac-In Irrigation	Per Acre	Acre-In of Irrigation	Ac-In of Irrig/Rain/Soil
200-12	15.61	*24.01	86	5.51	$566.74	$36.30	$23.60
Control	20.64	+29.04	173	8.38	$1140.07	$55.23	$39.25

***Includes 0 inches of water removed from five feet of soil, plus rainfall, and irrigation.**
+Includes 0 inches of soil water removed from five feet of soil, plus rainfall and irrigation.

Chad Hicks-Hartley County Demonstration, 2012

Planting and Crop Information - For his demonstration, Chad Hicks strip tilled and planted 49 acres of corn in the northeast corner of section 48, for his "200-12" field, "Hicks 200-12". Hicks planted the field with Pioneer 1564HR at a seeding rate of 24,000 seeds/acre. Hicks planted 310 acres, also strip tilled, in the north half of section of 73 to Pioneer1151HR at 28,000 seeds/acre for his "control" field, "Hicks Control". The 200-12 field was irrigated using a center pivot where seasonal water meter readings average 485 gpm and delivered an average of 1.05 inches of irrigation in a 2.0 day revolution. Periodic water flow readings by the District averaged 2215 gpm for the center pivot that irrigated the control field and delivered 1.20 inches in a 6.2 day revolution. One of the wells used to irrigate the control field was also used to irrigate the 200-12 field. That arrangement was a conflict for irrigation water during the 2012 growing season. The 200-12 field was not sufficiently irrigated to produce a comparable corn crop. Planting and crop information for "Hicks 200-12" and "Hicks Control" are shown in the table below. Each is the same unless specified.

Table – Planting and Crop Information for Hicks

200-12		*Control*	
Planted:	May 2	**Planted:**	May 17
Hybrid:	P1564HR	**Hybrid**:	P1151HR
Seeding Rate:	24,000	**Seeding Rate**:	28,000
Soil Type:	Sunray Clay Loam	**Tillage**:	Strip Till
Row Width:	30 Inches	**Herbicide:**	Round up
Fertilizer:	none, adequate residual.	**Fertilizer:**	240-50-40-2zn
Insecticide:	none	**Insecticide:**	Oberon
No. Acres:	49	**No. Acres:**	310
Harvested:	September 10	**Harvested:**	October 15
GPM Per Acre:	0	**GPM Per Acre:**	3.6
Irrig/Rain/SoilWater:	15.79"	**Irrig/Rain/SoilWater:**	30.25"

Beginning Soil Water Profile and Growing Season Rainfall

"200-12": Soil water was good at 1 foot and approximately one half at 2 feet prior to planting, but low at 3, 4, and 5 feet following last year's failed crop. The profile was at good levels at 2 and 3 feet by early season irrigation and May and June rainfall. There was no water at 4 and 5 feet during the growing season. Sunray clay loam soil holds approximately 2.0 inches of available water per foot for potential crop use. Weekly gypsum block readings and the AquaSpy® soil probe show adequate to good soil water levels until the third week in June when no water was available to continue producing a crop. A good 2.96 inch rain in July

showed renewed hope, but not enough followed. The gypsum blocks were installed March 29 prior to planting to obtain advanced soil water conditions.

"Control": Soil water was adequate to five feet when the soil moisture sensing gypsum blocks were installed in early June following planting. Weekly gypsum block readings and the AquaSpy® soil probe show all irrigation and rainfall were used by the crop, never allowing the soil profile to catch up. Weekly gypsum block readings show the crop depleted the soil profile. Sunray clay loam soil holds approximately 2.0 inches of available water per foot for potential crop use.

Both: Seasonal rainfall totaled 6.11 inches for the 200-12 field and 6.51 for the control as a result of different planting dates. Approximately one half of the rainfall was in June. Plants in the 200-12 field were severely stressed prior to, during, and following the extreme heat in late July and early August. Plants in the control field were at pollination to blister growth stages. The following table shows monthly rainfall as recorded by a district rain gauge located at the field.

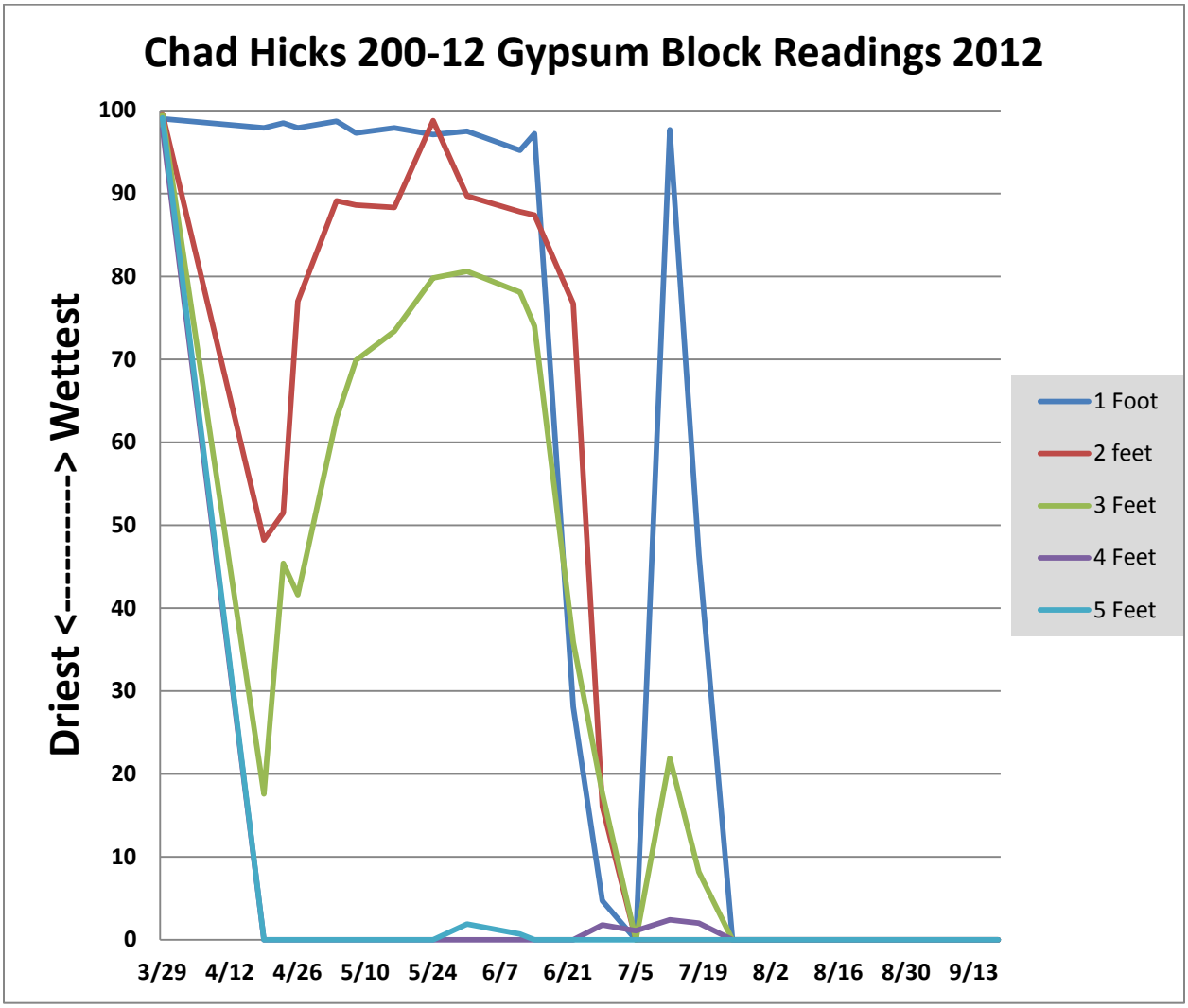
Table – Monthly Rainfall Data for Hicks

"200-12" May- .63" June- .99" July-3.13" August- 1.36" Sept-0" Total: 6.11"

"Control" May- .17" June- .99" July-3.13" August- 1.36" Sept- .86" Total: 6.51"

Growing Season Water Tracking – The district tracked crop total water throughout the growing season using rain gauges, water meters and both gypsum block and AquaSpy® soil moisture sensors. A set of five gypsum block soil moisture sensors was installed at 1, 2, 3, 4 and 5 feet and an AquaSpy® soil moisture probe was installed down to five feet in the root zone at one location to monitor soil water levels in the 200-12 field. Another set of the same type of sensors was installed in the Control field. Both sensors were installed in close proximity to each other in the field. Gypsum blocks were installed in each 200-12 field prior to planting. Gypsum blocks were installed in the Control field and the AquaSpy® probes in each field following crop emergence. Following this paragraph, a series of graphs and tables shows weekly gypsum block readings for the season; growing season water, including rainfall, irrigation, and soil moisture at various growth stages; and the order of irrigation and rainfall events for each field. Finally a form describes the protocols for each field. "Total Water," as shown on the graph for growing season water, is the sum of seasonal irrigation, rainfall and net soil water. Graphs and tables for the 200-12 field are shown first, followed by the illustrations for the Control field.

Graph – Gypsum Block Readings for Chad Hicks 200-12



Graph – Growing Season Water Tracking for Chad Hicks 200-12

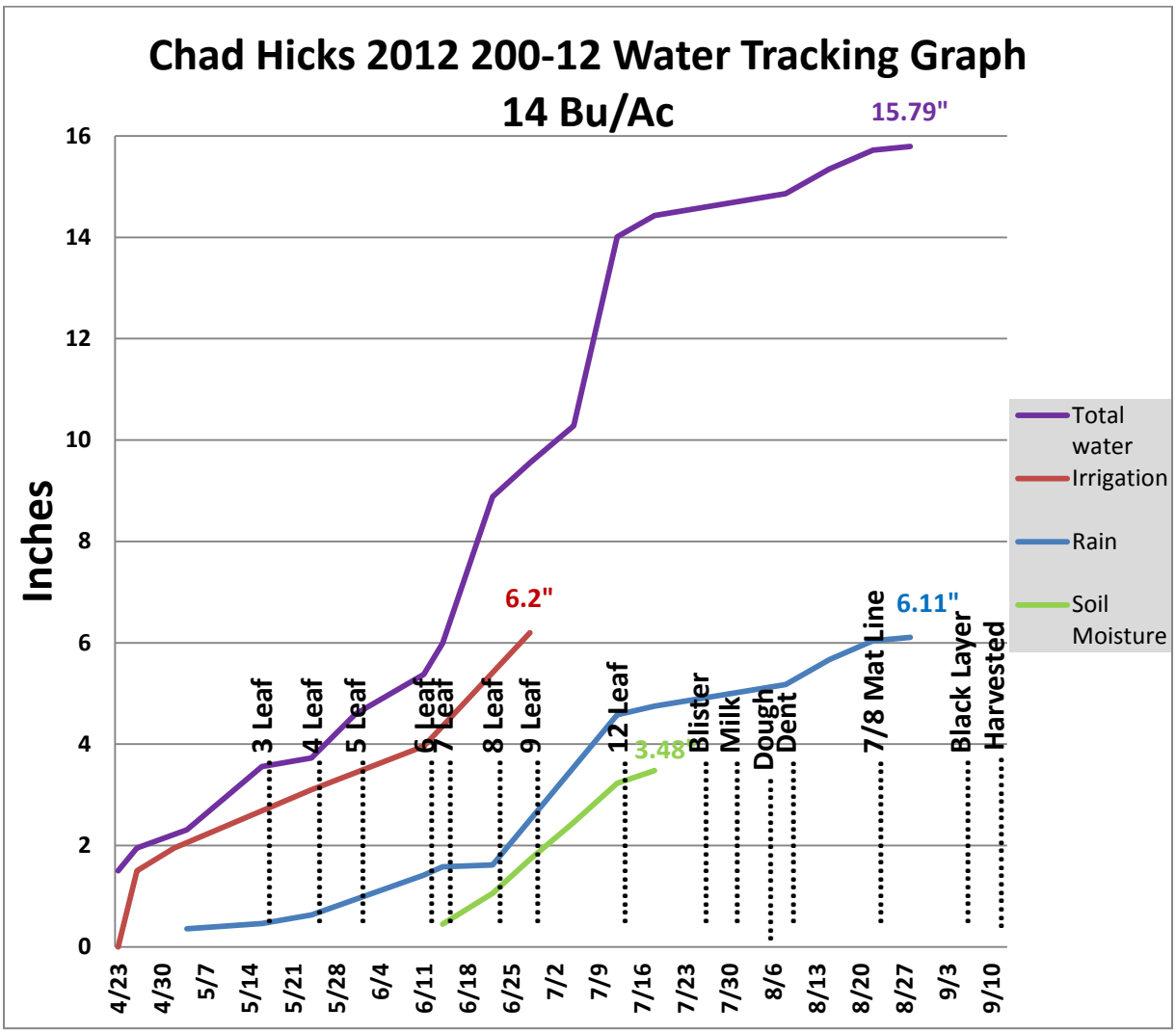


Table- Demonstration Field Data Chad Hicks 200-12

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
3/29			147248		99.0	99.6	99.5	97.8	99.1			
4/19	1.35		147248		97.9	48.2	17.6	0	0		N	
4/23	0.30	1.50	167156		98.5	51.5	45.4	0	0	Prewater	300 Y	500
4/26		0.45	173127		97.9	77.0	41.6	0	0	200-12	90 N	
5/2										Planted		
5/4	0.36		173127		98.7	89.1	62.9	0	0	200-12	165 N	
5/8			173127		97.3	88.6	69.9	0	0		165 N	
5/16	0.10	1.15	188441	3 leaf	97.9	88.3	73.4	0	0	200-12	165 N	
5/24	0.17		188441	4 leaf	97.1	98.8	79.8	0	0		170 N	
5/31		0.86	199844	5 leaf	97.5	89.7	80.6	0	1.9	200-12	200 N	
6/11	0.79		199844	7 leaf	95.2	87.8	78.1	0	0.7		180 N	
6/14	0.16		218638	6 leaf	97.2	87.4	74.0	0	0		315 Y	467
6/22	0.04	2.24	229593	8 leaf	28.1	76.7	35.9	0	0	200-12	261 N	
6/28			229593	9 leaf	4.7	16.1	17.7	1.8	0		261 N	
7/5			229593	9 leaf	0	0	0	1.1	0		261 N	
7/12	2.96		229593	12 leaf	97.7	0	21.9	2.4	0		261 N	
7/18	0.17		229593	Silk	46.5	0	8.2	2.0	0		261 N	
7/25			229593	Blister	0	0	0	0	0		261 N	
7/30			229593	Milk	0	0	0	0	0		261 N	
8/1			229593	Dough	0	0	0	0	0		261 N	
8/8	0.43		229593	Dent	0	0	0	0	0		261 N	
8/15	0.49		229593	Dent	0	0	0	0	0		261 N	
8/22	0.37		229593	7/8 Mat Ln	0	0	0	0	0		261 N	
8/28	0.07		229593	1.0 Mat Ln	0	0	0	0	0		261 N	
9/5			229593	Blk Layer	0	0	0	0	0		261 N	
9/12			229593	Harvest	0	0	0	0	0		N	
9/18			229593		0	0	0	0	0		N	
9/26			229593								N	
10/3			229593								N	
10/10			229593								N	
10/17			229593								N	
Total	6.11	6.20			2.00	1.12	0.36	0	0			
Net Soil Water is 3.48”												
Irrigation, Rain plus net soil water total 15.79”												

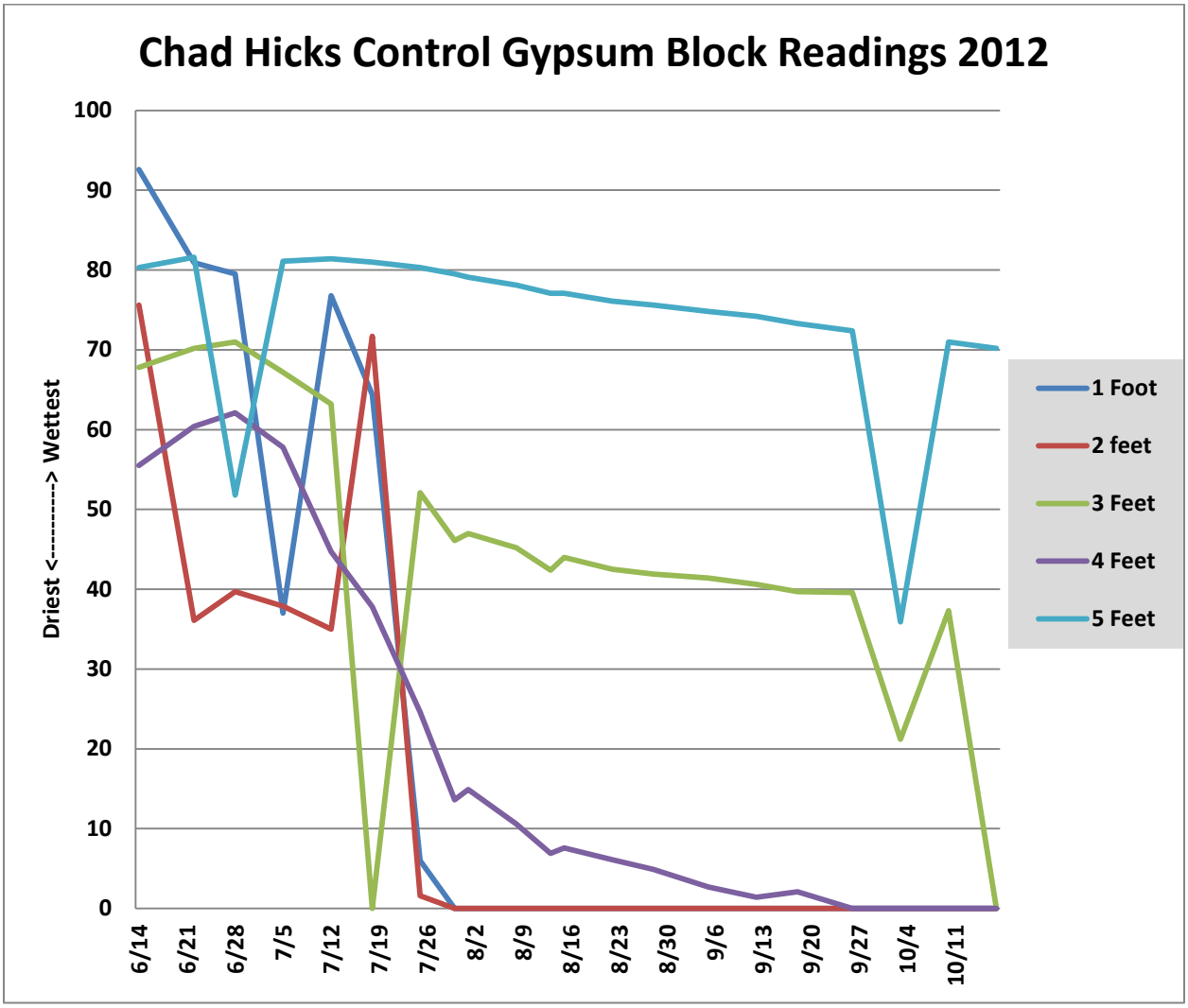
- Numbers in red are not counted in total

2012-Corn Demonstration
Irrigated Medium Season Corn

200-12

Year:	*2012*	**County:**	*Hartley*	**Grower:**	*Chad Hicks*
No. Acres:	*49*	**Variety/Hyb:**	*P1564HR*	**Soil Type:**	*Sunray Clay Loam*
Meter Type:	*McCrometer*				
Meter Mult:	*Gallons x 100*	**Tillage:**	*Strip Till*		
Fertilizer:	*240-50-40-2zn*	**Seeding:**	*24,000*		
Planted:	*May 2, 2012*	**Harvest:**	*September 10, 2012*		
Herbicide:	*Round Up*	**Insecticide:**	*Oberon*		
Yield:	*14 Bu/Acre*	**Prev. crop:**	*Wheat*	**Row width:**	*30 inch*
Irrigation method:	*Center Pivot*	**Prewater:**	*Yes*	**Well GPM:**	*485*
Distance between drops:	*60”*	**Distance from nozzle to ground:**		*16”*	
Application pattern:	*Spray*	**Crop row direction :**		*Straight*	
		GPS Location:	Latitude:	*36.02338*	
			Longitude:	*-102.37829*	

Graph – Gypsum Block Readings for Chad Hicks Control



Graph – Growing Season Water Tracking for Chad Hicks Control

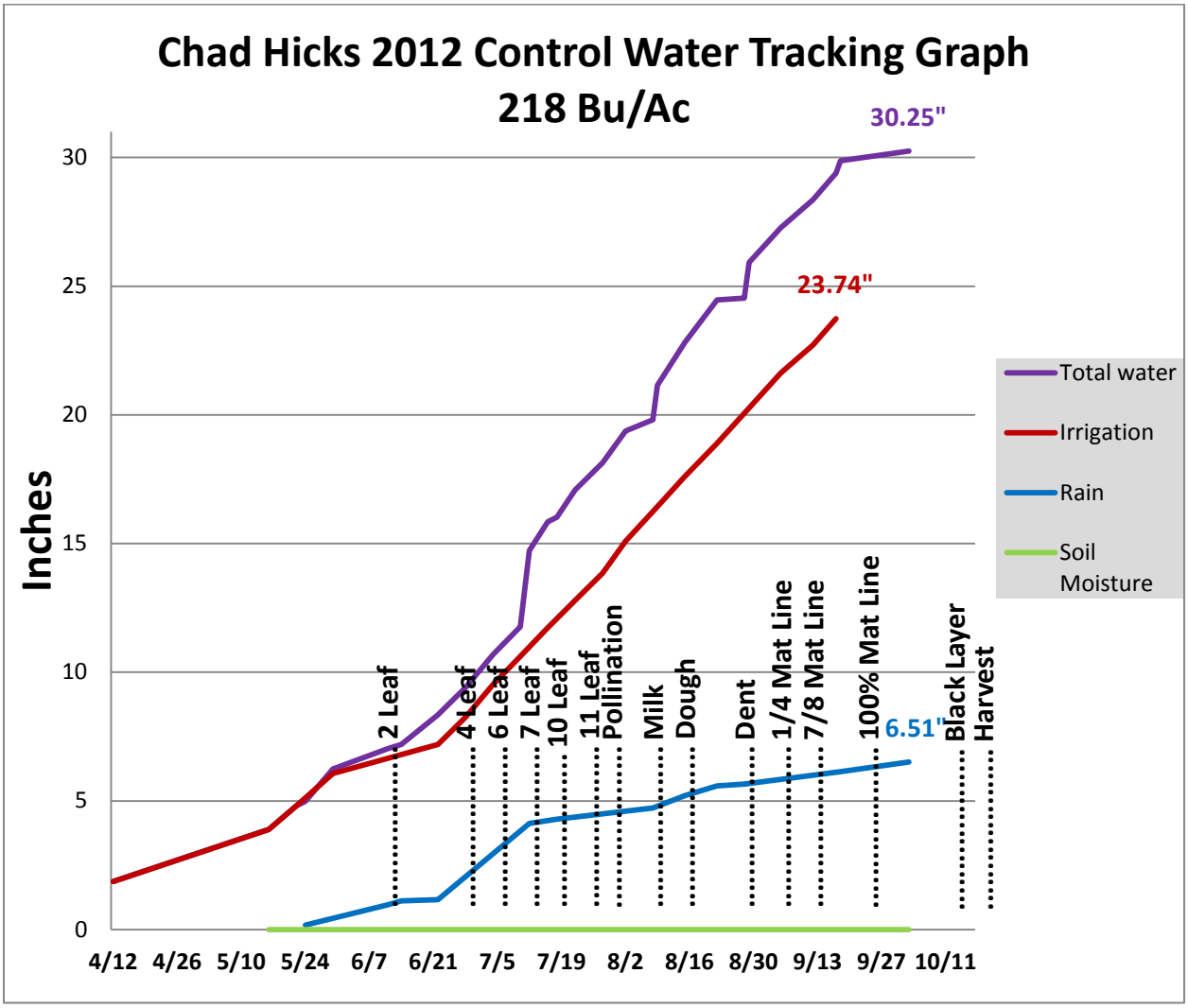


Table- Demonstration Field Data Chad Hicks Control

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
4/12		1.87	228 hrs							Prewater	22 Y	
4/19	1.35											2250
4/23	0.30		No meter									
5/4	0.36											
5/16	0.10	2.02	247 hrs							Prewater	353 N	2250
5/22		0.92	113 hrs							Control	14 Y	2250
5/24	0.17		No meter									
5/30		1.26	154 hrs							Control	2 N	2250
6/11	0.79			2 leaf							0 N	
6/14	0.16		No meter	2 leaf	92.6	75.6	67.8	55.5	80.3		347 N	
6/22	0.04	1.12	139 hrs	4 leaf	80.9	36.1	70.2	60.4	81.6		85 Y	2250
6/28		1.06	132 hrs							Control	82 Y	2250
6/28				6 leaf	79.5	39.7	71	62.1	51.8		120 Y	
7/4		1.26	156 hrs							Control	77 Y	2250
7/5				7 leaf	37.0	37.9	67.2	57.8	81.1		140 Y cw	
7/10		1.10	137 hrs							Control	63 Y cw	2250
7/12	2.96			10 leaf	76.8	35.0	63.2	44.7	81.4		181 Y cw	
7/16		1.12	139 hrs							Control	47 Y cw	2250
7/18	0.17			11 leaf	64.4	71.7	0	37.8	81.0		167 Y cw	
7/22		1.06	132 hrs							Control	66 Y cw	2250
7/25				Silk	6	1.6	52.1	24.6	80.3		215 Y cw	
7/28		1.06	132 hrs							Control	19 Y cw	2250
7/30				Pollination	0	0	46.1	13.6	79.5		152 Y cw	
8/1				Blister	0	0	47.0	14.9	79.1		256 Y cw	
8/2		1.24	151 hrs							Control	310 Y cw	2293
8/8	0.43			Milk	0	0	45.2	10.6	78.1		297 Y cw	
8/9		1.34	163 hrs							Control	346 Y cw	2293
8/13				Milk	0	0	42.4	6.9	77.1		235 Y cw	
8/15	0.49	1.18	144 hrs	Dough	0	0	44.0	7.6	77.1	Control	340 Y cw	2293
8/22	0.37	1.28	156 hrs	Dough	0	0	42.5	6.1	76.1	Control	22 Y cw	2293
8/28	0.07			Dent	0	0	41.9	4.9	75.6		350 Y cw	
8/29		1.38	168 hrs									
9/5		1.36	166 hrs	1/4 Mat ln	0	0	41.4	2.7	74.8	Control	96 Y cw	2293
9/12		1.08	144 hrs	7/8 Mat ln	0	0	40.6	1.4	74.2	Control	134 Y cw	2098
9/17		1.03	137 hrs							Control	359 N	2098
9/18	0.49			7/8 Mat ln	0	0	39.7	2.1	73.3		359 N	
9/26				1.0 Mat ln	0	0	39.6	0	72.4		359 N	
10/3	0.37			1.0 Mat ln	0	0	21.2	0	35.9		358 N	
10/10				Blk Layer	0	0	37.3	0	71.0		358 N	
10/17				Harvest	0	0	0	0	70.2		358 N	
Total	6.51	23.74			0	0	0	0	0			
irrigation, Rainfall plus Net Soil Water total 30.25 inches												

- Numbers in red are not counted in total

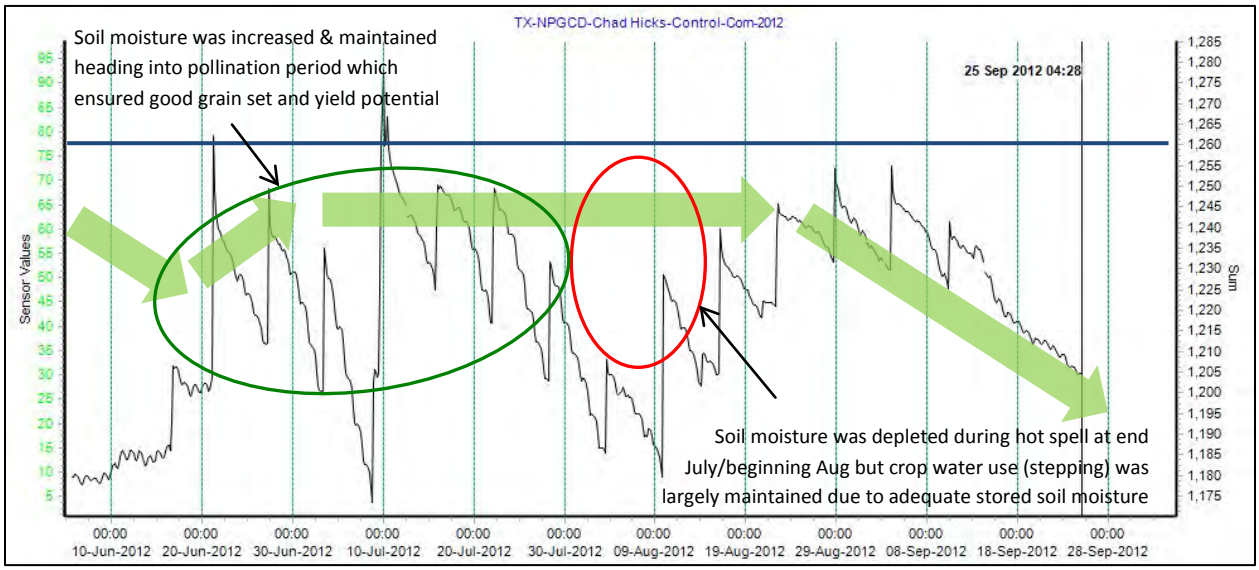
NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

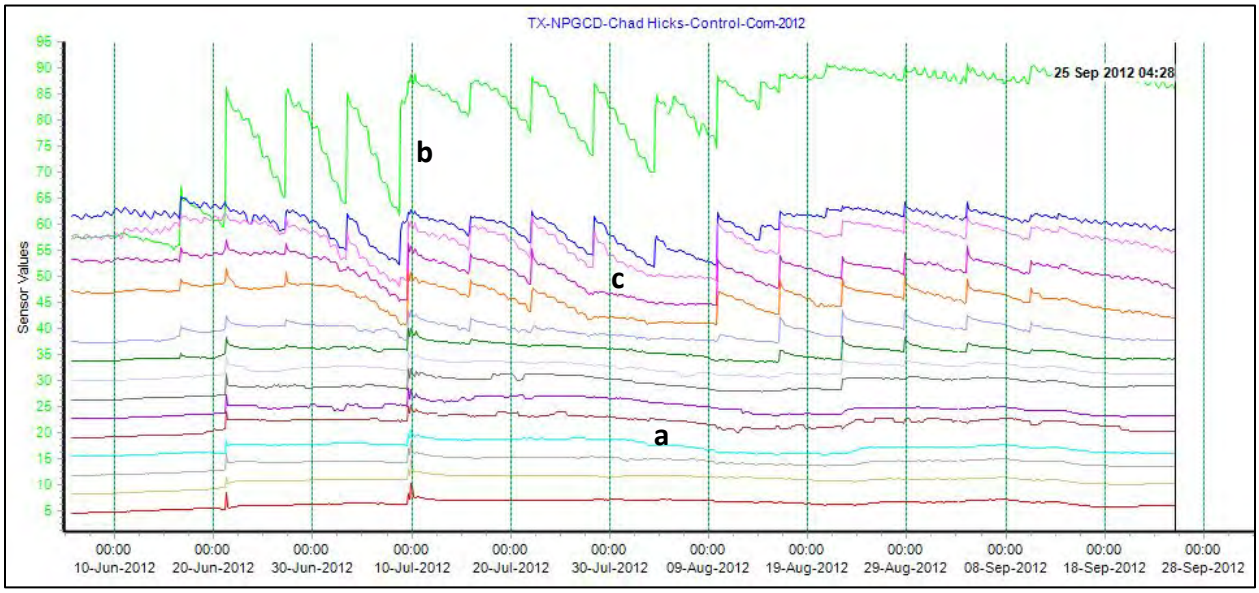
Control

Year:	*2012*	**County:**	*Hartley*	**Grower:**	*Chad Hicks*
No. Acres:	*310*	**Variety/Hyb:**	*P1151HR*	**Soil Type:**	*Sunray Clay Loam*
Meter Type:	*N/A*				
Meter Mult:	*N/A*	**Tillage:**	*Strip Till*		
Fertilizer:	*240-50-40-2zn*	**Seeding:**	*28,000*		
Planted:	*May 17, 2012*	**Harvest:**	*October 15, 2012*		
Herbicide:	*Round Up*	**Insecticide:**	*Oberon*		
Yield:	*218 Bu/Acre*	**Prev. crop:**	*Corn*	**Row width:**	*30 inch*
Irrigation method:	*Center Pivot*	**Prewater:**	*Yes*	**Well GPM:**	*2215*
Distance between drops:	*60”*	**Distance from nozzle to ground:**		*16”*	
Application pattern:	*Spray*	**Crop row direction :**		*Straight*	
		GPS Location:	Latitude:	*36.02338*	
			Longitude:	*-102.37829*	

Chad Hicks: AquaSpy Control Site (218 bu/ac; 19.85" irrigation)



Early irrigation was able to fully wet the soil and the stored soil moisture was able to keep up with demand during the early hot spell in late June. The large irrigation/rainfall on 9th July was able to replenish stored soil moisture and set the crop up during the critical pollination phase. This stored soil moisture was also critical during the second hot spell in late July to maintain water use. Late season irrigation kept up with demand.



(a) Active roots to 48"

(b) Wetting event on 9th July was key to replenishing soil moisture and keeping up with crop demand. The timing of this event was critical to the final yield outcome.

(c) While most irrigation was effective at penetrating to 20-24", irrigation during second hot spell was not effective past 8-12".

Harvest Results - The 200-12 field produced a 14 bushel per acre corn yield. Irrigation totaled 6.20 inches. There was not sufficient water available to irrigate the crop as needed after mid- June. The water was applied on larger crop acres that included the control field. Production in the control field was 218 bushels per acre, where seasonal irrigation and pre-water totaled 23.74 inches. Preseason irrigation was 1.95 inches in the 200-12 field and 3.89 in the control. Pre-water is included in the total irrigation amount. In comparison, production in the 200-12 field was 204 bushels less per acre than the control with 17.54 inches less irrigation. Corn production was 2.32 bushels (130lbs) per inch of irrigation in the 200-12 field compared to 9.18 (514lbs) in the control. Production from each inch of irrigation, rainfall and net soil water that totaled 15.79 inches was 0.89 bushels (49lbs) per acre in the 200-12 field. Irrigation, rainfall and net soil water totaled 30.25 inches in the control field where production was 7.20 bushels (403lbs) per inch. Crop production costs were $319.82 per acre less for the 200-12 field than for the control from reduced seed, fertilizer, irrigation and harvest expenses. At $6.59 per bushel, the additional corn yield in the control field amounts to $1334.36 more per acre. The control fields field's net gain was $1024.54 per acre with 17.54 inches more irrigation used compared to production from the 200-12 field. Another message that water available for irrigation is not what it used to be. A summary of the demonstration results are shown in the following table.

Table – 2012 Demonstration Results for Hicks 200-12 & Control

Irrigation		Irrig/Rain/Soil	PRODUCTION		CROP VALUE @ $6.59/Bu		
field	Inches	Inches	Bu/Ac	Bu/Ac-In Irrigation	Per Acre	Acre-In of Irrigation	Ac-In of Irrig/Rain/Soil
200-12	6.20	*15.79	14	2.32	$92.26	$14.88	$5.84
Control	23.74	+30.29	218	9.18	$1436.62	$60.51	$47.43

***Includes 3.48 inches of water removed from five feet of soil, plus rainfall, and irrigation.**
+Includes 0 inches of soil water removed from five feet of soil, plus rainfall and irrigation.

Brian Bezner-Dallam County Demonstration, 2012

Planting and Crop Information - For his demonstration, Brian Bezner strip tilled and planted 120 acres of corn in the southwest quarter of section 74, for his "200-12" field, "Bezner 200-12". Bezner planted 60 acres of the field with NK Syngenta N72D3111 and 60 acres with N72Q3111, each at a seeding rate of 27,000 seeds/acre. Bezner planted 124 acres, also strip tilled, in the northeast quarter of section 74 to NK Syngenta N72Q3111 at 33,000 seeds/acre for his "control" field, "Bezner Control". The 200-12 field was irrigated using a center pivot where seasonal water meter readings average 280 gpm and delivered an average of .93 inches of irrigation in a 7.5 day revolution. Water meter readings averaged 575 gpm for the center pivot that irrigated the control field and delivered 1.15 inches in a 4.5 day revolution. Planting and crop information for "Bezner 200-12" and "Bezner Control" are shown in the table below. Each is the same unless specified.

Table – Planting *and Crop Information for Bezner*

200-12		***Control***	
Planted:	May 16	**Planted:**	June 2
Hybrid:	N72D3111&N72Q3111	**Hybrid:**	N72Q3111
Seeding Rate:	27,000	**Seeding Rate**:	33,000
Soil Type:	Dallam & Perico fine sandy loam	**Herbicide:**	traxion, request, grounded, lumax
Row Width:	30 Inches	**Tillage:**	Strip Till
No Acres:	120	**No. Acres:**	122
Fertilizer:	95-42-9-9S-7zn	**Fertilizer**:	134-42-9-9S-7zn
Harvested:	August 17 silage	**Harvested:**	October 26
GPM Per Acre:	2.33	**GPM Per Acre:**	5.0
Irrig/Rain/SoilWater:	13.33"	**Irrig/Rain/SoilWater:**	30.05"

Beginning Soil Water Profile and Growing Season Rainfall

"200-12": Soil water was good at 1 foot, and 60 percent at 2, 4, and 5 feet prior to planting on May 16. It was about 40 percent at 3 feet. Irrigation and limited rainfall maintained soil water at one foot and improved available plant water at 2 feet. The crop used all irrigation and rainfall and depleted the soil profile at 1, 2, and 3 feet by the end of July and later from 4 and 5 feet, prior to harvest on August 17. Dallam fine sandy loam soil holds approximately 1.6 inches of available water in the first foot and 1.9 inches at 2, 3, 4, and 5 feet for potential crop use. Weekly gypsum block readings and the AquaSpy® soil probe show adequate to moderate soil water levels beginning the growing season, but inadequate by mid-July. The gypsum blocks were installed in late March, prior to planting, to obtain advanced soil water conditions.

"Control": Soil water was good to five feet when the soil moisture sensing gypsum blocks were installed on June 20 following planting. Weekly gypsum block readings and the AquaSpy® soil probe show high plant water use during the last two weeks in July and first week in August when soil water was depleted from 1, 2, 3 and 4 feet with continuous irrigation. The profile was refilled by irrigation and limited rainfall by late August, after crop

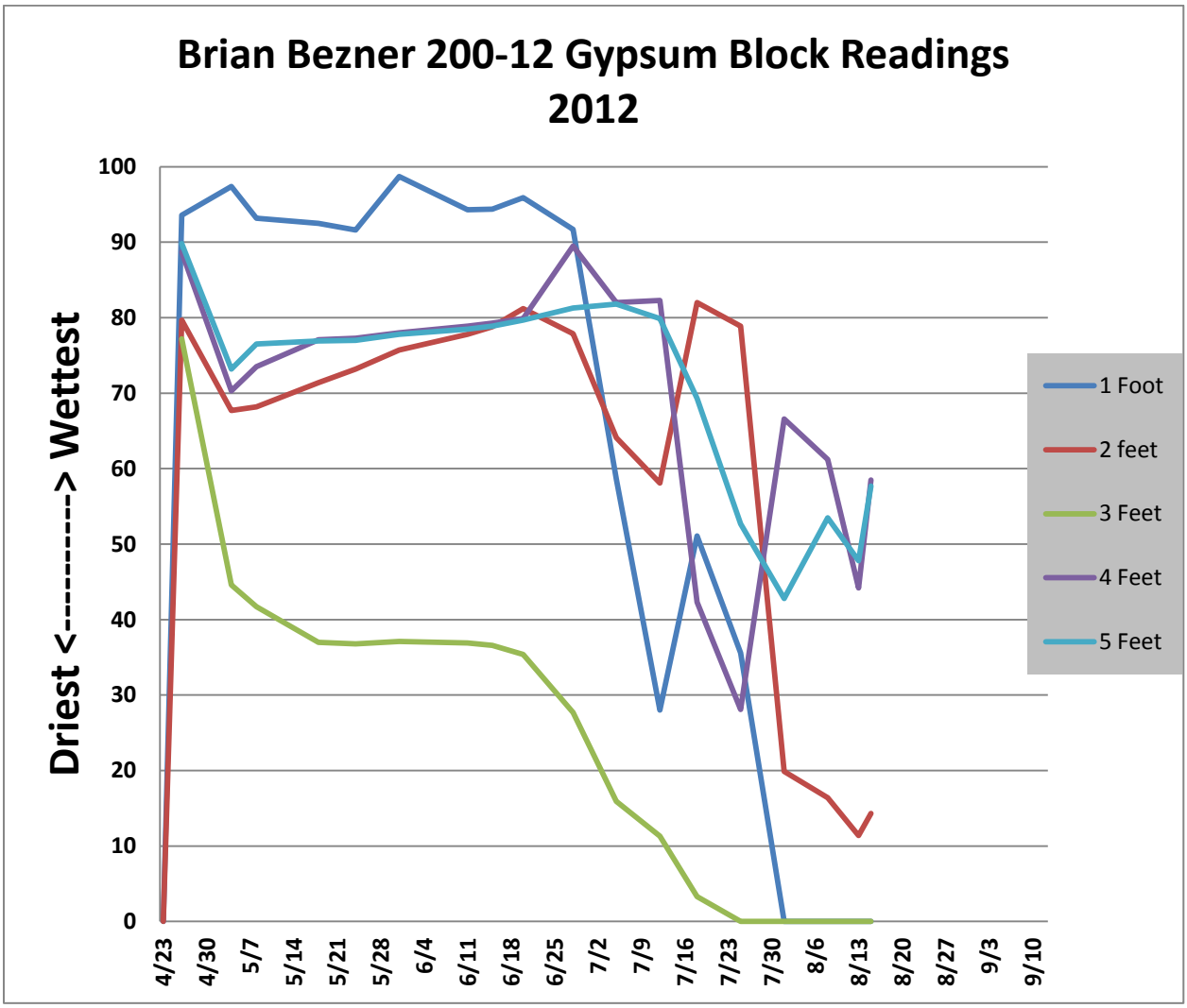
daily water use was much less. Dallam fine sandy loam soil holds approximately 1.60 inches available water from the first foot and 1.90 from 2, 3, 4 and 5 feet for potential crop use.
Both: Seasonal rainfall totaled 3.24 inches from planting until harvest in the 200-12 field. It was 3.46 inches in the control. The following tables show monthly rainfall as recorded by a district rain gauge located at the two fields.

Table – Monthly Rainfall Data for Bezner "200-12" & "Control"

200-12	May- .42"	June- 1.29"	July- .33"	August- 1.20"	Sept-	Total: 3.24"
Control	May-	June- 1.29"	July- .33"	August- 1.44"	Sept- .40"	Total: 3.46"

Growing Season Water Tracking – The district tracked crop total water throughout the growing season using rain gauges, water meters and both gypsum block and AquaSpy® soil moisture sensors. A set of five gypsum block soil moisture sensors was installed at 1, 2, 3, 4 and 5 feet and an AquaSpy® soil moisture probe was installed down to five feet in the root zone at one location to monitor soil water levels in the 200-12 field. Another set of the same type of sensors was installed in the Control field. Both sensors were installed in close proximity to each other in the field. Gypsum blocks were installed in the 200-12 field prior to planting. Gypsum blocks were installed in the Control field and the AquaSpy® probes in each field following crop emergence. Following this paragraph, a series of graphs and tables shows weekly gypsum block readings for the season; growing season water, including rainfall, irrigation, and soil moisture at various growth stages; and the order of irrigation and rainfall events for each field. Finally a form describes the protocols for each field. "Total Water," as shown on the graph for growing season water, is the sum of seasonal irrigation, rainfall and net soil water. Graphs and tables for the 200-12 field are shown first, followed by the illustrations for the Control field.

Graph – Gypsum Block Readings for Brian Bezner 200-12



Graph – Growing Season Water Tracking for Brian Bezner 200-12

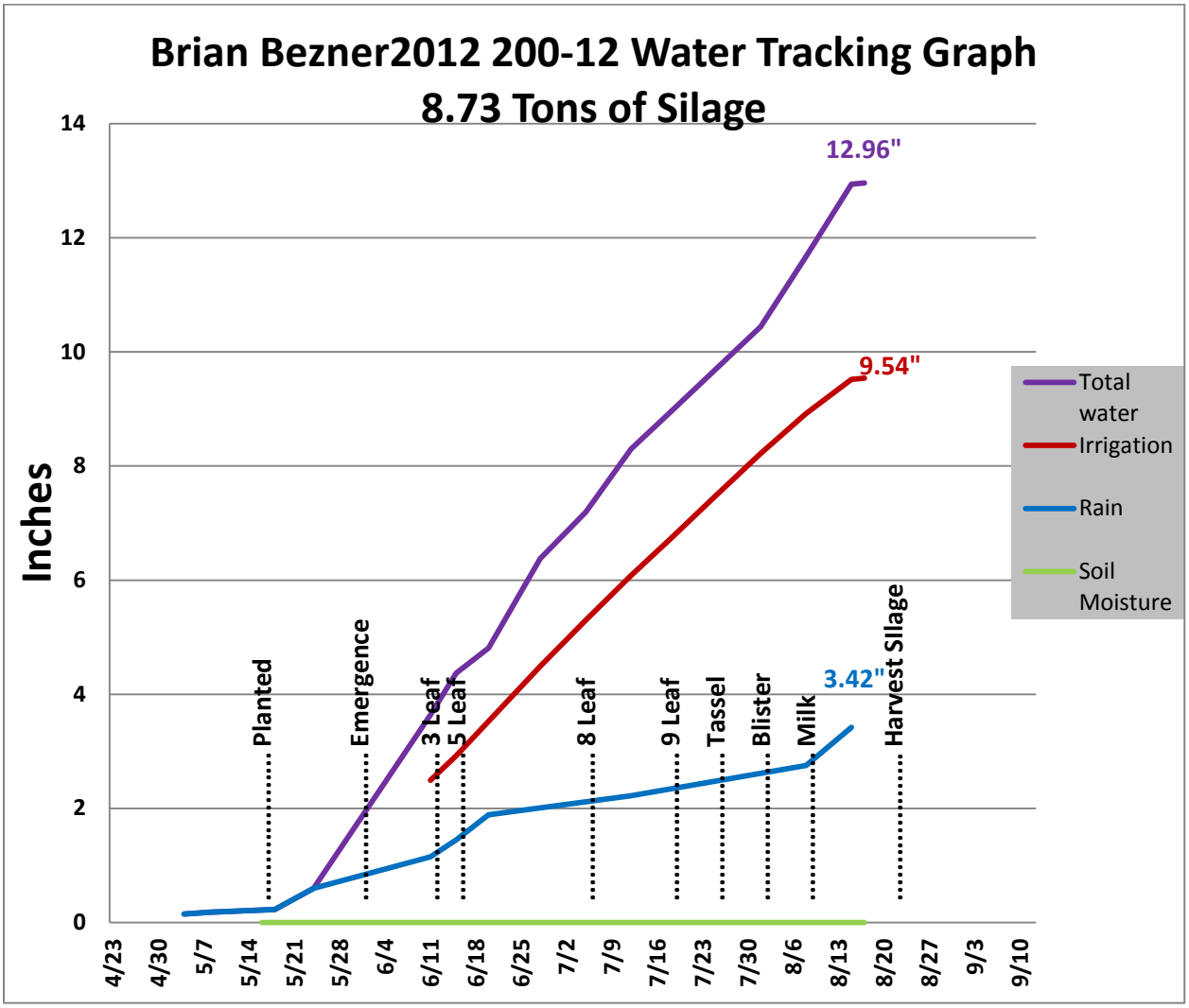


Table- Demonstration Field Data Brian Bezner's 200-12

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
4/23			no meter									
4/26			no meter		93.6	79.7	77.2	88.7	89.8		240 N	
5/4	0.15		no meter		97.4	67.7	44.6	70.3	73.2		180 N	
5/8	0.03		no meter		93.2	68.2	41.7	73.5	76.5		255 N	
5/16				planted								
5/18	0.05		no meter		92.5	71.4	37	77.1	76.9		270 Y	
5/24	0.37		no meter		91.6	73.2	36.8	77.3	77		45 Y	
		0.87	163 hrs									300
5/31			no meter	emerge	98.7	75.7	37.1	78	77.8		270 N	
		0.88	164 hrs									300
6/11	0.55	0.74	7.36	3 leaf	94.3	77.8	36.9	78.9	78.5		180 Y	295
6/15	0.3	0.43	11.66%	5 leaf	94.4	78.8	36.6	79.3	78.9		170 Y	271
6/20	0.44		11.79	5 leaf	95.9	81.2	35.4	79.9	79.7		330 Y	267
6/28		1.57	27.39	5 leaf	91.7	77.9	27.7	89.5	81.3		135 Y	266
7/5		0.81	35.52	8 leaf	58.6	64.1	15.9	82	81.8		218 Y cw	252
7/12	0.33	0.78	43.36	8 leaf	28	58.1	11.3	82.3	79.9		203 Y cw	255
7/18		0.64	49.8	9 leaf	51.1	82	3.3	42.3	69.3		176 Y cw	242
7/25		0.75	57.29	tassel	35.6	78.9	0	28.1	52.7		121 Y cw	245
8/1		0.75	64.82	blister	0	19.9	0	66.6	42.8		82 Y cw	235
8/8	0.53	0.7	71.86	milk	0	16.4	0	61.2	53.5		133 Y cw	187
8/13				milk	0	11.4	0	44.2	47.8		70 Y cw	
8/15	0.67	0.6	77.89	dough	0	14.3	0	58.5	57.7		191 Y cw	225
8/17		0.02	78.07	harvest								
8/28			78.07	silage								
Total	3.42	9.54			0	0	0	0	0			
Irrigation, Rain, Soil Is a total of 13.33 Inches												

- Numbers in red are not counted in total

NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

200-12

Year: *2012* **County:** *Dallam* **Grower:** *Brian Bezner*

No. Acres: *120* **Soil Type:** *Dallam & Perico Fine sandy Loam*

Meter Type: *Seametrics* **Variety/Hyb:** *N72D3111 &N72Q3111*

Meter Mult: *Ac Ft x 1* **Tillage:** *Strip Till*

Fertilizer: *95-42-9-9s-7zn* **Seeding:** *27,000*

Planted: *May 16, 2012* **Harvest:** *August 17, 2012*

Herbicide: *Trazion, Request, Grounded, Lumax* **Insecticide:** *None*

Yield: *8.73 Ton's Silage* **Prev. crop:** *Wheat* **Row width:** *30 Inch*

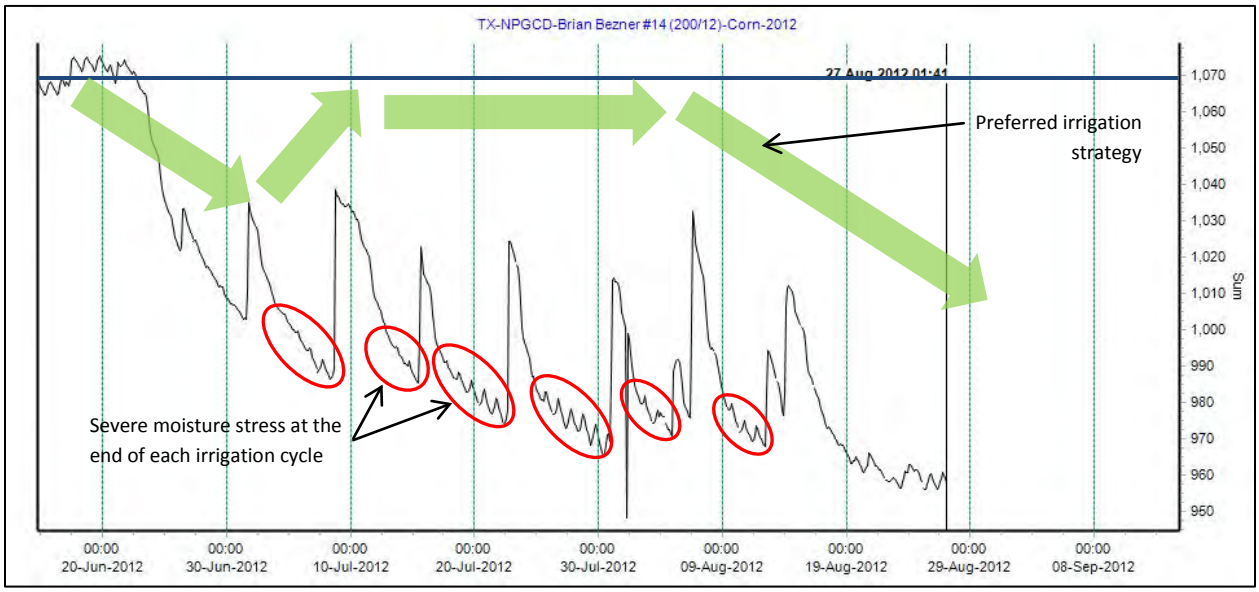
Irrigation method: *Center Pivot* **Prewater:** **Well GPM:** *280*

Distance between drops: *60”* **Distance from nozzle to ground:** *16”*

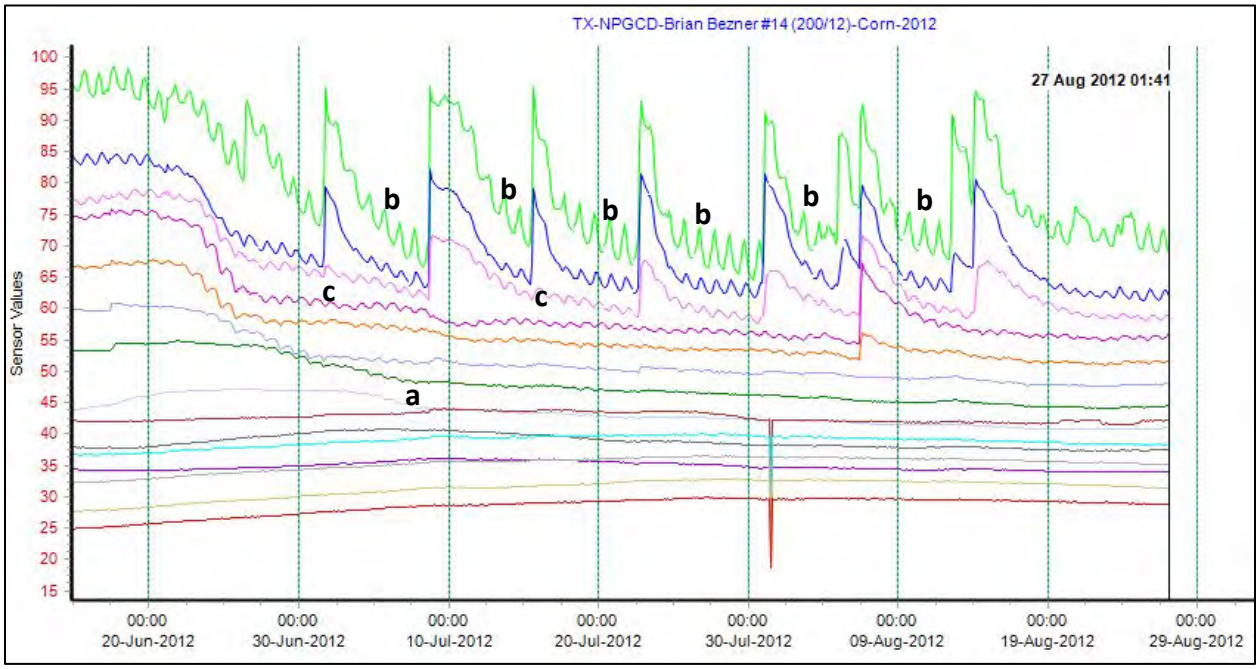
Application pattern: *Spray* **Crop row direction :** *Straight*

GPS Location: Latitude: *36.132557*
Longitude: *-102.961909*

Brian Bezner: AquaSpy 200/12 Site (8.73 t/ac silage; 9.54" irrigation)



Irrigation was not able to keep up with plant demand resulting in severe stress at the end of each irrigation cycle. Severe moisture stress during peak demand resulted in a massive loss of yield potential.



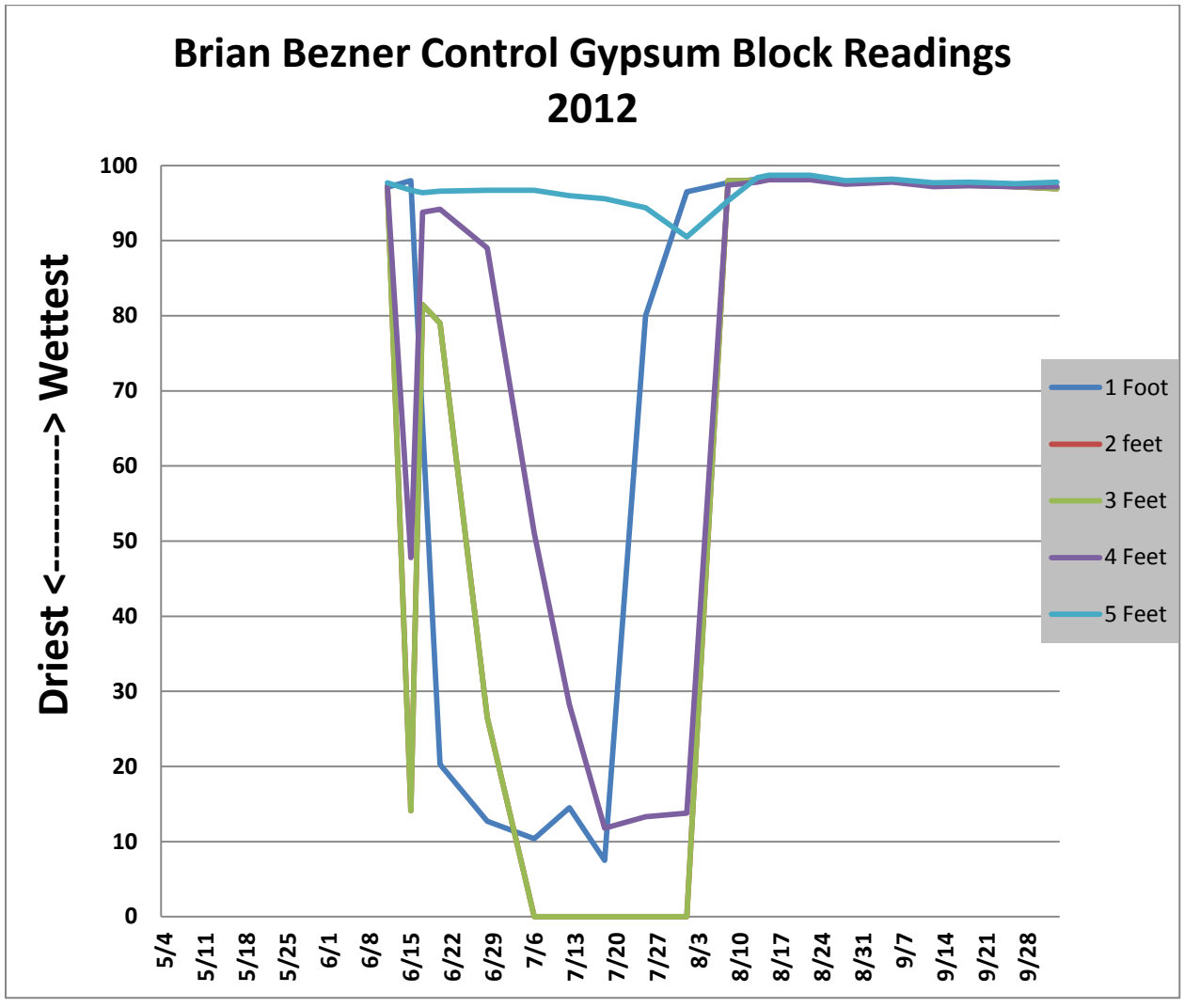
(a) Max root depth ~32"

(b) Severe moisture stress at the end of each cycle

(c) Irrigation not penetrating to 12"

The subsoil dried out and irrigation was never able to wet up the soil below 12" resulting in severe stress

Graph – Gypsum Block Readings for Brian Bezner Control



Graph – Growing Season Water Tracking for Brian Bezner Control

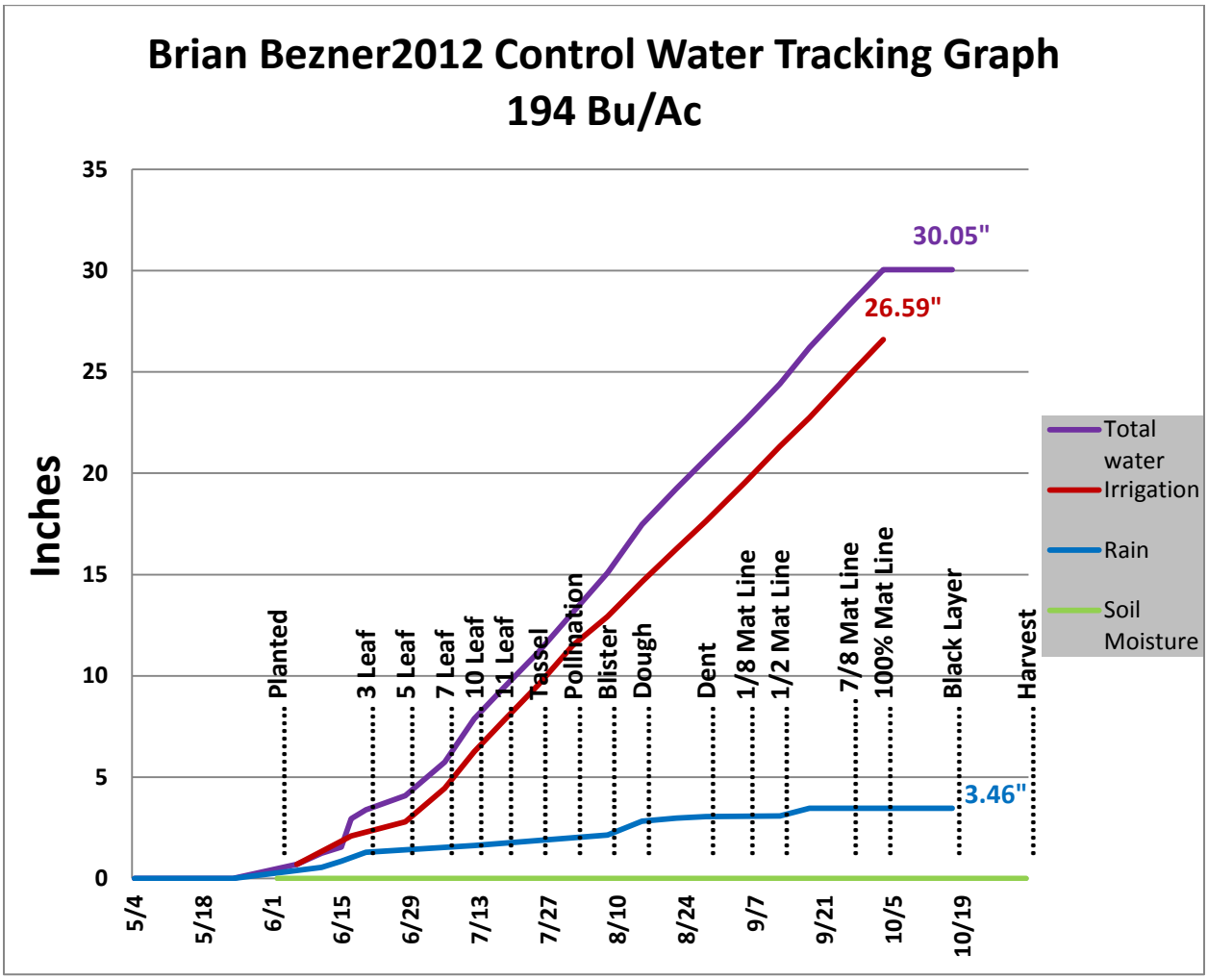


Table- Demonstration Field Data Brian Bezner's Control

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
5/4	0.15											
5/8	0.03											
5/18	0.05											
5/24	0.37											
6/2				planted						planted		
6/6		0.7	65 hrs							control		600
6/11	0.55		no meter									
6/15	0.3		no meter								330 Y	
		0.7	65 hrs							control		600
6/17		0.7	65 Hrs							control		600
6/20	0.44		no meter	3 leaf	97.1	97.2	97.3	97.2	97.7	control	30 Y	
6/28		0.7	7.18	5 leaf	98	97.5	14.1	47.8	96.7	control	140 Y	545
7/6		1.66	24.32	7 leaf	96.2	96.3	48.1	67.3	96.3	control	44 Y cw	590
7/12	0.33	1.8	42.88	10 leaf	65.6	80.5	81.5	93.8	96.4	control	226 Y cw	596
7/18		1.54	58.8	11 Leaf	20.3	8.8	79	94.2	96.6	control	328 Y cw	587
7/25		1.75	77	tassel	12.7	0	26.5	89	96.7	control	160 Y cw	540
8/1		1.95	97.18	pollin	10.4	0	0	51.1	96.7	control	339 Y cw	574
8/8	0.53	1.43	111.99	blister	14.5	0	0	28.2	96	control	143 Y cw	559
8/13				milk	7.5	0	0	11.8	95.6	control	180 Y cw	
8/15	0.67	1.72	129.79	dough	80	0	0	13.3	94.4	control	326 Y cw	551
8/22	0.16	1.62	146.51	dough	96.5	0	0	13.8	90.5	control	75 Y cw	549
8/28	0.08	1.37	160.64	dent	97.7	97.9	98	97.4	95.3	control	82 Y cw	570
9/5		1.93	180.62	1/8mat ln	98.2	98.1	98	97.8	98.4	control	237 Y cw	576
9/12	0.02	1.76	198.8	1/2mat ln	98.4	98.2	98.3	98.1	98.7	control	331 Y cw	484
9/18	0.38	1.41	213.42	1/2mar ln	98.4	98.2	98.3	98.1	98.7	control	306 N	
9/26		2.08	234.94	7/8mat ln	97.8	97.9	97.8	97.5	98	control	122 Y cw	
10/3		1.77	253.26	1.0mat ln	98	98	98.1	97.8	98.2		204 N	
10/10			253.32	1.0mat ln	97.3	97.3	97.4	97.2	97.7		204 N	

Date	Inches	Inches	Water	Growth	Soil Moisture					Crop	Pivot	Well
mm/dd	Rain	Irrigation	Meter	Stage	1 Foot	2 feet	3 Feet	4 Feet	5 Feet	Status	Position	Gpm
10/17	0.17		253.32	blk layer	97.5	26.2	97.4	97.3	97.8		204 N	
10/24			253.32	blk layer	97.2	4	97.2	97.2	97.6		204 N	
11/1			253.44	harvest	97	0	96.9	97.2	97.8		N	
Total	3.46	26.59			0	0	0	0	0			
Irrigation, Rain, Net Soil water is 30.05												

- Numbers in red are not counted in total

NORTH PLAINS GROUNDWATER Conservation District

2012-Corn Demonstration
Irrigated Medium Season Corn

Control

Year: *2012* **County:** *Dallam* **Grower:** *Brian Bezner*

No. Acres: *120* **Soil Type:** *Dallam & Perico Fine sandy Loam*

Meter Type: *Seametrics* **Variety/Hyb:** *N72Q3111*

Meter Mult: *Ac Ft x 1* **Tillage:** *Strip Till*

Fertilizer: *134-42-9-9s-7zn* **Seeding:** *33,000*

Planted: *June 2, 2012* **Harvest:** *October 26, 2012*

Herbicide: *Trazion, Request, Grounded, Lumax* **Insecticide:** *None*

Yield: *194 Bu/Acre* **Prev. crop:** **Row width:** *30 Inch*

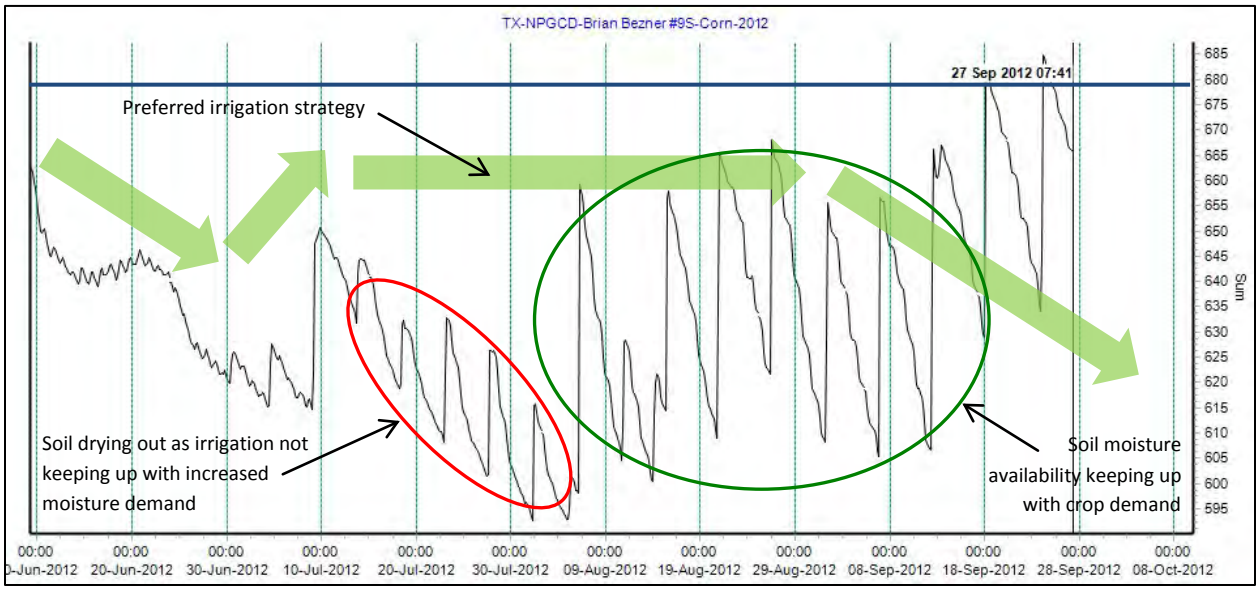
Irrigation method: *Center Pivot* **Prewater:** **Well GPM:** *575*

Distance between drops: *60”* **Distance from nozzle to ground:** *16”*

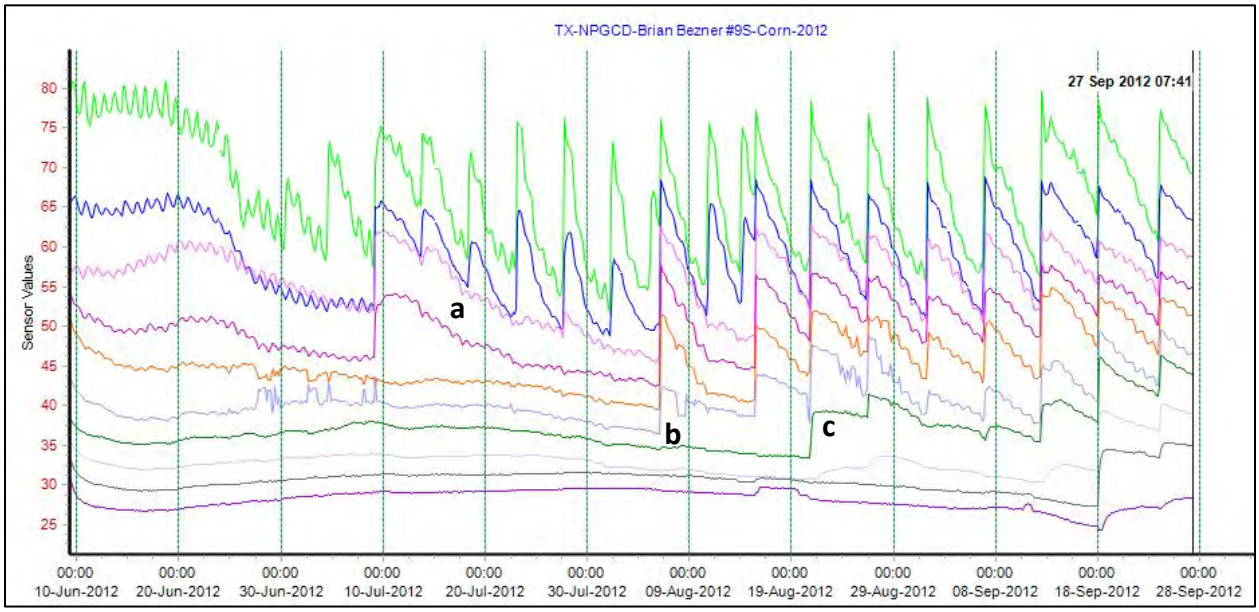
Application pattern: *Spray* **Crop row direction :** *Straight*

GPS Location: Latitude: *36.13294*
Longitude: *-102.94755*

Brian Bezner: AquaSpy Control Site (194 bu/ac; 26.6" irrigation)



The soil had low sub-soil moisture at the beginning of the season. Early irrigation was not keeping up with crop demand and the yield potential was likely to have been affected. However soil moisture was dramatically increased on 6th August and from that point on kept up with demand. Late moisture availability was able to produce a reasonable yield



(a) Early irrigation was not reaching 12"

(b) Irrigation or rainfall on 6th August reached 24"

(c) Irrigation from late August onwards was very effective at reaching 24"-32". Root activity and water uptake very active down to 32"

Harvest Results - The 200-12 field was harvested for corn silage on August 17. With only limited rainfall, available irrigation water was not sufficient to produce a grain crop. The field produced 8.73 tons of silage per acre. Irrigation totaled 9.54 inches. Production in the control field was 194 bushels per acre, where seasonal irrigation totaled 26.59 inches. There was no pre-season irrigation in either field. In comparison, production from the 200-12 field with the silage priced at $40 per ton has a value of $349.20 per acre. Irrigation was 17.05 inches less per acre than in the control. Value of grain corn priced at $6.59 per bushel is $1278.46 per acre. Corn silage production was .92 tons per inch of irrigation in the 200-12 field. Grain production was 7.29 bushels (408lbs) per inch in the control. Silage production from each inch of irrigation, rainfall and net soil water that totaled 13.33 inches was .65 tons per acre in the 200-12 field. Irrigation, rainfall and net soil water totaled 30.05 inches in the control field where production was 6.45 bushels (361lbs) per inch. Crop production costs were $124.99 per acre more for the control field than for the 200-12 from additional seed, fertilizer and irrigation expenses. At $6.59 per bushel for grain and $40 per ton for silage, the corn grain in the control field amounts to $929.26 more per acre. The control field's net gain for corn grain is $929.26 per acre with 17.05 inches more irrigation used compared to production from the 200-12 silage field. A summary of the demonstration results are shown in the following table.

Table – 2012 Demonstration Results for Bezner 200-12 & Control

Irrigation		Irrig/Rain/Soil	PRODUCTION		CROP VALUE @ $6.59/Bu&$40/Ton		
field	Inches	Inches	Tons/ac Bu/Ac	Tons&Bu/Ac -In Irrigation	Per Acre	Acre-In of Irrigation	Ac-In of Irrig/Rain/Soil
200-12	9.54	*13.33	8.73	.92 T	$349.20	$36.60	$26.19
Control	26.59	+30.05	194	7.29 bu	$1278.46	$48.08	$42.54

***Includes 0 inches of water removed from five feet of soil, plus rainfall, and irrigation.**
+Includes 0 inches of soil water removed from five feet of soil, plus rainfall and irrigation.

Irrigation and Production from Area Corn Fields by Better Harvest

Better Harvest Certified Crop Advisors shared irrigation and corn production results obtained in 867 area fields. Their combined data supports the NPGCD's 200-12 project and is summarized in the following table by irrigation capacity in gallons per minute per acre. The data shows that growers whose irrigation capacity was less than five gpm per acre received equal to more net income from the sale of their crops, less seed, fertilizer, irrigation and harvest expenses than those whose irrigation capacity was more than 5 and 6 gpm per acre. Additional data is in Appendix B.

Table – Comparison of Corn Production by Gpm per Irrigation Capacity from Better Harvest

Gpm	Number	Yield	Irrigation	Bushels/	Pounds/				
Per Acre	Fields	Bu/Acre	Inches	Ac.Inch	Ac.Inch				
< 5	83	226	19.1	11.82	662				
> 5 - < 6	357	230	23.3	9.85	552				
> 6	427	233	27.6	8.45	473				
Production Expense									
Gpm	Seed	Cost @	Nitrogen	Cost @	Irrigation	Cost @	Harvest	Cost @	Total
Per Acre	Rate	$3.12/1000	lbs/Acre	$.61/lb	Inches	$4.00/inch	Bushels	$.40/bu	Cost/Ac-$
< 5	28,000	87.50	178	108.58	19.1	76.36	226	90.28	362.72
> 5 - < 6	30,000	93.75	194	118.58	23.3	93.33	230	91.92	397.58
< 6	32,000	100.00	188	114.80	27.6	110.30	233	93.24	418.34
Bottom line at $8.00/ Bushel									
Gpm	Number	Yield	Production	Gross	Gross Value	Dollar			
Per Acre	Fields	Bu/Acre	Expenses	Value-$	less Prd Costs	Difference			
< 5	83	226	$362.72	1805.60	1442.88	basis			
> 5 - < 6	357	230	$397.59	1838.40	1440.81	-2.07			
> 6	427	233	$418.34	1864.80	1446.46	3.58			

Conclusion

The 200-12 Project demonstrates how water conservation technologies and irrigation management practice adjustments can reduce groundwater use and allow agricultural irrigation producers to remain financially viable with restricted and diminishing groundwater resources. By using real-time technologies to monitor soil-water conditions in the root zone, all nine demonstrations showed that growers can manage their irrigation water needs better and reduce crop irrigation. In the eleven 200-12 demonstration fields where grain was harvested, **Joe Reinart** produced 35 more bushels per acre in the control field than the 200-12 with 9.55 additional inches of irrigation. Crop production costs were $113.74 per acre more for the control field than the 200-12 field. The control field's net gain was $116.91 per acre compared to production from the 200-12 field. **Harold Grall** produced 27 more bushels per acre in the 200-12 field than the control with 1.20 less inches of irrigation. Crop production costs were $14.27 per acre more for the 200-12 field than for the control. The 200-12 field's net gain was $163.66 per acre. **Tommy Laubhan** produced nine more bushels per acre in the control field than the 200-12. Crop production costs were $14.91 per acre less for the 200-12 field than for the control from reduced irrigation and harvest expenses. The control field's net gain was $44.40 per acre with 2.47 inches additional irrigation used compared to production from the 200-12 field. **Hartley Feeders & Dennis Buss** produced 45 more bushels per acre in the 200-12 field than the control with 0.86 less irrigation**.** Crop production costs were $11.17 per acre more for the 200-12 field than for the control from reduced irrigation but primarily from increased harvest expenses. The 200-12 field's net gain was $285.38 per acre with 0.86 inches less irrigation used compared to production from the control field. **Brent Clark** produced 10 more bushels per acre in the 200-12 field compared to the control with 3.73 inches less irrigation. Crop production costs were $54.50 per acre less for the 200-12 field than for the control from reduced seed, fertilizer, irrigation and increased harvest expenses. The 200-12 field's net gain was $120.40 per acre. Both fields were damaged by hail at the 10 leaf stage. **Richard Schad** produced 72 more bushels per acre in the control field than the 200-12 with 1.06 additional inches of irrigation**.** Crop production costs were $97.97 per acre more for the control field than for the 200-12 from increased seed, fertilizer, irrigation and harvest expenses. The control field's net gain was $376.51 per acre. **Danny Krienke** produced 3 more bushels per acre in the 200-12 field than the control. Crop production costs were $8.82 per acre less for the 200-12 field than for the control from reduced irrigation and increased harvest expenses. The 200-12 field's net gain was $28.59 per acre with 2.10 inches less irrigation used compared to production from the control field. **Phil Haaland** produced 93 bushels per acre more in the control field than the 200-12. Crop production costs were $58.55 per acre less for the 200-12 field than for the control from reduced seed, irrigation and harvest expenses. The control field's net gain was $554.32 per acre with 3.61 inches more irrigation used compared to production from the

200-12 field. **Frische Brothers** produced one bushel per acre less in the 200-12 field than the control. Crop production costs were $5.72 per acre less for the 200-12 field than for the control from reduced irrigation and harvest expenses. The 200-12 field's net loss was $0.87 per acre with 1.12 inches less irrigation used compared to production from the control. Plants in both fields were damaged by hail at the seven leaf stage. **David Ford** produced 87 more bushels per acre in the control field compared to the 200-12. Crop production costs were $85.72 per acre less for the 200-12 field than for the control from reduced seed, fertilizer, irrigation and harvest expenses. The 200-12 field's net loss was $487.61 per acre with 5.03 inches less irrigation used compared to production from the control field. Plants in both fields were damaged by hail at the six to seven leaf growth stages. **Chad Hicks & 14 Mile Ranch** produced 204 bushels more per acre than the 200-12 field with 17.54 inches more irrigation. Crop production costs were $319.82 per acre less for the 200-12 field than for the control from reduced seed, fertilizer, irrigation and harvest expenses. The control field's net gain was $1024.54 per acre. There was not sufficient water available to irrigate the 200-12 field as needed after mid-June. **Brian Bezner** harvested the 200-12 field as corn silage on August 17. With only limited rainfall, available irrigation water was not sufficient to produce a grain crop. Silage production was 8.73 tons per acre. Grain production in the control field was 194 bushels per acre. Crop production costs were $124.99 per acre more for the control field than for the 200-12 from additional seed, fertilizer and irrigation expenses. The control field's net gain for corn grain is $929.26 acre with 17.05 inches more irrigation used compared to production from the 200-12 silage field. **We learned** that high efficiency LEPA center pivot systems are needed to help stretch available water for irrigation and that crop residue remains essential. Irrigation systems must get more of the available water to the crop. Also, we learned that drought tolerant hybrids were commonly planted, mostly in May, and performed well. The year 2012 delivered a clear message that rainfall is not what it once was, two consecutive years. **Additional data** obtained by Better Harvest Certified Advisors in 867 area grower's corn fields support the NPGCD's reduced corn irrigation project. Better Harvest data shows that sales of corn crops where system irrigation capacity was less than five gallons per minute per acre, less respective expenses for seed, fertilizer, irrigation and harvest, were equal or similar to that where system irrigation capacity was greater than five and six gallons per minute per acre. If the technologies and methods utilized by the demonstrations can be translated to three inches of reduced irrigation over the one million acres of corn and other crops in the District, the water savings will be 250,000 acre-feet of water per year. This water savings can prolong the viability of agriculture irrigation in the area.

Appendix A

			Inches	Inches	Inches	Inches	Inches	Inches Net	Irrig/Rain	Yield	Bu/Acre	Bu/Ac Inch
Grower	Field	Planted	preWater	Irrigation	Total Irrg	Rainfall	Rain&Irig	Soil Water	Soil Water	Bu/Acre	Inch Irrig	In Irrig/Rain/Soil
Reinart	**200-12**	16-May	0	18.20	18.20	6.82	25.02	3.90	28.92	170	9.34	5.88
	Control	23-Apr	6.50	21.25	27.75	7.25	35.00	0	35.00	205	7.38	5.85
Harold	**200-12**	28-May	0	16.87	16.87	3.14	20.01	4.17	24.18	167	9.90	6.90
	Control	24-May	0	18.07	18.07	3.85	21.92	0	21.92	140	7.75	6.38
Laubhan	**200-12**	4-May	0	20.31	20.31	4.08	24.39	0	24.39	165	8.12	6.76
	Control	4-May	0	22.78	22.78	4.08	26.86	0	26.86	174	7.64	6.48
Dennis	**200-12**	20-May	0.84	19.84	20.68	5.96	26.64	0	26.64	160	7.73	6.00
	Conrol	21-May	0.89	20.65	21.54	5.96	27.50	0	27.50	115	5.34	4.18
Brent	**200-12**	23-Apr	0	14.90	14.90	7.56	22.46	-0.16	22.30	143	9.60	6.41
	Control	23-Apr	0	18.63	18.63	7.56	26.19	1.50	27.69	133	7.14	4.80
Schad	**200-12**	11-May	3.11	16.42	19.53	4.64	24.17	2.58	26.75	135	6.91	5.04
	Control	1-May	5.11	15.48	20.59	3.37	23.96	1.43	25.39	207	10.00	8.15
Krienke	**200-12**	21-May	0	24.57	24.57	4.44	29.31	0.25	29.26	134	5.45	4.53
	Control	21-May	0	26.62	26.62	4.44	31.06	1.62	32.68	131	4.92	4.00
Phil	**200-12**	24-May	3.33	21.14	24.47	5.02	29.49	0	29.49	116	4.74	3.93
	Control	24-May	3.33	24.75	28.08	5.02	33.10	0	33.10	209	7.44	6.31
Frische	**200-12**	6-May	1.50	12.02	13.52	3.82	17.34	0	17.34	104	7.69	6.00
	Control	6-May	1.50	13.14	14.64	3.82	18.46	0	18.46	105	7.17	5.69
Ford	**200-12**	15-May	2.60	13.01	15.61	8.40	24.01	0	24.01	86	5.51	3.58
	Control	15-May	2.60	18.04	20.64	8.40	29.04	0	29.04	173	8.38	5.96
C. Hicks	**200-12**	2-May	1.95	4.25	6.20	6.11	12.31	3.48	15.79	14	2.26	0.89
	Control	17-May	3.89	19.85	23.74	6.51	30.25	0	30.25	218	9.18	7.20
Brian	**200-12**	16-May	0	9.54	9.54	3.24	12.78	0.55	13.33	8.73Tons*	.91 Tons	.65 Tons
	Control	2-Jun	0	26.59	26.59	3.46	30.05	0	30.05	194	7.30	6.45
Average	**200-12**				18.86	5.39	24.28		25.36	138	7.31	3.18
Average	**Control**				22.47	5.31	27.78		28.16	167	7.43	5.93

*Bezner 200-12 harvested as corn silage

Appendix B

Better Harvest Irrigation and Corn Production data from area Fields

Data from Better Harvest Dataset. Data taken from a dataset of 1369 fields representing over 256,000 acres. Problem fields resulting from hail, insect, weed , irrigation, or other problems removed leaving 867 fields used in this comparison.			
Color code			
Averages from Better Harvest data			
Averages of calculations made from Better Harvest data and assumptions			
Averages of calculations from assumptions			
GPM per acre	**Less than 5**	**5 to 6**	**Over 6**
Number of fields in group	83	357	427
Yield (bushels per acre)	225.7	229.8	233.1
Acre inches pumped (Assuming 80 days of pumping)	19.1	23.3	27.6
Bushels per acre inch from irrigation	11.82	9.85	8.45
Pounds per acre inch from irrigation	662	552	473
Bushels per acre inch from irrigation + 8" precip. and soil water	8.33	7.33	6.55
Pounds per acre inch from irrigation + 8" precip. and soil water	467	411	367
TN% at 4-leaf growth stage	3.96%	3.85%	3.79%
TN% at Pollination growth stage	2.67%	2.66%	2.48%
Pounds of N applied for bushel produced	0.788	0.846	0.807
Percentage of fields that had more than 75% of N applied preplant	3.6%	4.9%	3.3%
Percentage of fields that had more than 75% of N applied by irrigation	56.6%	54.3%	61.4%
Average Nitrogen applied per acre	178	194.4	188.2
Cost of N per acre (Assuming N cost at $.61 per unit of N)	$108.58	$118.58	$114.80
Assumed average GPM for calculating Irr. Cost	4.5	5.5	6.5
Irr. fuel cost per acre (assuming 80 days pumping at $4 per acre inch)	$76.36	$93.33	$110.30
Harvest cost per acre (Assuming harvest cost at $.40/bu.)	$90.28	$91.92	$93.24
Assumed seeding rate (seed per acre)	28,000	30,000	32,000
Seed cost per acre (Assuming seed cost of $250/bag or $3.125/1000 count)	$87.50	$93.75	$100.00
Total N fertilizer, Irrigation fuel, harvest, and seed cost per acre	$362.72	$397.58	$418.34
Gross income at $4/bushel minus N fert, irr. fuel, harvest & seed cost	$540.08	$521.62	$514.06
Gross income at $6/bushel minus N fert, irr. fuel, harvest & seed cost	$991.48	$981.22	$980.26
Gross income at $8/bushel minus N fert, irr. fuel, harvest & seed cost	$1,442.88	$1,440.82	$1,446.46
Differences of 6 GPM and 5 to 6 GPM group from less than 5GPM group at $4/bushel	n.a.	($18.46)	($26.02)
Differences of 6 GPM and 5 to 6 GPM group from less than 5GPM group at $6/bushel	n.a.	($10.26)	($11.22)
Differences of 6 GPM and 5 to 6 GPM group from less than 5GPM group at $8/bushel	n.a.	($2.06)	$3.58