
NORTH PLAINS
GROUNDWATER
Conservation District
200-12 Reduced Irrigation on
Corn Demonstration Project | 2013

Principal Participants:

Joe Reinart - Sherman County Cooperator

Harold Grall - Moore County Cooperator (NPGCD Director)

Brent Clark - Hartley County Cooperator

Danny Krienke - Ochiltree County Cooperator (NPGCD Director)

Brian Bezner - Dallam County Cooperator (NPGCD Director)

Richard Schad - Hansford County Cooperator

Myles Frische - Moore County Cooperator

Phil Haaland - Hartley County Cooperator (NPGCD Director)

David Ford - Hartley County Cooperator

Dennis Buss, JBS Hartley Feeders - Hartley County Cooperator

Tommy Laubhan - Lipscomb County Cooperator

Principal Staff:

Leon New - Agricultural Engineer (District Conservationist)

Paul Sigle - Agricultural Engineer (NPGCD)

Randy Coon - Natural Resource Specialist (NPGCD)

Craig Kondoff - Biological & Agricultural Engineer Intern (Texas A&M University)

Additional funding provided by:

Texas Water Development Board - Agricultural Water Conservation Grant

United States Department of Agriculture Natural Resources Conservation Service - Conservation Innovation Grant

A special thanks goes out to all those not mentioned above who help to make the "200-12" demonstrations possible.

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Executive Summary

In 2009, the District began planning the "200-12 Reduced Irrigation on Corn Demonstration Project" ("200-12" Project). 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. The "200-12" Project is led by cooperating growers to implement water conservation technologies and practices with the goal to grow 200 bushels of corn on 12 inches of irrigation per crop acre. The District"s board set the twelve inch goal based on the estimated need for 26 inches of total water per acre including six inches of total soil water at the beginning of the growing season, eight inches of rainfall during the growing season and 12 inches of irrigation water to grow a corn crop. When compared to AgriLife Extension"s Agri-Partner field demonstration program that averaged 21 inches irrigation water per acre over 10 years, the "200-12" Project demonstrates the next level of water conservation required for irrigation producers to stay financially viable into the future.

In 2013, eleven cooperating producers dedicated twenty-two demonstration fields encompassing 1672 acres. All 1672 acres dedicated to the project were harvested for corn grain. Corn yields averaged 200 bushels per acre in eleven "200-12" fields. Irrigation averaged 18.36 inches. Average pre-water in five "200-12" fields was 2.37 inches. Production averaged 11.17 bushels (625 lbs) per inch of irrigation. Average Irrigation, rainfall plus net soil water totaled 26.25 inches. Production averaged 226 bushels per acre in eleven Control fields. Average Irrigation was 23.28 inches. Production was 9.84 bushels (551 lbs) per inch of irrigation. Irrigation, rainfall and net soil water averaged 31.34 inches. No pre-water was applied in 10 of the 22 fields. **Appendix A** is a water summary and corn yield for each field. **Appendix B** is a summary of corn hybrids, seeding rates and planting dates selected by the eleven cooperators. **Appendix C** is a comparison of net return per acre for each **"**200-12" field compared to the Control field for 2013**.** Net return per acre averaged $600.23 for the "200-12" fields compared to $669.47 for the Control fields **Appendix D** is a math polynomial that indicates that the water management and corn production practices used in nine of the eleven "200-12" fields in 2013 can potentially produce more net return dollars per acre than those used in the Control fields. Two of the practices used for the "200-12" fields are only slightly less than those used in the Control fields. **Appendix E** is a comparison of net return per inch of irrigation for each "200-12" field compared to the Control field for 2013. Net return per inch of irrigation averaged $33.73 for the "200-12" fields compared to $30.09 for the Control fields. **Appendix F-1 through F-7** is an example and explanation of the seven EM38 layers received from CropMetrics electromagnetic (EM) soil survey for Brian Benzer"s 200-12 (L10) field. Results from the 2013 cooperating producers are as follows:

Joe Reinart of Sherman County dedicated 92 acres to the on-farm demonstration in two separate fields irrigated by different center pivot systems. Reinart strip tilled and planted 27 acres of corn at 25,000 seeds/acre on June 12 for his "200-12" field. He strip tilled and planted 65 acres at

32,000 seeds/acre on May 5 for his “Control” field. The “200-12” field produced 200 bushels per acre. Irrigation totaled 12.55 inches. Reinart only read and used the soil probe to irrigate the “200-12” field. Production in the Control field was 238 bushels per acre, where seasonal irrigation was 24.11 and pre-water 4.15 inches to establish a total of 28.26 inches. The Control field‟s net gain was $18.14 per acre with 15.71 inches more irrigation used compared to production from the “200-12” field. Reinart stated, “an additional 600 acres across the rest of our farm that mirrored the “200-12” field averaged 185 bushels per acre. And that “we will continue to plant early and late corn using the strategies learned from the 200-12 project”.

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 June 4 at 26,000 seeds/acre for his “200-12” field. Grall planted 120 acres, also strip tilled, on June 2 at 24,000 seeds/acre for his “Control” field. The “200-12” field produced 198 bushels per acre. Irrigation totaled 15.06 inches. Production in the Control field was 195 bushels per acre, where in-seasonal irrigation was 16.75 inches and pre-water 6.26 inches. Total irrigation for the Control field was 23.01 inches. Grall says “he thinks soil water was low in the Control field following the 2012 crop, so he decided to pre-water to help make a crop, considering he has only 300 gpm to irrigate 120 acres. And, that soil water was better in the 200-12 field”. In comparison, the “200-12” field produced 3 more bushels per acre than the Control with 7.95 less inches of irrigation. The “200-12” field‟s net gain was $49.64 per acre with 7.95 inches less irrigation used compared to production from the Control field.

Brent Clark of Hartley County dedicated 244 acres in two separate fields irrigated by different center pivots to the on-farm demonstration. Clark strip tilled and planted 122 acres of corn on April 25 at 28,000 seeds/acre for his “200-12” field. Clark planted 122 acres on April 25 at 32,000 seeds/acre, also strip tilled, for his “Control” field. The “200-12” field produced a 219 bushel per acre corn yield. Irrigation totaled 17.26 inches. Production in the Control field was 239 bushels per acre, where irrigation totaled 20.21 inches. In comparison, the Control field produced 20 more bushels per acre than the “200-12” field with 2.95 more inches of irrigation. The Control field‟s net gain was $41.93 per acre with 2.95 inches additional irrigation used compared to production from the “200-12” field. Brent said “corn in the “200-12” field stressed for water more than he wanted when the pump was being repaired during five days at the critical growth stage the first week in July”. Variable rate irrigation (VRI) was planned for the “200-12” field but not initiated due to the untimely pump repair.

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 40 acres of corn on May 18 at 28,000 seeds/acre in the northeast quarter of the circle for his “200-12” field. He planted 40 acres in the north portion of the circle on May 18 at 28,000 seeds/acre, also strip tilled, for his Control field. The northwest 40 acres were planted at 36,000 seeds/acre on June 25 for another comparison. The corn hybrid was short season. The “200-12” field produced 231 bushels per acre. Irrigation totaled 19.04 inches. Production in the Control field was 240 bushels per acre. Seasonal irrigation totaled 25.15 inches. There was no pre-season irrigation. The Control field produced nine more bushels per acre than the “200-12” and irrigation was 6.11

inches more. The Control field‟s net gain was $2.72 per acre with 6.11 inches more irrigation used compared to production from the “200-12” field. Yield from the late planted field was 201 bushels per acre. Irrigation totaled 19.96 inches. The “200-12” field‟s net gain was $149.45 per acre with 0.92 inches less irrigation compared to the late planted short season hybrid field.

Brian Bezner dedicated 222 acres in two fields irrigated by separate center pivot irrigation systems to the on-farm demonstration. Bezner strip tilled and planted 98 acres of corn on May 20 at 27,000 seeds/acre for his “200-12” field. He planted 124 acres on May 17 at 32,000 seeds/acre, also strip tilled, for his Control field. The “200-12” field produced 206 bushels per acre. Irrigation was 18.92 inches. Production in the Control field was 274 bushels per acre, where seasonal irrigation totaled 22.86 inches. There was no pre-season irrigation in either field. The Control field‟s net gain for corn grain is $256.72 per acre with 3.94 inches more irrigation used compared to production from the “200-12” field. Variable rate irrigation (VRI) was planned in conjunction with Syngenta but never initiated because separate soil moisture sensors did not indicate the need.

Richard Schad of Hansford County dedicated 165 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 18 at 26,000 seeds/acre in the east half circle for his “200-12” field. Schad planted 124 acres on May 17 at 32,000 seeds/acre, also strip tilled, for his “Control”. The “200-12” field produced a 196 bushel per acre corn yield. Pre-Irrigation was 3.20 inches and in season 15.76 making a totaled of 18.96 inches. Production in the Control field was 230 bushels per acre, where pre-water was 2.80 inches, in season 14.59 and total irrigation at 17.39 inches. In comparison, the Control field produced 34 more bushels per acre than the “200-12” with 1.57 less inches of irrigation. The Control field‟s net gain was $121.65 per acre with 1.57 inches less irrigation used compared to production from the “200-12” field. Schad stated, “two timely rains came immediately following irrigation of the “200-12” fields, which could have reduced irrigation had I known. I am stretched for water, rotate irrigation between four center pivots and must keep the water moving”.

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 7 at 28,000 seeds/acre for their “200-12” field. They planted the east half, 53 acres, on May 7 at 28,000 seeds/acre, also strip tilled, for their “Control” field. The “200-12” field produced a 176 bushel per acre corn yield. Pre-Irrigation was 3.00 inches, in season 14.01 and the total 17.01 inches. Production in the Control field was 223 bushels per acre. Pre-water was 3.00 inches, seasonal 19.40 and total irrigation 22.40 inches. In comparison, the “200-12” field produced 47 less bushel per acre than the Control and irrigation was 5.39 inches less. The “200-12” field‟s net loss was $189.55 per acre with 5.39 inches less irrigation used compared to production from the Control field. Seasonal rainfall totaled only 4.85 inches. Frische Brothers is another demonstration field where rainfall was similar to previous years.

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 4 acres from, 124 to 136

degrees in the circle, to corn on May 15 at 28,000 seeds/acre for his "200-12" field. He planted the remaining 116 acres in the circle on May 15 at 35,000 seeds/acre, also strip tilled, for his Control field. The "200-12" field produced a 191 bushel per acre corn yield. Irrigation totaled 19.04 inches of which 3.01 was pre-water. Production in the Control field was 287 bushels per acre. Seasonal irrigation totaled 27.35 inches. Pre-season irrigation was 4.93 inches making total irrigation 32.28 inches. In comparison, the "200-12" field produced 96 less bushels per acre than the Control and irrigation was 13.24 inches less. The "200-12" field's net loss was $312.25 per acre with 13.24 inches less irrigation used compared to production from the Control field. Haaland says "the lack of beneficial rainfall here during the growing season, like in other areas, made continuous irrigation essential".

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 east half circle on May 15 at 28,000 seeds/acre for his "200-12" field. He planted the west half circle 60 acres on May 15 at 28,000 seeds/acre, also strip tilled, for his "Control" field. The "200-12" field produced a 178 bushel per acre corn yield. Irrigation totaled 19.08 inches, of which 2.31 inches was pre-water. Production in the Control field was 191 bushels per acre. Seasonal irrigation was 19.97 inches, pre-water 2.10 and total irrigation 22.07 inches. The "200-12" field's net loss was $42.54 per acre with 2.99 inches less irrigation used compared to production from the Control field. Ford says "blowing was a problem early, especially on about 10 acres in the west "Control" half where plant population was decreased. I could not get it stopped", he said. Ford says "not enough timely rainfall to help when needed most". Also Ford says "that reduced corn irrigation following a previous cotton crop is not a good farming practice". The 2013 corn crop followed wheat.

Hartley Feeders (Dennis Buss) of Hartley County dedicated 120 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 18 at 28,000 seeds/acre in the north half of the circle for their "200-12" field. Hartley Feeders planted the north half 60 acres, also strip tilled, on May 19 at 28,000 seeds/acre for their "Control" field. The "200-12" field produced a 218 bushel per acre corn yield. Irrigation totaled 24.01 inches, of which pre-water was 1.56 inches. Production in the Control field was 176 bushels per acre, where seasonal irrigation was 20.35 inches, pre-water .72 and total irrigation 21.07 inches. In comparison, the "200-12" field produced 42 more bushels per acre than the Control with 2.94 inches more irrigation. The "200-12" field's net gain was $181.78 per acre with 2.95 inches more irrigation used compared to production from the Control field. Dennis Buss said "the soil probe really helped save water this summer. I was able to stop irrigation for the "200-12" field a whole week twice". Also, "Better Harvest saved a lot of money in fertilizer and corn was less stressed". And "the Control field has an area of less productive soil that likely contributed to the reduced yield there, plus the crop used all irrigation and soil water available in July. A good rain then would have helped".

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 southeast quarter of the circle on May 12 at a seeding rate of 31,700 seeds/acre for his

“200-12” field. He planted the northeast quarter, 61 acres, also strip tilled, on May 12 at 31,700 seeds/acre for his “Control” field. The “200-12” field produced a 189 bushel per acre corn yield. Irrigation totaled 21.07 inches. Production in the Control field was 191 bushels per acre. Seasonal irrigation totaled 21.40 inches. There was no pre-season irrigation. The Control field‟s net gain was $7.40 per acre with 0.33 inches additional irrigation used compared to production from the “200-12” field. Laubhan lost his center pivot on June 3 in a storm that also dumped 4.05 inches of rainfall on his two fields. A new system was in place and running on June 15. Two hail storms in August damaged his crop resulting in 35 percent adjustment by insurance. Laubhan says “the NPGCD “200-12” project provides good information and that I am glad to participate”.

What We Learned

- Yields were boosted by center pivots equipped with LEPA
- 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
- More knowledge of pre-season and seasonal soil moisture levels is needed
- Satellite crop imagery has potential as an additional management tool, but needs development

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 in the area.

NRCS CIG and TWDB grant funds partially funded the 2013 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, NM; 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. For **2013**, growers dedicated 1672 acres to the project as follows: Joe Reinart 92 acres in Sherman county; Harold Grall 240 acres in Moore county; Brent Clark 244 acres in Hartley county; Danny Krienke 120 acres in Ochiltree county; Brian Bezner 222 acres in Dallam county; Richard Schad 165 acres in Hansford county; Frische Brothers 107 acres in Moore county; Phil Haland 120 acres in Hartley county; David Ford 120 acres in Harley county; Hartley Feeders 120 acres in Hartley county and Tommy Laubhan 122 acres in Lipscomb county. The District is committed to continuing the demonstrations for the remaining one year. Information in this report provides results of the field scale demonstrations conducted in 2013. Additional information compiled in **2010**, **2011** and **2012** can be obtained from website northplainsgcd.org/education and the District office located at 603 East 1st street, Dumas, Texas. Telephone (806) 935-6401.

Methods

Each of the eleven 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 field, 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® 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® 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. The 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 $5.13 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, $3.80 per thousand; fertilizer,$4.80 per thousand seeds planted; irrigation $6.60 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. VRI prescriptions were written for three fields by NPGCD personnel in cooperation with the grower using CropMetrics Virtual Agronomist software in 2013. The VRI prescriptions were loaded on PivoTrac™ ‟s automatic center pivot speed control system but never initiated because of unexpected center pivot and pump interruptions. Variable Rate Irrigation by center pivot speed control was conducted in two "200-12" fields and one Control field in 2012 to initiate and learn the process. Midwest Soil Samplers provided electrical

conductivity mapping (EM) for an additional 458 acres in 2013 and all 2152 acres in the NPGCD reduced corn irrigation project in 2012. An electromagnetic (EM) instrument provides relative field specific differences to potentially improve crop production within the survey area. Resulting survey data is used primarily to guide precision agriculture practices such as variable rate seeding, fertilizer and irrigation. The survey provides seven layers of data. The layers are aspect, depressions, dual EM topsoil, dual EM subsoil, elevation, landscape and slope. The dual EM subsoil layer describes relative differences in soil texture and associated characteristics to approximately 36 inches. Dual EM Subsoil data is important to managing irrigation and writing Variable Rate Irrigation (VRI) prescriptions. District personnel use primarily the dual EM subsoil layer in writing VRI prescriptions. Survey Data will be used in 2014 to continue and expand variable rate irrigation where cooperating growers agree to use it. Satellite imagery was initiated and used from HydroBio to monitor plant stress, soil moisture and crop water use continuously for 792 acres in eleven fields in 2013. The fields included Bezner "200-12"; Haaland "200-12" and Control; Reinart "200-12" and Control; Grall Control; Ford "200-12" and Control; and Clark "200-12". The purpose was to learn the function of the imagery process and the potential as an additional beneficial irrigation and water management tool for growers. In summary, satellite imagery appears promising, however additional improvements are needed in monitoring soil moisture, especially beginning soil moisture. HydroBio had access to satellite data for only the western portion of NPGCD in 2013. The following discussion provides detailed 2013 growing season results and information for each grower's two fields.

Joe Reinart's 2013 Sherman County Demonstration

Planting and Crop Information: For his demonstration, Joe Reinart strip-tilled and planted 27 acres of corn in the northwest quarter of section 217, S1, for his "200-12" field, "Reinart 200-12". He planted the field with Channel 197-67 at a seeding rate of 25,000 seeds/acre. Cotton was planted on 26 acres in the circle and 12 acres were within acreage irrigated by the Control field center pivot. Reinart planted 65 acres, also strip tilled, in the mid-west quarter of section 217, S2, to Channel 215-52 at 32,000 seeds/acre for his "Control" field, "Reinart Control". The "200-12" field was irrigated using a center pivot where seasonal water meter readings average 350 gpm and delivered an average of 1.00 inches of irrigation in a 3.5 day revolution. Water meter readings averaged 400 gpm for the center pivot that irrigated the Control field and delivered 1.70 inches in a 5.0 day revolution. Planting and crop production information for "Reinart 200-12" and "Reinart Control" are shown in table 1 below.

Table 1: Planting and Crop Information for Joe Reinart

"200-12" Demonstration Field			
Planted:	*June 12*	**Harvested:**	*October 2*
Hybrid:	*CH197-67*	**Seeding Rate:**	*25,000*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*27*	**GPM Per Acre:**	*6.5 Share with Cotton*
Total Water:	*18.41 in.*	**Soil Type:**	*Sherm and Sunray Clay Loam*
Fertilizer:	*56-0-0*	**Insecticide:**	*None*
Herbicide:	*Bicep Lite, Charity, Glyphosate*		
Control Demonstration Field			
Planted:	*May 5*	**Harvested:**	*October 2*
Hybrid:	*CH215-52*	**Seeding Rate:**	*32,000*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*65*	**GPM Per Acre:**	*6.1*
Total Water:	*31.23 in.*	**Soil Type:**	*Sherm and Sunray Clay Loam*
Fertilizer:	*205-43-0-10-1.12micro*	**Insecticide:**	*None*
Herbicide:	*Aatrex, Balance Flex, Glyphosate, Charity*		

Beginning Soil Water Profile and Growing Season Rainfall

"200-12" Demonstration Field: Preseason soil water was good at 1 and 2 feet when gypsum blocks were installed in April. There was no soil moisture at 3 feet until a combination of rainfall and irrigation refilled the root zone in mid-July. Soil water was low at the beginning of the season at 4 feet, but actually increased following irrigation, ending the season with a net gain. Soil water was about 40 percent beginning the season at the 5 foot depth and 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 feet and some from 3 feet plus all irrigation and rainfall during the hot daily temperatures in late July and early August. Two beneficial rainfall events in late July and mid-August helped finish the crop. 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. Rainfall totaled 6.58 inches, with 4.55 inches falling in July and August. An additional 1.26 inches in September helped finish the June 12 planted crop.

Control Demonstration Field: The soil profile was basically depleted at 1, 2, 3 and 4 feet beginning the season, following the 2012 corn crop. The profile was refilled from 4.15 inches of pre-water prior to planting. Weekly gypsum block readings show the crop had adequate available water throughout the growing season. And, the soil profile gained 4.0 inches from planting until harvest. Meaning the soil profile was wetter at harvest than at planting. Gypsum blocks were installed in Conlen clay loam that holds approximately 1.80 inches of available water per foot for potential crop use. Rainfall totaled 6.97 inches, with 4.55 inches occurring in July and August, a significant increase compared to 2011 and 2012 crop years.

Table 2: Monthly Rainfall Data for Joe Reinart

	May	June	July	August	September	October	Total
"200-12"	0.00"	0.63"	2.04"	2.51"	1.24"	0.16"	**6.58"**
Control	0.63"	0.67"	2.04"	2.51"	1.12"	0.00"	**6.97"**

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 each Control field. Both the gypsum block sensors and the soil probe were installed in close proximity to each other in the field. Gypsum blocks were installed in the "200-12" fields and most Control fields prior to planting. Each AquaSpy® probe was installed following crop emergence, as well as gypsum blocks in any remaining fields. Installing and reading the gypsum blocks prior to planting provided advanced soil moisture conditions and information to help guide and manage irrigation. 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 same illustrations for the Control field.

Figure 1: Gypsum Block Readings for Joe Reinart's "200-12" Demonstration Field

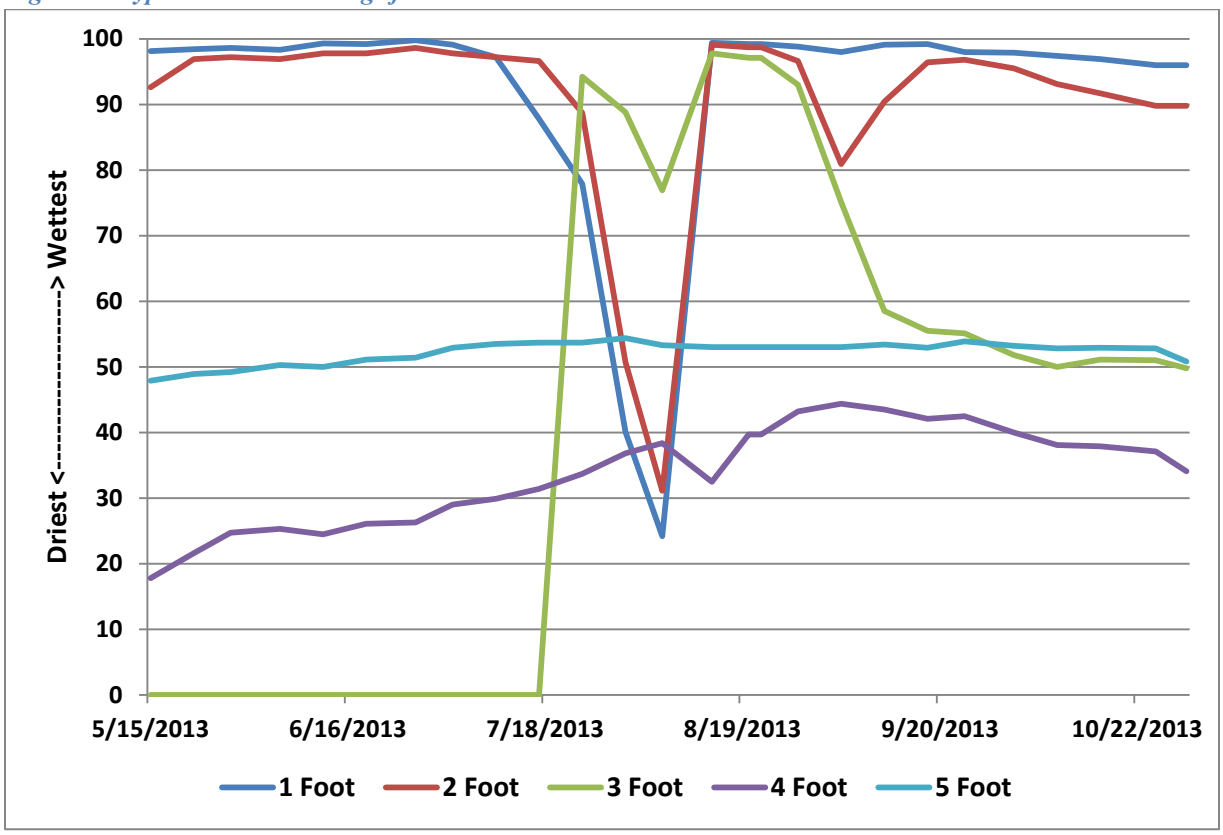


Figure 2: Growing Season Water Tracking for Joe Reinart's "200-12" Demonstration Field (200 bu/ac)

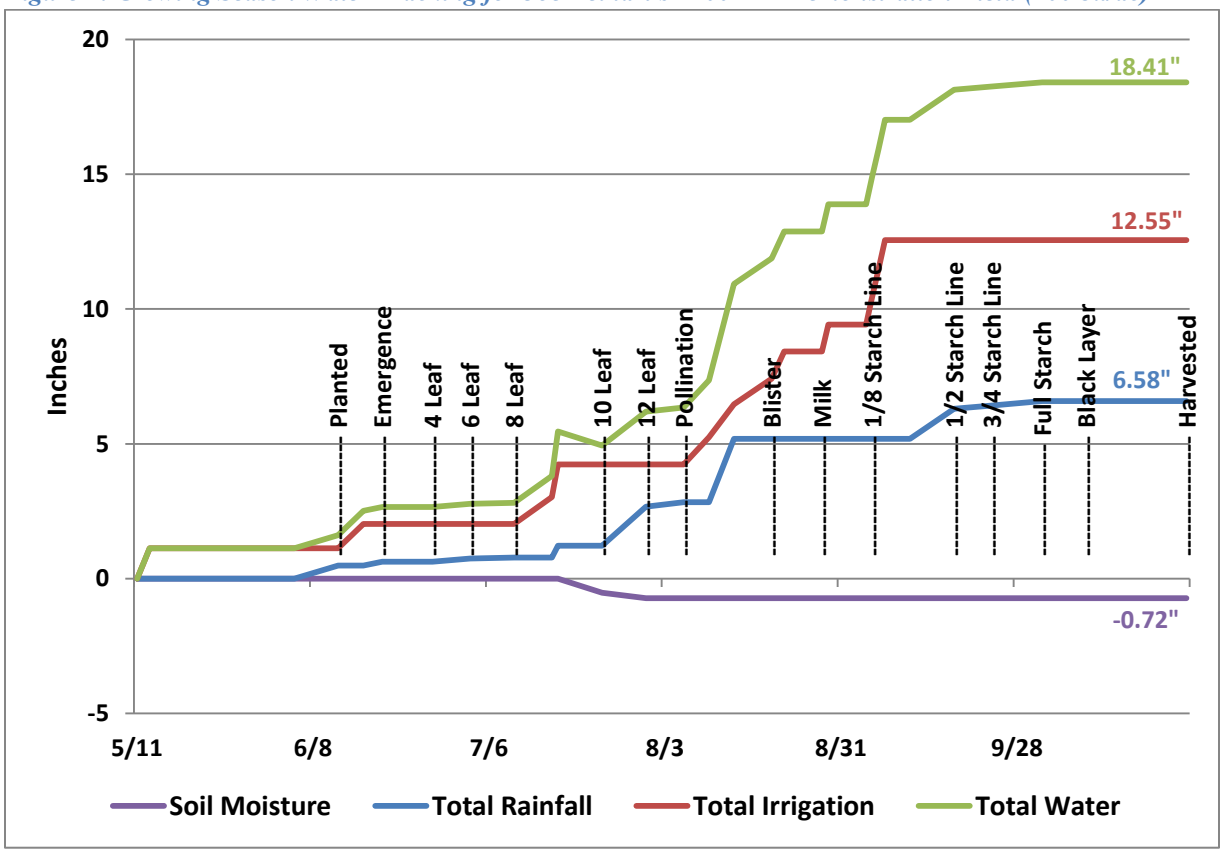


Table 3: Demonstration Field Data for Joe Reinart's "200-12" Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
4/19			No Meter		97.2	97.6	95.3	96.6	96.7		251 N		Randy
5/7			0.02		95.9	38.2	0.0	17.3	49.9		252 N		Randy
5/11			PivoTrac™							Cotton			Leon
5/12		0.55	PivoTrac™							Prewater	6	350	Leon
5/13		0.57	PivoTrac™							Prewater	220	350	Leon
5/15	0.63		6.78		98.1	92.6	0.0	17.8	47.9		240 md		Randy
5/18			PivoTrac™							Cotton			Leon
5/19			PivoTrac™							Cotton			Leon
5/22			10.62		98.4	96.9	0.0	21.6	48.9		235 N		R & C
5/27			PivoTrac™							Cotton			Leon
5/28			12.57		98.6	97.2	0.0	24.7	49.2		278 N		R & C
6/5	0.04		12.59		98.3	96.9	0.0	25.3	50.3		278 N		R & C
6/12	0.49		12.59		99.3	97.8	0.0	24.5	50.0	Planted	250 N		Leon
6/16		0.91	PivoTrac™									350	Leon
6/19	0.14		14.96	Emergance	99.2	97.8	0.0	26.1	51.1		235 N		R & C
6/27			14.96	4 Leaf	99.8	98.6	0.0	26.3	51.4		229 N		R & C
7/3	0.12		14.96	6 Leaf	99.1	97.8	0.0	29.0	52.9		234 N		R & C
7/10	0.03		14.96	8 Leaf	97.2	97.2	0.0	29.9	53.5		234 N		Leon
7/16		1.00	PivoTrac™	8 Leaf							233 N	350	R & C
7/17	0.44	1.21	18.41	8 Leaf	87.8	96.6	0.0	31.4	53.7		233 N		R & C
7/24			18.41	10 Leaf	77.9	88.7	94.2	33.7	53.7		233 N		Randy
7/31	1.45		18.41	12 Leaf	40.1	50.7	88.8	36.8	54.4		233 N		R & C
8/6	0.16		19.57	Pollination	24.2	31.1	76.9	38.4	53.3	200-12	303 Y	343	Leon
8/10		1.00	PivoTrac™	Pollination		99.1						350	R & C
8/14	2.35	1.23	23.06	Pollination	99.4	99.1	97.8	32.5	53.0		316 N		Leon
8/20		0.95	PivoTrac™	Blister	99.2	98.7	97.1	39.7	53.0			350	Randy
8/22		1.00	26.11	Blister	99.2	98.7	97.1	39.7	53.0		338 Y	348	Randy
8/28			26.39	Milk	98.8	96.6	93.0	43.2	53.0	200-12	329 Y	337	Leon
8/29		1.00	PivoTrac™	Dent						200-12		350	Leon
8/30			PivoTrac™							Cotton			Leon
9/2			PivoTrac™							Cotton			Leon
9/4			34.06	Dent	98.0	80.9	75.1	44.4	53.0	200-12	269 Y	343	Randy
9/5		1.03	PivoTrac™	1/8 ml						200-12		350	Leon
9/6		1.03	PivoTrac™	1/8 ml						200-12		350	Leon
9/7		1.07	38.96	1/8 ml						200-12	239 N	350	Leon
9/11			38.96	1/8 ml	99.1	90.4	58.5	43.5	53.4		232 N		Randy
9/18	1.12		38.96	1/2 ml	99.2	96.4	55.5	42.1	52.9		239 N		Randy
9/24	0.12		38.96	3/4 ml	98.0	96.8	55.1	42.5	53.9		231 N		Randy
10/2	0.16		38.96	1.0 ml	97.9	95.5	51.8	40.0	53.2		241 N		Randy
10/9			38.96	Black Layer	97.4	93.1	50.0	38.1	52.8		241 N		Randy
10/16			38.96	Black Layer	96.9	91.7	51.1	37.9	52.9		241 N		Randy
10/25			38.96	Harvested	96.0	89.8	51.0	37.1	52.8		189 N		Randy
10/30			38.96	Harvested	96.0	89.8	49.8	34.1	50.8		189 N		Randy
Total	**6.58**	**12.55**			**0.15”**	**0.23”**	**-0.90”**	**-0.18”**	**-0.02”**				
Net Soil Moisture is -0.72"													
Irrigation, Rainfall Plus Net Soil Moisture is 18.41"													

- Numbers in red are not counted to the total

2013-Corn Demonstration
Irrigated Medium Season Corn

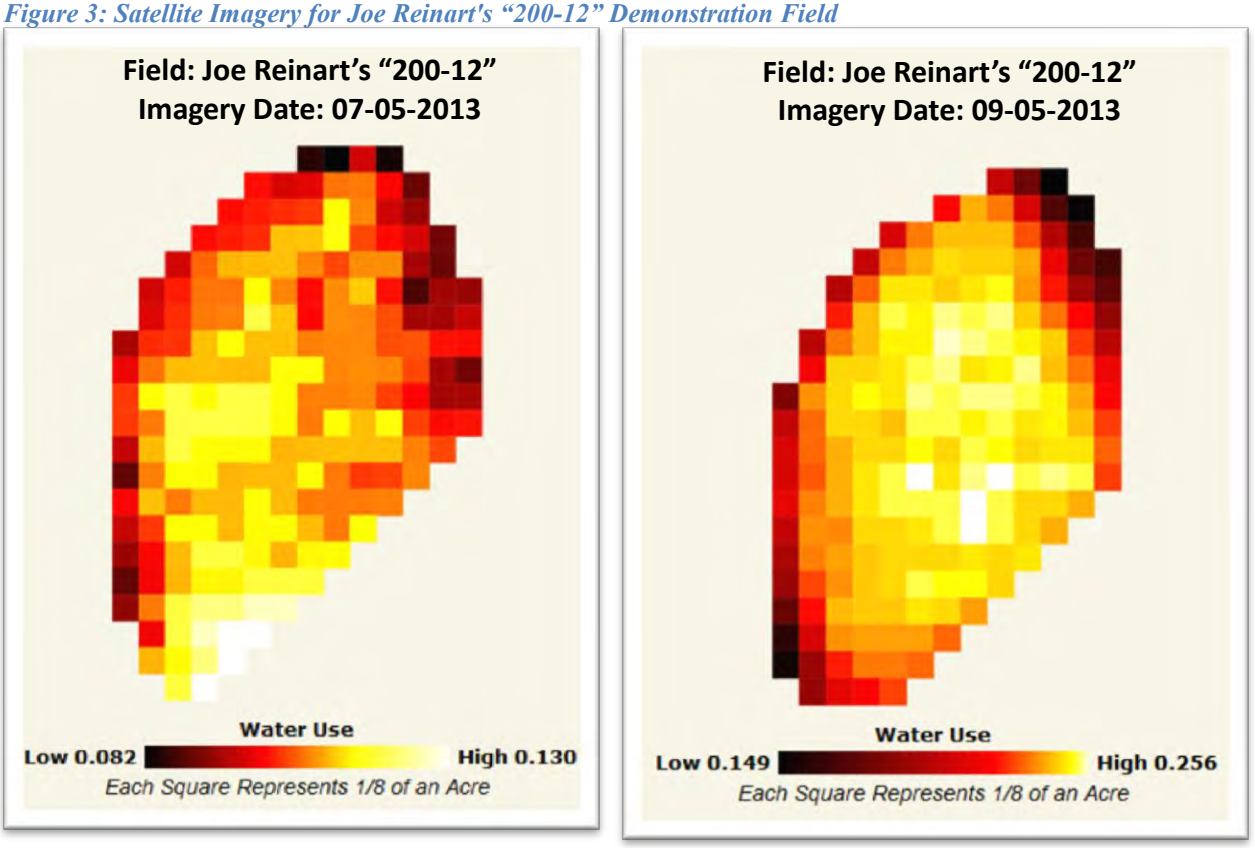
200-12

Year:	*2013*	**County:**	*Sherman*	**Grower:**	*Joe Reinart*
No. Acres:	*27*	**Hybrid:**	*CH197-67*	**Soil Type:**	*Sherm and Sunray Clay Loam*
Meter Type:	*Seametrics*				
Meter Mult:	*Ac Ft x 1*	**Tillage:**	*Strip Till*		
Fertilizer:	*56-0-0*	**Seeding:**	*25,000*		
Planted:	*June 12*	**Harvest:**	*October 25*		
Herbicide:	*Bicep Lite, Charity, Glyphosate*	**Insecticide:**	*None*		
Yield:	*200 bu/ac*	**Prev. crop:**	*Milo*	**Row width:**	*30 Inch*
Irrigation method:	*Center Pivot*	**Prewater:**	*1.12 in.*	**GPM/acre:**	*6.5*
Distance between drops:	*60"*	**Distance from nozzle to ground:**	*16"*		
Application pattern:	*LESA (spray)*	**Crop row direction :**	*Straight*		

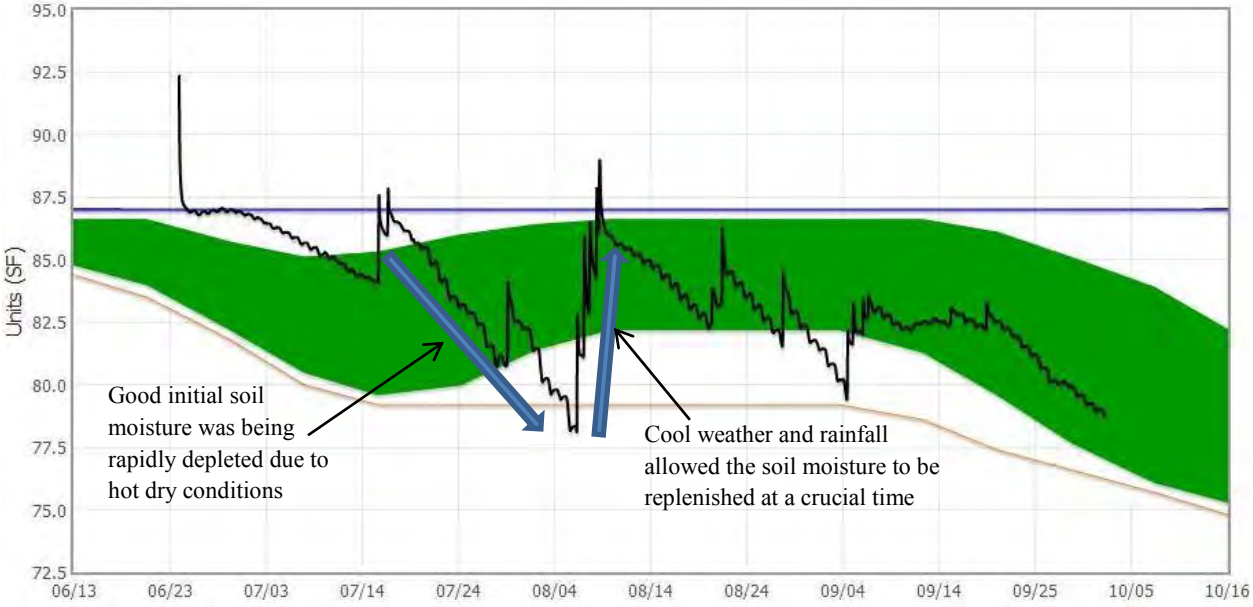
GPS Location of Pivot Pad		**GPS Location of Gypsum Blocks**	
Latitude:	*36.307258*	Latitude:	*36.305043*
Longitude:	*-102.148763*	Longitude:	*-102.148743*

Satellite Imagery: Satellite imagery was initiated and used in 2013 to learn and evaluate it‟s potential for an irrigation and water management tool for growers in connection with HydroBio. Joe Reinart‟s “200-12” (S1) field was one of ten “200-12” project fields included in 2013. A website was established and made available to project cooperators and District staff. We learned that satellite imagery has potential, but requires additional development, especially in establishing beginning soil moisture and monitoring the soil profile and root zone during the growing season. Two satellite images of Joe Reinart‟s “200-12” field are shown on the in figure 3 to illustrate examples of what is displayed on the website. The first image was on July 5 at the 7 leaf stage. The second image is on September 5 at 1/8 maturity line grain development. The satellite imagery data changes when the next satellite passes, usually in three day increments.

Figure 3: Satellite Imagery for Joe Reinart's “200-12” Demonstration Field



Joe Reinart's "200-12" Field AquaSpy® Probe Summary



The outstanding water use efficiency that this field achieved was due to a very large root system and a timely change in the weather. The field started out with a full soil moisture profile and the early hot, dry conditions encouraged rapid, deep root growth to 60" before tassel. Timely cool weather and rainfall refilled the profile to 60" and this was available during peak demand. Irrigation was effective with most irrigations penetrating to 20" deep.

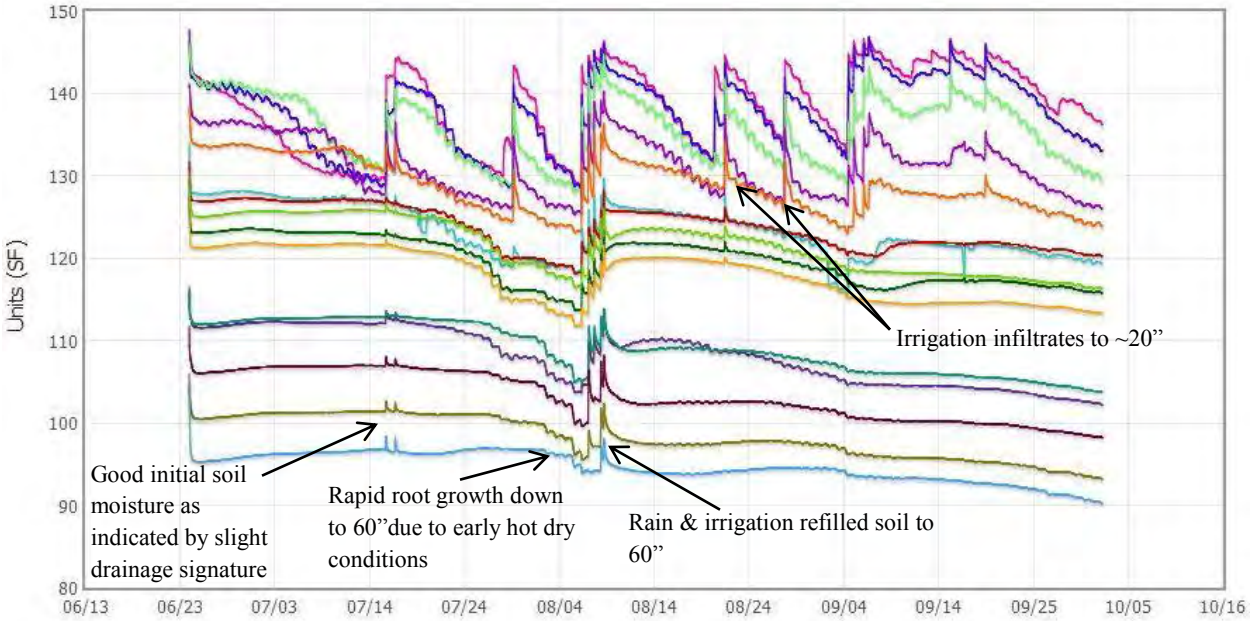


Figure 4: Gypsum Block Readings for Joe Reinart's Control Demonstration Field

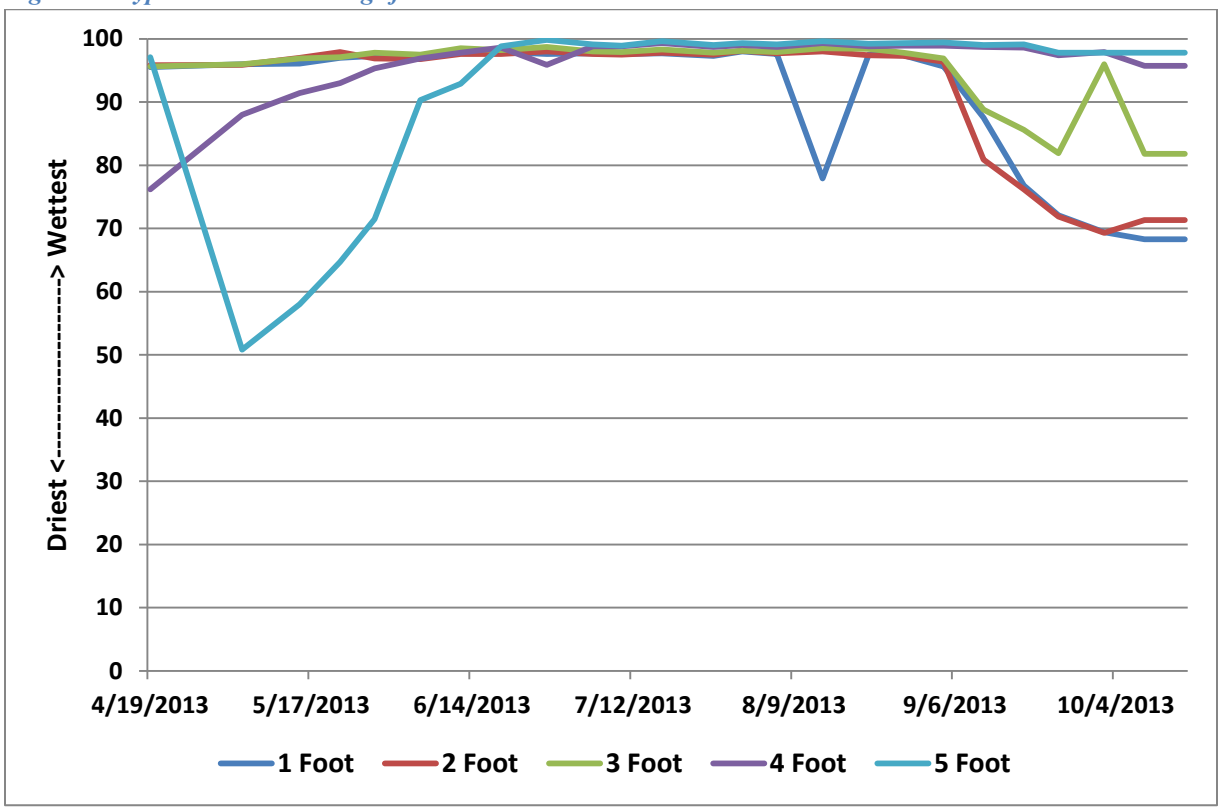


Figure 5: Growing Season Water Tracking for Joe Reinart's Control Demonstration Field (238 bu/ac)

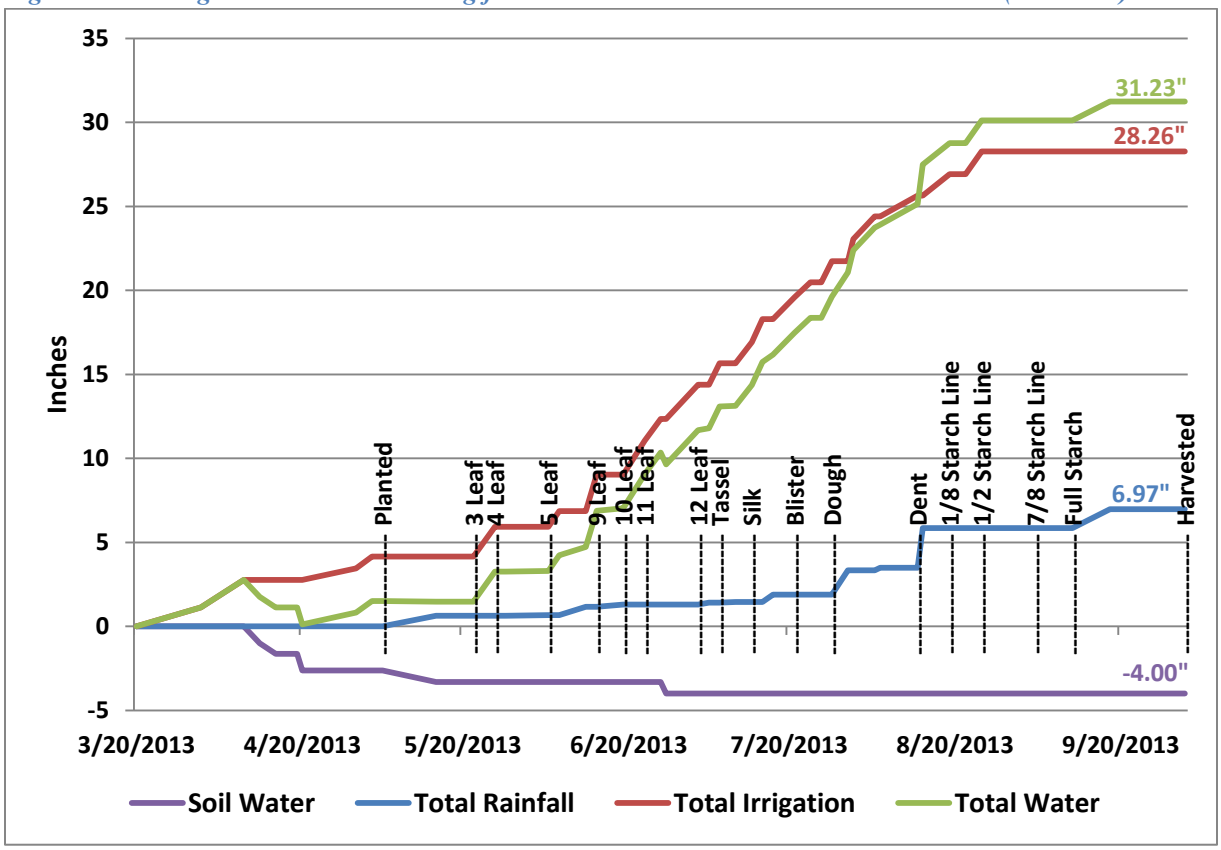


Table 4: Demonstration Field Data for Joe Reinart's Control Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 feet	3 Feet	4 Feet	5 Feet				
3/20	lid gone		93.42		6.2	25.3	20.5	gone	gone		321 N		Randy
4/1		1.13	99.53		7.1	26.0	17.1	20.7	gone	prewater	91 N		Randy
4/9		1.63	PivoTrac™							prewater		400	Leon
4/19			not read		95.5	95.8	95.6	76.2	97.1		295 N		Randy
4/30		0.70	PivoTrac™							prewater		400	Leon
5/3		0.69	PivoTrac™							prewater		400	Leon
5/5			118.49		96.0	95.9	96.0	88.0	50.8	planted	218 N		Randy
5/15	0.63		118.49		96.1	97.0	96.9	91.4	58.0		223 md		Randy
5/22			120.75	3 Leaf	97.0	97.9	97.1	93.0	64.7	Control	68 Y cw	413	R & C
5/26		1.78	PivoTrac™	4 Leaf						Control	300 N	400	Leon
5/28			120.77	4 Leaf	97.3	96.9	97.8	95.3	71.5		299 N		R & C
6/5	0.04		131.01	5 Leaf	97.2	96.8	97.5	96.9	90.3	Control	313 Y cw	435	R & C
6/7		0.94	PivoTrac™	6 Leaf						Control	28 Y	400	Leon
6/12	0.49		144.38	8 Leaf	98.2	97.6	98.5	97.8	92.9	Control	157 Y	422	R & C
6/14		2.16	PivoTrac™	9 Leaf						Control	94 Y	400	Leon
6/19	0.14		153.02	10 Leaf	97.9	97.6	98.2	98.6	98.8	Control	238 Y	394	R & C
6/23		2.03	PivoTrac™	11 Leaf						Control	28 Y	400	Leon
6/26		1.29	PivoTrac™	11 Leaf						Control	94 Y	400	Leon
6/27			166	11 Leaf	97.6	98.0	98.7	95.9	99.8	Control	125 Y	400	R & C
7/3		2.03	PivoTrac™	12 Leaf						Control	28 Y	400	Leon
7/5	0.12		176.74	12 Leaf	97.7	97.6	98.0	98.8	99.1	Control	5 Y	418	R & C
7/7		1.29	PivoTrac™	Tassel						Control	94 Y	400	Leon
7/10	0.03		188.96	Tassel	97.6	97.5	97.9	98.8	98.9	Control	352 Y	373	R & C
7/13		1.25	PivoTrac™	Silk						Control	28 Y	400	Leon
7/15		1.37	PivoTrac™	Silk						Control	94 N	400	Leon
7/17	0.44		197.12	Silk	97.7	97.8	98.3	99.3	99.6	Control	102 Y	392	R & C
7/21		1.30	PivoTrac™	Blister						Control	28 Y	400	Leon
7/24		0.89	PivoTrac™	Blister						Control	94 Y	400	Leon
7/26			208.6	Blister	97.3	97.5	97.8	98.7	99.0	Control	113 Y	381	R & C
7/28		1.25	PivoTrac™	Dough						Control	28 Y	380	Leon
7/31	1.45		220.17	Dough	98.0	98.1	98.1	99.0	99.3	Control	178 Y	382	Randy
8/1		1.32	PivoTrac™	Dough						Control	94 Y	380	Leon
8/5		1.35	PivoTrac™	Dough						Control	28 N	380	Leon
8/6	0.16		228.23	Dough	97.6	97.7	97.9	98.7	99.1	Control	26 N		R & C
8/13		1.24	PivoTrac™	Dent						Control	94 N	380	Leon
8/14	2.35		235.68	Dent	77.9	98.0	98.5	99.3	99.6		92 N		R & C
8/19		1.27	PivoTrac™	1/8 ml						Control	28 Y	380	Leon
8/22			243.89	1/8 ml	97.5	97.4	98.4	98.8	99.2		332 N		Randy
8/25		1.35	PivoTrac™	1/2 ml							94 N	380	Leon
8/28			249.48	1/2 ml	97.4	97.3	97.8	98.9	99.3		90 N		Randy
9/4			249.48	7/8 ml	95.6	96.4	96.9	98.9	99.4		90 N		Randy
9/11			249.48	1.0 ml	87.5	80.9	88.8	98.7	99.0		90 N		Randy
9/18	1.12		249.48	1.0 ml	76.8	76.2	85.6	98.6	99.1		90 N		Randy
9/24	0.12		249.48	Black Layer	72.1	71.9	81.9	97.4	97.8		90 N		Randy
10/2	0.16		249.48	Harvested	69.4	69.3	96.0	97.9	97.8		184 N		Randy
10/9			249.48	Harvested	68.3	71.3	81.8	95.7	97.8		219 N		Randy
10/16	0.39		249.48	Harvested	68.3	71.3	81.8	95.7	97.8		219 N		Randy
Total	**6.97**	**28.26**			**-1.00”**	**-0.63”**	**-1.00”**	**-1.32”**	**-0.05”**				
Net Soil Moisture is -4.00"													
Irrigation, Rainfall Plus Net Soil Moisture is 31.23"													

- Numbers in red are not counted in the total

2013-Corn Demonstration
Irrigated Medium Season Corn

Control

Year: *2013* **County:** *Sherman* **Grower:** *Joe Reinart*

No. Acres: *65* **Hybrid:** *CH215-52* **Soil Type:** *Sherm and Sunray Clay Loam*

Meter Type: *Seametrics*

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

Fertilizer: *205-43-0-10-1.12 micro* **Seeding:** *32,000*

Planted: *May 5* **Harvest:** *October 2*

Herbicide: *Aatrex, Balance Flex, Glyphosate, Charity* **Insecticide:** *None*

Yield: *238 Bu/Acre* **Prev. crop:** *Corn* **Row width:** *30 inch*

Irrigation method: *Center Pivot* **Prewater:** *4.15 in.* **GPM/acre:** *6.1*

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

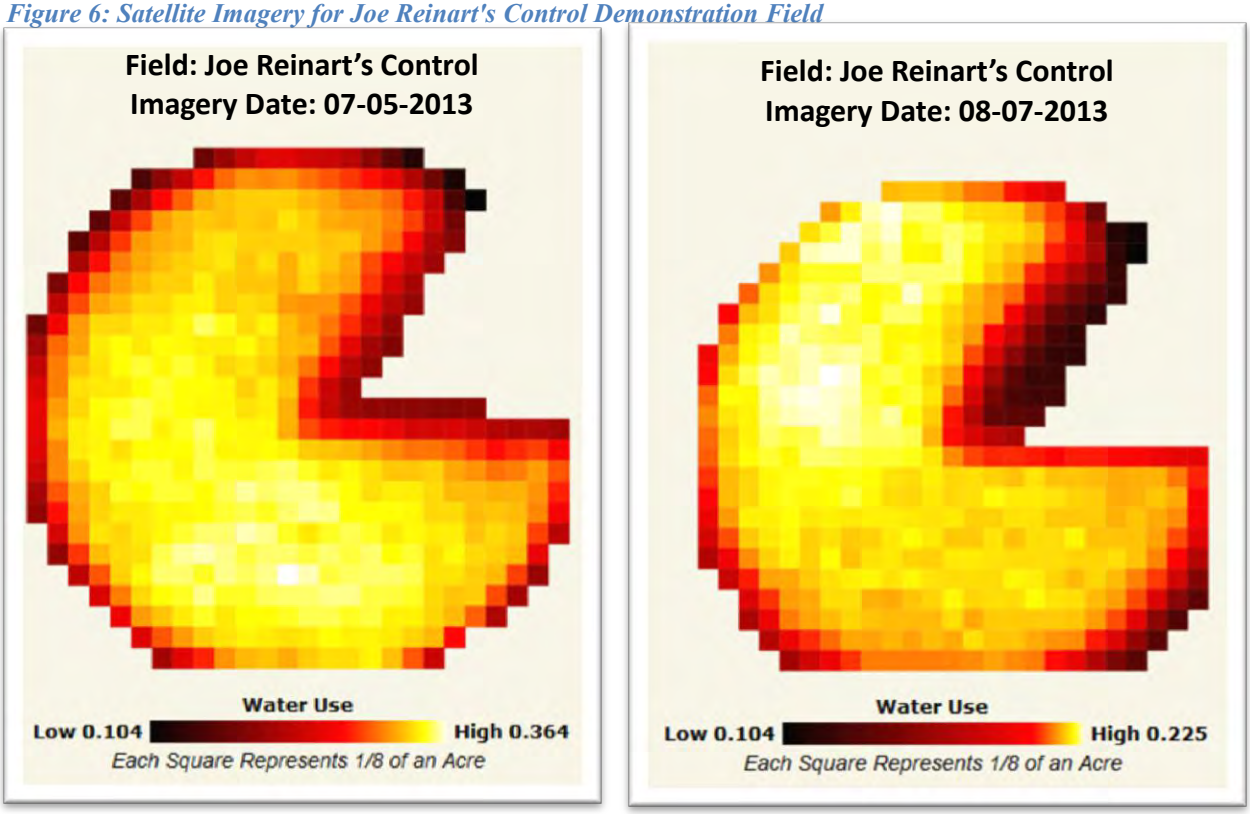
Application pattern: *Circle* **Crop row direction :** *Straight*

GPS Location of Pivot Pad
Latitude: *36.310763*
Longitude: *-102.148887*

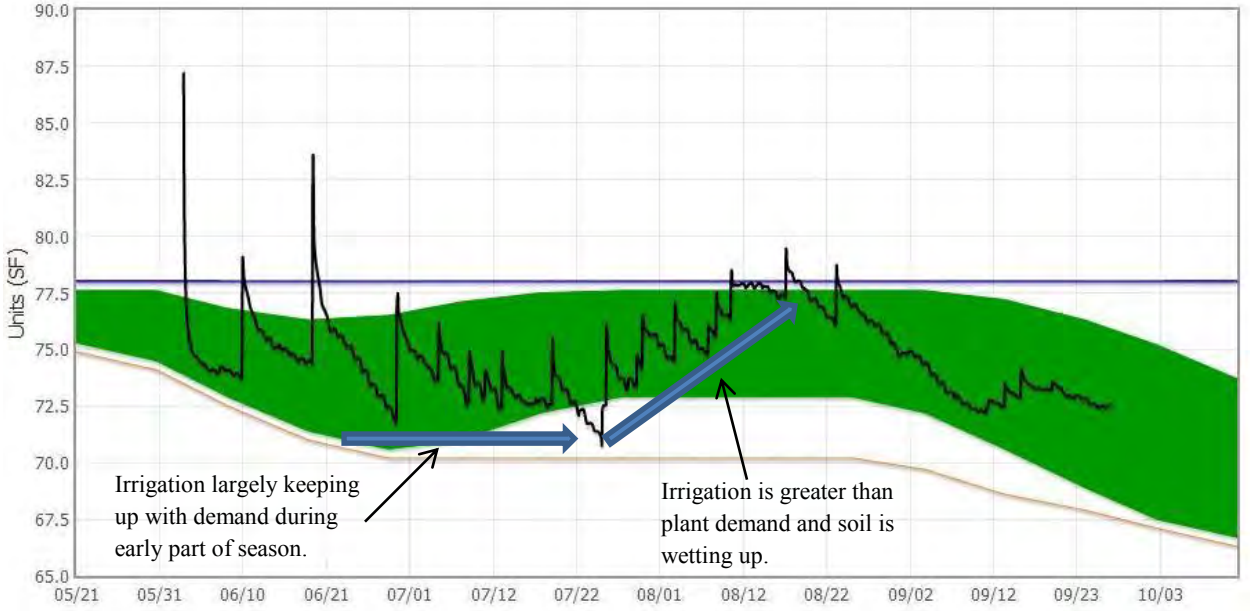
GPS Location of Gypsum Blocks
Latitude: *36.311458*
Longitude: *-102.15155*

Satellite Imagery: Joe Reinart‟s Control field (S2) was one of ten “200-12” project fields included in satellite imagery in 2013. A website was established and made available to project cooperators and District staff. We learned that satellite imagery has potential, but requires additional development, especially in establishing beginning soil moisture and monitoring the soil profile and root zone during the growing season. Two satellite images of Joe Reinart‟s Control field in figure 6 illustrate examples of what is displayed on the website. The first image is on July 5 at the 12 leaf growth stage. The second image is on September at 7/8 maturity line. Satellite imagery data changes when the next satellite passes, mostly in three day increments.

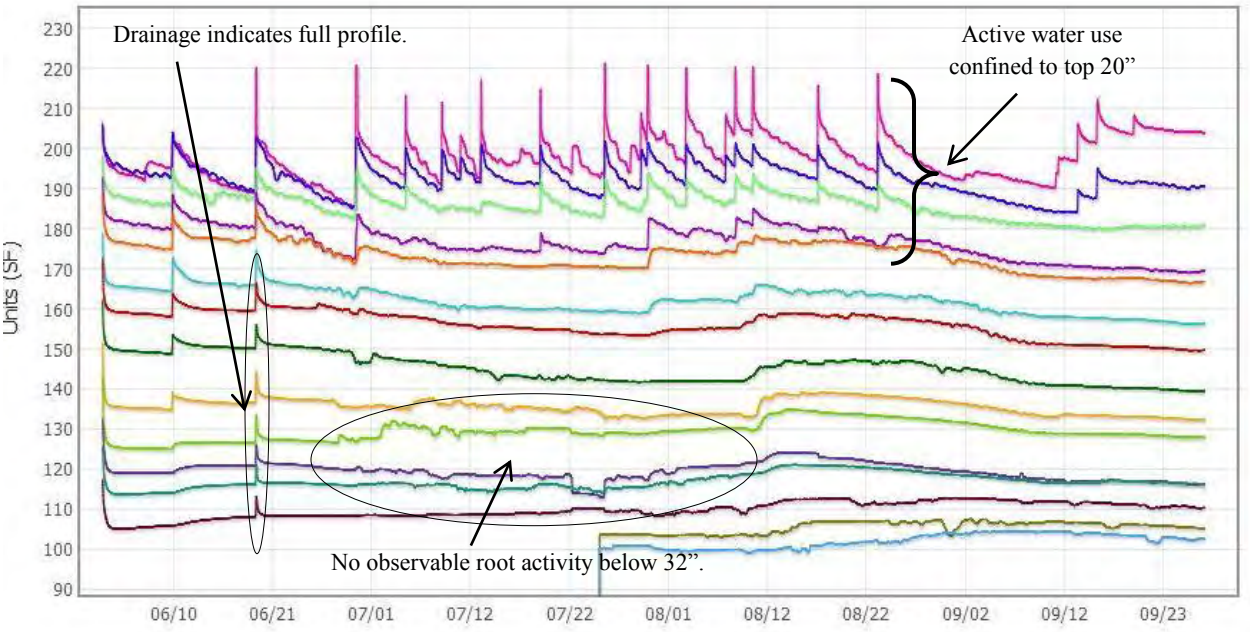
Figure 6: Satellite Imagery for Joe Reinart's Control Demonstration Field



Joe Reinart's Control Field AquaSpy® Probe Summary



Indications are that the field began with a full soil moisture profile, however frequent early irrigations reduced the need for the plant to put roots deeper to chase moisture. The result was an active root system in the top 20" of soil and the more frequent lighter irrigations were generally only able to penetrate to 16". Apart from early in the season, there was no evidence of drainage, despite the much higher application volume of irrigation throughout the season.



Harvest Results: The "200-12" field produced a 200 bushel per acre corn yield. Irrigation totaled 12.55 inches that includes 1.12 inches of pre-water. Production in the Control field was 238 bushels per acre, where seasonal irrigation was 28.26 and pre-water 4.15 inches to establish a total of 28.26 inches. Pre-season irrigation, when used, is included in all total irrigation. In comparison, the Control field produced 38 more bushels per acre than the "200-12" with 15.71 additional inches of irrigation. Corn production was 15.94 bushels (892lbs) per inch of irrigation in the "200-12" field compared to 8.42 bushels (472lbs) in the Control. Production from each inch of irrigation, rainfall and net soil water that totaled 18.41 inches was 10.86 bushels (608lbs) per acre in the "200-12" field. Irrigation, rainfall and net soil water totaled 31.23 inches in the Control field where production was 7.62 bushels (427lbs) per inch. Crop production costs were $176.80 per acre more for the Control field than for the "200-12" from increased seed, fertilizer, irrigation and harvest expenses. At $5.13 per bushel, the additional 38 bushel per acre corn yield amounts to $194.94 more per acre. The Control field"s net gain was $18.14 per acre with 15.71 inches more irrigation used compared to production from the "200-12" field. Net return per inch of irrigation was $52.60 from the "200-12" field compared to $24.00 from the Control. Net return from the additional 15.71 inches of irrigation applied on the Control field is $1.15 per acre inch compared to $81.75 per inch for the "200-12" field. Reinart stated, "We irrigated the "200-12" corn only watching the soil moisture probe. We planted an additional 600 acres across our farms that mirror the "200-12" field. Average yield was 185 bushels per acre with fertilizer at 114-40-0-10". And, "we will continue to plant early and late corn using the strategies learned from the 200-12 project". A summary of the demonstration results are shown in table 5.

Table 5: Joe Reinart's 2013 Demonstration Results

	Irrigation (in.)	Total Water (in.)	Production		Crop Value @ $5.13/bu		
			bu/ac	lb/ac-in Irrigation	Per Acre	Acre-in of Irrigation	Acre-in of Total Water
"200-12"	12.55	*18.41	200	892	$1,026.00	$81.75	$55.73
Control	28.26	†31.23	238	472	$1,220.94	$43.20	$39.10

*Includes -0.72 inches of water added to five feet of soil, plus rainfall, and irrigation.
†Includes -4.00 inches of water added to five feet of soil, plus rainfall, and irrigation.

Harold Grall's 2013 Moore County Demonstration

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 1151AM1 at a seeding rate of 26,000 seed/acre. Grall planted 120 acres, also strip tilled, in the northeast quarter of section 417 to Pioneer 1151AM1 at 24,000 seeds/acre for his "Control" field, "Grall Control". The "200-12" field was irrigated using a center pivot where seasonal water meter readings average 335 gpm and delivered an average of 1.11 inches of irrigation in a 7.5 day revolution. The center pivot was renozzled to 300 gpm in mid-June when one of two wells was lost. Irrigation was then 1.00 inch in a 7.5 day revolution. Water meter readings averaged 285 gpm for the center pivot that irrigated the Control field and delivered 1.00 inch in an 8.0 day revolution. Planting and crop information for "Grall 200-12" and "Grall Control" are shown in table 6 below.

Table 6: Planting and Crop Information for Harold Grall

"200-12" Demonstration Field			
Planted:	*June 4*	**Harvested:**	*October 30*
Hybrid:	*P1151AM1*	**Seeding Rate:**	*26,000*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*120*	**GPM Per Acre:**	*2.5*
Total Water:	*23.53 in.*	**Soil Type:**	*Sherm Silty Clay Loam*
Fertilizer:	*62-19-0 + 5 tons Compost*	**Insecticide:**	*Penncap/Cidetrac, Zeal*
Herbicide:	*Actamaster, Status, Power Max, Medal, Activator 90*		
Control Demonstration Field			
Planted:	*June 2*	**Harvested:**	*October 30*
Hybrid:	*P1151AM1*	**Seeding Rate:**	*24,000*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*120*	**GPM Per Acre:**	*2.4*
Total Water:	*27.61 in.*	**Soil Type:**	*Sherm Clay Loam*
Fertilizer:	*141-66-0*	**Insecticide:**	*Comite 11*
Herbicide:	*Balance Flex, Cinch ATZ, Liberate, Weedmaster, Laudis, Strut, Starane Ultra*		

Beginning Soil Water Profile and Growing Season Rainfall

"200-12" Demonstration Field: Gypsum block soil moisture sensors installed in April, prior to planting, show good soil water levels at 1, 2, 3, 4, and 5 feet in the profile. The crop began to use water stored at 1 and 2 feet at the end of August, plus irrigation and limited rainfall. Plants used water from 3 and 4 feet during the dough and dent growth stages in September and limited amounts from 5 feet in October maturing the crop. Rainfall totaled only 4.49 inches from planting until harvest in one of the demonstration fields where seasonal rainfall was lowest, in comparison to other fields. 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 April, prior to planting, to obtain pre-season soil water conditions.

Control Demonstration Field: Soil moisture sensing gypsum blocks were installed in March. The soil profile was basically empty to 5 feet following the 2012 corn crop. Pre-water was initiated in early April to begin refilling the soil profile. A total of 6.26 inches of pre-water was applied. Moisture sensors show the profile was full to 5 feet at planting. The crop used water stored at 2 feet in early July, 1, 3 and 4 feet in late July and early August plus all irrigation. Rainfall in July and August totaled only 1.37 inches, which was not enough help. Continuous late season irrigation when daily crop water use was much less, partially refilled the profile, mostly at 4 and 5 feet. Basically, the crop used all water available. Gypsum blocks were installed in Sherm clay loam that holds approximately 2.0 inches of available water per foot for potential crop use. Rainfall from planting until harvest totaled only 3.85 inches and 1.25 inches of that (1/3), fell in late September during grain maturity, which helped, but was late in the season. Table 7 shows monthly rainfall recorded by a District rain gauge located at each of the two fields.

Table 7: Monthly Rainfall Data for Harold Grall

	May	June	July	August	September	Total
"200-12"	0.00"	1.19"	0.67"	1.42"	1.21"	**4.49"**
Control	0.00"	1.19"	0.54"	0.83"	1.29"	**3.85"**

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 each Control field. Both the gypsum block sensors and the soil probe were installed in close proximity to each other in the field. Gypsum blocks were installed in the "200-12" fields and most Control fields prior to planting. Each AquaSpy® probe was installed following crop emergence, as well as gypsum blocks in any remaining fields. Installing and reading the gypsum blocks prior to planting provided advanced soil moisture conditions and information to help guide and manage irrigation. 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 same illustrations for the Control field.

Figure 7: Gypsum Block Readings for Harold Grall's "200-12" Demonstration Field

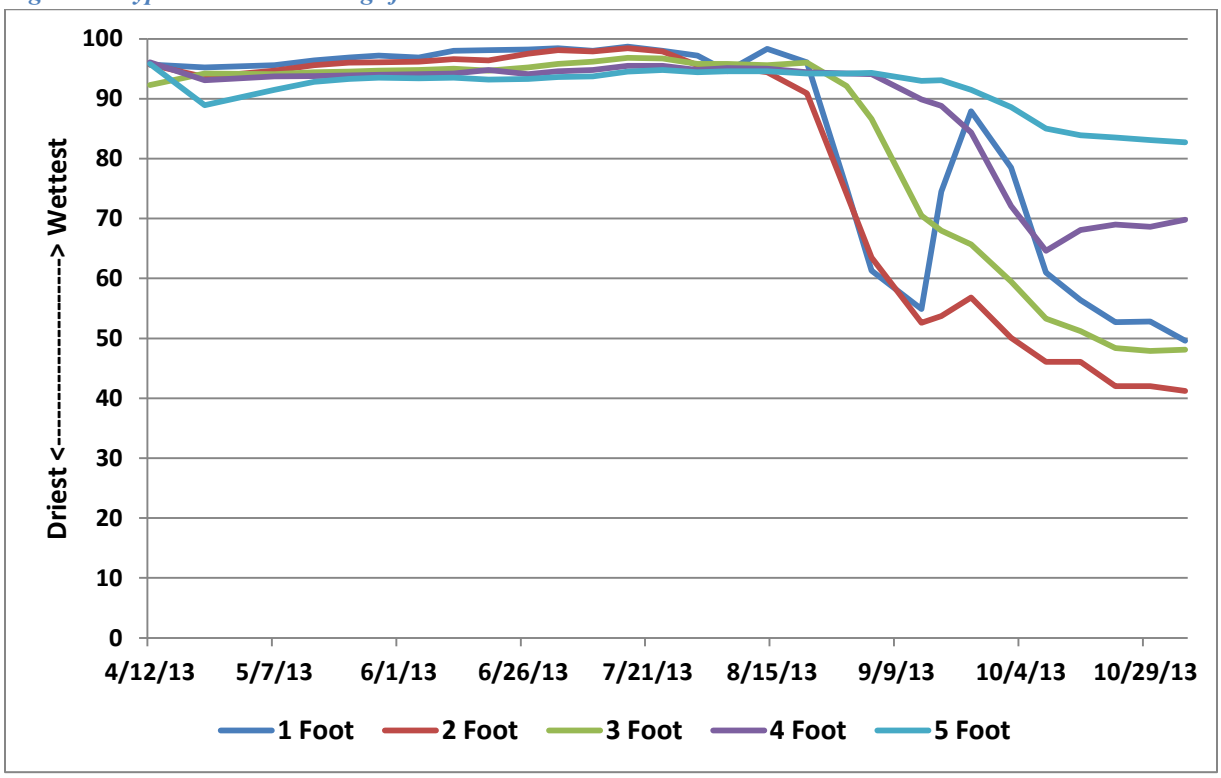


Figure 8: Growing Season Water Tracking for Harold Grall's "200-12" Demonstration Field (198 bu/ac)

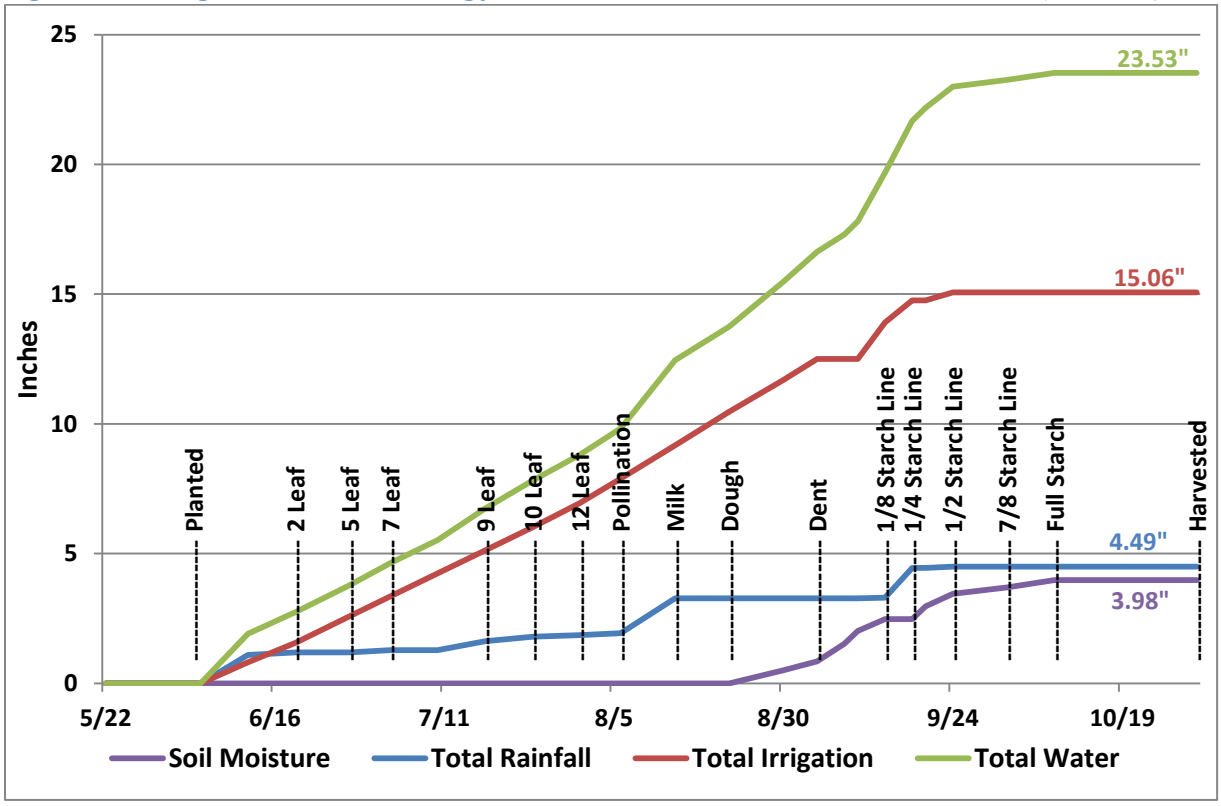


Table 8: Demonstration Field Data for Harold Grall's "200-12" Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
3/7	0.86		518475		43.0	Gone	0.0	0.0	24.5		181 N		Randy
3/20			518475		95.7	Gone	24.7	61.4	66.9		181 N		Randy
4/1	0.04		518475		94.4	Gone	27	61.5	67.2		181 N		Randy
4/12			518475		95.7	95.7	92.3	96.1	95.8		180 N		Randy
4/23			518475		95.2	93.6	94.2	93.1	88.9		180 N		Randy
5/7	0.09		518475		95.6	94.7	94.1	93.7	91.5		180 N		Randy
5/15			518475		96.4	95.6	94.4	93.8	92.8		180 N		Randy
5/22			518475		96.9	96.0	94.5	93.9	93.3		180 N		R & C
5/28			518475		97.2	96.1	94.7	94.0	93.5		180 N		R & C
6/4										Planted			Harold
6/5			519582		96.9	96.2	94.8	94.1	93.4		195 Y	368	R & C
6/12	1.09	0.81	545901		98.0	96.6	95.0	94.2	93.5	200-12	154 Y	361	R & C
6/19	0.10	0.75	570244	2 Leaf	98.1	96.4	94.7	94.8	93.2	200-12	113 Y	289	R & C
6/27		1.03	603678	5 Leaf	98.2	97.5	95.2	94.1	93.3	200-12	206 Y	289	R & C
7/3	0.09	0.76	628370	7 Leaf	98.4	98.1	95.8	94.6	93.6	200-12	182 Y	290	R & C
7/10		0.89	657490	7 Leaf	98.0	97.9	96.2	94.8	93.7	200-12	181 Y	279	R & C
7/17	0.34	0.88	686203	9 Leaf	98.7	98.4	96.8	95.5	94.5	200-12	184 Y	285	R & C
7/24	0.18	0.89	715165	10 Leaf	98.0	97.9	96.7	95.5	94.8	200-12	192 Y	288	R & C
7/31	0.06	0.94	745769	12 Leaf	97.2	95.6	95.8	94.8	94.4	200-12	230 Y	392	Randy
8/6	0.07	0.94	776513	Pollination	94.6	95.4	95.8	95.1	94.6	200-12	152 Y	382	R & C
8/14	1.35	1.28	818232	Milk	98.3	94.4	95.6	95.0	94.6	200-12	192 Y	377	R & C
8/22		1.29	860283	Dough	96.1	90.9	96.0	94.4	94.2	200-12	235 Y	354	Randy
8/30		1.23	900346	Dough	75.1	74.1	92.1	94.2	94.2	200-12	240 Y	354	Randy
9/4		0.81	926646	Dent	61.3	63.5	86.6	94.1	94.3	200-12	140 Y	347	Randy
9/14	0.02	1.41	972477	1/8 ml	54.9	52.6	70.5	89.9	93.0	200-12	210 Y	362	Randy
9/18	1.15	0.85	170	1/4 ml	74.5	53.7	68.0	88.8	93.1		108 N		Randy
9/24	0.04	0.30	9958	1/2 ml	87.9	56.8	65.7	84.4	91.5		180 N		Randy
10/2			9958	7/8 ml	78.5	50.1	59.5	72.1	88.6		180 N		Randy
10/9			9958	1.0 ml	61.0	46.1	53.3	64.6	85.0		180 N		Randy
10/16			9958	1.0 ml	56.4	46.1	51.2	68.1	83.9		180 N		Randy
10/23			9958	1.0 ml	52.7	42.0	48.4	69.0	83.5		180 N		Randy
10/30			9958	Harvested	52.8	42.0	47.9	68.6	83.1		165 N		Randy
11/6	0.25		9958	Harvested	49.6	41.2	48.1	69.8	82.7		165 N		Randy
Total	**4.49**	**15.06**			**0.85”**	**1.17”**	**0.98”**	**0.70”**	**0.28”**				
Net Soil Moisture is 3.98"													
Irrigation, Rainfall Plus Net Soil Moisture is 23.53"													

- Numbers in red are not counted in the total

NORTH PLAINS GROUNDWATER Conservation District

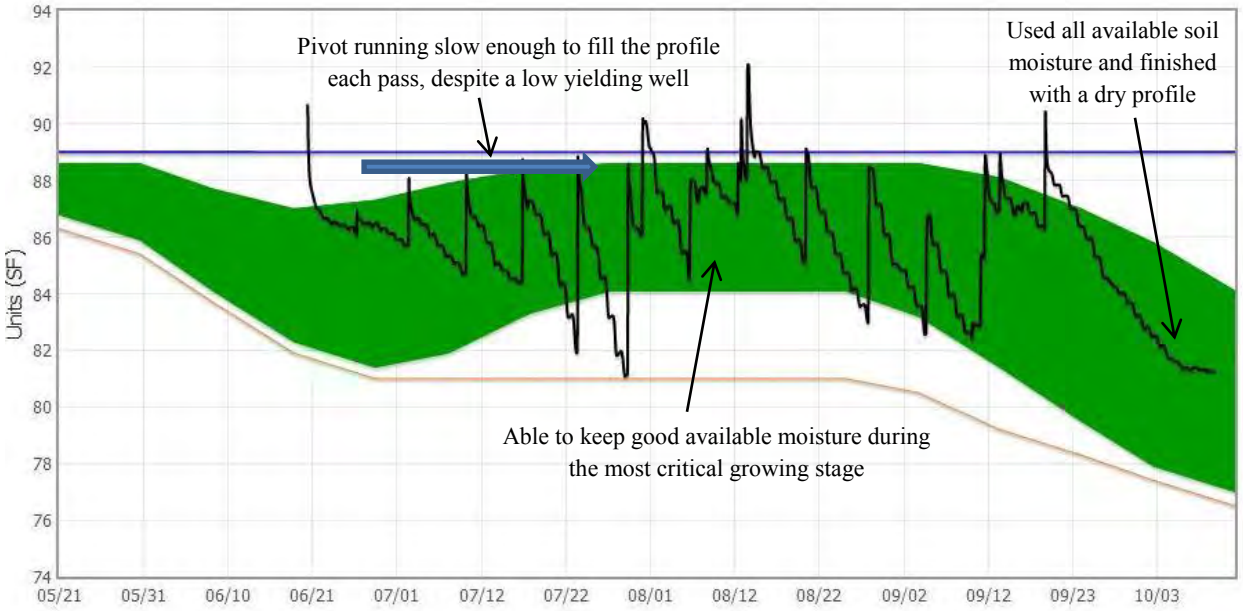
2013-Corn Demonstration
Irrigated Medium Season Corn

200-12

Year:	*2013*	**County:**	*Moore*	**Grower:**	*Harold Grall*
No. Acres:	*120*	**Hybrid:**	*P1151AM1*	**Soil Type:**	*Sherm Silty Clay Loam*
Meter Type:	*McCrometer*				
Meter Mult:	*Gallons x 100*	**Tillage:**	*Strip Till*		
Fertilizer:	*62-19-0 + 5 tons Compost*	**Seeding:**	*26,000*		
Planted:	*June 4*	**Harvest:**	*October 30*		
Herbicide:	*Actamaster, Status, Power Max, Medal, Activator 90*			**Insecticide:**	*Penncap/Cidetrac, Zeal*
Yield:	*198 bu/ac*	**Prev. crop:**	*Corn*	**Row width:**	*30 Inch*
Irrigation method:	*Center Pivot*	**Prewater:**	*None*	**GPM/acre:**	*2.5*
Distance between drops:	*60"*	**Distance from nozzle to ground:**		*16"*	
Application pattern:	*LEPA Bubbler*	**Crop row direction :**		*Straight*	

GPS Location of Pivot Pad		**GPS Location of Gypsum Blocks**	
Latitude:	*35.97143*	Latitude:	*35.968372*
Longitude:	*-102.136511*	Longitude:	*-102.135218*

Harold Grall's "200-12" Field AquaSpy® Probe Summary



This field began with a full profile and experienced good early root growth. The pivot speed allowed for good deep irrigations to 24"-28", which ensured good water use efficiency. Timely cool weather allowed irrigation to keep up with demand during the peak water use period, before the profile began to dry out towards the end of the season. The profile was depleted by the end of the season, ensuring all stored soil moisture was used by the crop.

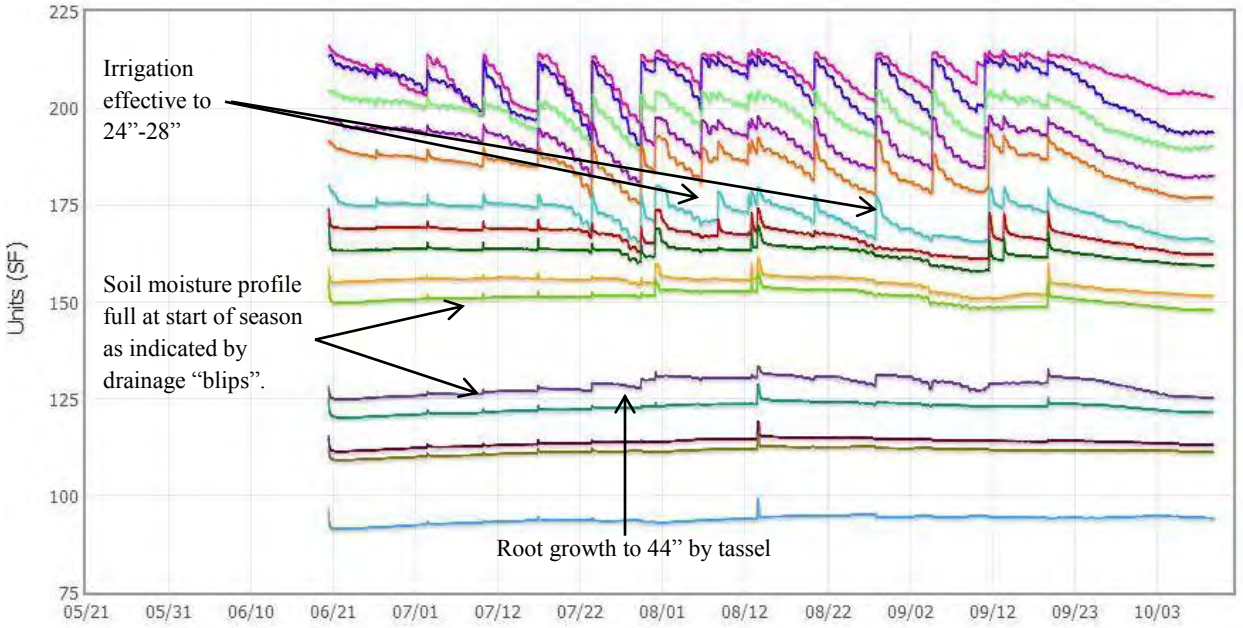


Figure 9: Gypsum Block Readings for Harold Grall's Control Demonstration Field

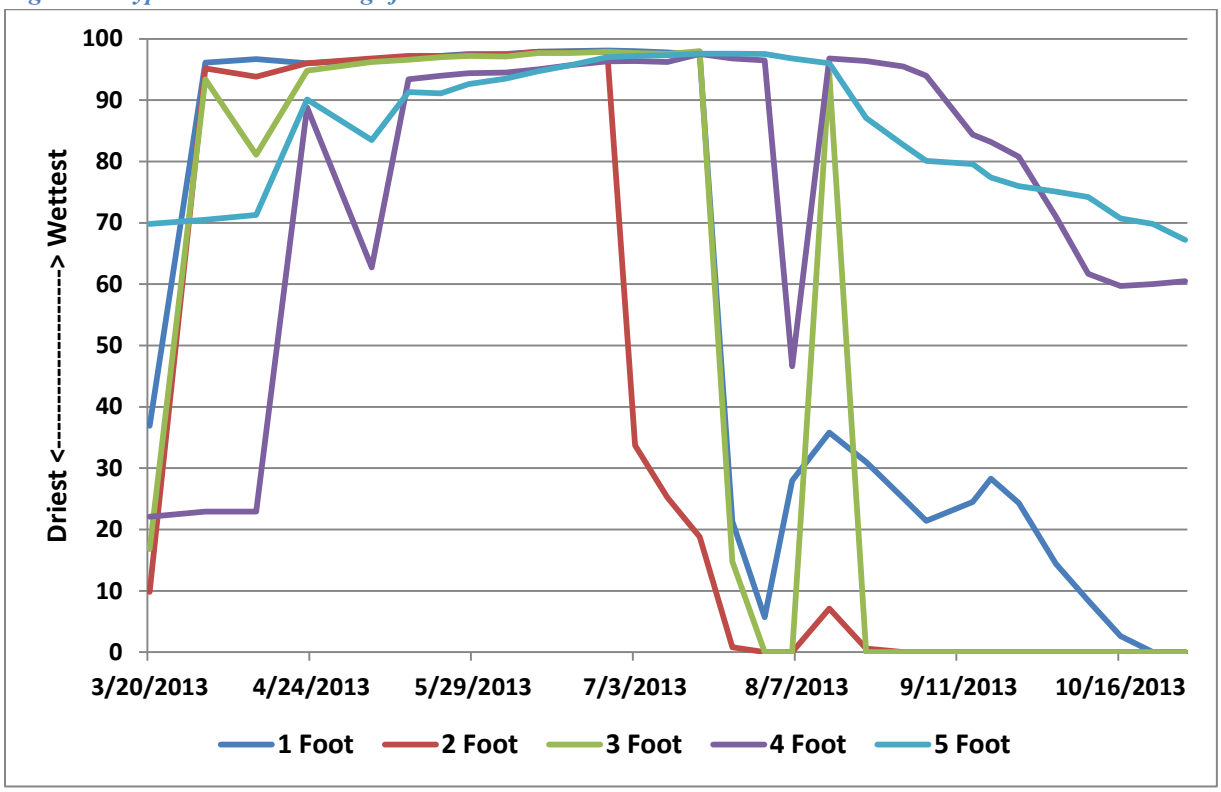


Figure 10: Growing Season Water Tracking for Harold Grall's Control Demonstration Field (195 bu/ac)

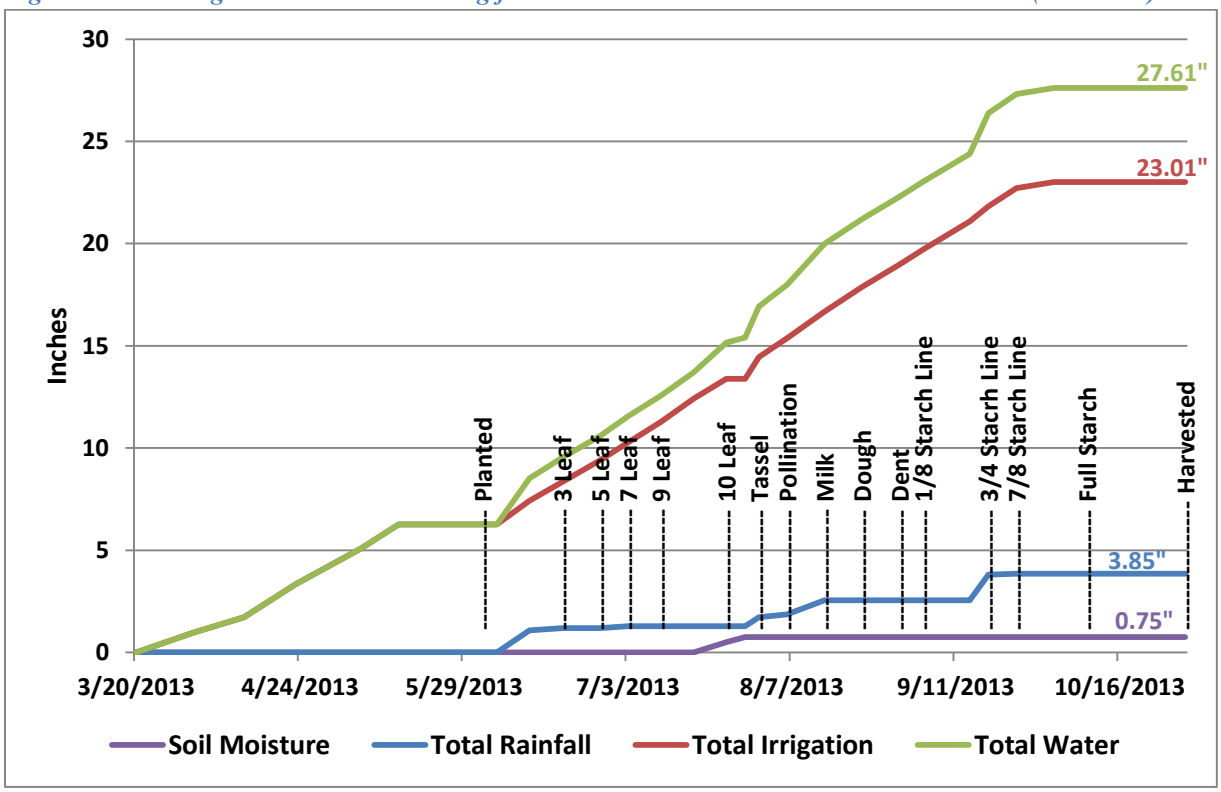


Table 9: Demonstration Field Data for Harold Grall's Control Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
3/7	0.59		181.47		0.0	0.0	0.0	0.0	0.0		153 N		Randy
3/20			181.47		36.9	9.8	16.8	22.1	69.8		153 N		Randy
4/1	0.03	0.96	191.04		96.1	95.2	93.4	22.9	70.5	Prewater	43 N		Randy
4/12		0.76	198.66		96.7	93.8	81.1	22.9	71.3	Prewater	270 N		Randy
4/23		1.61	214.77		96.0	96.0	94.8	88.8	90.1	Prewater	40 Y		Randy
5/7	0.17	1.76	232.35		96.6	96.8	96.2	62.7	83.5	Prewater	189 Y cw	318	Randy
5/15		1.17	244.01		97.1	97.2	96.6	93.4	91.3	Prewater	170 Y	310	Randy
5/22			244.33		97.2	97.2	97.0	94.0	91.1		179 N		R & C
5/28			244.33		97.5	97.3	97.2	94.4	92.6		180 N		R & C
6/2										Planted			Harold
6/5			246.08		97.5	97.4	97.1	94.5	93.5		14 Y	334	R & C
6/12	1.09	1.16	255.93		97.9	97.9	97.7	95.0	94.7	Control	59 Y	307	R & C
6/19	0.10	0.93	265.25	3 Leaf	98.0	97.9	97.7	95.7	95.7	Control	99 Y	297	R & C
6/27		1.05	275.73	5 Leaf	98.1	97.9	97.9	96.3	97.0	Control	154 Y	286	R & C
7/3	0.09	0.87	284.44	7 Leaf	98.0	33.7	97.7	96.4	97.2	Control	75 Y	330	R & C
7/10		1.00	294.46	9 Leaf	97.8	25.2	97.5	96.2	97.3	Control	36 Y	300	R & C
7/17		1.15	305.98	9 Leaf	97.4	18.8	98.0	97.5	97.6	Control	40 Y	290	R & C
7/24		0.96	315.6	10 Leaf	21.3	0.8	14.8	96.8	97.6	Control	311 Y	225	R & C
7/31	0.45	1.07	326.29	Tassel	5.7	0.0	0.0	96.5	97.5	Control	277 Y	215	Randy
8/6	0.13	0.92	335.52	Pollination	28.0	0.0	0.0	46.6	96.8	Control	97.3	273	R & C
8/14	0.70	1.31	348.6	Milk	35.8	7.1	94.3	96.8	96.0	Control	181 Y	272	R & C
8/22		1.20	360.62	Dough	31.0	0.6	0.0	96.4	87.1	Control	183 Y	255	Randy
8/30		1.10	371.68	Dent	25.1	0.0	0.0	95.5	82.7	Control	172 Y	271	Randy
9/4		0.73	379.01	1/8 ml	21.4	0.0	0.0	94.0	80.1	Control	40 Y	251	Randy
9/14		1.37	392.77	1/2 ml	24.5	0.0	0.0	84.4	79.6	Control	81 Y	347	Randy
9/18	1.25	0.74	400.16	3/4 ml	28.3	0.0	0.0	83.2	77.4	Control	314 Y	267	Randy
9/24	0.04	0.89	409.05	7/8 ml	24.3	0.0	0.0	80.8	76.0	Control	192 Y	267	Randy
10/2		0.30	412.05	7/8 ml	14.4	0.0	0.0	71.0	75.1		319 N		Randy
10/9			412.05	1.0 ml	8.4	0.0	0.0	61.7	74.2		319 N		Randy
10/16			412.05	1.0 ml	2.6	0.0	0.0	59.7	70.7		319 N		Randy
10/23			412.05	Black Layer	0.0	0.0	0.0	60.0	69.8		319 N		Randy
10/30			412.05	Harvested	0.0	0.0	0.0	60.5	67.2		310 N		Randy
11/6	0.29		412.05	Harvested	0.0	0.0	0.0	61.5	68.9		310 N		Randy
Total	**3.85**	**23.01**			**0.76”**	**0.21”**	**0.36”**	**-0.58”**	**0.00”**				
Net Soil Moisture is 0.75"													
Irrigation, Rainfall Plus Net Soil Moisture is 27.61"													

- Numbers in red are not counted in the total

2013-Corn Demonstration
Irrigated Medium Season Corn

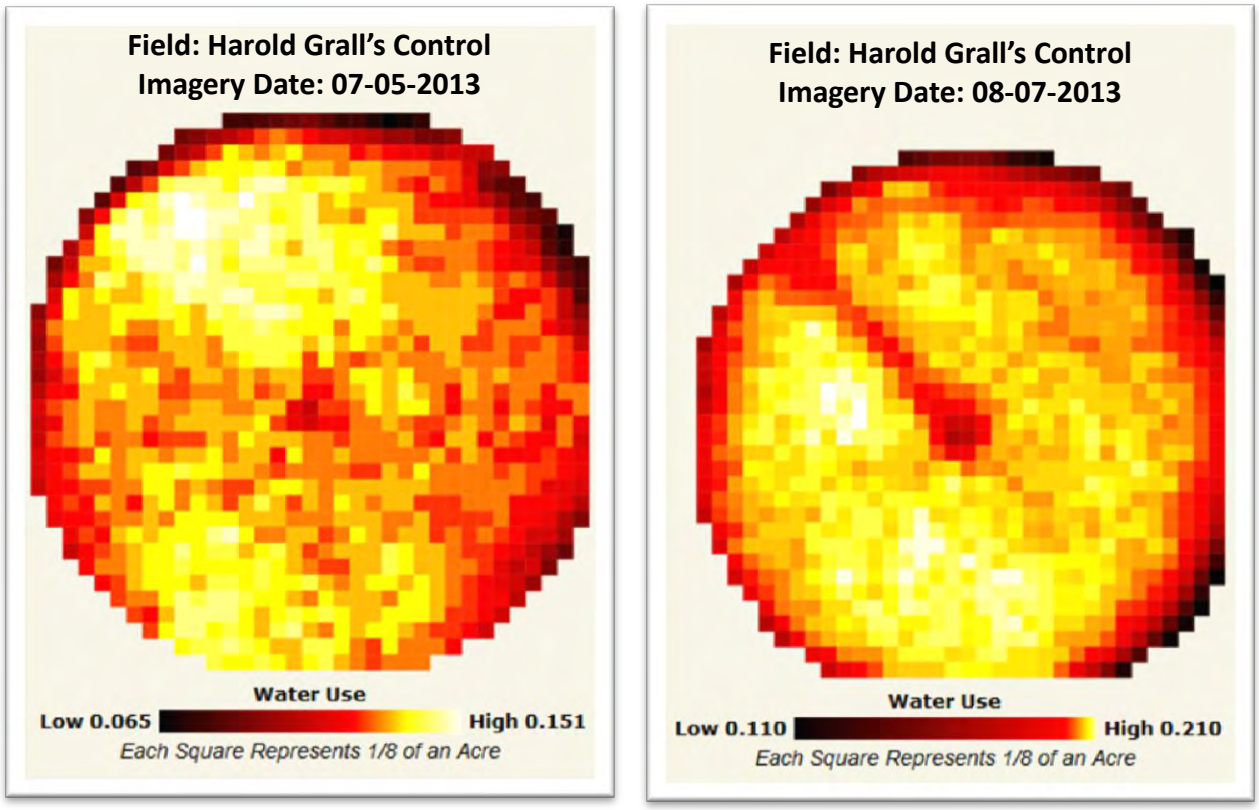
Control

Year:	*2013*	**County:**	*Hartley*	**Grower:**	*Harold Grall*
No. Acres:	*120*	**Hybrid:**	*P1151AM1*	**Soil Type:**	*Sherm Clay Loam*
Meter Type:	*Seametrics*				
Meter Mult:	*Ac Ft x 1*	**Tillage:**	*Strip Till*		
Fertilizer:	*141-66-0*	**Seeding:**	*24,000*		
Planted:	*June 2*	**Harvest:**	*October 30*		
Herbicide:	*Blance Flex, Cinch ATZ, Liberate, Weedmaster, Laudis, Strut, Starane Ultra*	**Insecticide:**	*Comite 11*		
Yield:	*195 bu/ac*	**Prev. crop:**	*Corn*	**Row width:**	*30 Inch*
Irrigation method:	*Center Pivot*	**Prewater:**	*6.26 in.*	**GPM/acre:**	*2.4*
Distance between drops:	*60"*	**Distance from nozzle to ground:**	*16"*		
Application pattern:	*LEPA Bubbler*	**Crop row direction :**	*Straight*		

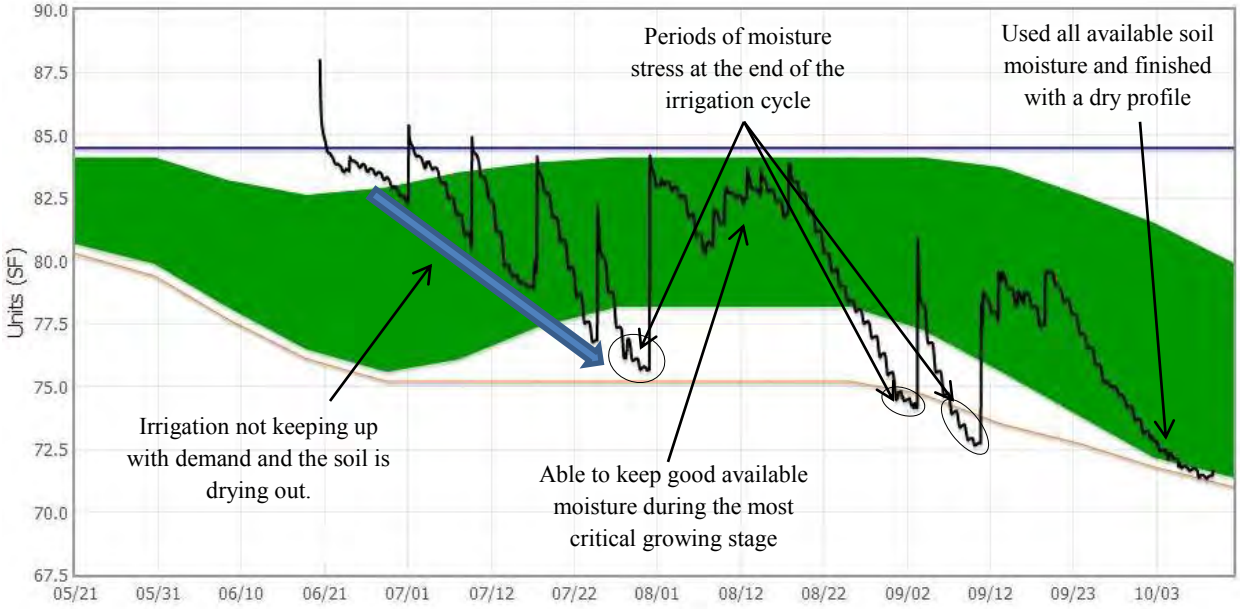
GPS Location of Pivot Pad		**GPS Location of Gypsum Blocks**	
Latitude:	*35.978769*	Latitude:	*35.982022*
Longitude:	*-102.181205*	Longitude:	*-102.181695*

Satellite Imagery: Satellite imagery was initiated and used in 2013 to learn and evaluate it‟s potential for an irrigation and water management tool for growers in connection with HydroBio. Harold Grall‟s Control field was one of ten “200-12” project fields included in 2013. A website was established and made available to project cooperators and District staff. We learned that satellite imagery has potential, but requires additional development, especially in establishing beginning soil moisture and monitoring the soil profile and root zone during the growing season. Two satellite images of Harold Grall‟s Control field are shown in figure 11 to illustrate examples of what is displayed on the website. The first image was on July 5 at the 7 leaf stage. The second image is on August 7 at pollination. The satellite imagery data changes when the next satellite passes, usually in three day increments.

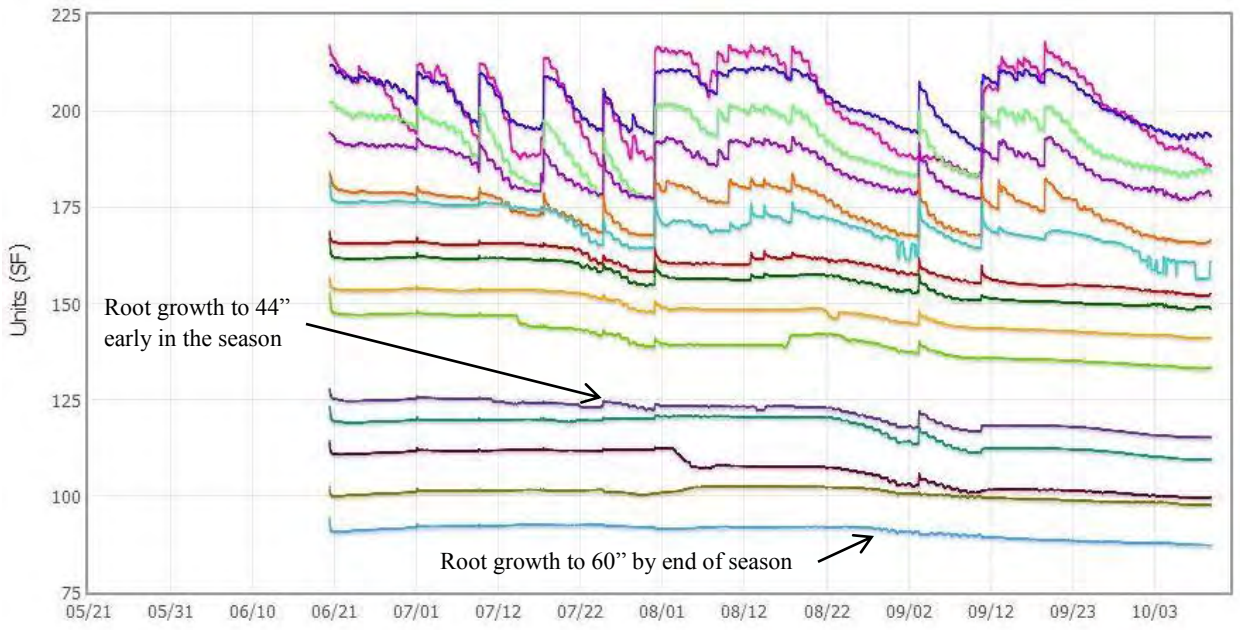
Figure 11: Satellite Imagery for Harold Grall's Control Demonstration Field



Harold Grall's Control Field AquaSpy® Probe Summary



This field appeared to start with a full soil moisture profile but the irrigation had trouble keeping up with early plant water use. As a result, the profile began drying out and there were indications of moisture stress around pollination, before a significant cool-down allowed the irrigation to catch up. It is possible that stress at this key stage hurt the yield potential of this crop. Subsequent banking of soil moisture in early August enabled the crop to better withstand hot conditions late in the season. The crop seemed to undergo some more temporary moisture stress in early September, forcing the roots to go all the way to 60". Stress at this time could have caused some tipping-back and yield loss or lower test weight. All of the soil moisture was depleted by the end of the season.



Harvest Results: The "200-12" field produced a 198 bushel per acre corn yield. Irrigation totaled 15.06 inches. There was no pre-water. Production in the Control field was 195 bushels per acre, where pre-water was 6.26 inches, seasonal 16.75 and total irrigation 23.01 inches. In comparison, the "200-12" field produced 3 more bushels per acre than the Control with 7.95 less inches of irrigation. Corn production was 13.15 bushels (736lbs) per inch of irrigation in the "200-12" field compared to 8.47 bushels (474lbs) in the Control. Production from each inch of irrigation, rainfall and net soil water that totaled 23.53 inches was 8.41 bushels (471lbs) per acre in the "200-12" field. Irrigation, rainfall and net soil water totaled 27.61 inches in the Control field where production was 7.06 bushels (395lbs) per inch. Crop production costs were $34.25 per acre more for the Control field than for the "200-12" primarily from increased irrigation expenses. At $5.13 per bushel, the additional 3 bushel per acre corn yield in the "200-12" field amounts to $15.39 more per acre. The "200-12" field"s net gain was $49.64 per acre with 7.95 inches less irrigation used compared to production from the Control field. Net return from the "200-12" field was $625.43 per acre compared to $575.79 from the Control. Net return from each inch of irrigation was $41.79 from the "200-12" field compared to $25.02 from the Control field. A summary of the demonstration results are shown in table 10 below.

Table 10: Harold Grall's 2013 Demonstration Results

	Irrigation (in.)	Total Water (in.)	Production		Crop Value @ $5.13/bu		
			bu/ac	lb/ac-in Irrigation	Per Acre	Acre-in of Irrigation	Acre-in of Total Water
"200-12"	15.06	*23.53	198	736	$1,015.74	$67.45	$43.17
Control	23.01	†27.61	195	475	$1,000.35	$43.47	$36.23

*Includes 3.98 inches of water removed from five feet of soil, plus rainfall, and irrigation.
†Includes 0.75 inches of 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, irrigation amount and other information to help maintain profitable corn production levels with reduced soil moisture levels and rainfall. Below are results of eight Pioneer and NK Syngenta hybrids at 26,000 seeding rates from within Grall‟s "200-12" field. Yields are at 15.5 percent moisture and rounded to the nearest number. Irrigation was 15.06 inches and rainfall 4.49 inches, the same as that reported for the "200-12" field.

Table 11: Corn Yields from Different Corn Hybrids

Hybrid	Seeding Rate	Yield (bu/ac)
P151YXR	26,000	214
P1690AM	26,000	201
N72D-3000G	26,000	200
P1266YHR	26,000	200
N72Q-CB/LL/	26,000	198
N72Q-3000G	26,000	196
P1498AM1	26,000	194
P1625CHR	26,000	194

Comments: Yields from all eight hybrids approximate 200 bushels per acre or more from 23.53 inches of irrigation, rainfall and net soil water. Results show crop genetics and growers‟ have responded to provide improved hybrid performance and practices for continued viable corn yields with much less water.

Variable Rate Irrigation for Harold Grall's "Control" Field: Variable Rate Irrigation (VRI) by center pivot speed control was planned for Grall‟s Control field using a prescription written from dual subsoil data obtained from a preseason electromagnetic (EM 38) soil survey. The VRI prescription was written by NPGCD personnel in coordination with Grall using Crop Metrics Virtual Agronomist software. The prescription is based on an eight day center pivot revolution and 300 gpm that applies 1.0 inch of irrigation. Travel speed of the center pivot varies in sixty 6-degree increments to apply different amounts of irrigation pre-programed in writing the prescription. The prescription is written to apply more irrigation on the west half and less on the southeast portion of the circle. Actual irrigation varies from 0.83 inches to 1.20 inches in prescribed areas of the field as shown in Figure 12. Center pivot variable speed control is accomplished by PivoTrac™ using the VRI prescription. Although planned and ready, VRI was never initiated in 2013 due to other priorities. Grall‟s VRI is one of four planned for the 2013 growing season to continue the VRI process following it‟s initiation in 2012.

Figure 12: Variable Rate Irrigation for Harold Grall's Control Demonstration Field

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 1hr 14min

Total Flat Rate Water Amount: 3,308,820.5 gal

Total VRI Water Amount: 3,329,806.4gal (1.01in/ac)

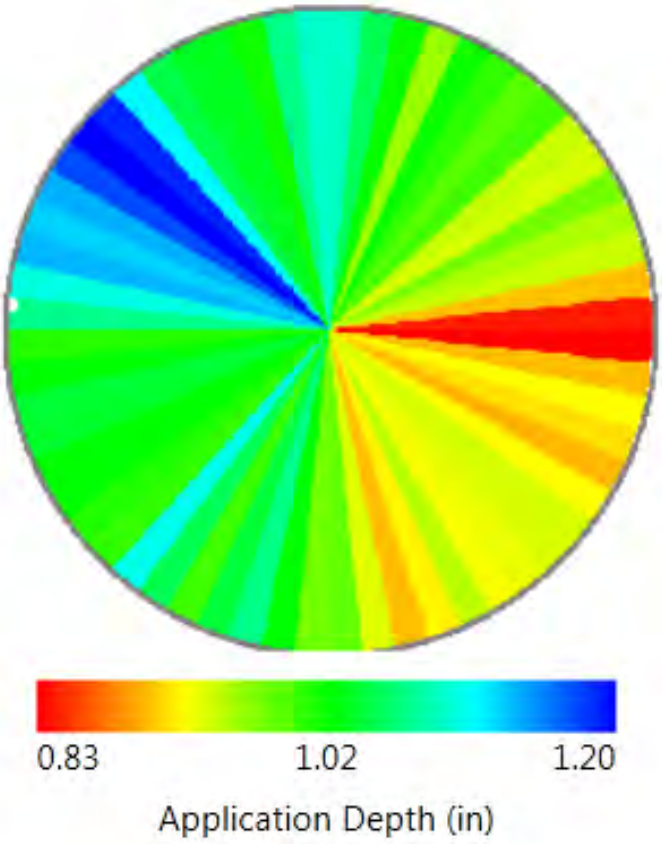


Table 12: Variable Rate Irrigation by Degree Sectors for Harold Grall's Control Field

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 (%)	DualEM Topsoil
0	6	1.91	1.09	9.19	55.07
6	12	2.01	1.05	9.51	56.95
12	18	2.02	1.03	9.65	58.52
18	24	2.02	0.98	10.39	59.75
24	30	2.02	1.00	9.87	57.82
30	36	2.01	1.00	9.99	57.79
36	42	2.02	0.98	10.14	58.75
42	48	2.02	0.98	10.07	58.42
48	54	2.02	0.95	10.56	60.47
54	60	2.02	0.94	10.63	60.70
60	66	2.02	0.99	10.27	59.12
66	72	2.02	0.98	10.48	59.86
72	78	2.03	0.94	10.58	60.06
78	84	2.03	0.90	11.06	61.63
84	90	2.02	0.84	11.85	63.76
90	96	2.02	0.83	12.01	64.39
96	102	2.03	0.90	11.09	62.02
102	108	2.03	0.93	10.79	60.58
108	114	2.03	0.92	10.93	61.31
114	120	2.04	0.90	11.11	62.21
120	126	2.04	0.93	10.80	62.26
126	132	2.04	0.94	10.63	62.08
132	138	2.04	0.94	10.64	62.72
138	144	2.04	0.93	10.71	62.60
144	150	2.04	0.93	10.76	63.14
150	156	2.05	0.95	10.52	62.11
156	162	2.05	0.93	10.83	61.55
162	168	2.05	0.90	11.07	61.34
168	174	2.05	0.94	10.66	61.20
174	180	1.94	0.98	10.18	60.26
180	186	2.14	0.98	10.22	59.31
186	192	2.05	1.02	9.80	56.88
192	198	2.05	1.02	9.78	55.09
198	204	2.05	1.04	9.63	54.84
204	210	2.05	1.00	10.03	55.64
210	216	2.04	1.06	9.53	55.29
216	222	2.05	1.10	9.07	53.82
222	228	2.04	1.00	9.99	56.98
228	234	2.05	1.01	9.95	58.08
234	240	2.04	1.02	9.83	58.17
240	246	2.04	1.02	9.81	59.65
246	252	2.03	1.03	9.67	58.90
252	258	2.04	1.04	9.64	59.10
258	264	2.04	1.06	9.39	58.68
264	270	2.04	1.01	9.94	59.39
270	276	1.96	1.07	9.35	57.87
276	282	2.03	1.10	9.10	56.81
282	288	2.03	1.19	8.40	54.97
288	294	2.03	1.13	8.87	54.18
294	300	2.03	1.14	8.78	53.57
300	306	2.03	1.20	8.50	53.07
306	312	2.02	1.23	8.32	53.60
312	318	2.02	1.19	8.42	55.55
318	324	2.02	1.11	8.98	56.50
324	330	2.02	1.05	9.57	58.06
330	336	2.02	1.03	9.69	58.61
336	342	2.02	1.03	9.72	58.56
342	348	2.03	1.01	9.87	58.58
348	354	2.05	1.07	9.36	56.60
354	360	2.14	1.10	9.16	55.08

www.CropMetrics.com

Brent Clark's 2013 Moore County Demonstration

Planting and Crop Information: For his demonstration, Brent Clark strip tilled and planted 122 acres of corn in the southeast quarter of section 206, for his "200-12" field, "Clark 200-12". Clark planted the field with Pioneer 1151AM at a seeding rate of 28,000 seeds/acre. Clark planted 122 acres, also strip tilled, in the northeast quarter of section 206 to Ch214-14 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 600 gpm and delivered an average of 1.20 inches of irrigation in a 4.5 day revolution. Water meter readings averaged 590 gpm for the center pivot that irrigated the Control field. Irrigation was 1.18 inches in a 4.5 day revolution. The previous crop was corn in both fields. Variable Rate Irrigation (VRI) was planned for the "200-12" field, but unexpected pump repair nixed those plans. Planting and crop information for "Clark 200-12" and "Clark Control" are shown in table 13 below.

Table 13: Planting and Crop Information for Brent Clark

"200-12" Demonstration Field			
Planted:	*April 25*	**Harvested:**	*October 2*
Hybrid:	*P1151AM*	**Seeding Rate:**	*28,000*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*122*	**GPM Per Acre:**	*5.0*
Total Water:	*23.52 in.*	**Soil Type:**	*Dumas Loam*
Fertilizer:	*170-47-0*	**Insecticide:**	*Comite*
Herbicide:	*Roundup, Halex GT*		
Control Demonstration Field			
Planted:	*April 25*	**Harvested:**	*October 2*
Hybrid:	*Ch214-14*	**Seeding Rate:**	*32,000*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*122*	**GPM Per Acre:**	*4.8*
Total Water:	*28.74 in.*	**Soil Type:**	*Sherm Clay Loam*
Fertilizer:	*200-47-0*	**Insecticide:**	*Comite, Headline*
Herbicide:	*Roundup, Halex GT*		

Beginning Soil Water Profile and Growing Season Rainfall

"200-12" Demonstration Field: Preseason soil water was good at 1, 2 and 3 feet and about 65 percent at 4 and 5 feet. Gypsum block sensors were installed in March to obtain advanced soil moisture levels. Early season irrigation refilled the 4 and 5 feet soil profile. The crop used most of the water stored at 1 and 2 feet in late June while the pump was being repaired. Generally, soil moisture was adequate during the growing season. Rainfall events were mostly 0.30 to 0.60 inches. Rainfall in July and August totaled 4.12 inches and helped produce the crop. Total rainfall was 7.62 inches, from planting until harvest. Dumas loam soil holds approximately 1.85 inches of available water per foot for crop use. The gypsum blocks were installed in mid-March prior to planting to obtain advanced soil water conditions.

Control Demonstration Field: Preseason soil water was good to five feet. Gypsum blocks were installed in early March to identify soil moisture levels prior to planting. The crop used most soil water from 1 and 2 feet and about half that at 3 feet in July and early August, plus irrigation and rainfall. Daily crop water use was high during this period. July and August rainfall totaled 4.12 inches from periodic events. Seasonal rainfall was 7.62 inches, which helped produce a good corn yield. Sherm clay loam soil holds approximately two inches of available water per foot for potential crop use. Seasonal rainfall for the "200-12" and Control fields are shown in table 14.

Table 14: Monthly Rainfall Data for Brent Clark

	May	June	July	August	September	Total
"200-12"	0.36"	1.10"	2.05"	2.07"	2.04"	**7.62"**
Control	0.36"	1.10"	2.05"	2.07"	2.04"	**7.62"**

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 each Control field. Both the gypsum block sensors and the soil probe were installed in close proximity to each other in the field. Gypsum blocks were installed in the "200-12" fields and most Control fields prior to planting. Each AquaSpy® probe was installed following crop emergence, as well as gypsum blocks in any remaining fields. Installing and reading the gypsum blocks prior to planting provided advanced soil moisture conditions and information to help guide and manage irrigation. 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 same illustrations for the Control field.

Figure 13: Gypsum Block Readings for Brent Clark's "200-12" Demonstration Field

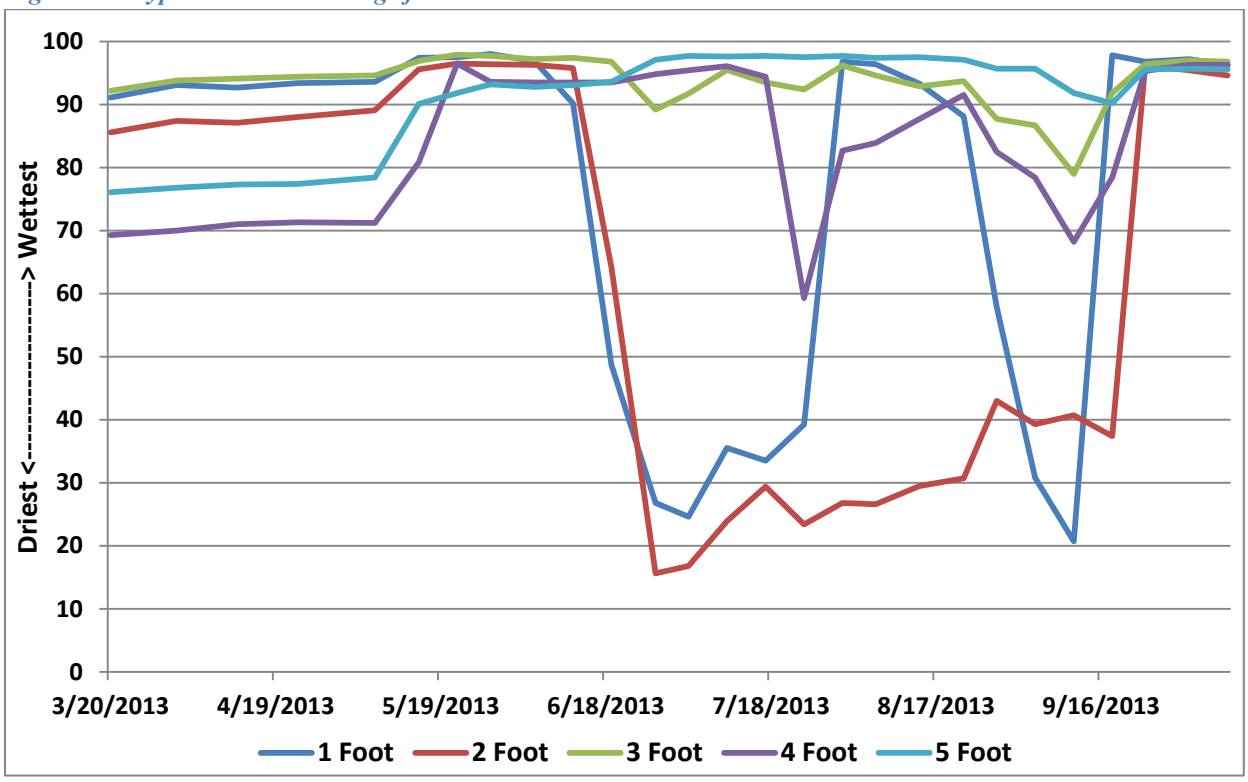


Figure 14: Growing Season Water Tracking for Brent Clark's "200-12" Demonstration Field (219 bu/ac)

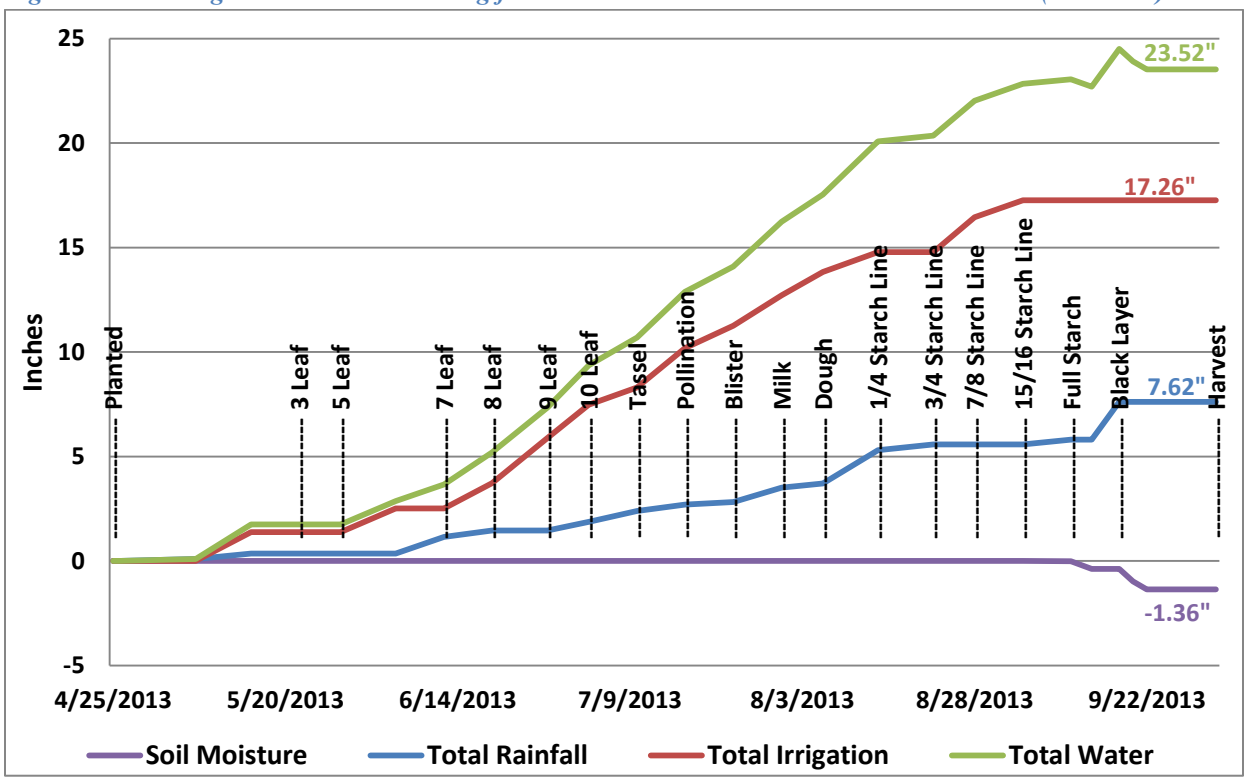


Table 15: Demonstration Field Data for Brent Clark's "200-12" Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
3/7	0.68		148.88		Gypsum Block Wires Cut						194 N		Randy
3/20	0.03		148.88		91.1	85.6	92.2	69.3	76.1		194 N		Randy
4/1			149.29		93.1	87.4	93.8	70.0	76.8		194 N		Randy
4/12			149.57		92.7	87.1	94.1	71.0	77.3		194 N		Randy
4/23			149.77		93.4	88.0	94.4	71.3	77.4		248 N		Randy
4/25										Planted			Brent
4/26			170.66										Leon
5/7	0.10		175.33		93.6	89.1	94.6	71.2	78.4		105 Yccw	598	Randy
5/15	0.26	1.39	184.78		97.4	95.6	96.9	80.8	90.1		187 N		Randy
5/22			185.02	3 Leaf	97.5	96.5	97.9	96.5	91.8		187 N		R & C
5/28			185.09	5 Leaf	98.0	96.4	97.7	93.6	93.2		84 N		R & C
6/5		1.12	196.52	5 Leaf	96.9	96.3	97.2	93.5	92.8		194 N		R & C
6/12	0.80		196.67	7 Leaf	90.2	95.8	97.4	93.5	93.1		194 N		R & C
6/19	0.30	1.22	209.05	8 Leaf	48.7	64.2	96.8	93.5	93.6	200-12	102 Y	482	R & C
6/27		2.15	230.88	9 Leaf	26.8	15.6	89.2	94.8	97.1	200-12	266 Y	605	R & C
7/3	0.42	1.60	247.16	10 Leaf	24.6	16.8	91.7	95.4	97.7	200-12	190 Y	626	R & C
7/10	0.51	0.83	255.58	Tassel	35.5	23.9	95.5	96.1	97.6	200-12	324 Y	605	R & C
7/17	0.31	1.88	274.71	Pollination	33.5	29.4	93.5	94.4	97.7	200-12	160 Y	633	R & C
7/24	0.13	1.07	285.62	Blister	39.2	23.4	92.4	59.3	97.5	200-12	231 Y	645	R & C
7/31	0.68	1.46	300.48	Milk	96.8	26.8	96.2	82.7	97.7		189 N		Randy
8/6	0.20	1.11	311.78	Dough	96.4	26.6	94.6	83.9	97.4	200-12	274 Y	625	R & C
8/14	1.59	0.95	321.41	1/4 ml	93.3	29.5	92.9	87.7	97.5		7 N		R & C
8/22	0.28		321.56	3/4 ml	88.1	30.7	93.7	91.5	97.1	200-12	3 Y	623	Randy
8/28		1.67	338.42	7/8 ml	57.9	43.0	87.7	82.5	95.7	200-12	219 Y	653	Randy
9/4		0.81	346.69	15/16 ml	30.8	39.3	86.7	78.4	95.7		340 N		Randy
9/11	0.23		346.69	1.0 ml	20.7	40.7	79.0	68.2	91.8		340 N		Randy
9/18	1.81		346.69	Black Layer	97.8	37.4	91.8	78.4	90.2		340 N		Randy
9/24	1.39		346.69	Black Layer	96.8	96.2	96.4	95.3	95.6		340 N		Randy
10/2			346.96	Harvested	97.2	95.4	97.0	96.3	95.7		14 N		Randy
10/9			346.69	Harvested	96.3	94.6	96.8	96.3	95.6		14 N		Randy
Total	**7.62**	**17.26**			**-0.14”**	**-0.23”**	**-0.10”**	**-0.50”**	**-0.39”**				
Net Soil Moisture is -1.36"													
Irrigation, Rainfall Plus Net Soil Moisture is 23.52"													

- Numbers in red are not in the totals

NORTH PLAINS GROUNDWATER Conservation District

2013-Corn Demonstration
Irrigated Medium Season Corn

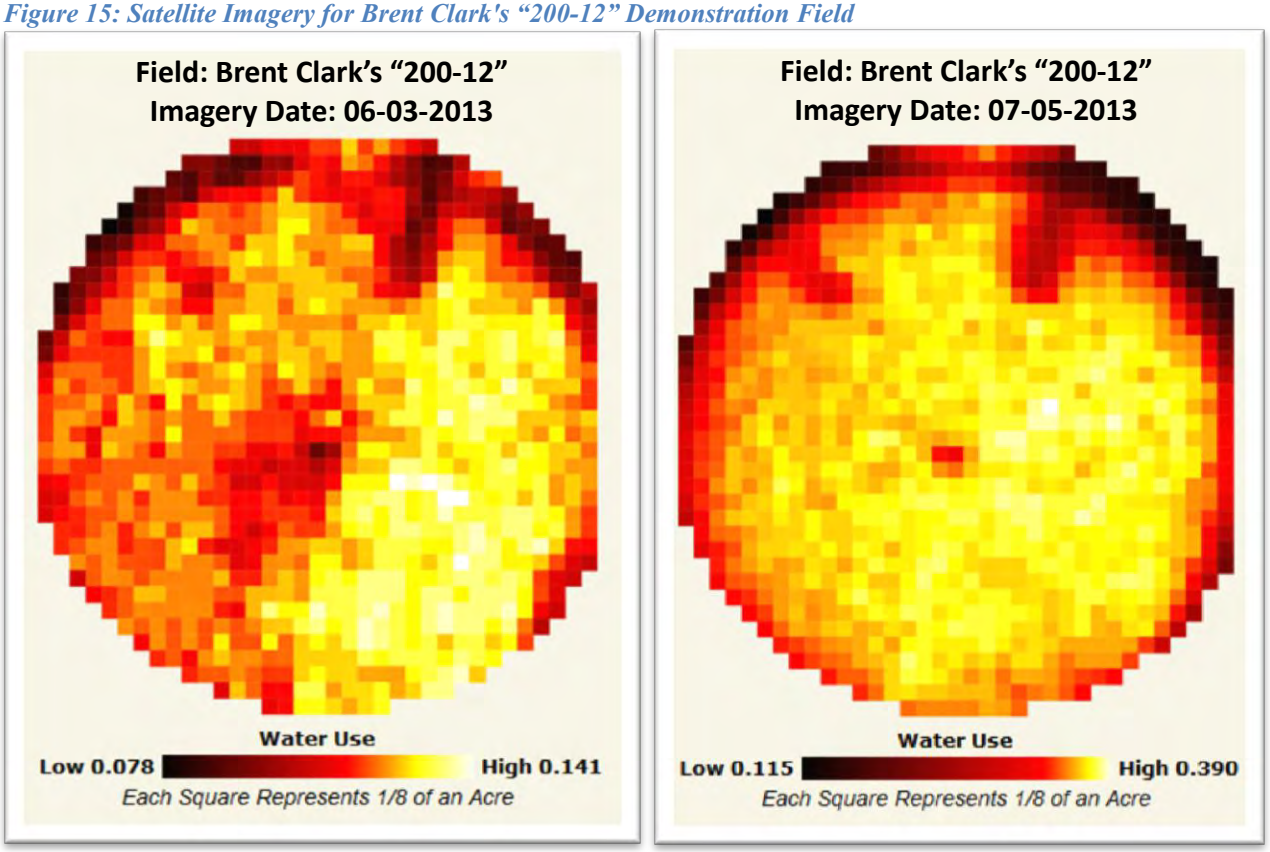
200-12

Year:	*2013*	**County:**	*Hartley*	**Grower:**	*Brent Clark*
No. Acres:	*122*	**Hybrid:**	*P1151AM*	**Soil Type:**	*Dumas & Sherm Clay Loam*
Meter Type:	*Seametrics*				
Meter Mult:	*Ac Ft x 1*	**Tillage:**	*Strip Till*		
Fertilizer:	*170-47-0*	**Seeding:**	*28,000*		
Planted:	*April 25*	**Harvest:**	*October 2*		
Herbicide:	*Roundup, Halex GT*	**Insecticide:**	*Comite, Headline*		
Yield:	*219 bu/ac*	**Prev. crop:**	*Corn*	**Row width:**	*30 Inch*
Irrigation method:	*Center Pivot*	**Prewater:**	*None*	**GPM/acre**	*5.0*
Distance between drops:	*60"*	**Distance from nozzle to ground:**	*16"*		
Application pattern:	*Spray*	**Crop row direction :**	*Straight*		

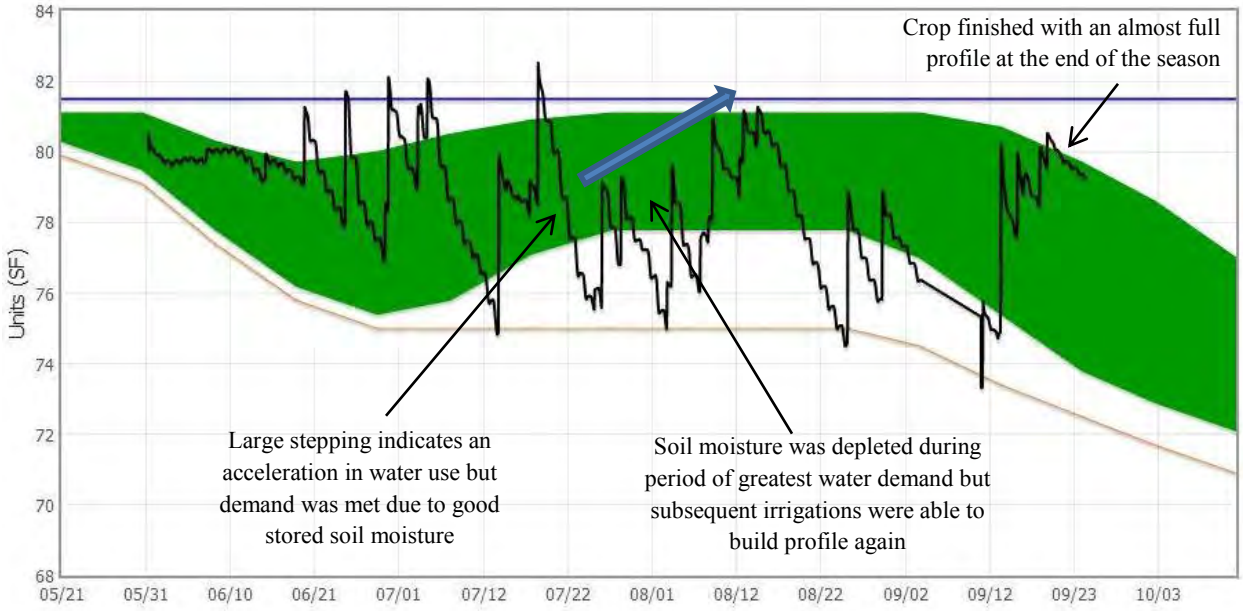
GPS Location of Pivot Pad		**GPS Location of Gypsum Blocks**	
Latitude:	*35.826612*	Latitude:	*35.8253*
Longitude:	*-102.164307*	Longitude:	*-101.167835*

Satellite Imagery: Satellite imagery was used in 2013 to learn and evaluate it‟s potential for an irrigation and water management tool for growers in connection with HydroBio. Brent Clark‟s “200-12” field was one of ten “200-12” project fields included in 2013. A website was established and made available to project cooperators and District staff. We learned that satellite imagery has potential, but requires additional development, especially in establishing beginning soil moisture and monitoring the soil profile and root zone during the growing season. Two satellite images of Brent Clark‟s “200-12” field are shown in figure 15 to illustrate examples of what is displayed on the website. The first image was on June 3 at the 5 leaf stage. The second image is on July 5 at the 11 leaf growth stage. White squares indicate highest water use. The satellite imagery data changes when the next satellite passes, usually in three day increments.

Figure 15: Satellite Imagery for Brent Clark's “200-12” Demonstration Field



Brent Clark's "200-12" Field AquaSpy® Probe Summary



The profile was not full at the start of the season but was able to be filled during early vegetative growth. This moisture was depleted quickly during early hot weather and the crop looked like it would run out of water before a cool-down just prior to tassel. Irrigation, combined with rainfall was able to bank enough moisture to keep up with demand during mid-late July. Irrigation was able to keep up with demand during late July and early August, and was even able to bank some soil moisture in the top 36". This moisture was necessary to keep up with demand late in the season, due to another round of hot weather. Late irrigation and or rainfall were not utilized and the crop finished with a nearly full profile.

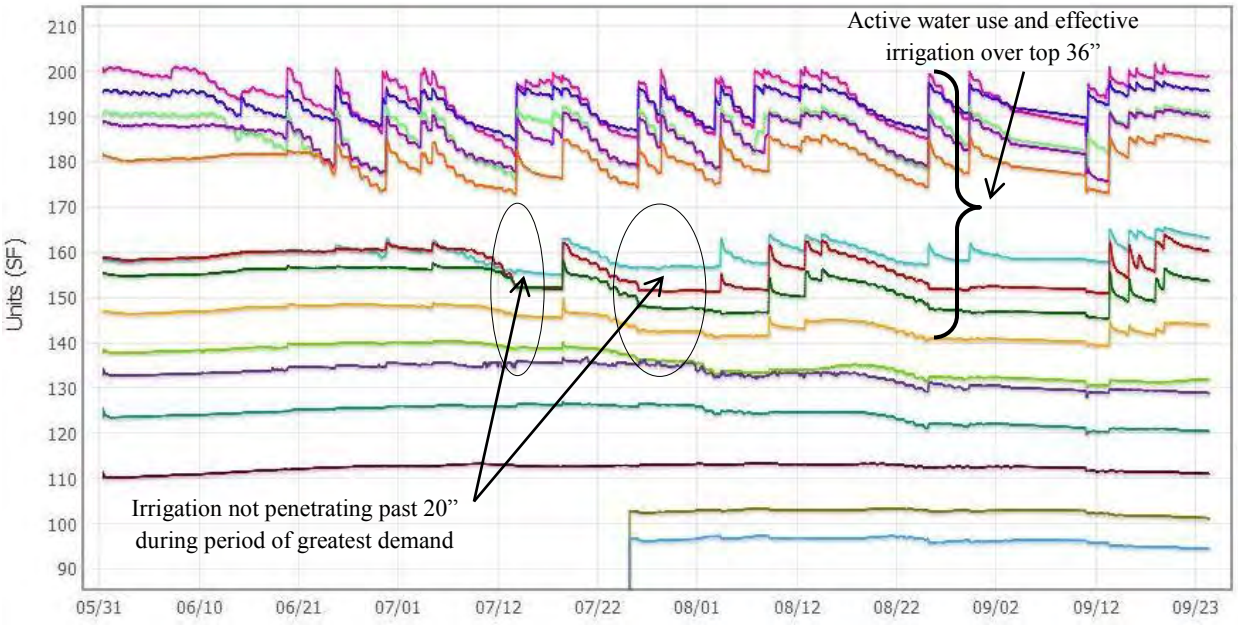


Figure 16: Gypsum Block Readings for Brent Clark's Control Demonstration Field

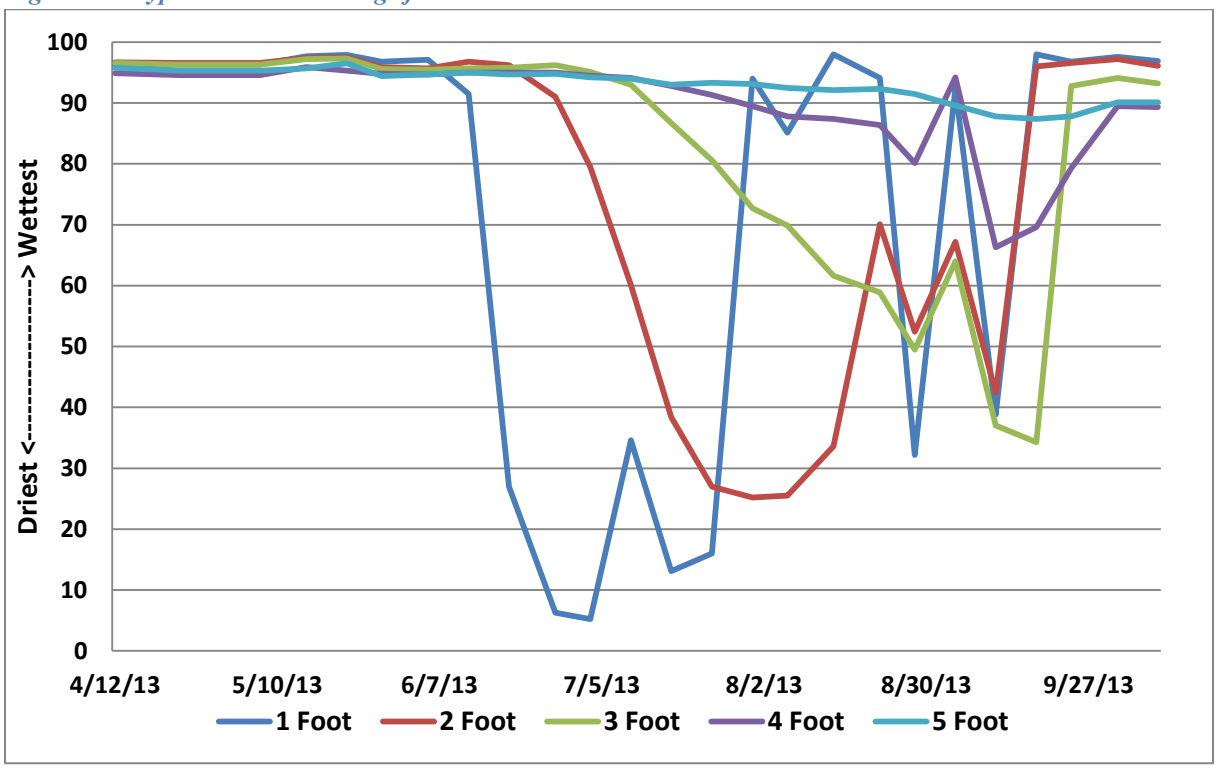


Figure 17: Growing Season Water Tracking for Brent Clark's Control Demonstration Field (239 bu/ac)

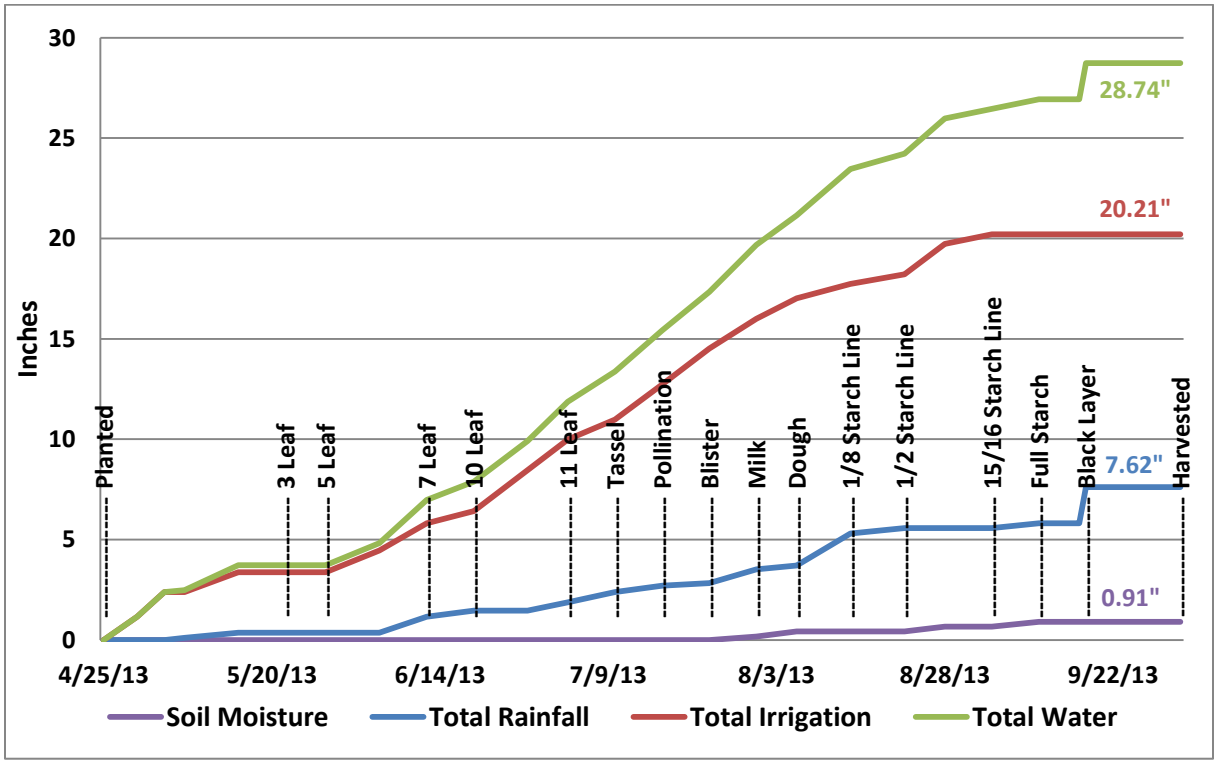


Table 16: Demonstration Field Data for Brent Clark's Control Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
3/7	0.68		186.22		0.0	0.0	0.0	0.0	0.0		34 N		Randy
3/20	0.03		186.22		0.0	95.8	95.7	93.7	0.0		34 N		Randy
4/1			186.22		0.0	96.8	96.7	94.8	0.0		34 N		Randy
4/12			186.26		96.0	96.7	96.6	94.9	95.8		34 N		Randy
4/23			186.26		96.3	96.6	96.3	94.6	95.3		34 N		Randy
4/25										Planted			Brent
4/30		1.15	197.95										Leon
5/4		1.23	210.45										Leon
5/7	0.10		211.29		96.3	96.6	96.3	94.6	95.3		301 Yccw	628	Randy
5/15	0.26	0.99	220.53		97.7	97.4	97.2	95.9	95.7		356 N		Randy
5/22			220.53	3 Leaf	97.9	97.5	97.3	95.3	96.5		356 N		R & C
5/28			220.53	5 Leaf	96.8	95.9	95.6	94.8	94.4		196 N		R & C
6/5		1.09	231.62	5 Leaf	97.1	95.7	95.5	94.7	94.7		18 N		R & C
6/12	0.80	1.35	245.33	7 Leaf	91.5	96.8	95.7	95.0	95.0	Control	326 Y	605	R & C
6/19	0.30	0.61	251.56	10 Leaf	27.0	96.2	95.8	95.0	94.7	Control	165 Y	140	R & C
6/27		2.03	272.26	10 Leaf	6.3	91.0	96.2	95.0	94.8	Control	285 Y	590	R & C
7/3	0.42	1.54	287.91	11 Leaf	5.2	79.5	95.1	94.5	94.2	Control	188 Y	593	R & C
7/10	0.51	0.98	297.94	Tassel	34.6	60.1	93.0	94.1	94.0	Control	254 Y	573	R & C
7/17	0.31	1.76	315.91	Pollination	13.1	38.4	86.7	92.8	93.0	Control	87 Y	583	R & C
7/24	0.13	1.78	334.00	Blister	16.0	27.0	80.6	91.3	93.3	Control	283 Y	574	R & C
7/31	0.68	1.49	349.17	Milk	94.0	25.2	72.7	89.5	93.1		195 N		Randy
8/6	0.20	1.01	359.51	Dough	85.1	25.5	69.9	87.8	92.5	Control	240 Y	568	R & C
8/14	1.59	0.73	366.96	1/8 ml	98.0	33.6	61.6	87.4	92.1		16 N		R & C
8/22	0.28	0.48	371.88	1/2 ml	94.1	70.1	58.9	86.4	92.3	Control	240 Y	595	Randy
8/28		1.51	387.31	1/2 ml	32.2	52.4	49.5	80.1	91.5	Control	151 Y	587	Randy
9/4		0.48	392.27	15/16 ml	92.4	67.2	64.0	94.2	89.6		11 N		Randy
9/11	0.23		392.27	1.0 ml	38.8	42.4	37.0	66.3	87.8		11 N		Randy
9/18	1.81		392.27	Black Layer	98.0	96.0	34.3	69.6	87.4		11 N		Randy
9/24	1.39		392.27	Black Layer	96.8	96.6	92.8	79.3	87.8		11 N		Randy
10/2			392.27	Harvested	97.6	97.2	94.1	89.5	90.1		28 N		Randy
10/9			392.27	Harvested	96.9	96.1	93.2	89.3	90.1		28 N		Randy
Total	**7.62**	**20.21**			**0.00”**	**0.00”**	**0.17”**	**0.49”**	**0.25”**				
Net Soil Moisture is 0.91"													
Irrigation, Rainfall Plus Net Soil Moisture is 28.74"													

- Numbers in red are not counted in totals

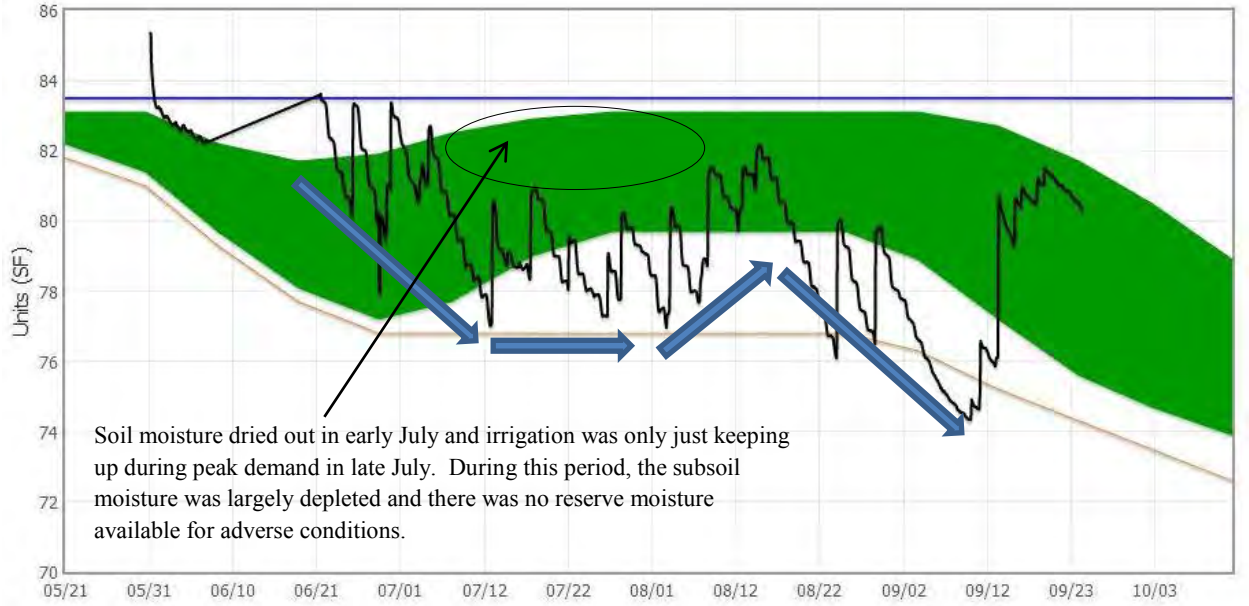
2013-Corn Demonstration
Irrigated Medium Season Corn

Control

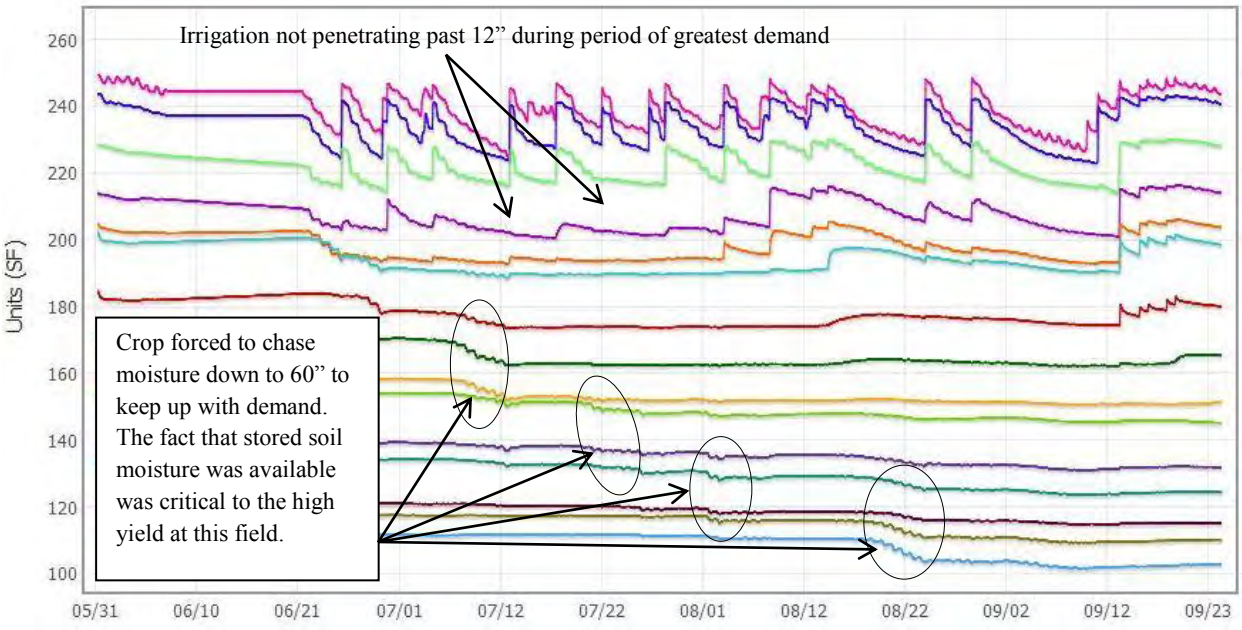
Year:	*2013*	**County:**	*Hartley*	**Grower:**	*Brent Clark*
No. Acres:	*122*	**Hybrid:**	*CH214-14*	**Soil Type:**	*Sherm Clay Loam*
Meter Type:	*Seametrics*				
Meter Mult:	*Ac Ft x 1*	**Tillage:**	*Strip Till*		
Fertilizer:	*200-47-0*	**Seeding:**	*32,000*		
Planted:	*April 25*	**Harvest:**	*October 2*		
Herbicide:	*Roundup, Halex GT*	**Insecticide:**	*Comite, Headline*		
Yield:	*239 bu/ac*	**Prev. crop:**	*Corn*	**Row width:**	*30"*
Irrigation method:	*Center Pivot*	**Prewater:**	*None*	**GPM/acre**	*4.8*
Distance between drops:	*60"*	**Distance from nozzle to ground:**	*16"*		
Application pattern:	*Spray*	**Crop row direction :**	*Straight*		

GPS Location of Pivot Pad		**GPS Location of Gypsum Blocks**	
Latitude:	*35.833831*	Latitude:	*35.836218*
Longitude:	*-102.164263*	Longitude:	*-102.16145*

Brent Clark's Control Field AquaSpy® Probe Summary



Profile starts full then is depleted due to warm weather and increasing plant demand. Luckily there was cool weather during peak demand which allowed good pollination and grain set. The soil moisture profile was able to be replenished before hot weather in late August dried the profile out once more. The root growth at this field was very rapid and very deep (>60") and this, combined with a good soil moisture profile at the start and a cool period during peak demand, enabled this crop to perform much better than expected. It is also possible that the field average was greater than the exact location of the probe, since the probe data would indicate that this crop had to work hard to produce the 239 bu/ac yield.



Harvest Results: The "200-12" field produced a 219 bushel per acre corn yield. Irrigation totaled 17.26 inches. Production in the Control field was 239 bushels per acre, where seasonal irrigation totaled 20.21 inches. No pre-season irrigation was applied in either field. In comparison, the Control field produced 20 bushels more per acre than the "200-12" with 2.95 inches more irrigation. Corn production was 12.69 bushels (710lbs) per inch of irrigation in the "200-12" field compared to 11.83 (662lbs) in the Control. Production from each inch of irrigation, rainfall and net soil water that totaled 23.52 inches was 9.31 bushels (521lbs) per acre in the "200-12" field. Irrigation, rainfall and net soil water totaled 28.74 inches in the Control field where production was 8.32 bushels (466lbs) per inch. Crop production costs were $60.67 per acre more for the Control field than for the "200-12" from increased seed, fertilizer, irrigation and harvest expenses. At $5.13 per bushel, the additional corn yield amounts to $102.60 more per acre. The Control field‟s net gain was $49.63 per acre with 2.95 inches more irrigation used compared to production from the "200-12" field. Net return from the additional 2.95 inches of irrigation was $16.82. Net return per inch of irrigation from the "200-12" field is $40.22 compared to $36.43 for the Control. A summary of the demonstration results are shown in table 17 below.

Table 17: Brent Clark's 2013 Demonstration Results

	Irrigation (in.)	Total Water (in.)	Production		Crop Value @ $5.13/bu		
			bu/ac	lb/ac-in of Irrigation	Per Acre	Acre-in of Irrigation	Acre-in of Total Water
"200-12"	17.26	*23.52	219	711	$1,123.47	$65.09	$47.77
Control	20.21	†28.74	239	662	$1,226.07	$60.67	$42.66

*Includes -1.36 inches of water added to five feet of soil, plus rainfall, and irrigation.
†Includes 0.91 inches of water removed from five feet of soil, plus rainfall, and irrigation.

Danny Krienke's 2013 Ochiltree County Demonstration

Planting and Crop Information: Danny Krienke had three fields for his demonstration in 2013. Krienke strip tilled and planted 40 acres of corn in the middle one third (330-30 degrees) of the north half of section 47, for his "200-12" field, "Krienke 200-12". Krienke planted the "200-12" field to Pioneer 33B54 at a seeding rate of 28,000 seeds/acre. He planted the northeast one third (30 to 90degrees) 40 acres, also strip tilled, to P33B54 at 28,000 seeds/acre for his "Control" field, "Krienke Control". The third 40 acre field (270 to 30 degrees) was strip tilled and planted to P35F40 at a seeding rate of 36,000 seeds/acre on June 25 for his "short season field", "Krienke SS". The three fields were from 270 to 90 degrees in the north half irrigated circle. Seasonal water meter readings averaged 612 gpm and delivered an average of 1.08 inches of irrigation in an 8 day revolution. Planting and crop information for "Krienke 200-12", "Krienke Control" and "Krienke SS" are „shown in the table 18 below.

Table 18: Planting and Crop Information for Danny Krienke

"200-12" Demonstration Field			
Planted:	*May 18*	**Harvested:**	*October 24*
Hybrid:	*P33B54*	**Seeding Rate:**	*28,000*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*40*	**GPM Per Acre:**	*5.1*
Total Water:	*31.55 in.*	**Soil Type:**	*Sherm Clay Loam*
Fertilizer:	*73-76-0*	**Insecticide:**	*Oberon, Stratego (fungicide)*
Herbicide:	*Cinch ATZ, Roundup*		
Control Demonstration Field			
Planted:	*May 18*	**Harvested:**	*October 24*
Hybrid:	*P33B54*	**Seeding Rate:**	*28,000*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*40*	**GPM Per Acre:**	*5.1*
Total Water:	*33.71 in.*	**Soil Type:**	*Sherm Clay Loam*
Fertilizer:	*136-76-0*	**Insecticide:**	*Oberon, Stratego (fungicide)*
Herbicide:	*Cinch ATZ, Roundup*		
Short Season Corn Demonstration Field			
Planted:	*June 25*	**Harvested:**	*November 21*
Hybrid:	*P35F40*	**Seeding Rate:**	*36,000*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*40*	**GPM Per Acre:**	*5.1*
Total Water:	*30.13 in.*	**Soil Type:**	*Sherm Clay Loam*
Fertilizer:	*152-0-0*	**Insecticide:**	*None*
Herbicide:	*Cinch ATZ, Roundup*		

Beginning Soil Water Profile and Growing Season Rainfall

"200-12" Demonstration Field: Preseason soil water was good at 1, 2, 3, 4 and 5 feet in April, prior to planting. Weekly gypsum block readings that followed show soil water was good at all depths in the profile following planting and early season irrigation. Additional readings indicate the crop rooted deep and used most water from 4 feet and about half from 5 feet plus irrigation in

late July. The profile was refilled at all depths by irrigation and rainfall after daily crop water use decreased. Plants used most water from 1, 2 and 3 feet in September finishing the crop. End of the season soil water is good at 4 and 5 feet. Sherm clay loam soil holds approximately 2.0 inches of available water per foot for crop use. Rainfall was 2.19 inches in June, 1.42 in July and 3.37 inches in August; helping to produce a good yield. Total rainfall for the season was 8.56 inches, and back to a more normal level for this location. Gypsum blocks were installed in mid-April, prior to planting to obtain advanced soil water conditions.

Control Demonstration Field: Soil water was good at 1, 2 and 3 feet but none at 4 and 35 percent at 5 feet prior to planting. Weekly gypsum block readings show good soil moisture levels were maintained at 1 foot during the growing season from irrigation and periodic rainfall. And, that plant roots used extensive water from 2 and 3 feet and limited amounts from 4 and 5 feet. Rainfall helped produce the crop, especially 2.19 inches in June and 3.37 inches in August. Two rainfall events in mid-September that totaled 1.37 inches helped finish the crop. Sherm clay loam soil holds approximately 2.0 inches available water per foot for potential crop use.

Short Season Corn Demonstration Field: Gypsum block soil moisture sensors were installed in late June following planting. The sensors show beginning soil moisture was good at 1, 2, 3, 4 and 5 feet. Plants used 75 percent of the water stored at 2 feet plus irrigation during the dough stage in September. Crop roots used moisture from 4 and 5 feet in October during grain maturity. The sensors show soil moisture was used from 1, 2, 3, 4 and 5 feet when needed during the growing season. Rainfall from planting until harvest totaled 8.02 inches, with 3.37 inches in August during tassel and pollination being most beneficial. Rainfall and cooler temperatures definitely contributed to producing a 201 bushel per acre yield from the June 25 planted crop.

Table 19: Monthly Rainfall Data for Danny Krienke

	May	June	July	August	September	October	Total
"200-12"	0.05"	2.19"	1.42"	3.37"	1.53"	0.00"	**8.56"**
Control	0.05"	2.19"	1.42"	3.37"	1.53"	0.00"	**8.56"**
Short Season	0.00"	0.00"	1.42"	3.37"	1.53"	1.70"	**8.02"**

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 each Control field. Both the gypsum block sensors and the soil probe were installed in close proximity to each other in the field. Gypsum blocks were installed in the "200-12" fields and most Control fields prior to planting. Each AquaSpy® probe was installed following crop emergence, as well as gypsum blocks in any remaining fields. Installing and reading the gypsum blocks prior to planting provided advanced soil moisture conditions and information to help guide and manage irrigation. 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 same illustrations for the Control field and short season field.

Figure 18: Gypsum Block Readings for Danny Krienke's "200-12" Demonstration Field

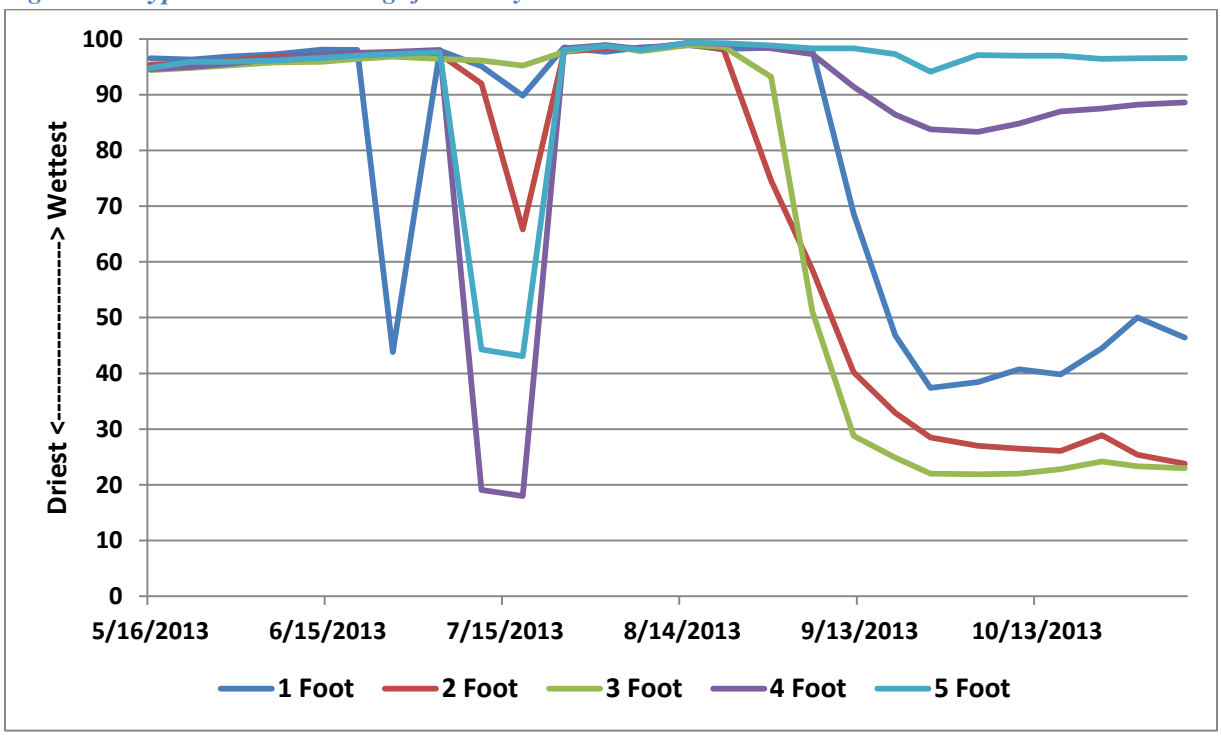


Figure 19: Growing Season Water Tracking for Danny Krienke's "200-12" Demonstration Field (231 bu/ac)

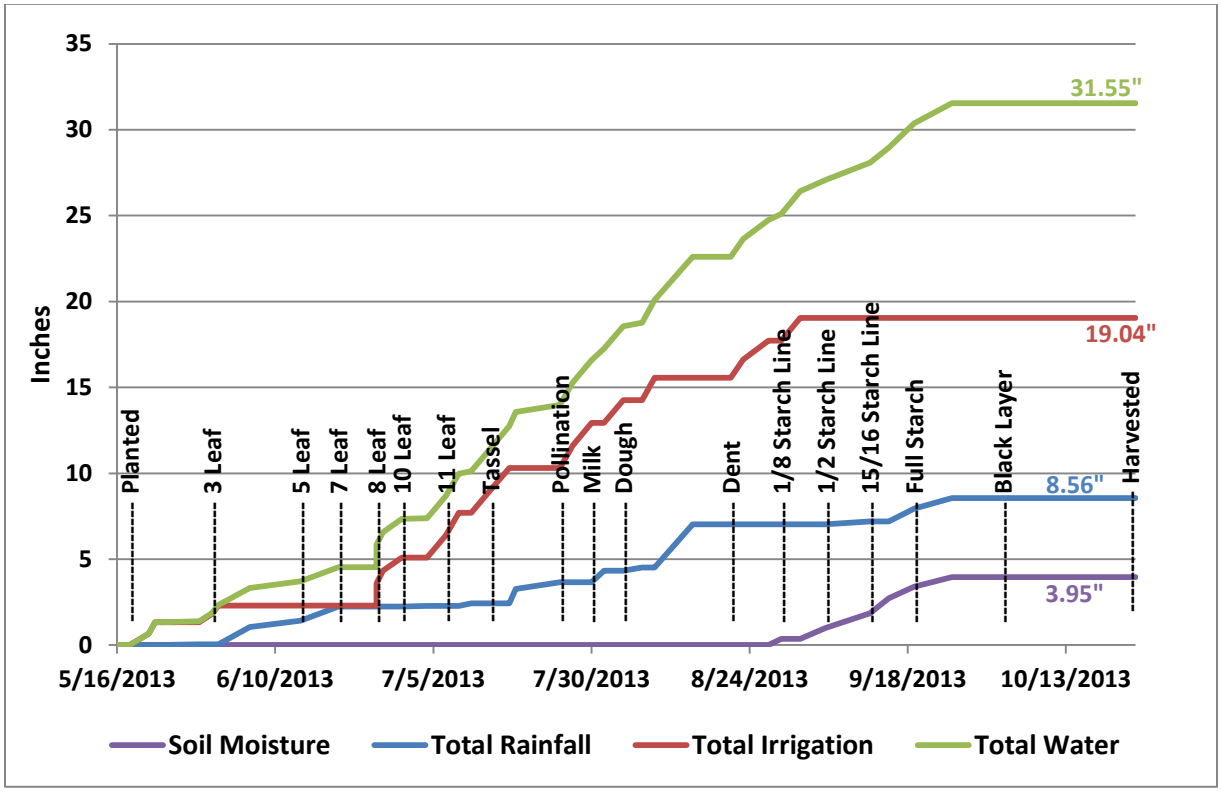


Table 20: Demonstration Field Data for Danny Krienke's "200-12" Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
3/8	0.54		15125								187 N		Randy
4/25			177033		95.8	96.3	96.5	95.5	96.4		157 N		Randy
5/10	0.06		250358		96.1	95.4	94.4	8.8	91.6	Wheat	175 Y		Randy
5/16			326322		96.5	95.4	94.4	94.6	94.8	Wheat	179 Y		Randy
5/18										Planted			Danny
5/21		0.66	PivoTrac™							200-12	330 Y	570	Leon
5/22		0.67	PivoTrac™							200-12	30 Y	560	Leon
5/23			402646		96.3	95.6	94.8	95.0	95.9	Wheat	109 Y		R & C
5/29	0.05		448151		96.8	96.0	95.2	95.5	95.9		104 N		R & C
5/31		0.48	PivoTrac™	3 Leaf						200-12	330 Y	570	R & C
6/1		0.48	PivoTrac™	3 Leaf						200-12	30 Y	570	Leon
6/6	0.99		522559	3 Leaf	97.2	96.9	95.8	96.4	96.1	Wheat	138 Y		R & C
6/14	0.38		601795	5 Leaf	98.1	97.0	95.9	97.2	96.6	Wheat	156	625	R & C
6/20	0.82		0.88	7 Leaf	98.0	97.2	96.4	97.5	97.0		96 N		R & C
6/26			8.76	8 Leaf	43.8	97.6	96.8	97.7	97.3	200-12	345 Y	623	R & C
6/26		1.30	PivoTrac™	9 Leaf						200-12	330 Y	625	Leon
6/27		0.73	PivoTrac™	9 Leaf						200-12	330 Y	625	Leon
6/30		0.78	PivoTrac™	10 Leaf						200-12	30 Y	625	Leon
7/4	0.04		30.72	10 Leaf	97.9	97.2	96.4	98.0	97.6	200-12	335 Y	610	Craig
7/7		1.30	PivoTrac™	11 Leaf						200-12	330 Y	625	Leon
7/9		1.30	PivoTrac™	11 Leaf						200-12	30 Y	610	Leon
7/11	0.15		49.53	11 Leaf	95.1	92.0	96.1	19.1	44.3	Control	74 Y	593	R & C
7/14		1.32	PivoTrac™	Tassel						200-12	330 Y	615	Leon
7/17		1.29	PivoTrac™	Tassel						200-12	30 Y	595	Leon
7/18	0.83		67.95	Tassel	89.8	65.8	95.2	18.0	43.1	200-12	8 Y	594	R & C
7/25	0.40		82.19	Pollination	98.5	97.7	97.7	98.3	98.0	200-12	336 Y	607	R & C
7/27		1.31	PivoTrac™	Pollination						200-12	330 Y	600	Leon
7/30		1.31	PivoTrac™	Milk						200-12	30 Y	605	Leon
8/1	0.66		101.07	Milk	97.7	98.3	98.9	98.9	98.7	Control	79 Y	607	Randy
8/4		1.32	PivoTrac™	Dough						200-12	330 Y	605	Leon
8/7	0.19		117.14	Dough	98.5	98.2	97.8	98.2	98.0	200-12	321 Y	616	R & C
8/9		1.32	PivoTrac™	Dough						200-12	30 Y	605	Leon
8/15	2.52		122.31	Dough	98.9	99.1	98.9	99.3	99.3		92 N		R & C
8/21			124.72	Dent	98.2	98.1	98.6	99.1	99.2	SS	307 Y	625	Randy
8/23		1.05	PivoTrac™	Dent						200-12	30 Y	625	Leon
8/27		1.10	PivoTrac™	Dent						200-12	330 Y	625	Leon
8/29			144.44	1/8 ml	98.4	74.6	93.2	98.3	98.8	SS	276 Y	620	Randy
9/12	0.16		180.1	15/16 ml	68.7	40.2	28.8	91.4	98.3	SS	295 Y	603	Randy
9/19	0.75		190.72	1.0 ml	46.8	32.9	24.9	86.4	97.3		107 N		Randy
9/25	0.62		190.72	1.0 ml	37.4	28.5	22.0	83.8	94.1		107 N		Randy
10/3	0.73		190.72	Black Layer	38.4	27.0	21.9	83.3	97.1		107 N		Randy
10/10			190.72	Black Layer	40.7	26.5	22.0	84.8	97.0		107 N		Randy
10/17	0.97		190.72	Black Layer	39.8	26.1	22.8	87.0	97.0		87 N		Randy
10/24			200.77	Harvested	44.5	28.9	24.2	87.5	96.4	Wheat	114 Y		Randy
10/30			220.46	Harvested	50.0	25.4	23.3	88.2	96.5	Wheat	154 Y	632	Randy
11/7			221.29	Harvested	46.4	23.8	23.0	88.6	96.6	Wheat	186 Y		Randy
Total	**8.56**	**19.04**			**1.08"**	**1.25"**	**1.37"**	**0.34"**	**-0.09"**				
Net Soil Moisture is 3.95"													
Irrigation, Rainfall Plus Net Soil Moisture is 31.55"													

- Numbers in red are not counted in the total

NORTH PLAINS GROUNDWATER Conservation District

2013-Corn Demonstration
Irrigated Medium Season Corn

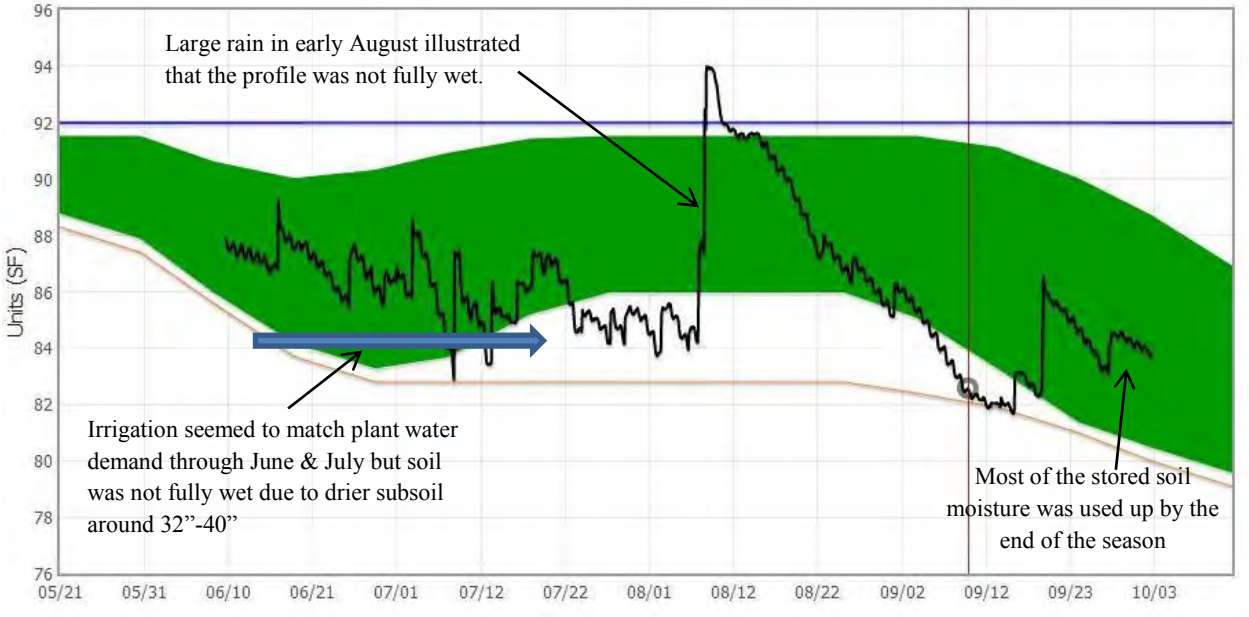
200-12

Year:	*2013*	**County:**	*Ochiltree*	**Grower:**	*Danny Krienke*
No. Acres:	*40*	**Hybrid:**	*P33B54*	**Soil Type:**	*Sherm Clay Loam*
Meter Type:	*Seametrics*				
Meter Mult:	*Acre-Feet*	**Tillage:**	*Strip Till*		
Fertilizer:	*73-76-0*	**Seeding:**	*28,000*		
Planted:	*May 18*	**Harvest:**	*October 24*		
Herbicide:	*Cinch ATZ, Roundup*	**Insecticide:**	*Oberon, Stratego (fungicide)*		
Yield:	*231 bu/ac*	**Prev. crop:**	*Wheat*	**Row width:**	*30"*
Irrigation method:	*Center Pivot*	**Prewater:**	*None*	**GPM/acre:**	*5.1*
Distance between drops:	*60"*	**Distance from nozzle to ground:**	*16"*		
Application pattern:	*Spray*	**Crop row direction :**	*Straight*		

GPS Location of Pivot Pad		**GPS Location of Gypsum Blocks**	
Latitude:	*36.402727*	Latitude:	*36.407498*
Longitude:	*-100.859866*	Longitude:	*-100.860631*

Elevation: *2940 Feet*

Danny Krienke's "200-12" Field AquaSpy® Probe Summary



This field seemed to have trouble getting irrigation to penetrate past 8" for most of the season, whereas a large rainfall in early August wet right through the profile. This would tend to indicate that not all of the irrigation was being seen by the probe due to variable local wetting patterns vs. probe placement. The probe data indicates that the top 28" and the soil below 44" was wet at the start of the season. However, it would also appear that there was a drier band at the start of the season from 32"- 40", but this was subsequently wet up with the large rainfall event in early August. Roots went all the way to 60" but most water use was from 44" and above. The final irrigation was well-timed for maximum water use efficiency.

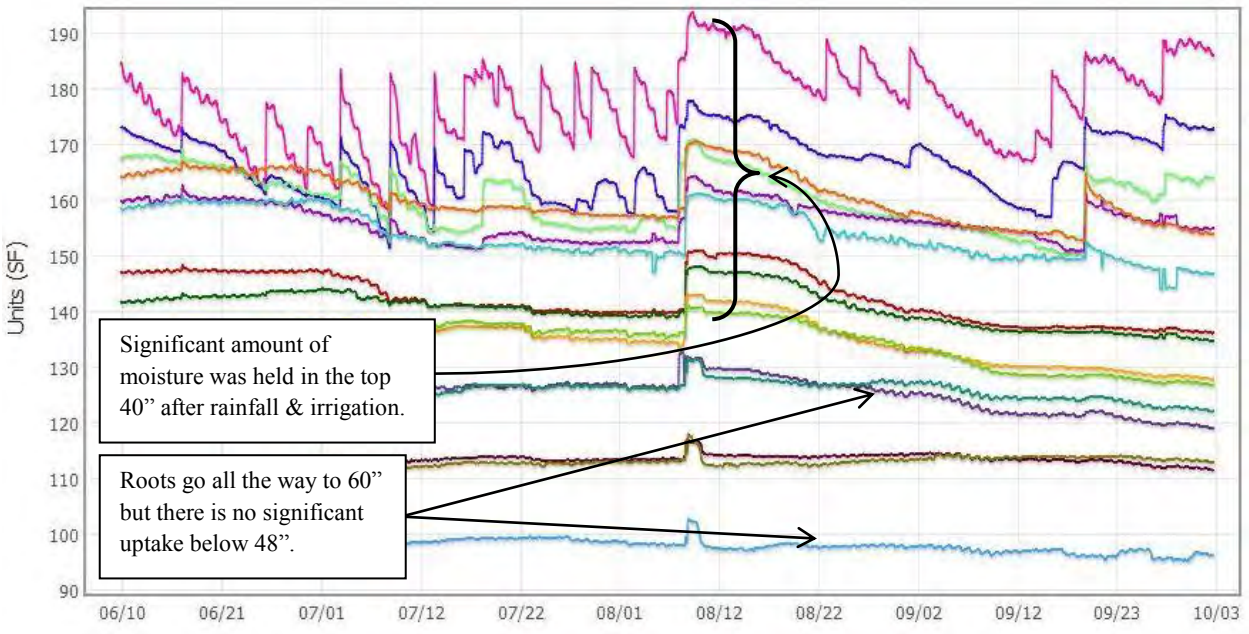


Figure 20: Gypsum Block Readings for Danny Krienke's Control Demonstration Field

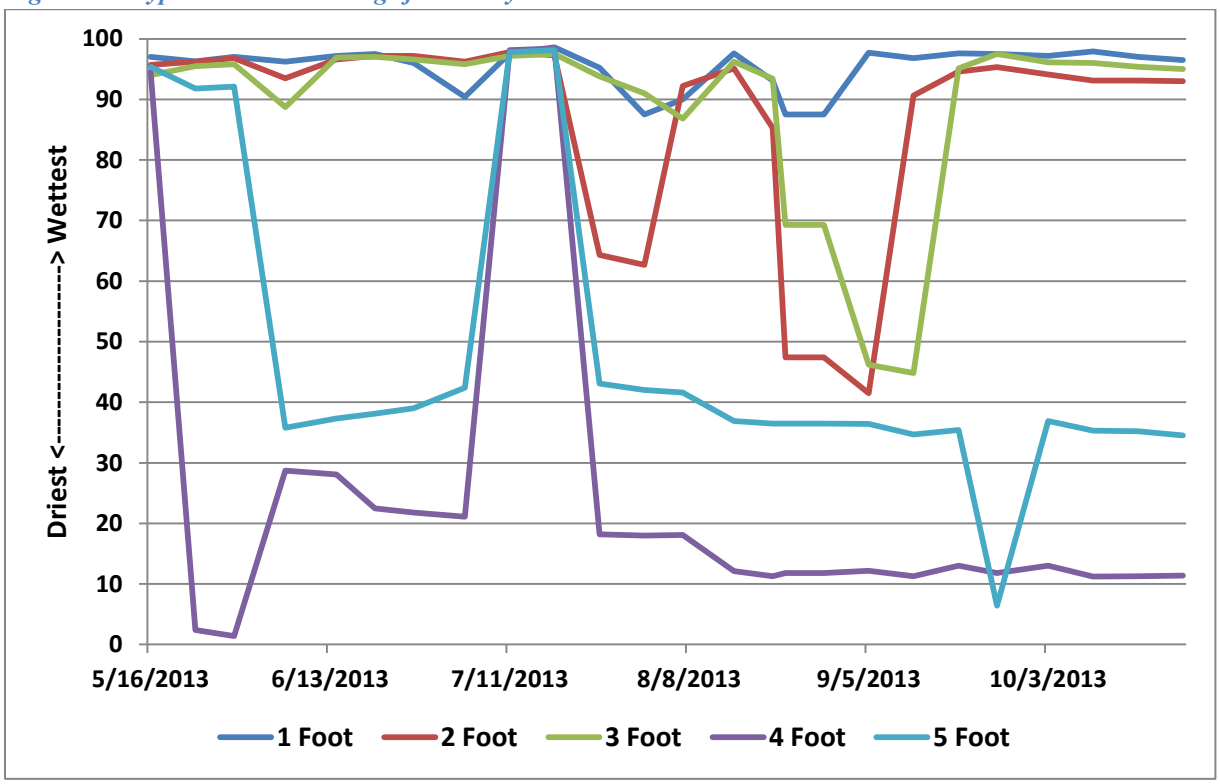


Figure 21: Growing Season Water Tracking for Danny Krienke's Control Demonstration Field (240 bu/ac)

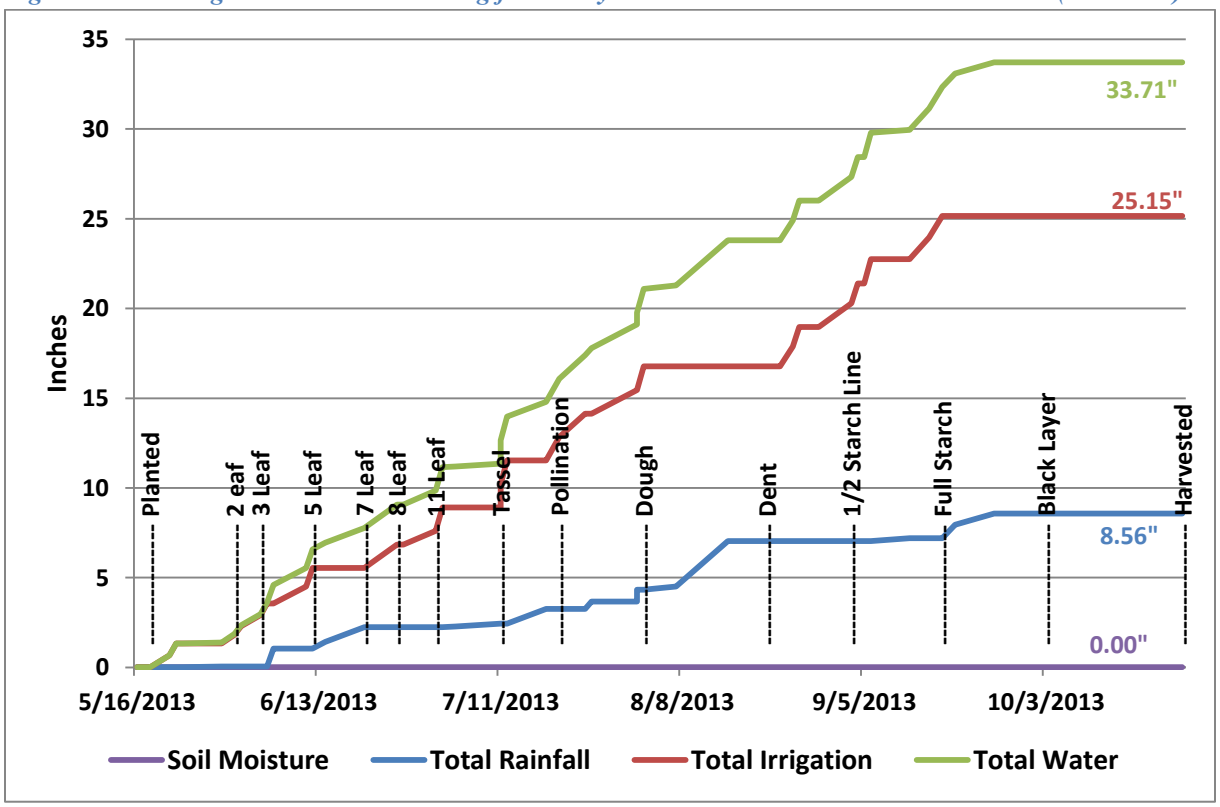


Table 21: Demonstration Field Data for Danny Krienke's Control Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
3/8	0.54		15125								187 N		Randy
4/25			177033		94.1	95.0	95.3	90.4	96.6		157 N		Randy
5/10			250358		96.5	95.4	94.4	94.6	94.8	Wheat	123 Y		Randy
5/16			326322		97.0	95.7	94.0	94.6	95.4	Wheat	175 Y cw		Randy
5/18										Planted			Danny
5/21		0.66	PivoTrac™							Control	30 Y	570	Leon
5/22		0.67	PivoTrac™							Control	90 Y	560	Leon
5/23			402648		96.3	96.2	95.5	2.4	91.8	Wheat	109 Y		R & C
5/29	0.05		448151		97.0	96.8	95.8	1.4	92.1		104 N		R & C
5/31		0.48	PivoTrac™	2 Leaf						Control	30 Y	570	Leon
6/1		0.48	PivoTrac™	2 Leaf						Control	90 Y	570	Leon
6/4		0.63	PivoTrac™	3 Leaf						Control	30 Y	625	Leon
6/5		0.63	PivoTrac™	3 Leaf						Control	90 Y	625	Leon
6/6	0.99		522559	3 Leaf	96.2	93.5	88.7	28.7	35.8	Wheat	138 Y		R & C
6/11		0.95	PivoTrac™	4 Leaf						Control	30 Y	625	Leon
6/12		1.03	PivoTrac™	5 Leaf						Control	90 Y	625	Leon
6/14	0.38		601795	5 Leaf	97.2	96.6	96.9	28.1	37.3	Wheat	138 Y		R & C
6/20	0.82		0.88	7 Leaf	97.5	97.2	97.0	22.5	38.1		96 N	680 ok	R & C
6/25		1.30	PivoTrac™	8 Leaf						Control	30 Y	625	Leon
6/26			8.76	8 Leaf	96.0	97.2	96.6	21.8	39.0	200-12	345 Y	623	R & C
7/1		0.78	PivoTrac™	11 Leaf						Control	90 Y	625	Leon
7/2		1.30	PivoTrac™	11 Leaf						Control	30 Y	625	Leon
7/4	0.04		30.72	11 Leaf	90.4	96.2	95.8	21.1	42.4	200-12	335 Y	610	Craig
7/11	0.15		49.53	12 Leaf	97.6	97.8	97.2	98.1	97.8	Control	74 Y	593	R & C
7/11		1.30	PivoTrac™	Tassel						Control	90 Y	615	Leon
7/12		1.32	PivoTrac™	Tassel						Control	30 Y	600	Leon
7/18	0.83		67.95	Tassel	98.6	97.3	97.5	98.4	98.1	200-12	8 Y	594	R & C
7/20		1.29	PivoTrac™	Pollination						Control	90 N	590	Leon
7/24		1.31	PivoTrac™	Pollination						Control	30 Y	600	Leon
7/25	0.4		82.19	Pollination	95.2	64.3	93.8	18.2	43.1	200-12	336 Y	607	R & C
8/1		1.32	PivoTrac™	Milk						Control	90 Y	600	Leon
8/1	0.66		101.07	Milk	87.5	62.7	91.0	18.0	42.0	Control	79 Y	607	Randy
8/2		1.32	PivoTrac™	Dough						Control	30 Y	605	Leon
8/7	0.19		117.14	Dough	90.0	92.2	86.8	18.1	41.6	200-12	321 Y	616	R & C
8/15	2.52		122.31	Dough	97.6	95.1	96.2	12.1	36.9		92 N		R & C
8/21			124.72	Dent	93.1	85.3	93.4	11.3	36.5	SS	307 Y	625	Randy
8/23			144.44	1/4 ml	87.5	47.4	69.3	11.8	36.5	SS	276 Y	620	Randy
8/25		1.10	PivoTrac™	1/4 ml						Control	90 Y	625	Leon
8/26		1.10	PivoTrac™	1/4 ml						Control	30 Y	625	Leon
8/29			144.44	1/4 ml	87.5	47.4	69.3	11.8	36.5	SS	276 Y	620	Randy
9/3		1.32	PivoTrac™	1/2 ml						Control	90 Y	620	Leon
9/4		1.10	PivoTrac™	1/2 ml						Control	30 Y	620	Leon
9/5			163.61	1/2 ml	97.7	41.5	46.2	12.2	36.4	Control	53 Y	619	Randy
9/6		1.36	PivoTrac™	7/8 ml						Control	90 N	625	Leon
9/12	0.16		180.1	7/8 ml	96.8	90.6	44.8	11.3	34.7	SS	295 Y	603	Randy
9/15		1.20	PivoTrac™	15/16 ml						Control	30 Y	600	Leon
9/17		1.20	PivoTrac™	1.0 ml						Control	90 N	600	Leon
9/19	0.75		190.72	15/16 ml	97.6	94.6	95.1	13.0	35.4		107 N		Randy
9/25	0.62		190.72	1.0 ml	97.5	95.3	97.5	11.8	6.4		107 N		Randy
10/3	0.73		190.72	Blk Layer	97.2	94.1	96.1	13.0	36.9		107 N		Randy
10/10			190.72	Blk Layer	97.9	93.1	96.0	11.2	35.3		107 N		Randy
10/17	0.97		190.72	Blk Layer	97.0	93.1	95.4	11.3	35.2		87 N		Randy
10/24			200.71	Harvested	96.5	93.0	95.0	11.4	34.5		114 Y		Randy
10/30			220.46	Harvested	96.6	93.5	94.8	12.0	34.8	Wheat	154 Y	632	Randy
11/7	0.28		221.29	Harvested	96.3	92.9	94.7	10.4	33.5	Wheat	186 Y		Randy
Total	**8.56**	**25.15**			**1.08”**	**1.25”**	**1.37”**	**0.34”**	**-0.09”**				
Net Soil Moisture is 0.00"													
Irrigation, Rainfall Plus Net Soil Moisture is 33.71"													

- Numbers in red are not counted in total

2013-Corn Demonstration
Irrigated Medium Season Corn

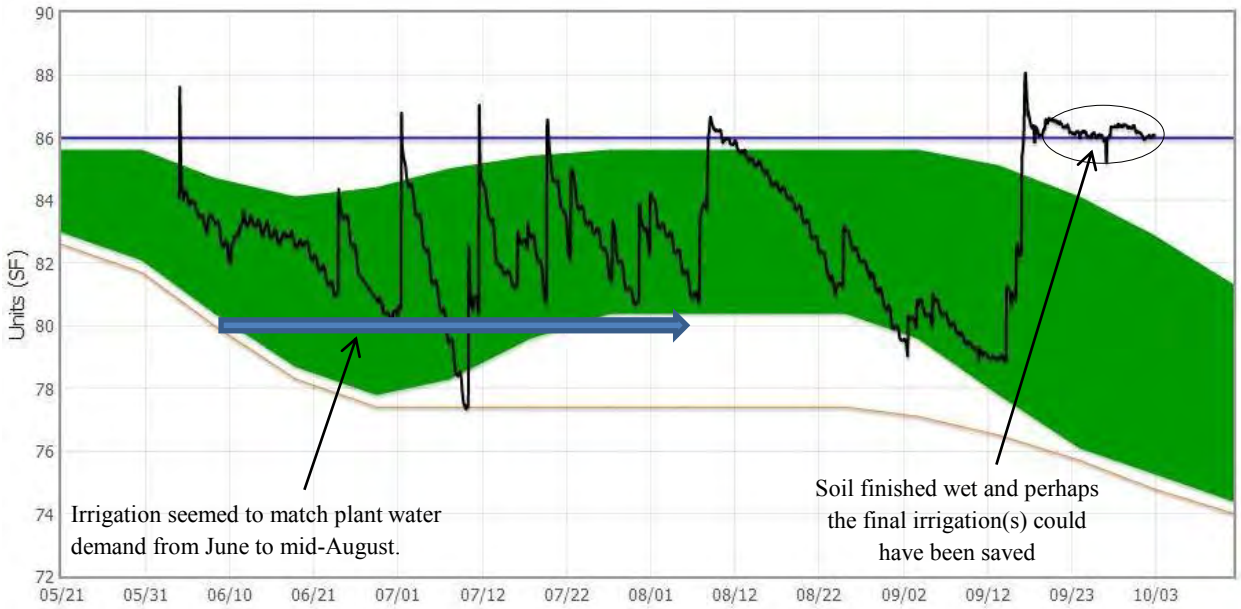
Control

Year:	*2013*	**County:**	*Ochiltree*	**Grower:**	*Danny Krienke*
No. Acres:	*40*	**Hybrid:**	*P33B54*	**Soil Type:**	*Sherm Clay Loam*
Meter Type:	*Seametrics*				
Meter Mult:	*Acre-Feet*	**Tillage:**	*Strip Till*		
Fertilizer:	*136-76-0*	**Seeding:**	*28,000*		
Planted:	*May 18*	**Harvest:**	*October 24*		
Herbicide:	*Cinch ATZ, Roundup*	**Insecticide:**	*Oberon, Stratego (fungicide)*		
Yield:	*240 bu/ac*	**Prev. crop:**	*Wheat*	**Row width:**	*30"*
Irrigation method:	*Center Pivot*	**Prewater:**	*none*	**GPM/acre:**	*5.1*
Distance between drops:	*60"*	**Distance from nozzle to ground:**	*16"*		
Application pattern:	*Spray*	**Crop row direction :**	*Straight*		

GPS Location of Pivot Pad		**GPS Location of Gypsum Blocks**	
Latitude:	*36.402727*	Latitude:	*36.403847*
Longitude:	*-100.859866*	Longitude:	*-100.859146*

Elevation: *2940 Feet*

Danny Krienke's Control Field AquaSpy® Probe Summary



The soil was kept pretty wet all season at this field and as such, there wasn"t as much root growth as seen at the "200-12" field. The roots grew to 48" for the Control compared to 60" for the "200-12" field. There was some instability in the sensor readings from the 44"- 60" sensors but there was little evidence of drainage, despite the wet conditions. This field finished with a full soil profile and this was probably the main difference for a 5 bushel difference in yield, despite a 6" difference in irrigation. Much of the water was actually left in the soil at the end of the season rather than being put to use in yield formation.

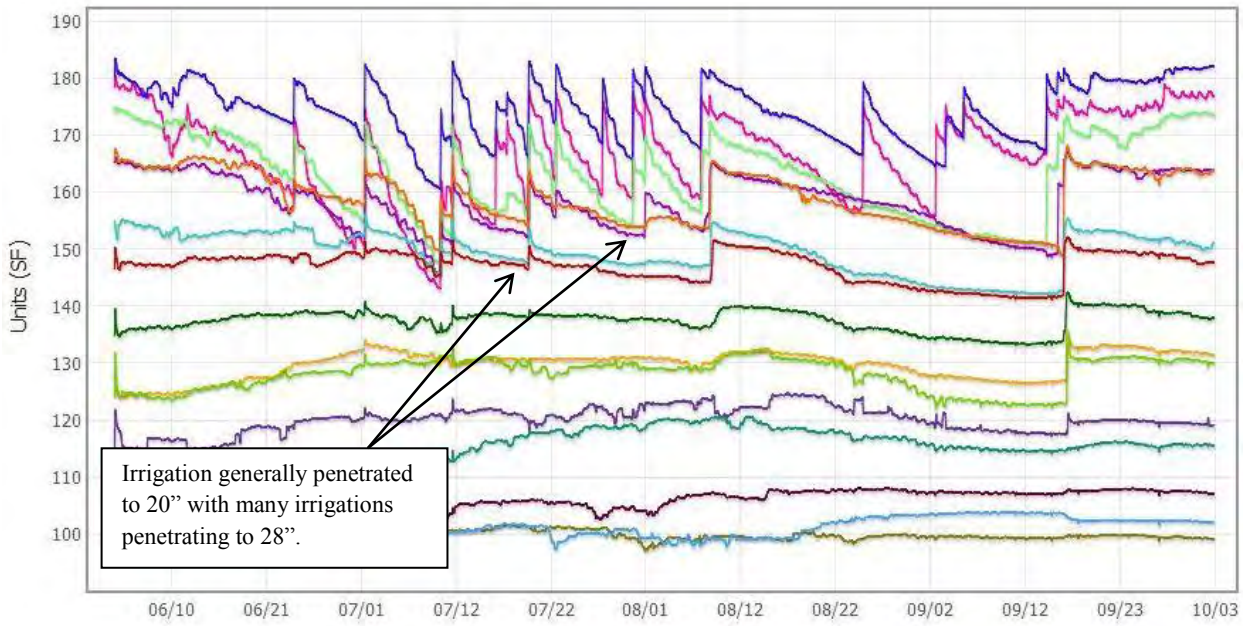


Figure 22: Gypsum Block Readings for Danny Krienke's Short Season Corn

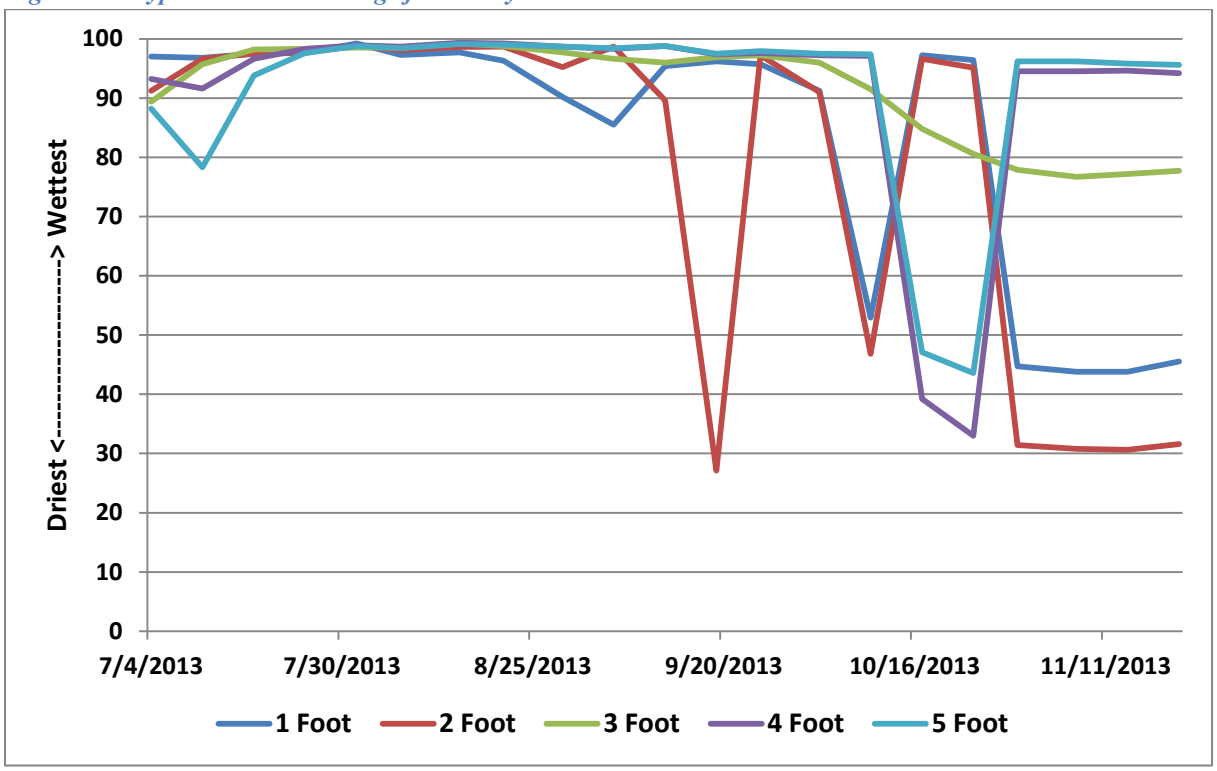


Figure 23: Growing Season Water Tracking for Danny Krienke's Short Season Corn (201 bu/ac)

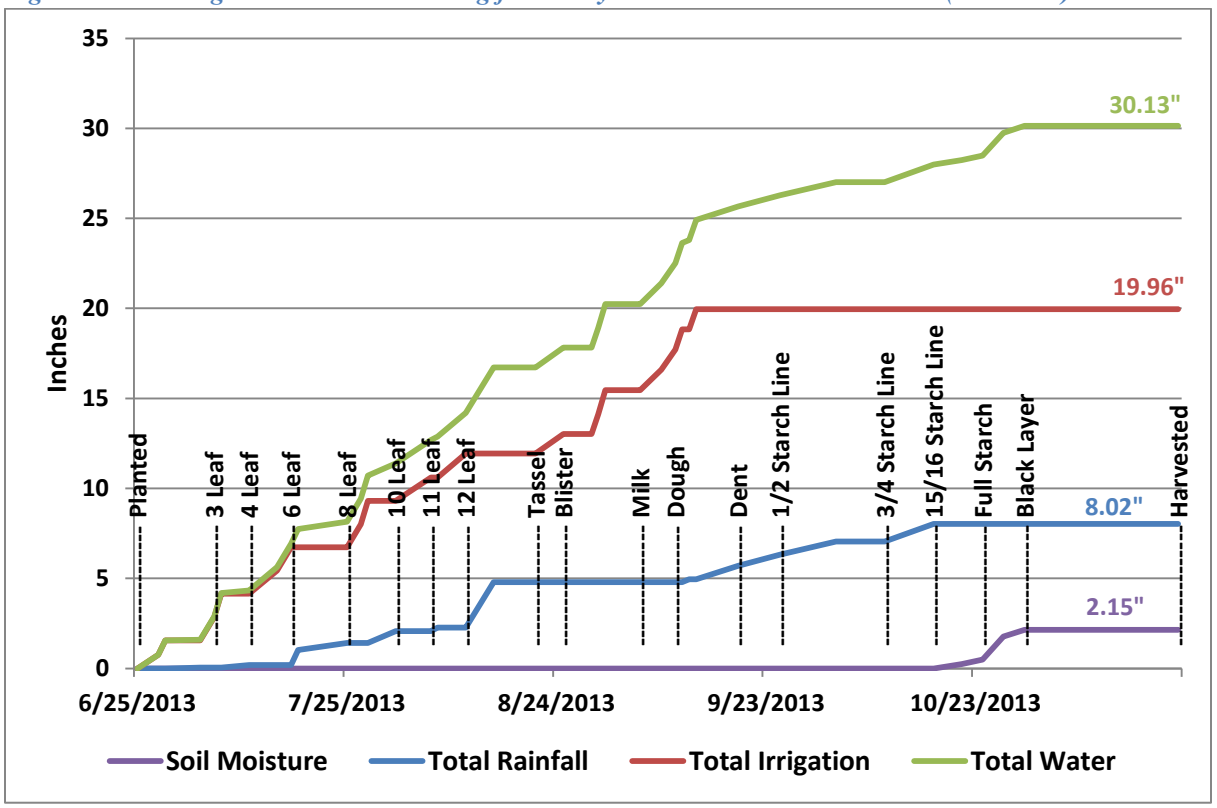


Table 22: Demonstration Field Data for Danny Krienke's Short Season Corn

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 feet	3 Feet	4 Feet	5 Feet				
6/25			8.76							Planted			Danny
6/28		0.76	PivoTrac™	Emergence						SS	270 Y	625	Leon
6/29		0.79	PivoTrac™	Emergence						SS	330 Y	625	Leon
7/4	0.04		30.72	Emergence	97.0	91.2	89.4	93.2	88.2	200-12	335 Y	610	Craig
7/6		1.30	PivoTrac™	3 Leaf						SS	270 Y	625	Leon
7/7		1.30	PivoTrac™	3 Leaf						SS	330 Y	610	Leon
7/11	0.15		49.53	4 Leaf	96.8	96.6	95.7	91.6	78.3	Control	74 Y	593	R & C
7/15		1.29	PivoTrac™	5 Leaf						SS	270 Y	620	Leon
7/17		1.29	PivoTrac™	6 Leaf						SS	330 Y	605	Leon
7/18	0.83		67.95	6 Leaf	97.5	97.5	98.2	96.6	93.8	200-12	8 Y	594	R & C
7/25	0.4		82.19	8 Leaf	97.6	97.7	98.3	98.3	97.6	200-12	336 Y	607	R & C
7/27		1.28	PivoTrac™	9 Leaf						SS	270 Y	610	Leon
7/28		1.29	PivoTrac™	9 Leaf						SS	330 Y	605	Leon
8/1	0.66		101.07	10 Leaf	99.2	98.8	98.5	98.9	98.8	Control	79 Y	607	Randy
8/6		1.31	PivoTrac™	11 Leaf						SS	270 Y	615	Leon
8/7	0.19		117.14	11 Leaf	97.3	98.1	98.5	98.7	98.4	200-12	321 Y	616	R & C
8/11		1.32	PivoTrac™	12 Leaf						SS	330 Y	605	Leon
8/15	2.52		122.31	12 Leaf	97.7	98.6	99.2	99.3	99.1		92 N		R & C
8/21			124.72	Tassel	96.3	98.7	98.8	99.2	99.0	SS	307 Y	625	Randy
8/25		1.10	PivoTrac™	Blister						SS	330 N	625	Leon
8/29			144.44	Blister	90.2	95.2	97.7	98.7	98.7	SS	277 Y	620	Randy
8/30		1.10	PivoTrac™	Blister						SS	270 Y	625	Leon
8/31		1.32	PivoTrac™	Blister						SS	330 Y	620	Leon
9/5			163.61	Milk	85.5	98.7	96.6	98.3	98.4	Control	53 Y	619	Randy
9/8		1.15	PivoTrac™	Milk						SS	330 Y	620	Leon
9/10		1.12	PivoTrac™	Dough						SS	270 Y	600	Leon
9/11		1.12	PivoTrac™	Dough						SS	330 Y	600	Leon
9/12	0.16		180.1	Dough	95.4	89.6	96.0	98.8	98.8	SS	295 Y	603	Randy
9/13		1.12	PivoTrac™	Dough						SS	270 N	600	Leon
9/19	0.75		190.72	Dent	96.2	27.1	96.9	97.4	97.5		107 N		Randy
9/25	0.62		190.72	1/2 ml	95.7	97.2	97.2	97.6	97.9		107 N		Randy
10/3	0.73		190.72	1/2 ml	91.2	91.0	96.0	97.2	97.5		107 N		Randy
10/10			190.72	3/4 ml	52.9	46.8	91.5	97.1	97.4		107 N		Randy
10/17	0.97		190.72	15/16 ml	97.2	96.6	84.8	39.2	47.1		87 N		Randy
10/24			200.77	1.0 ml	96.4	95.1	80.6	33.0	43.6	Wheat	114 Y		Randy
10/30			220.46	Blk Layer	44.7	31.4	77.9	94.5	96.2	Wheat	154 Y	632	Randy
11/7	0.28		221.29	Blk Layer	43.8	30.8	76.7	94.5	96.2	Wheat	186 Y		Randy
11/14			221.29	Blk Layer	43.8	30.6	77.2	94.6	95.8		186 N		Randy
11/21			221.29	Harvested	45.5	31.6	77.7	94.2	95.6		186 N		Randy
Total	**8.02**	**19.96**			**-0.05”**	**0.00”**	**-0.27”**	**0.33”**	**-0.01”**				
Net Soil Moisture is 2.15"													
Irrigation, Rainfall Plus Net Soil Moisture is 30.13"													

- Number in red are not counted in total

2013-Corn Demonstration
Irrigated Medium Season Corn

NORTH PLAINS GROUNDWATER Conservation District

Short Season Corn

Year: *2013* **County:** *Ochiltree* **Grower:** *Danny Krienke*

No. Acres: *40* **Hybrid:** *P35F40* **Soil Type:** *Sherm Clay Loam*

Meter Type: *Seametrics*

Meter Mult: *Acre-Feet* **Tillage:** *Strip Till*

Fertilizer: *152-0-0* **Seeding:** *36,000*

Planted: *June 25* **Harvest:** *November 21*

Herbicide: *Cinch ATZ, Roundup* **Insecticide:** *None*

Yield: *201 bu/ac* **Prev. crop:** *Wheat* **Row width:** *30"*

Irrigation method: *Center Pivot* **Prewater:** *None* **GPM/acre:** *5.1*

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

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

GPS Location of Pivot Pad

Latitude: *36.402727*

Longitude: *-100.859866*

Elevation: *2940 Feet*

Harvest Results: The "200-12" field produced a 231 bushel per acre corn yield. Irrigation totaled 19.04 inches. Production in the Control field was 240 bushels per acre. Seasonal irrigation totaled 25.15 inches. The Short Season field produced 201 bushels per acre. Irrigation totaled 19.96 inches. There was no pre-season irrigation. The Control field produced 9 more bushels per acre than the "200-12" and irrigation was 6.11 inches more. Corn production was 12.13 bushels (679lbs) per inch of irrigation in the "200-12" field compared to 9.54 (534lbs) in the Control. Production from each inch of irrigation, rainfall and net soil water that totaled 31.55 inches was 7.32 bushels (410lbs) per acre in the "200-12" field. Irrigation, rainfall and net soil water totaled 33.71 inches in the Control field where production was 7.12 bushels (399lbs) per inch. Crop production costs were $43.45 per acre less for the "200-12" field than for the Control from reduced irrigation, fertilizer and harvest expenses. At $5.13 per bushel, the nine bushel per acre increased corn yield in the Control field amounts to $46.17 more per acre. The Control field"s net gain was $2.72 per acre with 6.11 inches less irrigation used compared to production from the Control field. Net return for the additional 6.11 inches of irrigation was $0.45 per inch. Net return from the "200-12" field was $740.03 per acre compared to $742.81 from the Control field. The "200-12" field produced 30 more bushels per acre than the Short Season field with 0.95 less inches of irrigation. Net return from the "200-12" field was $149.45 per acre more than from the short season field. Net return from the "200-12" field was $740.03 compared to $590.58 from the Short Season. A summary of the demonstration results are shown in table 23.

Table 23: Danny Krienke's 2013 Demonstration Results

	Irrigation (in.)	Total Water (in.)	Production		Crop Value @ $5.13/bu		
			bu/ac	lb/ac-in of Irrigation	Per Acre	Acre-in of Irrigation	Acre-in of Total Water
"200-12"	19.04	*31.55	231	679	$1,185.03	$62.24	$37.56
Control	25.15	†33.71	240	534	$1,231.20	$48.95	$36.52
Short Season	19.96	ᵡ30.13	201	564	$1,031.13	$51.66	$34.22

*Includes 3.95 inches of water removed from five feet of soil, plus rainfall, and irrigation.
†Includes 0 inches of water removed from five feet of soil, plus rainfall, and irrigation.
ᵡIncludes 2.15 inches of water removed from five feet of soil, plus rainfall, and irrigation.

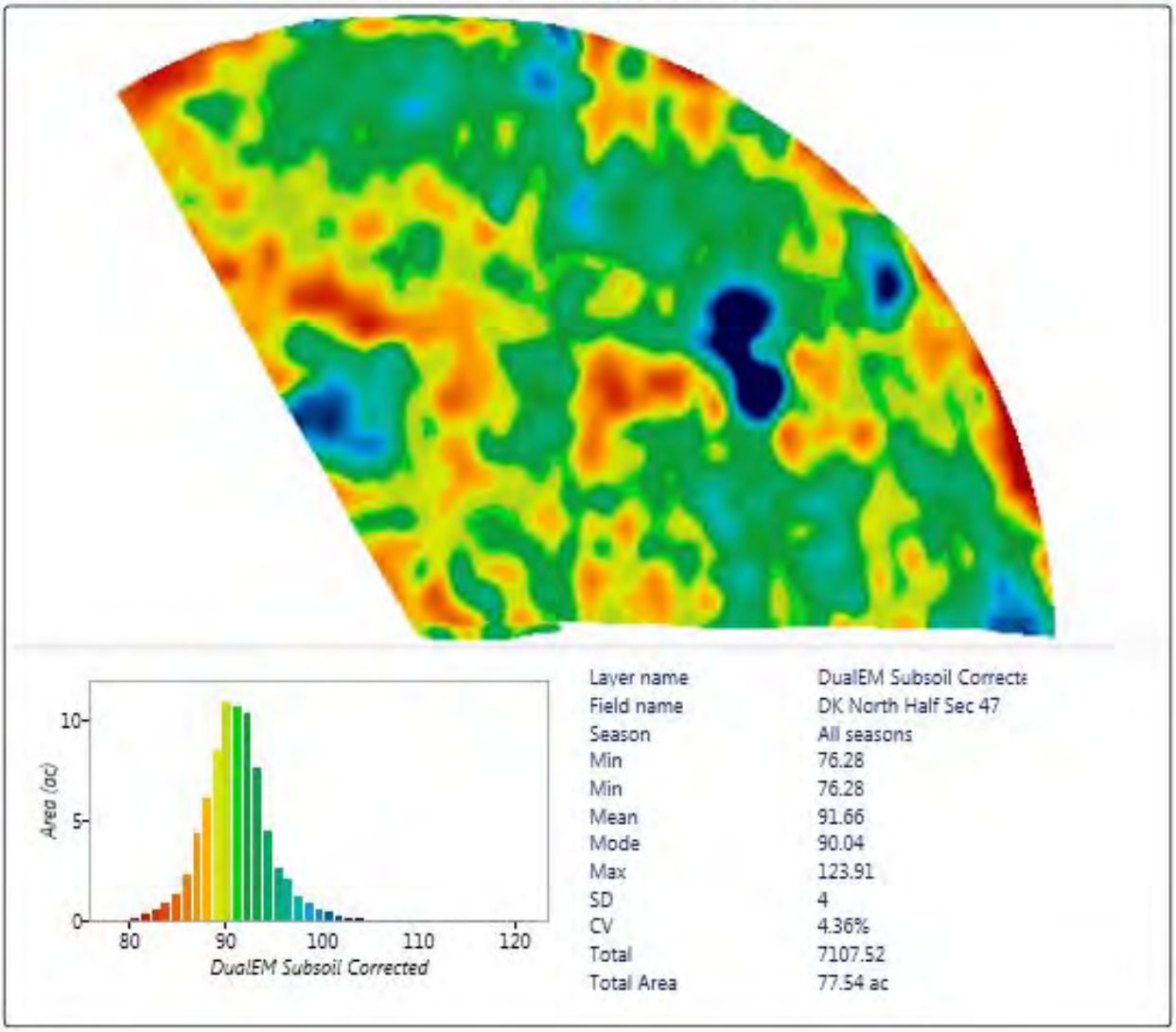
Electromagnetic EM 38 Soil Survey: An Electromagnetic EM 38 soil survey was conducted on the northeast 80 acres of the north half of section 47, the location of Krienke"s "200-12" and Control fields. The "200-12" field was from 330 to 30 degrees in the circle, the Control from 30 to 90 degrees. Image/map of the dual EM subsoil layer for Krienke"s "200-12" and Control fields are shown in Figure 24. The dual EM subsoil layer describes relative differences in soil texture and associated characteristics to 36 inches. District personnel use primarily the dual EM subsoil layer in writing Variable Rate Irrigation (VRI) prescriptions.

Figure 24: Dual EM Subsoil Map for Krienke's "200-12" and Control Demonstration Field

Virtual Agronomist
Data Management Program

Grower Danny Krienke
Farm Krienke Farms
Field DK North Half Sec 47

DualEM Subsoil Corrected



Layer name	DualEM Subsoil Correcte
Field name	DK North Half Sec 47
Season	All seasons
Min	76.28
Min	76.28
Mean	91.66
Mode	90.04
Max	123.91
SD	4
CV	4.36%
Total	7107.52
Total Area	77.54 ac

Comments:

This layer records the different soil textures found in the first three feet of soil. Heaver soils are indicated by higher values in blue. The red color indicates the lighter soils, and blue indicates the heaver soil in relation to the rest of the field.

www.CropMetrics.com

Brain Bezner's 2013 Dallam County Demonstration

Planting and Crop Information: For his demonstration, Brian Bezner strip tilled and planted 98 acres of corn in the northwest quarter of section 67 (L10) for his "200-12" field, "Bezner 200-12". Bezner planted the field with NK Syngenta N78S3111 at a seeding rate of 27,000 seeds/acre. Bezner planted 124 acres, also strip tilled, in the southwest quarter of section 65 (L7) to NK Syngenta N78N3000G at 32,000 seeds/acre for his "Control" field, "Bezner Control". The "200-12" field (L10) was irrigated using a center pivot where seasonal water meter readings average 380 gpm and delivered an average of 1.13 inches of irrigation in a 5.5 day revolution. Water meter readings averaged 500 gpm for the center pivot that irrigated the Control field (L7) and delivered 1.33 inches in a 6.2 day revolution. Variable Rate Irrigation (VRI) was planned in combination with Syngenta in each quarter of the "200-12" (L10) field. The field was divided as the north half for the "200-12" project and the south half the Syngenta project. NPGCD installed a set of gypsum blocks in both the Northeast quarter and northwest quarter of the circle. Syngenta" soil moisture sensors and computer software never called for VRI irrigation, so it was not initiated. Planting and crop information for "Bezner 200-12" (L10) and "Bezner Control" (L7) are shown in the table 24 below.

Table 24: Planting and Crop Information for Brain Bezner

"200-12" Demonstration Field (L10 West)			
Planted:	*May 20*	**Harvested:**	*October 30*
Hybrid:	*N78S3111*	**Seeding Rate:**	*27,000*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*98*	**GPM Per Acre:**	*3.9*
Total Water:	*23.99 in.*	**Soil Type:**	*Dallam Fine Sandy Loam*
Fertilizer:	*152-53-52-27S-1Zn*	**Insecticide:**	*Quilt Xcel (Fungicide)*
Herbicide:	*Lumax, RT Master 3*		
Control Demonstration Field (L7)			
Planted:	*May 17*	**Harvested:**	*October 30*
Hybrid:	*NK78N3000G*	**Seeding Rate:**	*32,000*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*124*	**GPM Per Acre:**	*4.0*
Total Water:	*34.81 in.*	**Soil Type:**	*Dallam & Perico Fine Sandy Loam, Dallam Loamy Fine Sand*
Fertilizer:	*48-53-52-27S-1Zn*	**Insecticide:**	*Comite 2, Besiege, Quilt Xcel (Fungicide)*
Herbicide:	*Lexar EZ, Vision*		

Beginning Soil Water Profile and Growing Season Rainfall

"200-12" Demonstration Field (L10 East): Beginning soil water was about 50 percent at one foot, 30 percent at 2 and 3 feet and 80 percent at 4 and 5 feet prior to planting on May 20. Basically, the crop lived on Irrigation water from the first foot until the center pivot travel rate was slowed down to apply more water in early July. A 2.13 inch rainfall in mid-July helped refill the soil profile to 5 feet. Irrigation, rainfall, plus half the water stored at 2 feet, and all at 3 and 4 feet was used by the crop in July. Another 2.65 inch rainfall in mid-August, plus irrigation, refilled all except the 5 foot depth again. Daily plant water use was then much less. Good soil

moisture was maintained until harvest from both irrigation and rainfall. 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. The gypsum blocks were installed in early May, prior to planting. July rainfall totaled 2.44 inches, August 3.05 and September 3.87 inches that contributed to the 206 bushel corn yield, although September rainfall was late in the season. Total rainfall measured and recorded was 10.21 inches from planting until harvest.

"200-12" Demonstration Field (L10 West): Beginning soil moisture was only good at1 foot. The soil profile was depleted at 2, 3 and 4 feet and about 40 percent at 5 feet prior to planting. The profile was finally refilled at 2 and 3 feet by a 2.13 inch rainfall in mid-July at the 9 leaf growth stage and continuous irrigation. Another 2.65 inch rainfall in mid-August plus irrigation refilled the soil profile to 5 feet. Significant rainfall was required to rewet the profile. A 1.15 inch rainfall in mid-September at grain maturity helped maintain a good corn yield. Timely rainfall really contributed to the 206 bushel per acre harvest. Total rainfall for the season was 10.21 inches.

Control Demonstration Field (L10): Beginning soil water was good at 1, 2, 3 and 4 feet. It was dry at 5 feet. Plants used all irrigation, rainfall and soil water from 2 and 3 feet in July. Soil water stored at 4 feet was used in early August. The profile was empty in mid-August. A timely 2.65 inch rainfall plus continuous irrigation refilled the soil profile to 4 feet. It remained dry at 5 feet throughout the growing season. Rainfall totaled 10.07 inches from planting until harvest and contributed to the 274 bushel per acre corn yield. Monthly rainfall is listed in table 25.

Table 25: Monthly Rainfall Data for Brian Bezner

	May	June	July	August	September	October	Total
"200-12"	0.07"	0.51"	2.44"	3.05"	3.87"	0.27"	**10.21"**
Control	0.07"	0.51"	2.44"	3.05"	3.87"	0.13"	**10.07"**

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 each Control field. Both the gypsum block sensors and the soil probe were installed in close proximity to each other in the field. Gypsum blocks were installed in the "200-12" fields and most Control fields prior to planting. Each AquaSpy® probe was installed following crop emergence, as well as gypsum blocks in any remaining fields. Installing and reading the gypsum blocks prior to planting provided advanced soil moisture conditions and information to help guide and manage irrigation. 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 same illustrations for the Control field.

Figure 25: Gypsum Block Readings for Brian Bezner's East "200-12" Demonstration Field

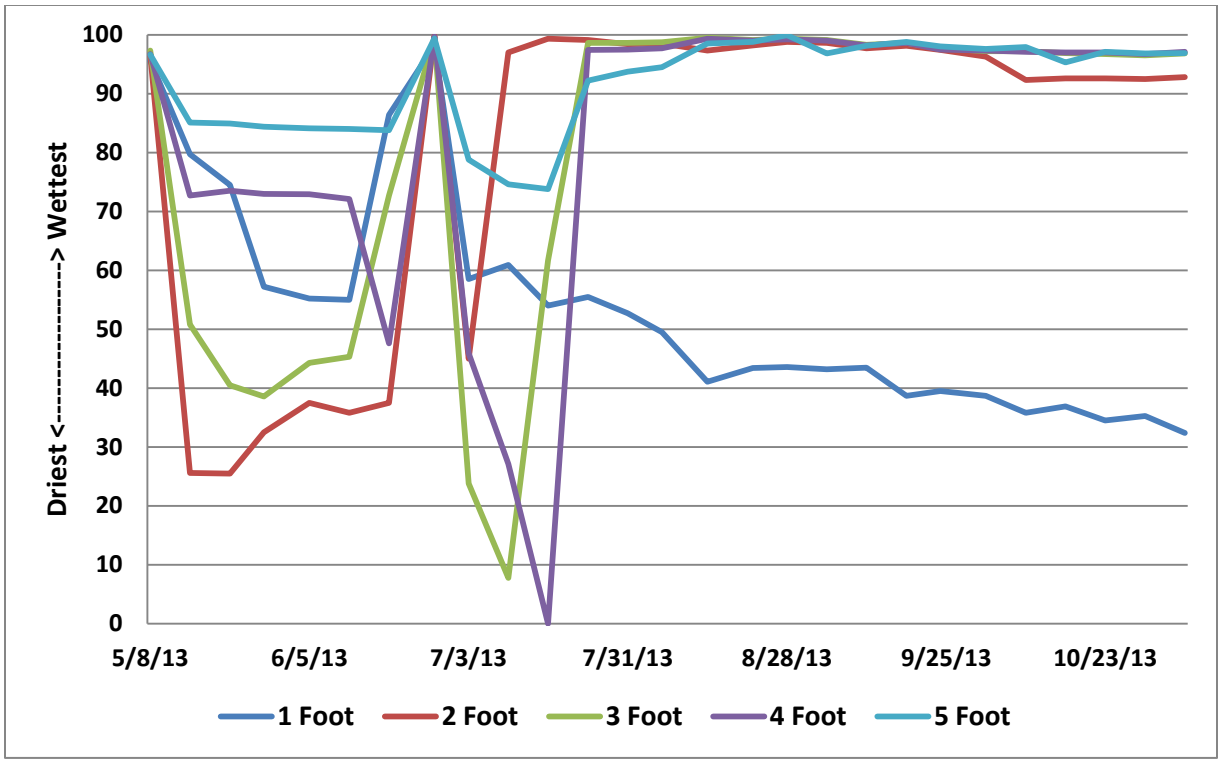


Figure 26: Growing Season Water Tracking for Brian Bezner's East "200-12" Demonstration Field (206 bu/ac)

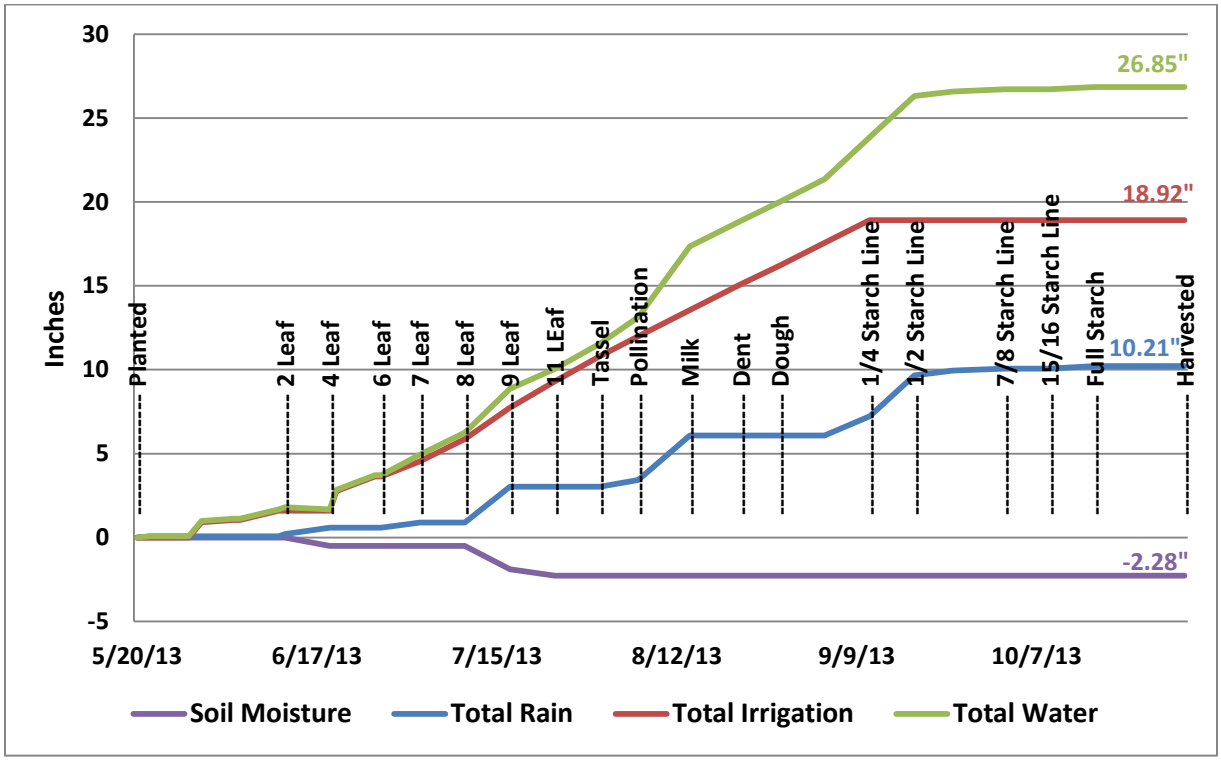


Table 26: Demonstration Field Data for Brian Bezner's East "200-12" Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
5/8	no gauge		No Meter		95.6	96.6	97.3	96.7	96.6		324 N		R & L
5/15	no gauge		No Meter		79.7	25.6	50.8	72.7	85.1		324 N		Randy
5/20										Planted			Todd
5/22	0.07		No Meter		74.5	25.5	40.5	73.5	84.9		314 N		R & C
5/28			No Meter		57.2	32.5	38.6	73.0	84.4	200-12	61 Y		R & C
5/30		0.91	PivoTrac™									270	Leon
6/4		0.14	PivoTrac™									270	Leon
6/5			No Meter		55.2	37.5	44.3	72.9	84.1		325 N		R & C
6/11		0.55	PivoTrac™									270	Leon
6/12	0.14		No Meter	2 Leaf	55.0	35.8	45.3	72.1	84.0		70 N		R & C
6/19	0.37		No Meter	4 Leaf	86.4	37.5	72.7	47.6	83.8	200-12	359 Y		R & C
6/20		1.16	PivoTrac™									270	Leon
6/26		0.87	PivoTrac™									270	Leon
6/27			7.72	6 Leaf	98.2	99.8	99.6	99.7	99.4	200-12	84 Y	?	R & C
7/3	0.31	0.91	15.14	7 Leaf	58.5	45.0	23.8	45.9	78.8	200-12	348	270 R	R & C
7/10		1.32	25.96	8 Leaf	60.9	97.0	7.8	27.1	74.6	200-12	35 Y	470	R & C
7/17	2.13	1.88	41.31	9 Leaf	54.0	99.3	61.7	0.0	73.8	200-12	79 Y	380	R & C
7/24		1.57	54.19	11 Leaf	55.5	99.1	98.6	97.4	92.2	Syngenta	129 Y	400	R & C
7/31		1.50	66.47	Tassel	52.7	98.4	98.6	97.5	93.7	200-12	65 Y	401	Randy
8/6	0.4	1.18	76.15	Pollination	49.5	98.5	98.7	97.7	94.5	200-12	49 Y	390	R & C
8/14	2.65	1.56	88.95	Milk	41.1	97.3	99.5	99.3	98.5	Syngenta	162 Y	325	R & C
8/22		1.54	101.58	Dent	43.4	98.2	99.1	99.0	98.8	200-12	18 Y	362	Randy
8/28		1.11	110.66	Dough	43.6	98.8	99.3	99.2	99.9	Syngenta	237 Y	327	Randy
9/4		1.36	121.77	Dough	43.2	98.6	99.1	99.0	96.8	200-12	296 Y	368	Randy
9/11	1.15	1.36	132.92	1/4 ml	43.5	97.7	98.3	98.2	98.1	200-12	294 Y		Randy
9/18	2.45		132.92	1/2 ml	38.7	98.1	98.6	98.6	98.8		278 N		Randy
9/24	0.27		132.92	1/2 ml	39.5	97.4	97.7	97.5	98.0		278 N		Randy
10/2	0.13		132.92	7/8 ml	38.7	96.3	97.2	97.3	97.6		278 N		Randy
10/9			132.92	15/16 ml	35.8	92.3	97.2	97.1	97.9		278 N		Randy
10/16	0.14		132.92	1.0 ml	36.9	92.6	96.9	97.0	95.3		278 N		Randy
10/23			132.92	Black Layer	34.5	92.6	96.7	97.0	97.1		278 N		Randy
10/30			132.92	Harvested	35.3	92.5	96.5	96.7	96.8		289 N		Randy
11/6	0.55		132.92	Harvested	32.4	92.8	96.8	97.1	96.9		289 N		Randy
Total	**10.21**	**18.92**			**0.32”**	**-1.59”**	**-1.60”**	**-1.74”**	**-0.53”**				
Net Soil Moisture is -2.28"													
Irrigation, Rainfall Plus Net Soil Moisture is 26.85"													

- Numbers in red are not counted in the total

2013-Corn Demonstration
Irrigated Medium Season Corn

East 200-12

Year:	*2013*	**County:**	*Dallam*	**Grower:**	*Brian Bezner*
No. Acres:	*49*	**Hybrid:**	*N78S3111*	**Soil Type:**	*Dallam Fine Sandy Loam*
Meter Type:	*Seametrics*				
Meter Mult:	*Ac Ft x 1*	**Tillage:**	*Strip Till*		
Fertilizer:	*152-53-52-27S-1Zn*	**Seeding:**	*27,000*		
Planted:	*May 20*	**Harvest:**	*October 30*		
Herbicide:	*Lumax, RT Master 3*	**Insecticide:**	*Quilt Xcel (Fungicide)*		
Yield:	*206 Bu/Acre*	**Prev. crop:**	*Wheat*	**Row width:**	*30 Inch*
Irrigation method:	*Center Pivot*	**Prewater:**	*None*	**GPM/acre:**	*3.9*
Distance between drops:	*60"*	**Distance from nozzle to ground:**	*16"*		
Application pattern:	*Spray*	**Crop row direction :**	*Straight*		

GPS Location of Pivot Pad		**GPS Location of South Gypsum Blocks**	
Latitude:	*36.12241074*	Latitude:	*36.11993*
Longitude:	*-103.0212555*	Longitude:	*-103.023125*

Figure 27: Gypsum Block Readings for Brian Bezner's West "200-12" Demonstration Field

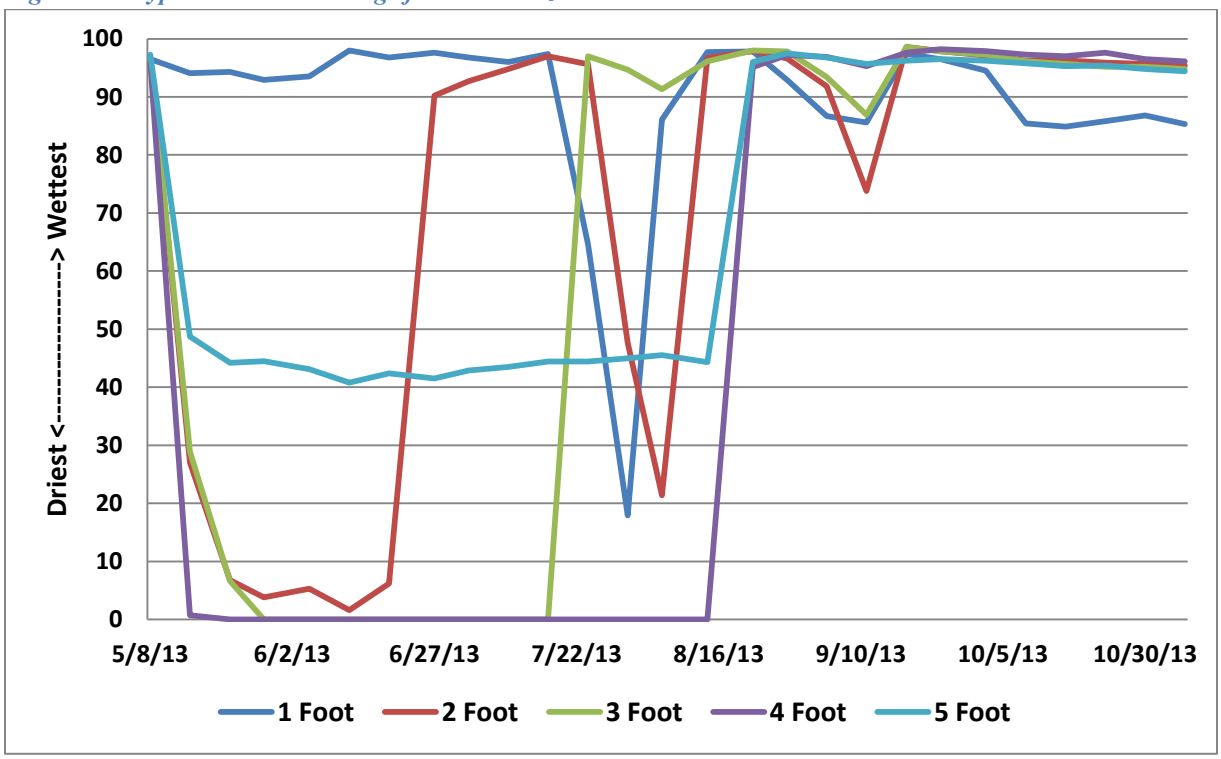


Figure 28: Growing Season Water Tracking for Brian Bezner's West "200-12" Demonstration Field (206 bu/ac)

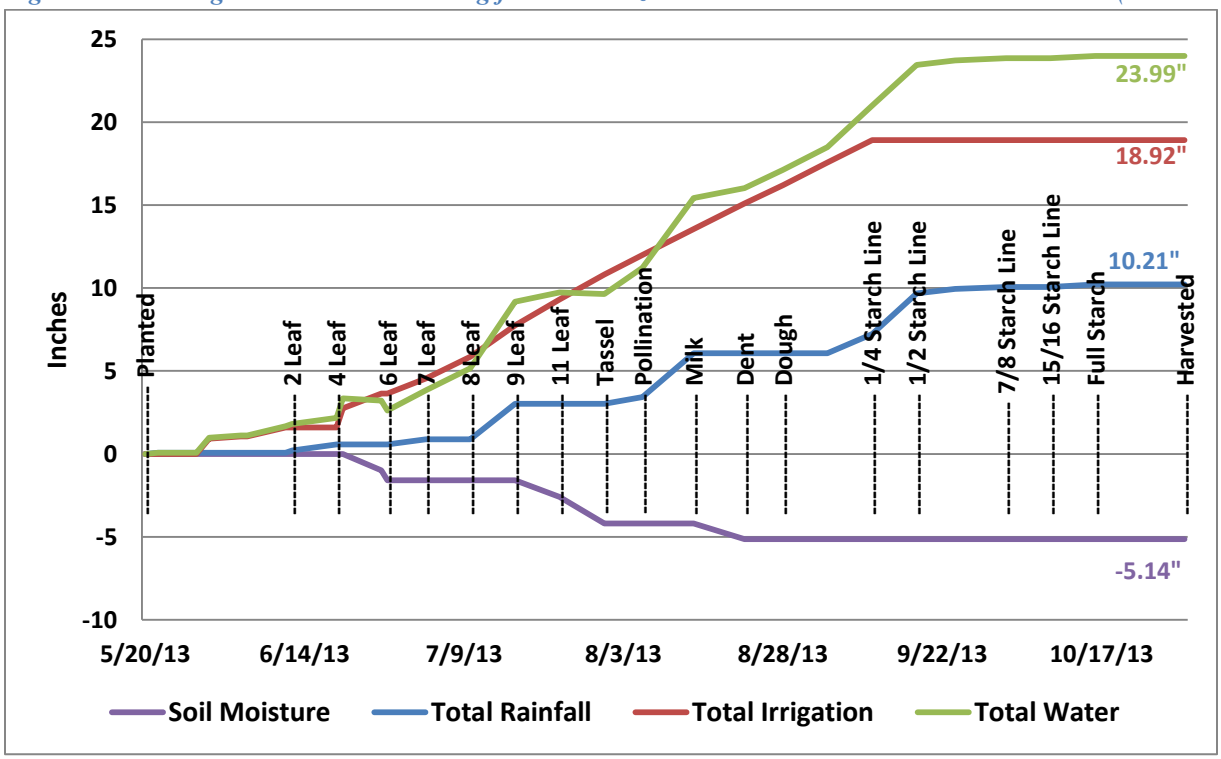


Table 27: Demonstration Field Data for Brian Bezner's West "200-12" Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 feet	3 Feet	4 Feet	5 Feet				
5/8	No Gauge		No Meter		96.5	96.6	96.6	96.0	97.3		324 N		R & L
5/15	No Gauge		No Meter		94.1	27.0	28.9	0.7	48.7		324 N		Randy
5/20										Planted			Todd
5/22	0.07		No Meter		94.3	6.8	6.6	0.0	44.2		314 N		R & C
5/28			No Meter		92.9	3.8	0.0	0.0	44.5	200-12	61 Y		R & C
5/30		0.91	PivoTrac™									270	Leon
6/4		0.14	PivoTrac™									270	Leon
6/5			No Meter		93.5	5.3	0.0	0.0	43.1		325 N		R & C
6/11		0.55	PivoTrac™									270	Leon
6/12	0.14		No Meter	2 Leaf	98.0	1.6	0.0	0.0	40.8		70 N		R & C
6/19	0.37		No Meter	4 Leaf	96.8	6.2	0.0	0.0	42.4	Control	359 Y		R & C
6/20		1.16	PivoTrac™									270	Leon
6/26		0.87	PivoTrac™									270	Leon
6/27			7.72	6 Leaf	97.6	90.2	0.0	0.0	41.5	200-12	84 Y	?	R & C
7/3	0.31	0.91	15.14	7 Leaf	96.8	92.7	0.0	0.0	42.9	Control	348	270 R	R & C
7/10		1.32	25.96	8 Leaf	96.0	94.8	0.0	0.0	43.5	200-12	35 Y	470	R & C
7/17	2.13	1.88	41.31	9 Leaf	97.4	97.0	0.0	0.0	44.4	200-12	79 Y	380	R & C
7/24		1.57	54.19	11 Leaf	64.6	95.6	97.0	0.0	44.4	Syngenta	129 Y	400	R & C
7/31		1.50	66.47	Tassel	17.9	47.6	94.7	0.0	45.0	200-12	65 Y	401	Randy
8/6	0.4	1.18	76.15	Pollination	86.1	21.4	91.3	0.0	45.5	200-12	49 Y	390	R & C
8/14	2.65	1.56	88.95	Milk	97.7	96.7	96.1	0.0	44.3	Syngenta	162 Y	325	R & C
8/22		1.54	101.58	Dent	97.8	97.9	98.0	95.1	96.0	200-12	18 Y	362	Randy
8/28		1.11	110.66	Dough	92.9	96.6	97.8	97.2	97.5	Syngenta	237 Y	327	Randy
9/4		1.36	121.77	Dough	86.7	91.8	93.4	96.9	96.8	Control	296 Y	368	Randy
9/11	1.15	1.36	132.92	1/4 ml	85.6	73.8	86.9	95.3	95.7	Control	294 Y	dry	Randy
9/18	2.45		132.92	1/2 ml	97.4	98.6	98.6	97.6	96.2		278 N		Randy
9/24	0.27		132.92	1/2 ml	96.5	97.9	97.8	98.2	96.5		278 N		Randy
10/2	0.13		132.92	7/8 ml	94.5	97.1	97.3	97.9	96.2		278 N		Randy
10/9			132.92	15/16 ml	85.4	96.2	96.1	97.3	95.8		278 N		Randy
10/16	0.14		132.92	1.0 ml	84.9	96.3	95.7	97.0	95.3		278 N		Randy
10/23			132.92	Black Layer	85.8	95.9	95.2	97.6	95.4		278 N		Randy
10/30			132.92	Harvested	86.8	95.7	95.2	96.5	94.8		289 N		Randy
11/6	0.55		132.92	Harvested	85.3	95.4	94.8	96.1	94.4		289 N		Randy
Total	**10.21**	**18.92**			**0.45"**	**-1.09"**	**-0.58"**	**-0.63"**	**-0.43"**				
Net Soil Moisture is -5.14"													
Irrigation, Rainfall Plus Net Soil Moisture is 23.99"													

- Numbers in red are not counted in total

2013-Corn Demonstration
Irrigated Medium Season Corn

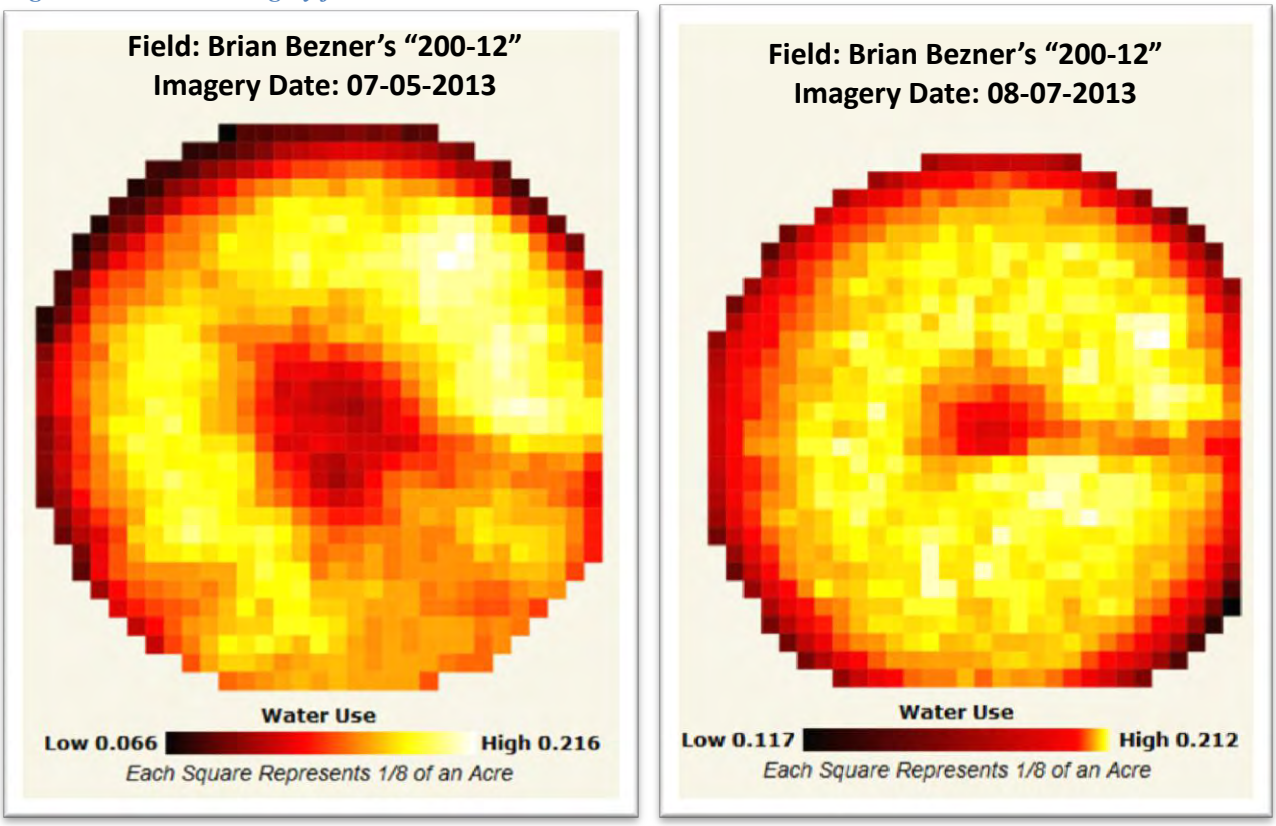
West 200-12

Year:	*2013*	**County:**	*Dallam*	**Grower:**	*Brian Bezner*
No. Acres:	*49*	**Hybrid:**	*N78S3111*	**Soil Type:**	*Dallam Fine Sandy Loam*
Meter Type:	*Seametrics*				
Meter Mult:	*Ac Ft x 1*	**Tillage:**	*Strip Till*		
Fertilizer:	*152-53-52-27S-1Zn*	**Seeding:**	*27,000*		
Planted:	*May 20*	**Harvest:**	*October 30*		
Herbicide:	*Lumax, RT Master 3*	**Insecticide:**	*Quilt Xcel (Fungicide)*		
Yield:	*206 Bu/Acre*	**Prev. crop:**	*Wheat*	**Row width:**	*30 Inch*
Irrigation method:	*Center Pivot*	**Prewater:**	*None*	**GPM/acre:**	*3.9*
Distance between drops:	*60"*	**Distance from nozzle to ground:**	*16"*		
Application pattern:	*Spray*	**Crop row direction :**	*Straight*		

GPS Location of Pivot Pad		**GPS Location of North Gypsum Blocks**	
Latitude:	*36.12241074*	Latitude:	*36.125172*
Longitude:	*-103.0212555*	Longitude:	*-103.022037*

Satellite Imagery: Satellite imagery was initiated and used in 2013 to learn and evaluate its potential for an irrigation and water management tool for growers in connection with HydroBio. Brian Bezner‟s “200-12” (L10) was one of ten “200-12” project fields included in 2013. A website was established and made available to project cooperators and District staff. We learned that satellite imagery has potential, but requires additional development, especially in establishing beginning soil moisture and monitoring the soil profile and root zone during the growing season. Two satellite images of Brian Bezner‟s “200-12” field, one on July 5 and another on August 7 are shown in figure 29 to illustrate examples of what is displayed on the website. The first image was on July 5th at the 7 leaf stage. The second image is on September 7th at pollination. The satellite imagery data changes when the next satellite passes, usually in three day increments.

Figure 29: Satellite Imagery for Brian Bezner's “200-12” Demonstration Field



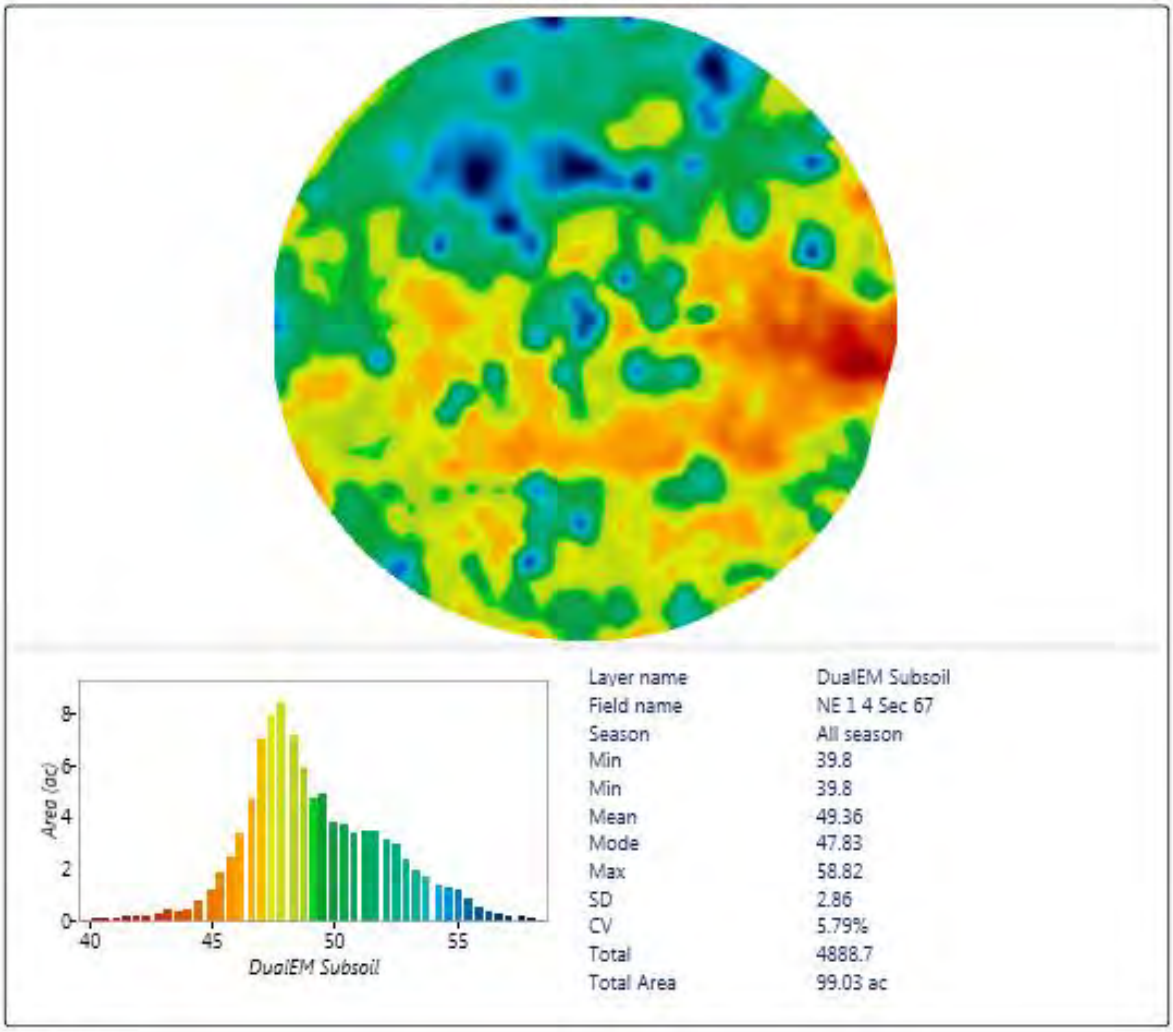
Electromagnetic EM 38 Soil Survey: An Electromagnetic EM 38 soil survey was conducted on Bezner‟s “200-12” (L10) field. An image/map of the dual EM subsoil layer is shown in Figure 30. The dual EM subsoil layer describes relative differences in soil texture and associated characteristic s to 36 inches. District personnel use primarily the dual EM subsoil layer in writing Variable Rate Irrigation (VRI) prescriptions.

Figure 30: Dual EM Subsoil Image of Brian Bezner's "200-12" (L10) Demonstration Field

Virtual Agronomist
Base Management Program

Grower Brian Benzer
Farm Benzer Farms
Field NE 1 4 Sec 67

DualEM Subsoil



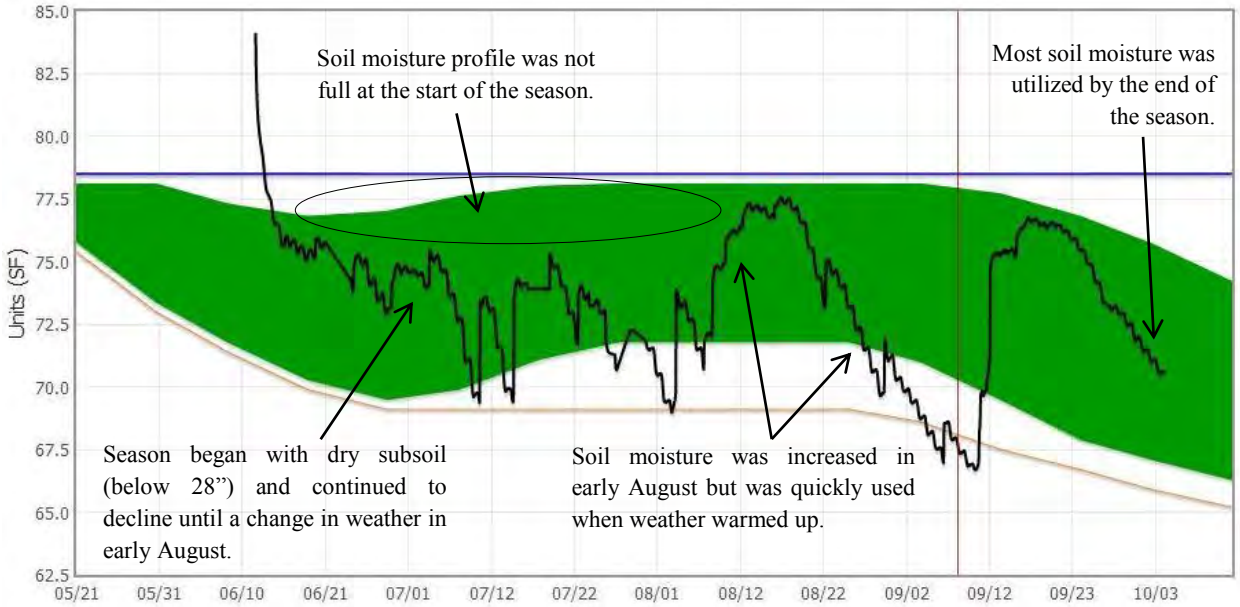
Layer name	DualEM Subsoil
Field name	NE 1 4 Sec 67
Season	All season
Min	39.8
Min	39.8
Mean	49.36
Mode	47.83
Max	58.82
SD	2.86
CV	5.79%
Total	4888.7
Total Area	99.03 ac

Comments:

Blue describes heavier subsoil texture in the field with more water holding capacity. Red represents lighter subsoil texture with less water holding capacity. Dual EM Subsoil is to three feet.

www.CropMetrics.com

Brian Bezner's "200-12" Field AquaSpy® Probe Summary



This field began with a good moisture profile in the top 24" but was drier in the subsoil below 28". Irrigation was effective at wetting down 20"-28" but it was only during a rainfall event around 8/8 that moisture penetrated to 36". As such, there was not a lot of contribution of stored soil moisture and the crop relied heavily on irrigation to form yield. The rainfall event(s) that occurred in mid -August and again in September contributed heavily to the yield that was achieved.

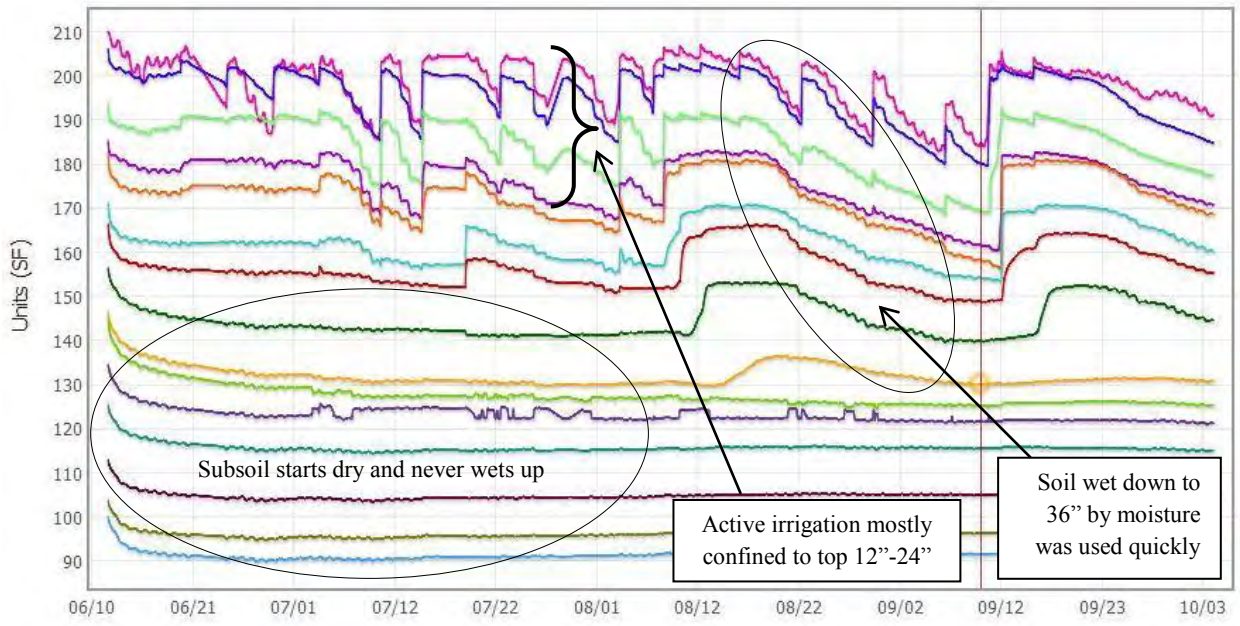


Figure 31: Gypsum Block Readings for Brian Bezner's Control Demonstration Field

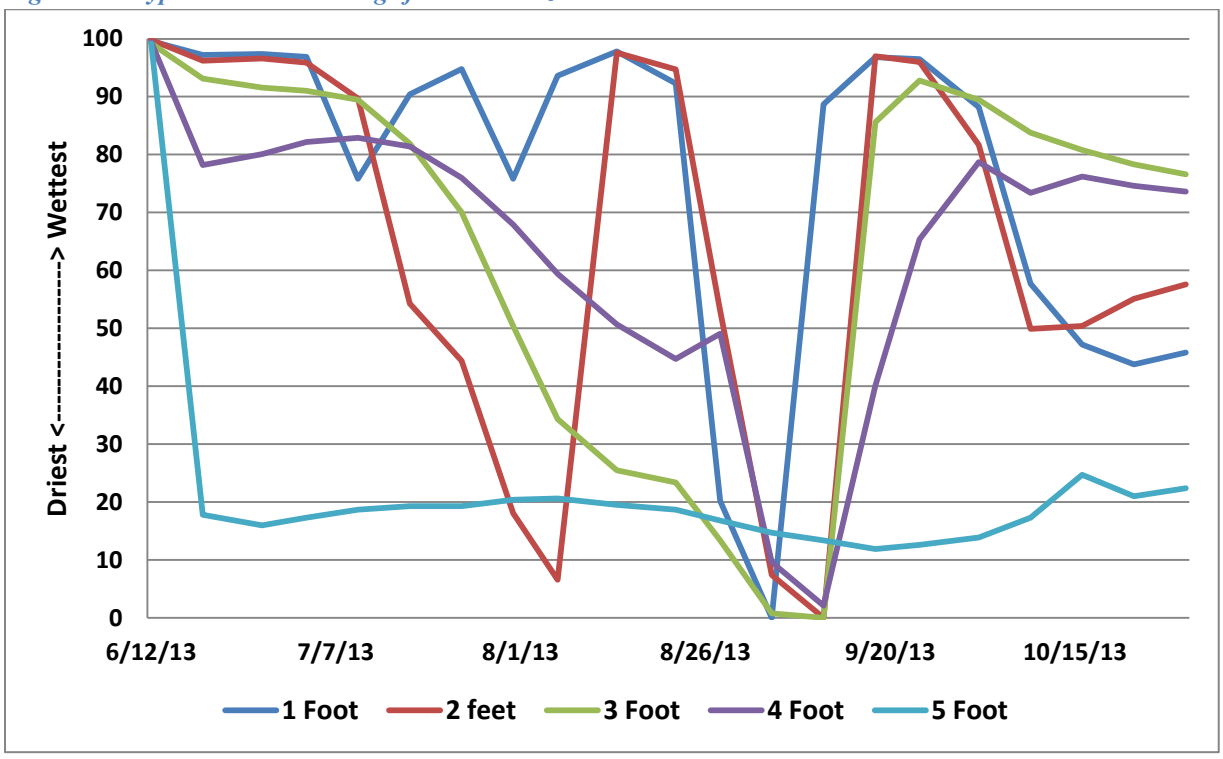


Figure 32: Growing Season Water Tracking for Brian Bezner's Control Demonstration Field (274 bu/ac)

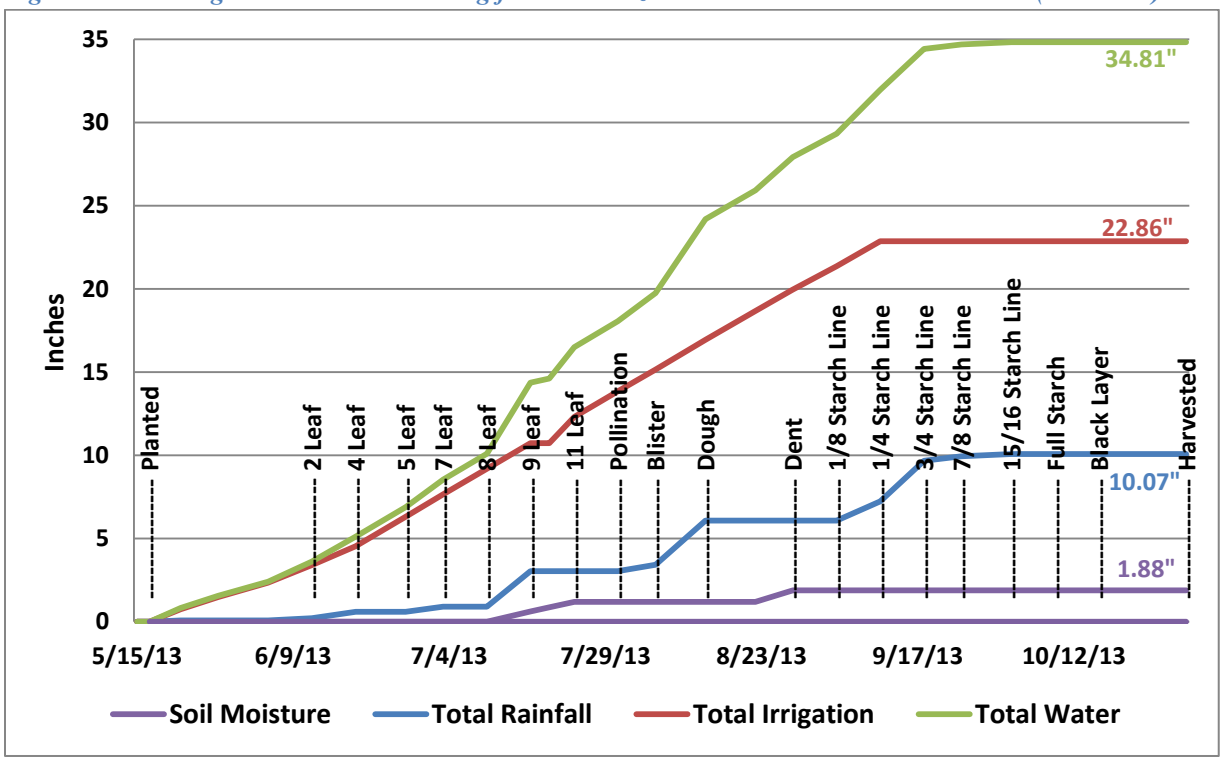


Table 28: Demonstration Field Data for Brian Bezner's Control Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
5/8	No Gauge		6.66		96.5	96.9	96.6	96.0	97.3		321 N		R & L
5/15	No Gauge		6.66								286 N		Randy
5/17										Planted			Brian
5/22	0.07	0.75	14.39							Control	170 Y	449	R & C
5/28		0.73	21.96							Control	122 N		R & C
6/5		0.85	30.8							Control	224 N		R & C
6/12	0.14	1.06	41.75	2 Leaf	99.6	99.8	99.2	99.4	99.2	Control	252 N		R & C
6/19	0.37	1.13	53.5	4 Leaf	97.2	96.2	93.1	78.2	17.8	Control	88 Y	540	R & C
6/27		1.77	71.78	5 Leaf	97.4	96.6	91.6	80.1	16.0	Control	262 Y	495	R & C
7/3	0.31	1.35	85.78	7 Leaf	96.9	95.9	91.0	82.2	17.3	Control	219 Y	523	R & C
7/10		1.55	101.83	8 Leaf	75.8	89.7	89.5	82.9	18.7	Control	288 Y	490	R & C
7/17	2.13	1.54	117.76	9 Leaf	90.4	54.3	81.9	81.4	19.3	Control	330 Y	538	R & C
7/24		1.56	133.89	11 Leaf	94.8	44.4	70.0	76.0	19.3	Control	15 Y	480	R & C
7/31		1.55	149.91	Pollination	75.8	18.1	50.4	67.9	20.4	Control	189 Y	515	Randy
8/6	0.4	1.31	163.48	Blister	93.6	6.6	34.3	59.4	20.6	Control	176 Y	507	R & C
8/14	2.65	1.78	181.86	Dough	97.8	97.6	25.5	50.7	19.5	Control	296 Y	528	R & C
8/22		1.74	199.84	Dough	92.3	94.7	23.4	44.7	18.7	Control	255 Y	470	Randy
8/28		1.29	213.15	Dent	20.2	53.0	13.4	49.1	16.8	Control	315 Y	505	Randy
9/4		1.40	227.65	1/8 ml	0.0	7.4	0.8	9.6	14.7	Control	247 Y	494	Randy
9/11	1.15	1.50	243.21	1/4 ml	88.7	0.0	0.0	2.1	13.4	Control	276 Y		Randy
9/18	2.45		243.23	3/4 ml	96.8	97.0	85.6	40.1	11.9		295 N		Randy
9/24	0.27		243.23	7/8 ml	96.5	96.0	92.8	65.4	12.6		295 N		Randy
10/2	0.13		243.23	15/16 ml	88.2	81.7	89.5	78.7	13.9		295 N		Randy
10/9			243.23	1.0 ml	57.7	49.9	83.8	73.4	17.3		295 N		Randy
10/16	0.14		243.23	Black Layer	47.2	50.4	80.8	76.2	24.7		295 N		Randy
10/23			243.23	Black Layer	43.8	55.1	78.3	74.6	21.0		295 N		Randy
10/30			243.23	Harvested	45.8	57.6	76.6	73.6	22.4		258 N		Randy
11/6	0.55		243.23	Harvested	Blocks DMI								Randy
Total	**10.07**	**22.86**			**0.79”**	**0.86”**	**0.32”**	**0.04”**	**-0.13”**				
Net Soil Moisture is 1.88"													
Irrigation, Rainfall Plus Net Soil Moisture is 34.81"													

- Number in red are not counted in total

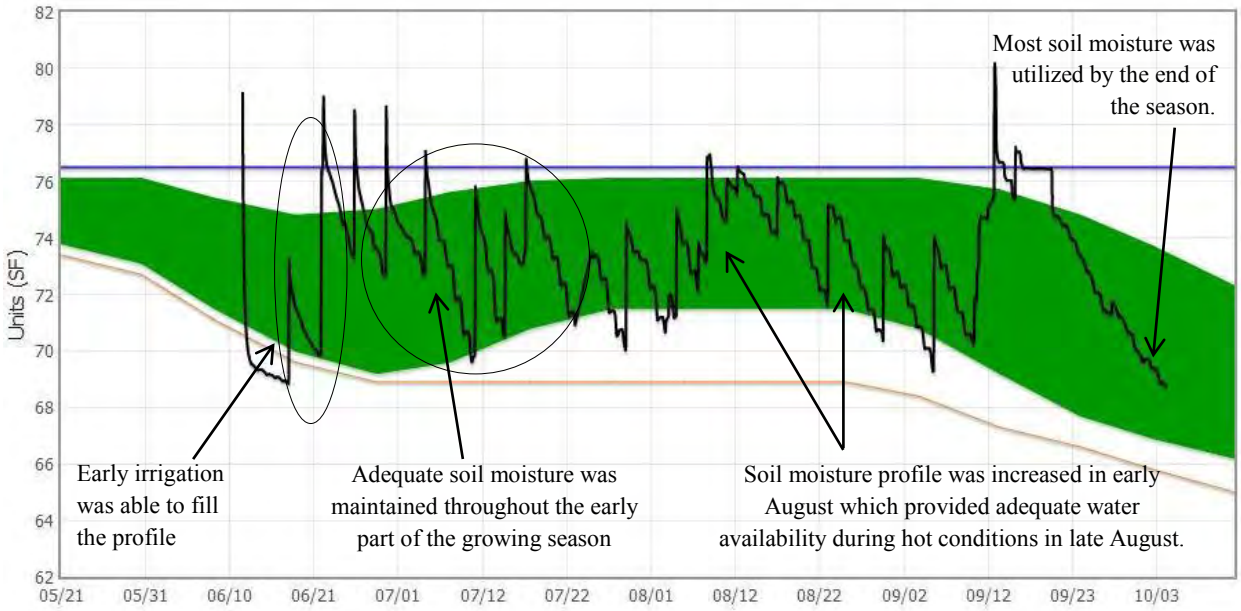
2013-Corn Demonstration
Irrigated Medium Season Corn

Control

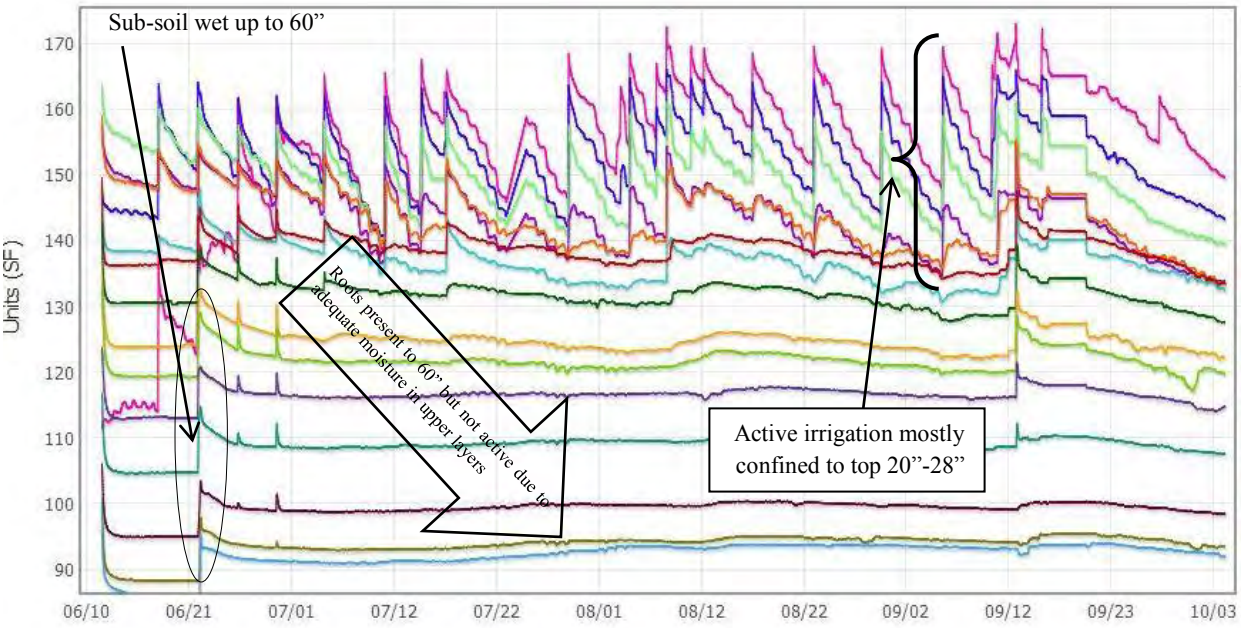
Year:	*2013*	**County:**	*Dallam*	**Grower:**	*Brian Bezner*
No. Acres:	*124*	**Hybrid:**	*NK78N3000G*	**Soil Type:**	*Dallam & Perico Fine Sandy Loam, Dallam Loamy Fine Sand*
Meter Type:	*Seametrics*				
Meter Mult:	*Ac Ft x 1*	**Tillage:**	*Strip Till*		
Fertilizer:	*48-53-52-27S-1Zn*	**Seeding:**	*32,000*		
Planted:	*May 17*	**Harvest:**	*October 30*		
Herbicide:	*Lexar EZ, Vision*	**Insecticide:**	*Comite 2, Besiege, Quilt Xcel (Fungicide)*		
Yield:	*274 bu/ac*	**Prev. crop:**	*Corn*	**Row width:**	*30 Inch*
Irrigation method:	*Center Pivot*	**Prewater:**	*None*	**GPM/acre:**	*4.0*
Distance between drops:	*60"*	**Distance from nozzle to ground:**	*16"*		
Application pattern:	*LEPA Bubble*	**Crop row direction :**	*Straight*		

GPS Location of Pivot Pad		**GPS Location of Gypsum Blocks**	
Latitude:	*36.124*	Latitude:	*36.123885*
Longitude:	*-102.994609*	Longitude:	*-102.998503*

Brian Bezner's Control Field AquaSpy® Probe Summary



The nearly 60 bu/ac increase in yield with only 4" extra water on this field compared to the "200-12" field was probably due to the fact that, while both fields started with relatively dry subsoil, this field was able to be wet up at depth while the "200-12" field was not. This difference in starting moisture, combined with more frequent and deeper irrigations, meant that moisture was more readily available and a high yield was the result. Irrigation in this field followed the desired irrigation template outlined by the green zone in the summary graph above.



Harvest Results: The "200-12" field produced a 206 bushel per acre corn yield. Irrigation totaled 18.92 inches. Production in the Control field was 274 bushels per acre, where seasonal irrigation totaled 22.86 inches. There was no pre-season irrigation in either field. In comparison, production from the Control field was 68 bushels more with 3.94 more inches of irrigation. Corn production was 10.89 bushels (610lbs) per inch of irrigation in the "200-12" field. Grain production was 11.99 bushels (671lbs) per inch in the Control. Grain production from each inch of irrigation, rainfall and net soil water that totaled 23.99 inches was 8.59 bushels (481lbs) per acre in the "200-12" field. Irrigation, rainfall and net soil water totaled 34.81 inches in the Control field where production was 7.87 bushels (441lbs) per inch. Crop production costs were $92.13 per acre more for the Control field than for the "200-12" from additional seed, fertilizer and irrigation expenses. At $5.13 per bushel for corn grain, value for 68 bushels per acre more in the Control field amounts to $348.84 more per acre. The Control field's net gain for corn grain is $256.71 per acre with 3.94 inches more irrigation used compared to production from the "200-12" field. Net return was $629.67 per acre from the "200-12" field compared to $886.39 from the Control. A summary of the demonstration results are shown in table 29.

Table 29: Brian Bezner's 2013 Demonstration Results

	Irrigation (in.)	Total Water (in.)	Production		Crop Value @ $5.13/bu		
			bu/ac	lb/ac-in of Irrigation	Per Acre	Acre-in of Irrigation	Acre-in of Total Water
"200-12" W	18.92	*23.99	206	610	$1,056.78	$55.86	$44.05
Control	22.86	†34.81	274	671	$1,405.62	$61.49	$40.38

*Includes -5.14 inches of water added to five feet of soil, plus rainfall, and irrigation.
†Includes 1.88 inches of water removed from five feet of soil, plus rainfall, and irrigation.

Richard Schad's 2013 Hansford County Demonstration

Planting and Crop Information: For his demonstration, Richard Schad strip tilled and planted 41 acres of corn in the east half circle of the northwest quarter of section 157 for his "200-12" field, "Schad 200-12". He planted the field with Channel 211-99VT3 at a seeding rate of 26,000 seeds per acre. Schad planted 124 acres, also strip tilled, in the southeast quarter of section 157 to Channel 215-52VT at 32,000 seeds per 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. At that capacity, 1.25 inches of irrigation was delivered to the crop in a 2.7 day revolution. Water meter readings averaged 880 gpm for the center pivot that irrigated the Control field. The system applied 1.44 inches of irrigation in a 3.8 day revolution. The two wells that typically pump 1700 gpm irrigate 416 acres of cotton and corn. Available water is stretched, especially when no rainfall helps. Planting and crop information for "Schad 200-12" and "Schad Control" are shown in table 30.

Table 30: Planting and Crop Information for Richard Schad

"200-12" Demonstration Field			
Planted:	*May 18*	**Harvested:**	*October 10*
Hybrid:	*CH211-99VT3P*	**Seeding Rate:**	*26,000*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*41*	**GPM Per Acre:**	*4.1*
Total Water:	*28.00 in.*	**Soil Type:**	*Gruver Clay Loam*
Fertilizer:	*215-72-0-3S-2Zn*	**Insecticide:**	*Onenger*
Herbicide:	*Aatrex, Basis Blend, Brash, Aim, PowerMax, Diacomba, Laudis, Brimstone*		
Control Demonstration Field			
Planted:	*May 17, 2013*	**Harvested:**	*October 10, 2013*
Hybrid:	*CH215-52VTP*	**Seeding Rate:**	*32,000*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*124*	**GPM Per Acre:**	*4.1*
Total Water:	*28.05 in.*	**Soil Type:**	*Sherm Silty Clay Loam*
Fertilizer:	*220-52-0-3S-2Zn*	**Insecticide:**	*Onenger*
Herbicide:	*Aatrex, Brash, Diacomba, PowerMax, Laudis*		

Beginning Soil Water Profile and Growing Season Rainfall

"200-12" Demonstration Field: Pre-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 and 4 feet and about 35 percent at 5 feet. Weekly readings show good soil moisture levels were maintained at 1, 2, 3 and 4 feet until mid-July. The crop then depleted soil water at 1 and 2 feet followed by that at 3 and 4 feet. Soil water had improved to about 90 percent at 5 feet and some water was used from that depth. The irrigation system was down for about a week during this period and contributed to plant roots searching for water. The crop could have used more irrigation during this period, but had to wait for center pivot repair. The crop was in the 12 leaf to tassel growth stages when the pivot was down. One inch of rainfall during the period helped, but was not enough. Gypsum blocks were installed in Gruver clay loam soil which holds approximately 2.0

inches of available water per foot for potential crop use. Rainfall was 2.37 inches in June, 1.55 in July and 4.16 in August. Total rainfall from planting until harvest was 10.14 inches. Gypsum blocks were installed in mid-April prior to planting but following pre-water.

Control Demonstration Field: Soil moisture sensing gypsum blocks were installed in mid-April following pre-water but prior to planting. Beginning gypsum block readings show the soil profile was full. Weekly gypsum block readings show good moisture levels were maintained for the crop. About 65 percent of the soil water was used from 1 foot and 35 percent from 2 feet in July. Otherwise, the soil profile remained mostly full. Gypsum blocks were installed in Sherm silty clay loam soil that holds approximately 2.0 inches of available water per foot for potential crop use. Rainfall totaled 9.82 inches for the Control field. Timely rainfalls of more than one inch fell in June, July and August. Growing season rainfall was much different than in 2011 and 2012. Monthly rainfalls recorded by a gauge located at the two fields are listed in table 31.

Table 31: Monthly Rainfall Data for Richard Schad

	May	June	July	August	September	Total
"200-12"	0.16"	2.37"	1.55"	4.16"	1.90"	**10.14"**
Control	0.16"	2.37"	1.55"	4.16"	1.58"	**9.82"**

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 each Control field. Both the gypsum block sensors and the soil probe were installed in close proximity to each other in the field. Gypsum blocks were installed in the "200-12" fields and most Control fields prior to planting. Each AquaSpy® probe was installed following crop emergence, as well as gypsum blocks in any remaining fields. Installing and reading the gypsum blocks prior to planting provided advanced soil moisture conditions and information to help guide and manage irrigation. 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 same illustrations for the Control field.

Figure 33: Gypsum Block Readings for Richard Schad's "200-12" Demonstration Field

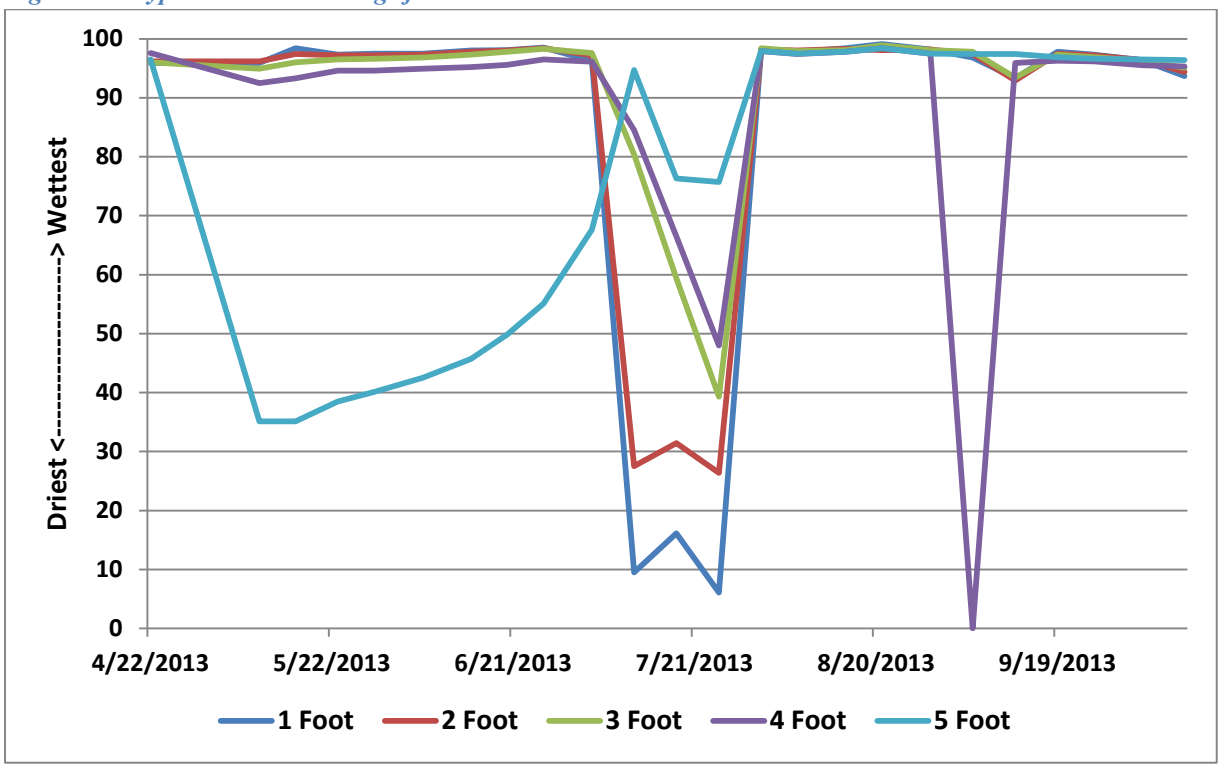


Figure 34: Growing Season Water Tracking for Richard Schad's "200-12" Demonstration Field (196 bu/ac)

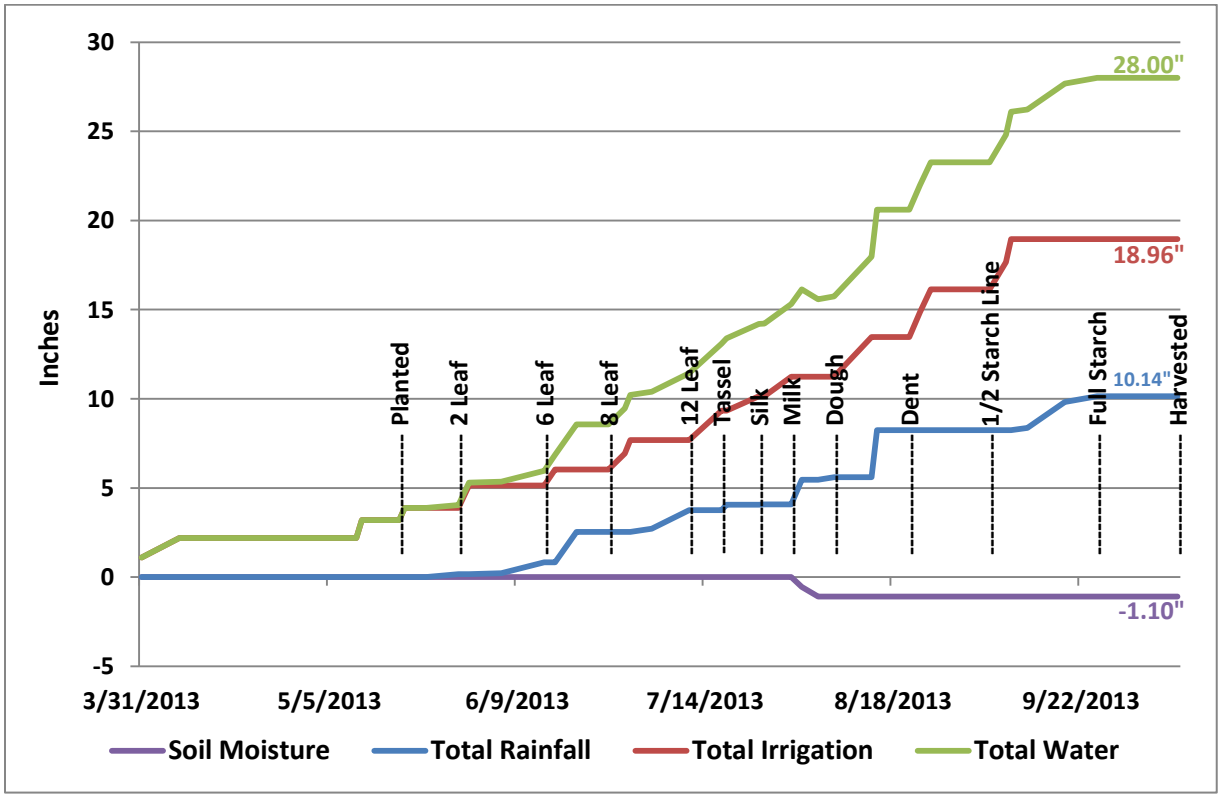


Table 32: Demonstration Field Data for Richard Schad's "200-12" Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
3/8	0.82		137.24		Gypsum Blocks Gone						193 N		Randy
3/31		1.10	PivoTrac™							Prewater	48 N	700	Leon
4/7		1.10	PivoTrac™							Prewater	180 Y	700	Leon
4/22			159.61		95.9	96.2	96.0	97.6	96.5		309 N		Randy
5/10			168.21		95.9	96.2	94.9	92.5	35.1		151 Y	762	Randy
5/11		1.00	PivoTrac™							Prewater	48 N	700	Leon
5/16	0.39		174.56		98.4	97.4	96.0	93.3	35.1		34 N		Randy
5/18										Planted			Richard
5/19		0.68	PivoTrac™							200-12	180 Y	700	Leon
5/23			186.81		97.3	97.2	96.5	94.6	38.5		182 N		R & C
5/29	0.16		187.72	2 Leaf	97.5	97.2	96.6	94.6	40.1		132 N		R & C
5/31		1.26	PivoTrac™	3 Leaf						200-12	180 Y	700	Leon
6/6	0.06		201.58	3 Leaf	97.5	97.3	96.8	94.9	42.5		182 N		R & C
6/14	0.61		201.65	6 Leaf	98.0	97.8	97.3	95.2	45.7		188 N		R & C
6/16		0.89	PivoTrac™	7 Leaf						200-12	48 N	700	Leon
6/20	1.70		205.91	7 Leaf	98.1	98.0	97.8	95.6	49.8		56 Y	60 creep	R & C
6/26			206.02	8 Leaf	98.5	98.4	98.3	96.5	55.1		47 N		R & C
6/29		0.90	PivoTrac™	9 Leaf						200-12	180 Y	700	Leon
6/30		0.75	PivoTrac™	9 Leaf						200-12	48 N	700	Leon
7/4	0.19		212.07	9 Leaf	96.3	97.2	97.6	96.1	67.6		47 N	130 ?	Craig
7/11	1.04		213.72	12 Leaf	9.5	27.5	80.4	84.5	94.7		47 N	135	R & C
7/17		1.65	PivoTrac™	Tassel						200-12	48 N	700	Leon
7/18	0.30		221.83	Tassel	16.1	31.4	59.4	66.5	76.3		49 N		R & C
7/24		0.81	PivoTrac™	Silk						200-12	180 N	700	Leon
7/25	0.02		225.69	Silk	6.1	26.4	39.3	48.0	75.7		174 N	39	R & C
7/30		1.10	PivoTrac™	Milk						200-12	141 N	700	Leon
8/1	1.37		230.62	Milk	98.1	98.2	98.4	97.9	97.9		141 N		Randy
8/7	0.16		233.84	Dough	97.8	98.0	97.9	97.4	97.5	200-12	96 Y	800	R & C
8/10		0.95	PivoTrac™	Dough						200-12	48 Y	700	Leon
8/14		1.27	PivoTrac™	Dough						200-12	180 N	700	Leon
8/15	2.63		239.83	Dough	98.4	98.3	98.1	97.8	97.8		172 N		R & C
8/21			239.83	Dent	99.1	98.1	98.9	98.4	98.4		172 N		Randy
8/23		1.38	PivoTrac™	1/4 ml						200-12	48 Y	700	Leon
8/25		1.29	PivoTrac™	1/4 ml						200-12	180 N	700	Leon
8/29			250.51	1/4 ml	98.2	98.2	98.1	97.5	97.5		184 N		Randy
9/5			250.51	1/2 ml	96.8	97.4	97.8	0.0	97.4		184 N		Randy
9/8		1.53	PivoTrac™	15/16 ml						200-12	48 Y	700	Leon
9/9		1.30	PivoTrac™	15/16 ml						200-12	180 N	700	Leon
9/12	0.12		259.52	15/16 ml	93.3	92.9	93.4	95.9	97.4		192 N		Randy
9/19	1.46		259.52	15/16 ml	97.8	97.5	97.3	96.3	96.9		192 N		Randy
9/25	0.32		259.52	1.0 ml	97.3	97.2	96.9	96.2	96.6		192 N		Randy
10/3			259.52	Black Layer	96.4	96.4	96.3	95.5	96.5		192 N		Randy
10/10			259.52	Harvested	93.7	94.4	95.1	95.3	96.4		192 N		Randy
10/17	0.76		259.52	Harvested	93.3	94.4	95.1	95.0	96.1		192 N		Randy
Total	**10.14**	**18.96**			**0.05”**	**0.05”**	**0.00”**	**-0.07”**	**-1.13”**				
Net Soil Moisture is -1.10"													
Irrigation, Rainfall Plus Net Soil Moisture is 28.00"													

- Number in red are not counted in the total

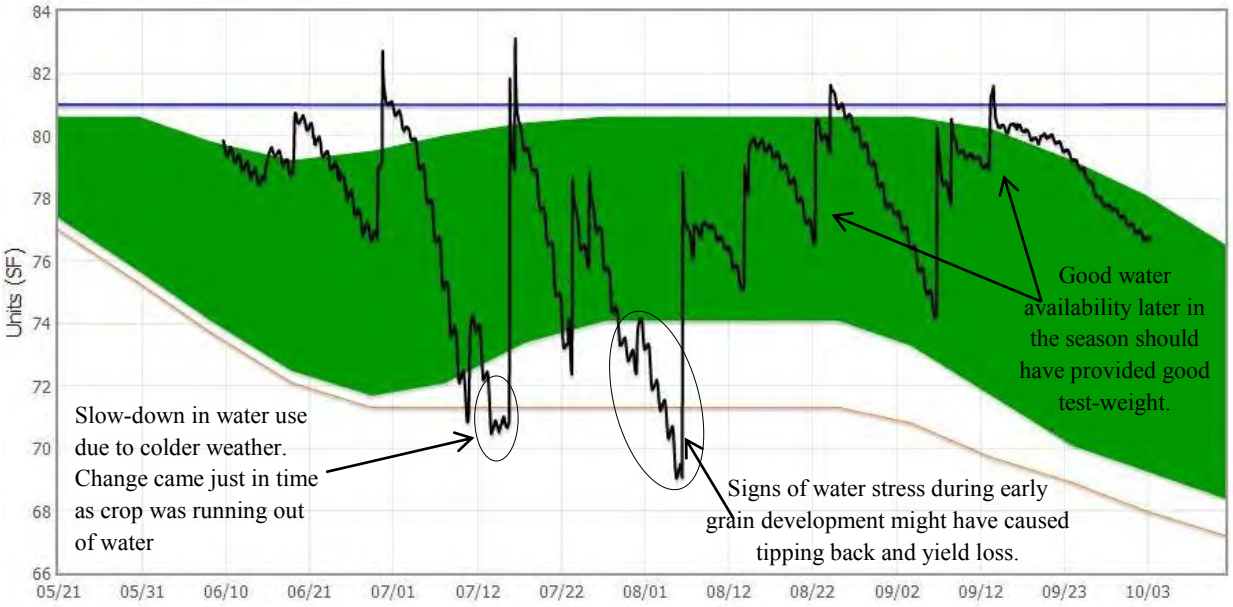
2013-Corn Demonstration
Irrigated Medium Season Corn

200-12

Year:	*2013*	**County:**	*Hansford*	**Grower:**	*Richard Schad*
No. Acres:	*41*	**Hybrid:**	*Ch211-99VT3P*	**Soil Type:**	*Gruver Clay Loam*
Meter Type:	*Seametrics*	**Meter Mult:**	*Acre-Feet*		
Tillage:	*Strip Till*				
Fertilizer:	*215-72-0-3S-2Zn*	**Seeding:**	*26,000*		
Planted:	*May 18*	**Harvest:**	*October 10*		
Herbicide:	*Aatrex, Basis Blend, Brash, Aim, PowerMax, Diacomba, Laudis, Brimstone*			**Insecticide:**	*Onenger*
Yield:	*196 bu/ac*	**Prev. crop:**	*Milo*	**Row width:**	*30 Inch*
Irrigation method:	*Center Pivot*	**Prewater:**	*3.20 in.*	**GPM/acre:**	*4.1*
Distance between drops:	*60"*	**Distance from nozzle to ground:**		*16"*	
Application pattern:	*Spray*	**Crop row direction :**		*Straight*	

GPS Location of Pivot Pad		**GPS Location of Gypsum Blocks**	
Latitude:	*36.30999*	Latitude:	*36.307958*
Longitude:	*-101.545877*	Longitude:	*-101.543827*

Richard Schad's "200-12" Field AquaSpy® Probe Summary



This field began with good stored soil moisture but it was used rapidly during late vegetative growth and early reproductive growth. The plant developed a very large root system but this seemed to be in response to the fact that the plant needed to find water to maintain water use. There was a period in late July / early August where it appeared that the crop ran into moisture stress and this may have affected yield through tipping-back of the ears. Subsequent irrigation was able to re-wet the soil but the damage to yield potential had already been done. The data from this field looks quite different from the Control field and it is hard to reconcile the fact that less irrigation was used on the Control field, based on the soil moisture graphs.

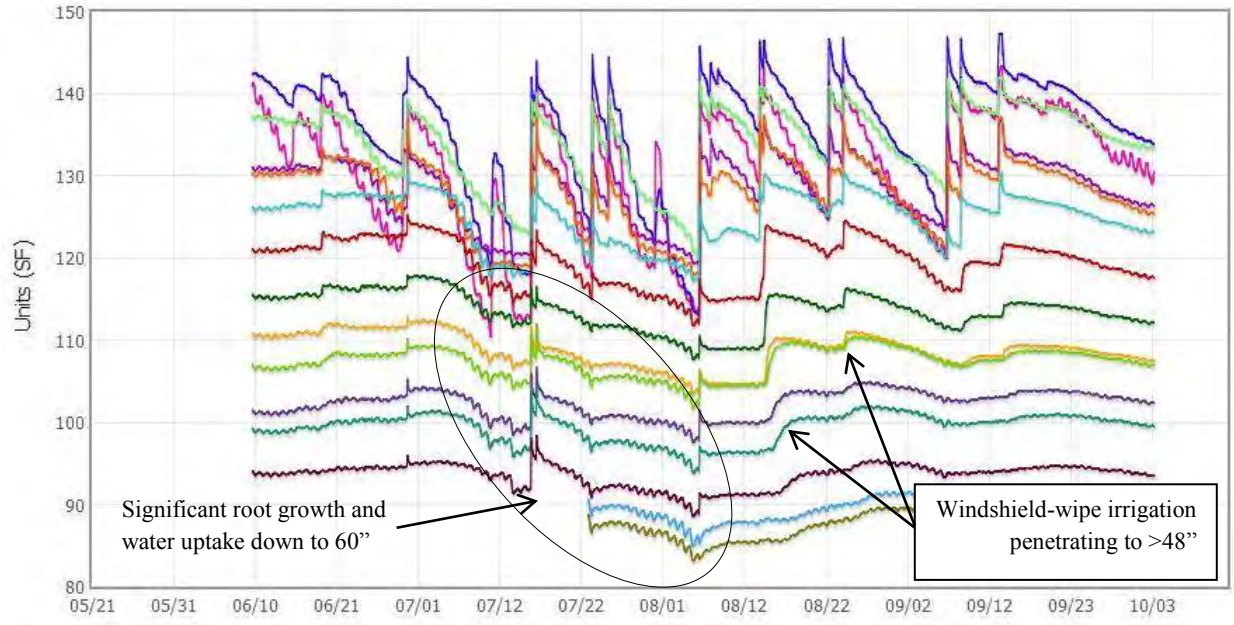


Figure 35: Gypsum Block Readings for Richard Schad's Control Demonstration Field

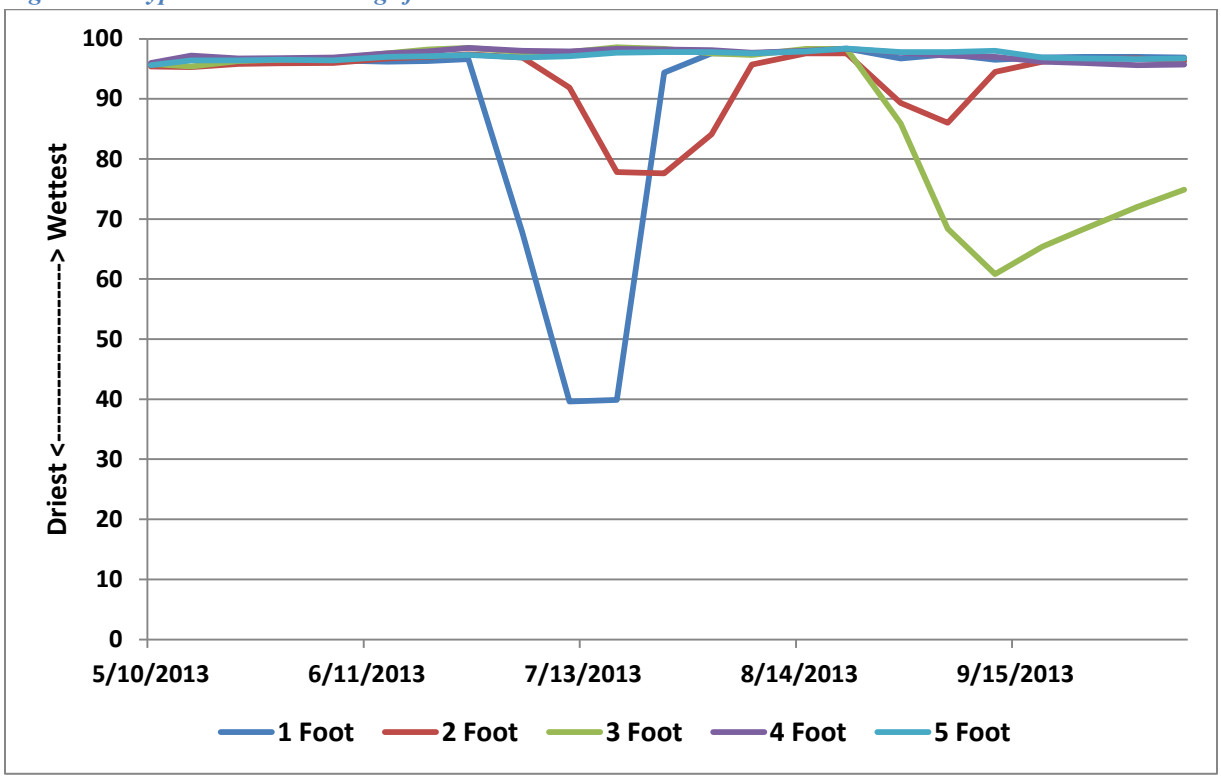


Figure 36: Growing Season Water Tracking for Richard Schad's Control Demonstration Field (230 bu/ac)

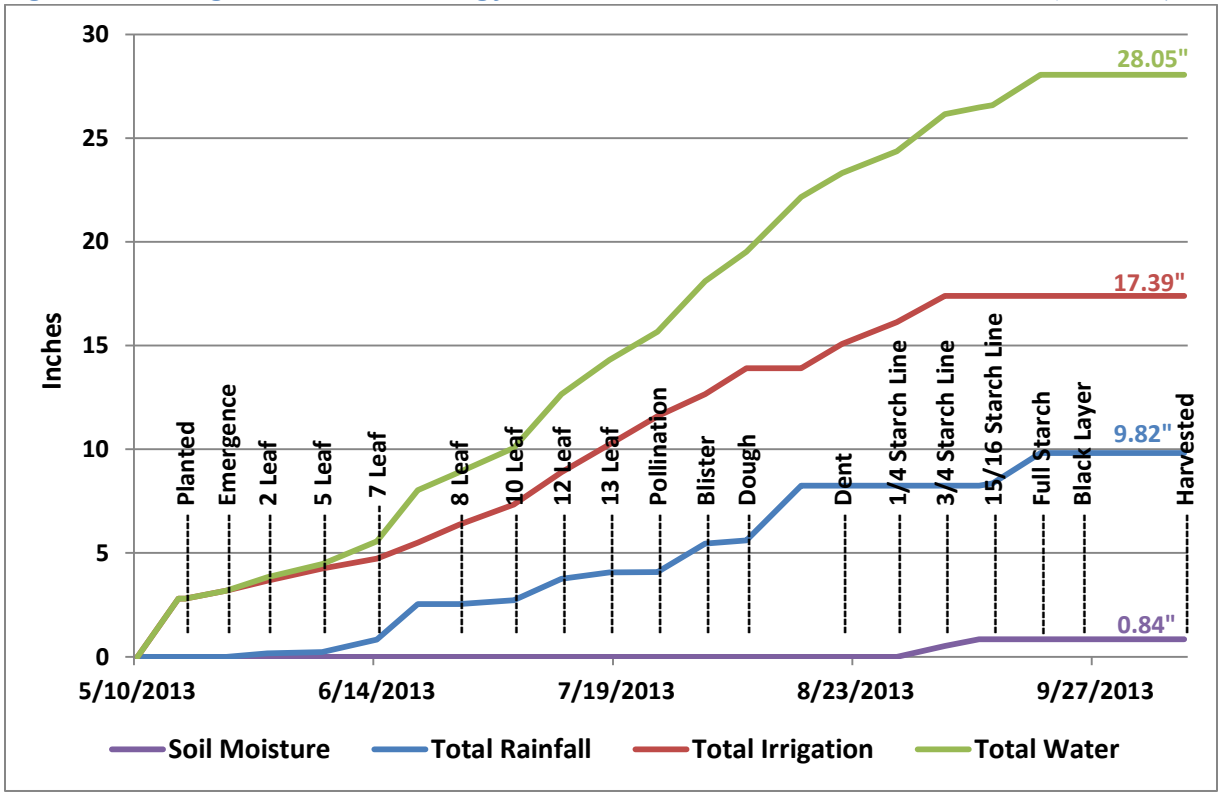


Table 33: Demonstration Field Data for Richard Schad's Control Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
4/22			152		97.5	96.8	96.3	96.9	96.2	Prewater	47 Y	775	Randy
5/10			180		95.6	95.4	95.8	96.0	95.6		95 Y	840	Randy
5/16	0.39	2.80	181		96.8	95.3	95.4	97.2	96.4		137 N		Randy
5/17										Planted			Richard
5/23		0.39	185	Emergence	96.1	95.8	96.3	96.7	96.4		90 N		R & C
5/29	0.16	0.48	190	2 Leaf	96.4	95.9	96.5	96.8	96.5		27 N		R & C
6/6	0.06	0.58	196	5 Leaf	96.4	96.0	96.7	96.9	96.4	Control	5 Y	813	R & C
6/14	0.61	0.48	201	7 Leaf	96.2	96.7	97.6	97.6	97.0		56 N		R & C
6/20	1.70	0.77	209	7 Leaf	96.3	97.0	98.2	97.9	97.1		109 N		R & C
6/26		0.87	218	8 Leaf	96.6	97.4	98.5	98.5	97.3	Control	119 Y	940	R & C
7/4	0.19	0.97	228	10 Leaf	67.7	96.9	97.8	98.0	96.9	Control	57 Y	990	Craig
7/11	1.04	1.55	244	12 Leaf	39.6	91.9	97.8	97.9	97.1		148 N		R & C
7/18	0.30	1.35	258	13 Leaf	39.9	77.8	98.6	98.3	97.7	Control	4 Y	950	R & C
7/25	0.02	1.35	272	Pollination	94.4	77.6	98.3	98.2	97.8		232 N		R & C
8/1	1.37	1.06	283	Blister	97.6	84.1	97.6	98.1	97.8	Control	126 Y	879	Randy
8/7	0.16	1.26	296	Dough	97.6	95.7	97.3	97.7	97.6	Control	334 Y	940	R & C
8/15	2.63		303	Dough	98.0	97.6	98.3	98.0	97.9		74 N		R & C
8/21		1.16	308	Dent	98.4	97.6	98.3	98.3	98.4	Control	264 Y	890	Randy
8/29		1.06	319	1/4 ml	96.7	89.3	85.9	97.7	97.8	Control	234 Y	830	Randy
9/5		1.26	332	3/4 ml	97.4	86.0	68.4	97.2	97.8		106 N		Randy
9/12	0.12		332	15/16 ml	96.5	94.5	60.8	97.0	98.0		105 N		Randy
9/19	1.46		332	1.0 ml	96.9	96.2	65.4	96.2	96.9		105 N		Randy
9/25	0.32		332	Black Layer	97.0	96.6	68.3	96.0	96.7		105 N		Randy
10/3			332	Black Layer	97.0	96.7	72.0	95.6	96.6		105 N		Randy
10/10			332	Harvested	96.9	96.3	74.9	95.7	96.7		140 N		Randy
10/17	0.76		332	Harvested	97.1	96.6	78.3	95.9	96.6		140 N		Randy
Total	**9.82**	**17.39**			**-0.06”**	**0.00”**	**0.85”**	**0.05”**	**0.00”**				
Net Soil Moisture is 0.84"													
Irrigation, Rainfall Plus Net Soil Moisture is 28.05"													

- Numbers in red are not counted in the total

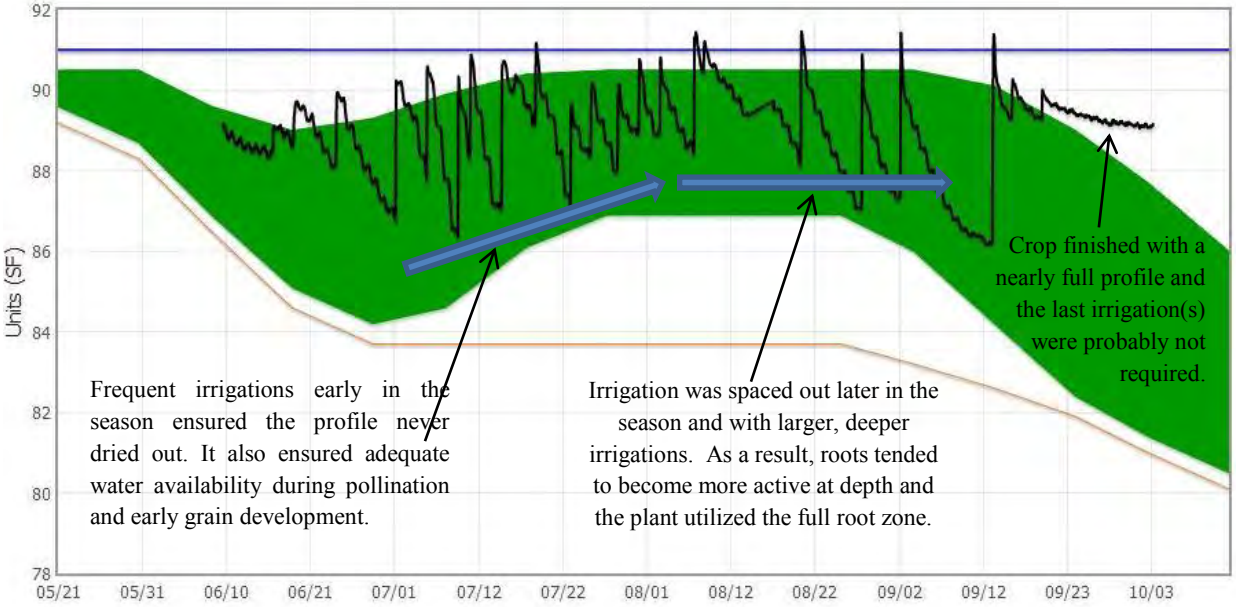
2013-Corn Demonstration
Irrigated Medium Season Corn

Control

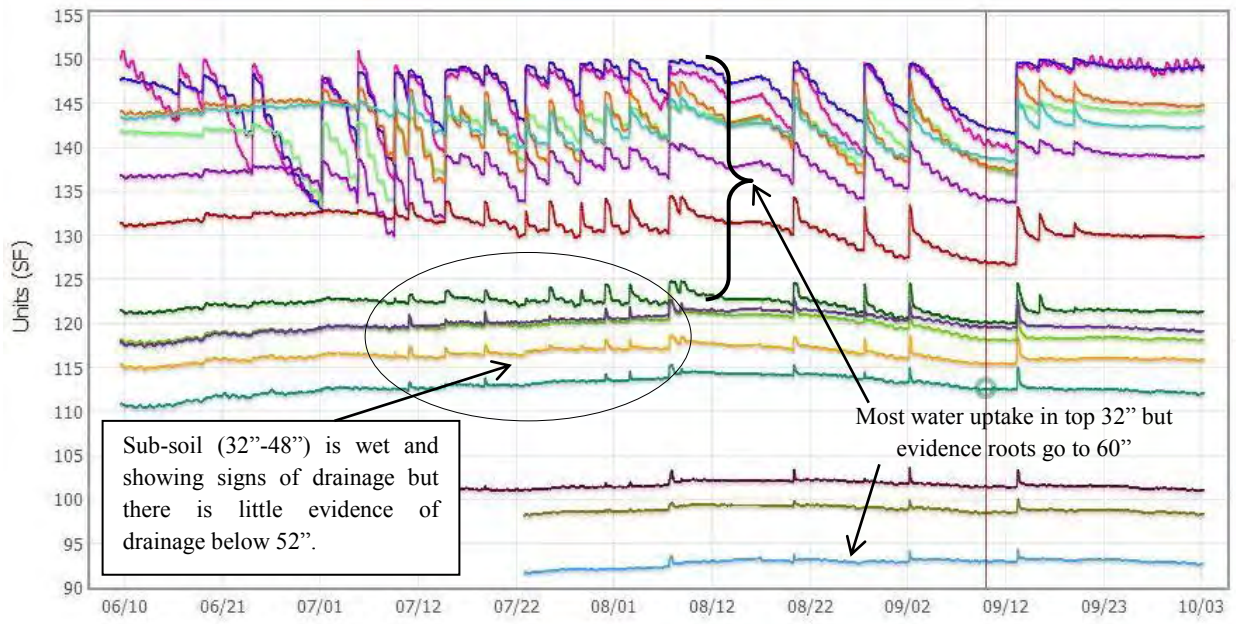
Year:	*2013*	**County:**	*Hansford*	**Grower:**	*Richard Schad*
No. Acres:	*124*	**Hybrid:**	*Ch215-52VTP*	**Soil Type:**	*Sherm Silty Clay Loam*
Meter Type:	*Senninger*	**Meter Mult:**	*Ac Ft x 1*		
Tillage:	*Strip Till*				
Fertilizer:	*220-52-0-3S-2Zn*	**Seeding:**	*32,000*		
Planted:	*May 17*	**Harvest:**	*October 10*		
Herbicide:	*Aatrex, Brash, Diacomba, PowerMax, Laudis*			**Insecticide:**	*Onenger*
Yield:	*230 bu/ac*	**Prev. crop:**	*Corn*	**Row width:**	*30 Inch*
Irrigation method:	*Center Pivot*	**Pre-water:**	*2.80*	**GPM/acre:**	*4.1*
Distance between drops:	*60"*	**Distance from nozzle to ground:**	*16"*		
Application pattern:	*Spray*	**Crop row direction :**	*Straight*		

GPS Location of Pivot Pad		**GPS Location of Gypsum Blocks**	
Latitude:	*36.30262*	Latitude:	*36.303792*
Longitude:	*-101.536916*	Longitude:	*-101.54041*

Richard Schad's Control Field AquaSpy® Probe Summary



This field started with a nearly full profile and good soil moisture was maintained throughout the growing season. Most of the active water use was in the top 32" but there is evidence that roots went to 60". The fact that roots were present in wet soil but not using large amounts of water indicates that this crop never had any moisture stress. The irrigation interval was quite short (3 days) during the early part of the growing season and then it seems the pivot was slowed to put on larger, deeper applications. This strategy matched irrigation with plant requirements (i.e. followed the green irrigation template) and a high water use efficiency was the result. It would appear from this data that more than 17.4" of irrigation was applied and there may have been some localized effects due to probe location.



Harvest Results: The "200-12" field produced a 196 bushel per acre corn yield. Irrigation totaled 18.96 inches of which 3.20 inches were pre-water. Production in the Control field was 230 bushels per acre, where total irrigation was 17.39 inches. Pre -season irrigation was 2.80 inches for the Control field. In comparison, the Control field produced 34 more bushels per acre than the "200-12" with 1.57 less inches of irrigation. Corn production was 10.34 bushels (579lbs) per inch of irrigation in the "200-12" field compared to 13.23 bushels (741lbs) in the Control. Production from each inch of irrigation, rainfall and net soil water that totaled 28.00 inches was 7.00 bushels (392lbs) per acre in the "200-12" field. Irrigation, rainfall and net soil water totaled 28.05 inches in the Control field where production was 8.20 bushels (459lbs) per inch. Crop production costs were $52.77 per acre more for the Control field than for the "200-12" from increased seed, fertilizer, irrigation and harvest expenses. At $5.13 per bushel, the additional 34 bushel per acre corn yield amounts to $174.42 more per acre. The Control field‟s net gain was $121.63 per acre with 1.57 inches less irrigation used compared to production from the "200-12" field. Net return from the "200-12" field was $590.10 compared to $711.73 from the Control with 1.57 inches less irrigation. Schad stated, "Two timely rains occurred immediately following irrigation of the "200-12" field, which could have reduced irrigation, had I known. I am stretched for water, rotate irrigation between four center pivots and must keep water moving. Yields were good with help from rain for a change." A summary of Schad‟s demonstration results are shown in table 34.

Table 34: Richard Schad's 2013 Demonstration Results

	Irrigation (in.)	Total Water (in.)	Production		Crop Value @ $ 5.13/bu		
			bu/ac	lb/ac-in Irrigation	Per Acre	Acre-in of Irrigation	Acre-in of Total Water
"200-12"	18.96	*28.00	196	579	$1,005.48	$53.03	$35.91
Control	17.39	†28.05	230	741	$1,179.90	$67.85	$42.06

*Includes -1.10 inches of water added to five feet of soil, plus rainfall, and irrigation.
†Includes 0.84 inches of 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, irrigation amount and other information to help maintain profitable corn production levels with less water and to support rainfall. Below are corn yields from two seeding rates from eight Channel and Pioneer corn hybrids planted within Schad‟s "200-12" field. Irrigation totaled 18.96 inches and rainfall 10.14 inches.

Table 35: Corn Yields from Eight Channel & Pioneer Corn Hybrids at Two Seeding Rates

Hybrid	Seeding Rate	Yield (bu/ac)
Channel 214-00DGVT2PRIB	*24,000*	*232*
Channel 214-13VT2PRIB	*24,000*	*214*
Channel 211-98VT2PRIB	*24,000*	*207*
Pioneer 1498HR	*24,000*	*206*
Channel 211-00DGVT2PRIB	*24,000*	*205*
Channel 209-00DGVTPRIB	*24,000*	*200*
Channel 207-00DGVT2PRIB	*24,000*	*196*
Channel 216-00DGVT3PRIB	*24,000*	*193*
Channel 214-00DGVT2PRIB	*28,000*	*216*
Channel 214-13VT2PRIB	*28,000*	*208*
Channel 211-98VT2PRIB	*28,000*	*207*
Pioneer 1498HR	*28,000*	*198*
Channel 207-00DGVT2PRIB	*28,000*	*198*
Channel 216-00DGVT3PRIB	*28,000*	*192*
Channel 209-00DGVT2PRIB	*28,000*	*191*
Channel 211-00DGVT2PRIB	*28,000*	*191*

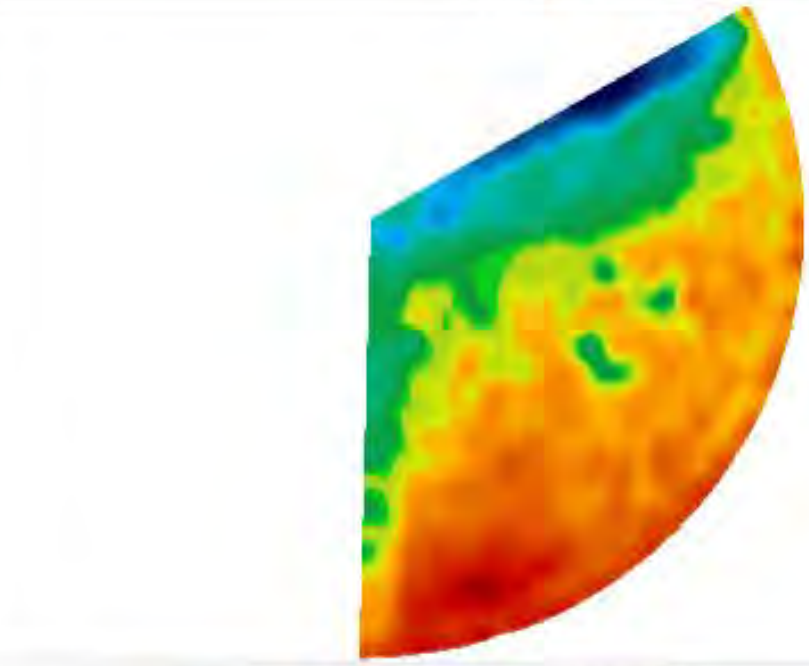
Variable Rate Irrigation (VRI) for Schad's "200-12" Field: Variable Rate Irrigation (VRI) by center pivot speed control was prepared for Schad‟s "200-12" field. A prescription was written using the dual EM subsoil layer obtained from a preseason electromagnetic (EM 38) soil survey using Crop Metrics Virtual Agronomist software. An Image of the dual EM survey is in Figure 37. The prescription was based on a three day revolution and 700 gpm that apply an average of 1.0 inch of irrigation. Schad‟s prescription is written to apply more irrigation on the south and southeast portion of the field and less on the northeast portion of the "200-12" field. Actual irrigation varies from 0.65 inches to 1.25 inches in prescribed areas of the field as shown in Figure 38. Center pivot variable speed control in twenty, 6-degree increments was to be accomplished by PivoTrac™ using the VRI prescription. The "200-12" field is from 54 to 180 degrees in the circle. The prescription is shown in Table 36. Although planned and ready, VRI was never initiated due to center pivot repair that created delays in irrigation. Schad‟s VRI is one of four planned for the 2013 growing season to continue the VRI process following it‟s initiation in 2012.

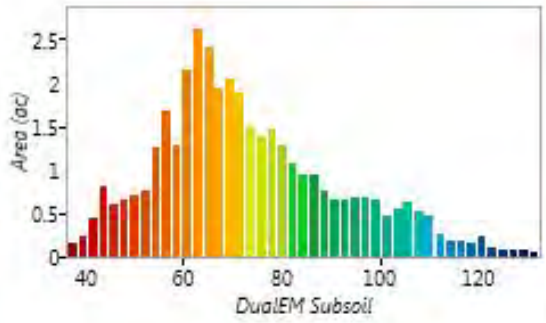
Figure 37: Dual EM Subsoil Image of Richard Schad's "200-12" Demonstration Field

Virtual Agronomist
Base Management Program

Grower Richard Schad
Farm Schad Farms
Field NW 1 4 Sec 157

DualEM Subsoil





Layer name	DualEM Subsoil
Field name	NW 1 4 Sec 157
Season	All seasons
Min	37.06
Min	37.06
Mean	74.33
Mode	62.79
Max	133.54
SD	18.83
CV	25.34%
Total	2863.19
Total Area	38.52 ac

Comments:

Blue describes heavier subsoil texture in the field with more water holding capacity. Red represents lighter subsoil texture with less water holding capacity. Dual EM Subsoil is to three feet.

www.CropMetrics.com

Figure 38: Variable Rate Irrigation (VRI) for Richard Schad's "200-12" Demonstration Field

virtual agronomist
Base Management Program

Grower Richard Schad
Farm Schad Farms
Field NW 1 4 Sec 157

Pivot VRI by Sector Report

Base Application Depth: 1.00 in

Base Walk Rate: 30.00 (%)

Total Area: 38.08 ac **Total Time:** 0d 8hr 13min

Total Flat Rate Water Amount: 1,034,113.8 gal

Total VRI Water Amount: 1,064,196.0gal (1.03in/ac)

www.CropMetrics.com

Table 36: Variable Rate Irrigation by Degree Sectors for Richard Schad's "200-12" Demonstration Field

Virtual Agronomist
Base Management Program

Grower Richard Schad
Farm Schad Farms
Field NW 1 4 Sec 157

Pivot VRI by Sector Report

Start Angle	Stop Angle	Area (ac)	Application (in)	Speed (%)
60	66	1.74	0.65	46.00
66	72	1.90	0.76	39.34
72	78	1.90	0.81	37.18
78	84	1.90	0.84	35.64
84	90	1.92	0.89	33.54
90	96	1.90	0.97	31.05
96	102	1.92	1.02	29.53
102	108	1.92	1.01	29.81
108	114	1.91	1.04	28.89
114	120	1.91	1.05	28.69
120	126	1.92	1.04	28.71
126	132	1.92	1.12	26.90
132	138	1.91	1.13	26.54
138	144	1.92	1.16	25.90
144	150	1.92	1.20	24.91
150	156	1.92	1.24	24.12
156	162	1.92	1.25	24.07
162	168	1.91	1.22	24.53
168	174	1.92	1.16	25.94
174	180	1.92	0.99	30.34

www.CropMetrics.com

Frische Brothers' 2013 Moore County Demonstration

Planting and Crop Information: For their demonstration, Frische Brothers strip tilled and planted 53 acres of corn in the west half circle of the southwest quarter of section 96, for their "200-12" field, "Frische 200-12". Frische planted the west half circle with Pioneer 1151AM at a seeding rate of 28,000 seeds per acre. They planted the east half 54 acres, also strip tilled, to P1151AM at 28,000 seeds per acre for their "Control" field, "Frische Control". Both the west half circle "200-12" field and east half Control field were irrigated using the same center pivot. Seasonal water meter readings averaged 760 gpm. At that capacity, the system delivered an average of 1.32 inches of irrigation in a 3.5 day revolution. An adjoining similar acreage of grain sorghum was irrigated separately with the same irrigation well. Planting and crop information for "Frische 200-12" and "Frische Control" are shown in the table 37 below.

Table 37: Planting and Crop Information for Frische Brothers

"200-12" Demonstration Field			
Planted:	*May 7*	**Harvested:**	*October 1*
Hybrid:	*P1151AM*	**Seeding Rate:**	*28,000*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*53*	**GPM Per Acre:**	*3.5*
Total Water:	*21.84 in.*	**Soil Type:**	*Sunray & Sherm Silty Clay Loam*
Fertilizer:	*152-11-1.5-3S*	**Insecticide:**	*Comite*
Herbicide:	*Basic Blend, Atrazine, 2,4D LV 6, Traxion, Status*		
Control Demonstration Field			
Planted:	*May 7*	**Harvested:**	*September 30*
Hybrid:	*P1151AM*	**Seeding Rate:**	*28,000*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*53*	**GPM Per Acre:**	*3.5*
Total Water:	*27.52 in.*	**Soil Type:**	*Conlen & Sunray Loam*
Fertilizer:	*152-11-1.5-3S*	**Insecticide:**	*Comite*
Herbicide:	*Basic Blend, Atrazine, 2,4D LV 6, Traxion, Status*		

Beginning Soil Water Profile and Growing Season Rainfall

"200-12" Demonstration Field: Initial gypsum block readings in April indicate the soil profile was full to 5 feet. Weekly gypsum block readings that followed showed soil water was used from 1, 2 and 3 feet in July and early August plus irrigation. Additional readings show only the 1 foot depth was refilled by irrigation and rainfall that followed. Readings do not show root activity at 4 and 5 feet in the root zone. Sherm silty clay loam soil holds approximately 2.0 inches of available water per foot for crop use. Gypsum blocks were installed in May prior to planting. Seasonal rainfall was only 4.85 inches. And, 2.57 inches, 53 percent, of that was one event in mid-August at the dent stage of grain maturity. There was no beneficial rainfall in May and June and 1.39 inches in July.

Control Demonstration Field: Soil water was good to 5 feet in the profile when the gypsum blocks were installed in April. Gypsum blocks were installed in Sunray loam soil prior to

planting. Weekly gypsum block readings show good soil water levels until early July, then declining rapidly at 1, 2, and 3 feet during July when plant water use was high. Additional irrigation was applied on the Control field in early August at the dough stage that refilled the profile. Plants then used soil water from 1, 2, 3 and 4 feet plus irrigation to finish the crop. Sunray loam holds approximately 2.0 inches per foot for potential crop use. Rainfall totaled 4.85 inches for the season. "Frische Control" is one of the demonstration fields where rainfall was no better than in 2012. 53 percent, 2.57 inches, of total rainfall was in one event in mid- August at the dent stage.

Table 38: Monthly Rainfall Data for Frische Brothers

	May	June	July	August	September	Total
"200-12"	0.15"	0.08"	1.39"	2.68"	0.55"	**4.85"**
Control	0.15"	0.08"	1.39"	2.68"	0.55"	**4.85"**

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 each Control field. Both the gypsum block sensors and the soil probe were installed in close proximity to each other in the field. Gypsum blocks were installed in the "200-12" fields and most Control fields prior to planting. Each AquaSpy® probe was installed following crop emergence, as well as gypsum blocks in any remaining fields. Installing and reading the gypsum blocks prior to planting provided advanced soil moisture conditions and information to help guide and manage irrigation. 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 same illustrations for the Control field.

Figure 39: Gypsum Block Readings for Frische Brothers' "200-12" Demonstration Field

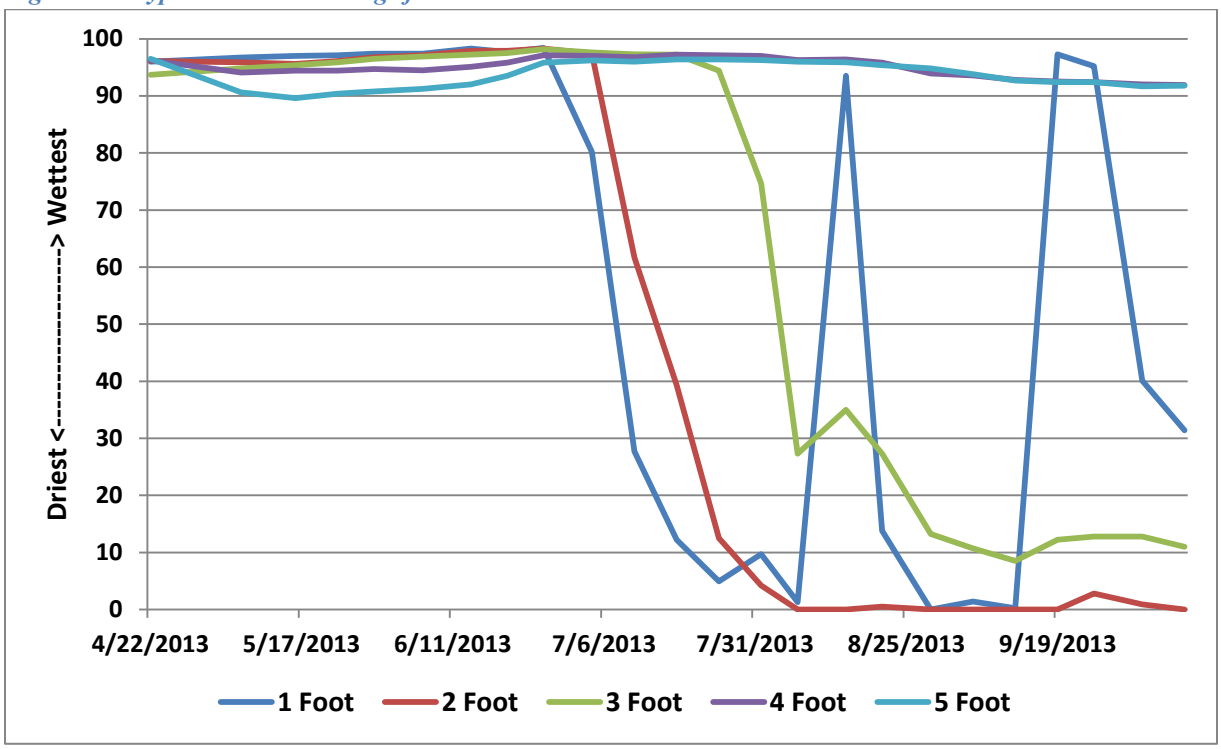


Figure 40: Growing Season Water Tracking for Frische Brothers' "200-12" Demonstration Field (176 bu/ac)

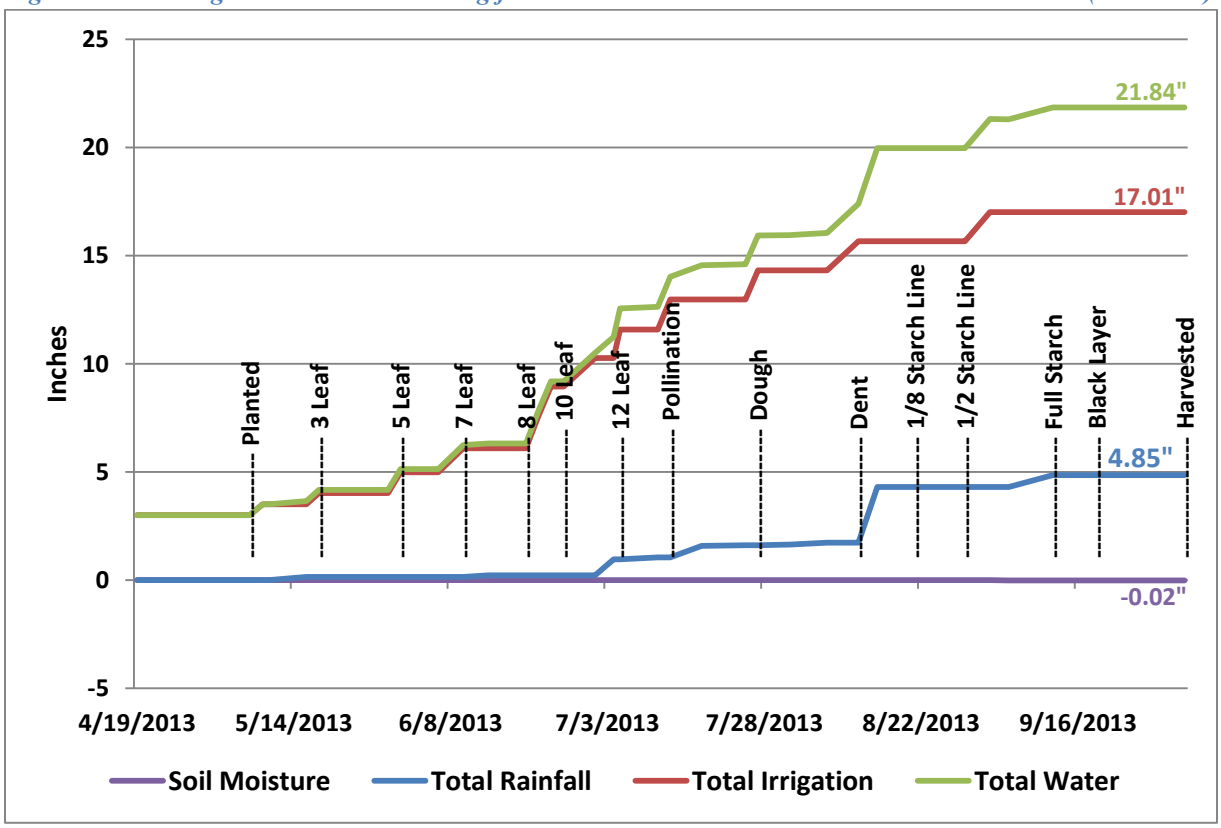


Table 39: Demonstration Field Data for Frische Brothers' "200-12" Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
3/8	0.53		No Meter								180 N		Randy
4/19		3.00	PivoTrac™							Prewater	191 N	750	Leon
4/22					96.0	96.1	93.7	96.2	96.5		191 N		Randy
5/7			0.02		96.7	95.9	94.8	94.1	90.6	Planted	181N		Randy
5/9		0.51								200-12	360 N	750	Leon
5/10												812	Randy
5/16	0.15		4.59		97.0	95.6	95.4	94.4	89.6		188 N		Randy
5/18		0.51	PivoTrac™	3 Leaf						200-12	360 N	750	Leon
5/23			9.46	3 Leaf	97.1	96.1	95.9	94.4	90.4		195 N		R & C
5/29			9.75	3 Leaf	97.4	96.8	96.5	94.7	90.8	200-12	206 Y	778	R & C
5/31		0.96	PivoTrac™	5 Leaf						200-12	360 Y	750	Leon
6/6			23.05	5 Leaf	97.4	97.1	96.9	94.5	91.2	200-12	299 Y	775	R & C
6/10		1.11	PivoTrac™	7 Leaf						200-12	360 Y	750	Leon
6/14	0.08		30.02	7 Leaf	98.3	97.9	97.2	95.1	92.0		167 N		R & C
6/20			36.83	8 Leaf	97.7	97.9	97.5	95.8	93.5		354 N		R & C
6/22		1.50	PivoTrac™	8 Leaf						200-12	360 Y	750	Leon
6/24		1.36	PivoTrac™	9 Leaf						200-12	360 Y	750	Leon
6/26			56.56	10 Leaf	98.4	98.3	98.2	97.1	95.8		189 N		R & C
7/1		1.32	PivoTrac™	11 Leaf						200-12	360 Y	750	Leon
7/4	0.74		72.76	11 Leaf	80.2	97.4	97.6	97.0	96.2	200-12	287 Y	776	Craig
7/5		1.31	PivoTrac™	12 Leaf						200-12	360 Y	750	Leon
7/11	0.08		82.7	12 Leaf	27.7	61.7	97.3	96.8	96.0		200 N		R & C
7/13		1.39	PivoTrac™	Pollination						200-12	360 Y	750	Leon
7/18	0.53		95.03	Pollination	12.2	39.3	97.2	97.2	96.4		194 N		R & C
7/25	0.04		95.03	Blister	4.9	12.5	94.4	97.1	96.4		194 N		R & C
7/27		1.34	PivoTrac™	Dough						200-12	360 Y	750	Leon
8/1	0.02		113.5	Dough	9.7	4.2	74.6	97.0	96.3		2 N		Randy
8/7	0.09		118.26	Dough	1.3	0.0	27.3	96.3	96.0	Control	148 Y	667	R & C
8/12		1.35	PivoTrac™	Dent						200-12	360 Y	750	Leon
8/15	2.57		131.28	Dent	93.5	0.0	35.0	96.4	95.9		183 N		R & C
8/21			131.28	1/8 ml	13.8	0.5	27.3	95.8	95.4		182 N		Randy
8/29			146.82	1/2 ml	0.0	0.0	13.2	93.9	94.8	Control	89 Y	758	Randy
9/2		1.35	PivoTrac™	7/8 ml						200-12	180 Y	750	Leon
9/5			150.26	7/8 ml	1.4	0.0	10.7	93.6	93.8		353 N		Randy
9/12	0.55		150.26	1.0 ml	0.2	0.0	8.5	92.8	92.7		353 N		Randy
9/19	1.13		150.26	Black Layer	97.3	0.0	12.2	92.5	92.4		353 N		Randy
9/25			150.26	Black Layer	95.2	2.8	12.8	92.4	92.4		353 N		Randy
10/3			150.26	Harvested	40.1	0.9	12.8	92.0	91.7		14 N		Randy
10/10			150.26	Harvested	31.4	0.0	11.0	91.9	91.8		14 N		Randy
Total	**4.85**	**17.01**			**0.00"**	**0.00"**	**0.00"**	**0.10"**	**-0.12"**				
Net Soil Moisture is -0.02"													
Irrigation, Rainfall Plus Net Soil Moisture is 21.84"													

- Numbers in red are not counted in the total

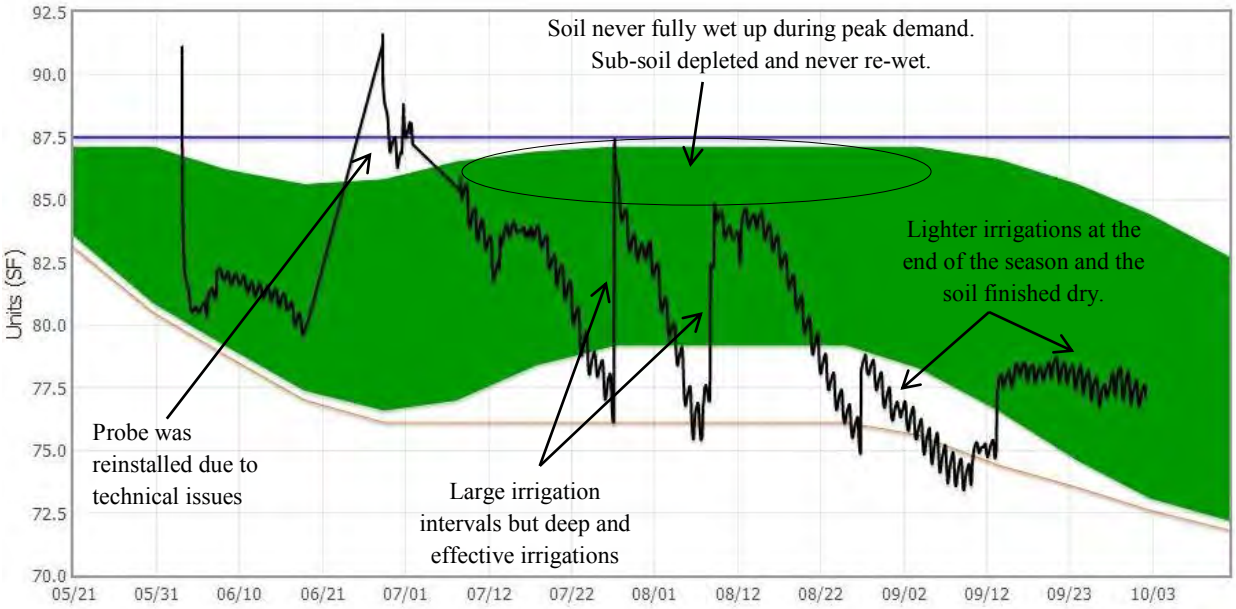
2013-Corn Demonstration
Irrigated Medium Season Corn

200-12

Year:	*2013*	**County:**	*Moore*	**Grower:**	*Frische Brothers*
No. Acres:	*53*	**Hybrid:**	*P1151AM*	**Soil Type:**	*Sherm Silty Clay Loam, Sunray Loam*
Meter Type:	*Seametrics*	**Tillage:**	*Strip Till*		
Meter Mult:	*Ac Ft x 1*	**Seeding:**	*28,000*		
Fertilizer:	*152-11-1.5-3S*	**Harvest:**	*October 1*		
Planted:	*May 7*	**Insecticide:**	*Comite*		
Herbicide:	*Basic Blend, Atrazine, 2,4 D LV 6, Traxion, Laudis, Status*				
Yield:	*176 Bu/Acre*	**Prev. crop:**	*Milo*	**Row width:**	*30 Inch*
Irrigation method:	*Center Pivot*	**Prewater:**	*3.00 in.*	**GPM/acre:**	*3.5*
Distance between drops:	*60"*	**Distance from nozzle to ground:**	*16"*		
Application pattern:	*Spray*	**Crop row direction :**	*Straight*		

GPS Location of Pivot Pad		**GPS Location of Gypsum Blocks**	
Latitude:	*36.044706*	Latitude:	*36.047723*
Longitude:	*-101.824565*	Longitude:	*-101.825137*

Frische Brothers' "200-12" Field AquaSpy® Probe Summary



The pivot at this field appeared to be running slow with long irrigation intervals but relatively deep and effective irrigations. There was good sub-soil moisture available but the root system only seemed to be effective down to 40", despite evidence that the roots went to 56" later in the season. This lack of root vigor at depth, despite moisture being available, may be symptomatic of something else going on with this field (i.e. hybrid, soil type, texture, etc). The last two irrigations were much lighter and the plant responded by seeking out soil moisture but it would appear that the low yield is not only related to the amount of irrigation or water use.

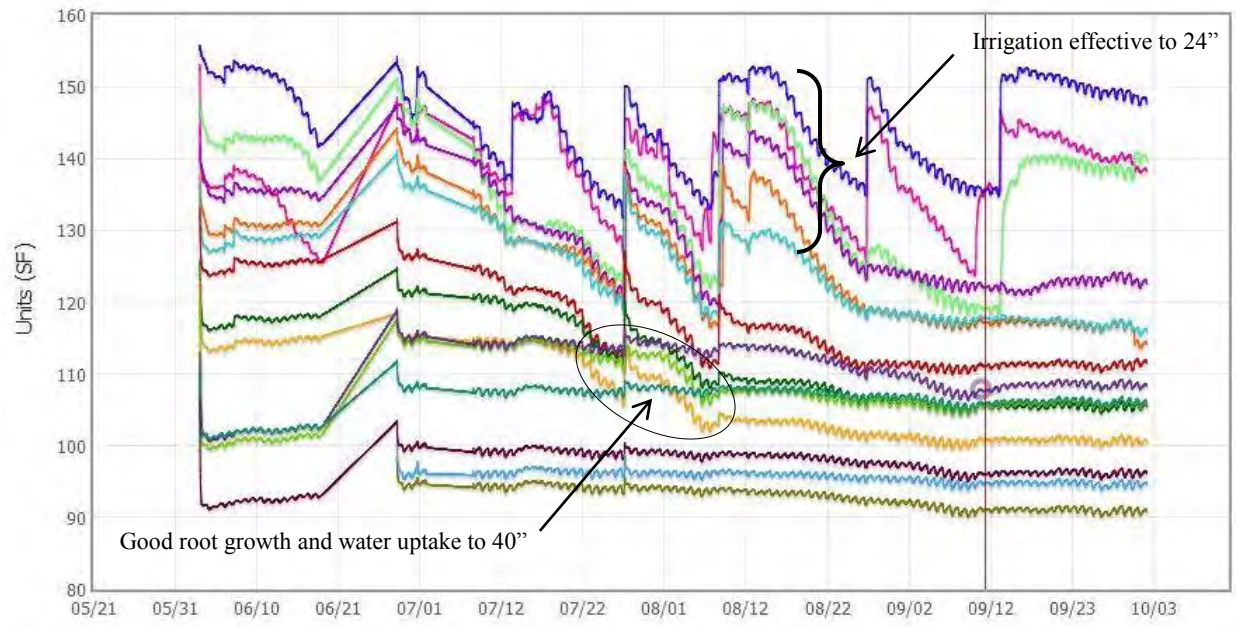


Figure 41: Gypsum Block Readings for Frische Brothers' Control Demonstration Field

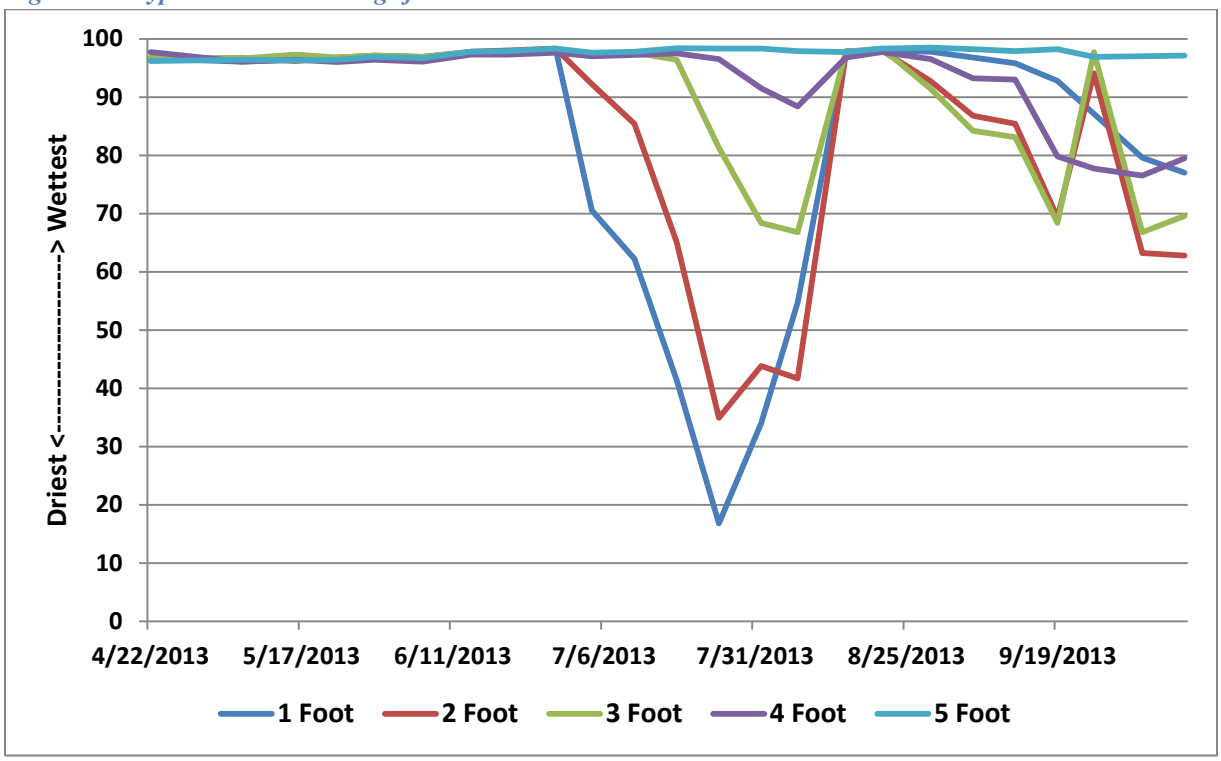


Figure 42: Growing Season Water Tracking for Frische Brothers' Control Demonstration Field (223 bu/ac)

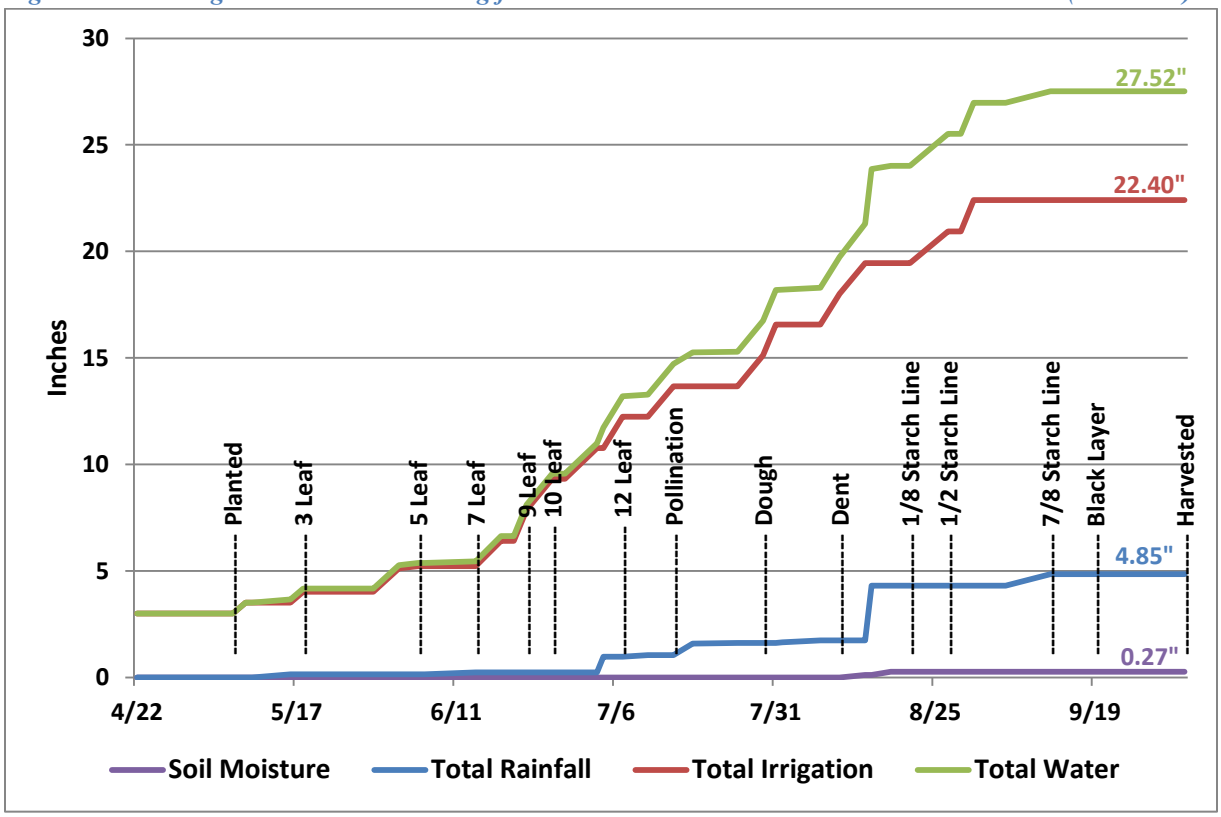


Table 40: Demonstration Field Data for Frische Brothers' Control Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
3/8	0.53		No Meter		0.0	0.0	0.0	0.0	0.0		180 N		Randy
4/22		3.00	PivoTrac™							Prewater		750	Leon
4/22			No Meter		96.6	96.5	96.8	97.7	96.2		191 N		Randy
5/7			0.02		96.1	96.7	96.6	96.1	96.4	Planted	180 N		Randy
5/9		0.51	PivoTrac™							Control		750	Leon
5/10												812	Randy
5/16	0.15		4.59		96.4	96.2	97.3	96.4	96.3		188 N		Randy
5/18		0.51	PivoTrac™	3 Leaf							180 Y	750	Leon
5/23			9.46	3 Leaf	96.7	96.8	96.8	96.0	96.4		195 N		R & C
5/29			9.75	3 Leaf	96.9	97.1	97.1	96.4	96.9	200-12	206 Y	778	R & C
6/2		1.09	PivoTrac™	4 Leaf						Control	180 N	750	Leon
6/5		0.11	PivoTrac™	5 Leaf						Control	180 Y	750	Leon
6/6			23.05	5 Leaf	96.4	96.9	96.9	96.1	96.7	200-12	299 Y	775	R & C
6/14	0.08		30.02	7 Leaf	97.8	97.8	97.7	97.3	97.8		167 N		R & C
6/18		1.19	PivoTrac™	8 Leaf						Control	180 Y	750	Leon
6/20			36.83	8 Leaf	97.8	98.0	97.7	97.3	97.9		354 N		R & C
6/22		1.46	PivoTrac™	9 Leaf						Control	180 Y	750	Leon
6/26		1.46	PivoTrac™	10 Leaf						Control	180 Y	750	Leon
6/28			56.56	10 Leaf	98.2	98.3	97.9	97.6	98.3		189 N		R & C
7/3		1.43	PivoTrac™	11 Leaf						Control	180 Y	750	Leon
7/4	0.74		72.76	11 Leaf	70.5	92.2	97.0	97.0	97.6	200-12	287 Y	776	Craig
7/7		1.47	PivoTrac™	12 Leaf						Control	180 Y	750	Leon
7/11	0.08		82.7	12 Leaf	62.2	85.4	97.6	97.2	97.8		200 N		R & C
7/15		1.44	PivoTrac™	Pollination						Control	180 Y	750	Leon
7/18	0.53		95.03	Pollination	41.4	65.1	96.4	97.5	98.4		194 N		R & C
7/25	0.04		95.03	Blister	16.8	34.9	81.3	96.5	98.3		194 N		R & C
7/29		1.45	PivoTrac™	Dough						Control	reverse	750	Leon
7/31		1.44	PivoTrac™	Dough						Control	2 N	750	Leon
8/1	0.02		113.5	Dough	34.0	43.8	68.4	91.5	98.3		2 N		Randy
8/7	0.09		118.26	Dough	54.7	41.7	66.8	88.4	97.9	Control	148 Y	667	R & C
8/10		1.44	PivoTrac™	Dent						Control	180 Y	750	Leon
8/14		1.45	PivoTrac™	Dent						Control	180 Y	750	Leon
8/15	2.57		131.28	Dent	97.9	97.6	97.8	96.8	97.7		183 N		R & C
8/18													
8/21			131.28	1/8 ml	98.0	98.0	98.3	97.7	98.3		182 N		Randy
8/27		1.49	PivoTrac™	1/2 ml						Control	360 Y	750	Leon
8/29			146.82	1/2 ml	97.8	92.7	91.4	96.5	98.5	Control	89 Y	758	Randy
8/31		1.46	PivoTrac™	3/4 ml						Control	360 N	750	Leon
9/5			150.26	3/4 ml	96.8	86.8	84.2	93.2	98.2		353 N		Randy
9/12	0.55		150.26	7/8 ml	95.8	85.4	83.1	93.0	97.9		353 N		Randy
9/19	1.13		150.26	Black Layer	92.8	69.3	68.4	79.8	98.2		353 N		Randy
9/25			150.26	Black Layer	87.1	94.1	97.7	77.7	96.9		353 N		Randy
10/3			150.26	Harvested	79.6	63.2	66.8	76.5	97.0		14 N		Randy
10/10			150.26	Harvested	77.0	62.8	69.6	79.5	97.1		14 N		Randy
Total	**4.85**	**22.40**			**0.00"**	**0.12"**	**0.17"**	**0.08"**	**-0.10"**				
Net Soil Moisture is 0.27"													
Irrigation, Rainfall Plus Net Soil Moisture is 27.52"													

- Numbers in red are not counted in the total

2013-Corn Demonstration
Irrigated Medium Season Corn

NORTH PLAINS GROUNDWATER Conservation District

Control

Year: *2013* **County:** *Moore* **Grower:** *Frische Brothers*

No. Acres: *54* **Hybrid:** *P1151AM* **Soil Type:** *Conlen Loam, Sunray Loam*

Meter Type: *Seametrics* **Tillage:** *Strip Till*

Meter Mult: *Ac Ft x 1* **Seeding:** *28,000*

Fertilizer: *152-11-1.5-3S* **Harvest:** *September 30*

Planted: *May 7* **Insecticide:** *Comite*

Herbicide: *Basic Blend, Atrazine, 2,4 D LV 6, Traxion, Laudis, Status*

Yield: *223 Bu/Acre* **Prev. crop:** *Milo* **Row width:** *30 Inch*

Irrigation method: *Center Pivot* **Prewater:** *3.00 in.* **Well GPM:** *3.5*

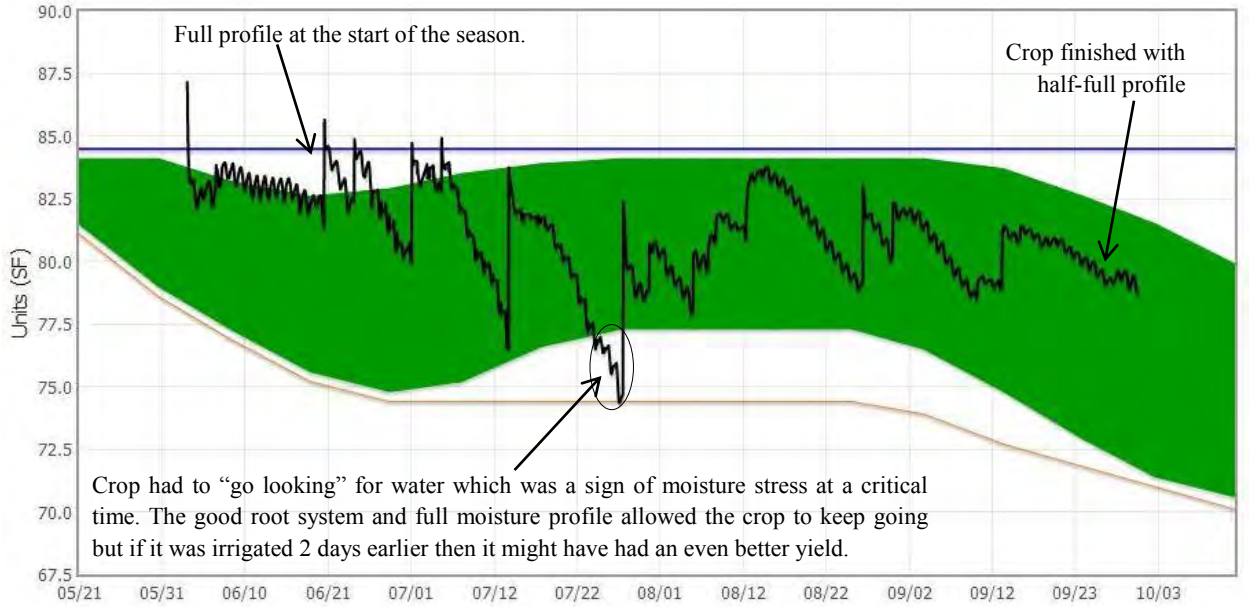
Distance between drops: *60"* **Distance from nozzle to ground:** *16"*

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

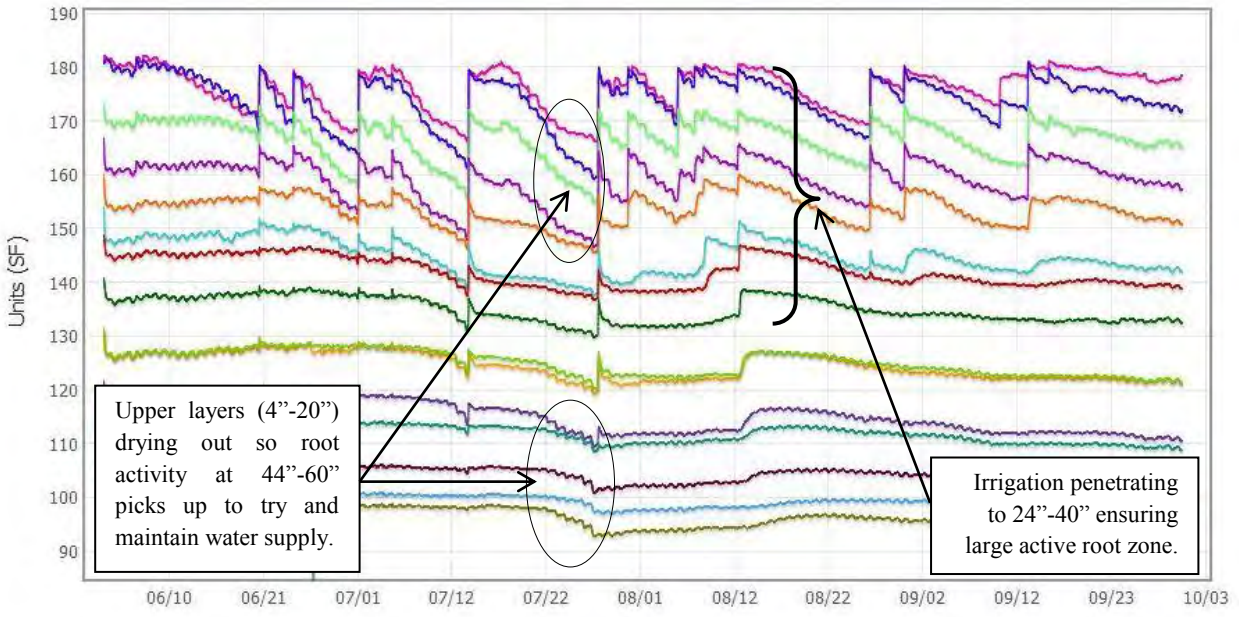
GPS Location of Pivot Pad
Latitude: *36.044706*
Longitude: *-101.824565*

GPS Location of Gypsum Blocks
Latitude: *36.047732*
Longitude: *-101.823592*

Frische Brothers' Control Field AquaSpy® Probe Summary



The 5" of extra irrigation water that the Control received compared to the "200-12" field seemed to set the crop up better at the start of the season and also provide more moisture during grain filling. This field started with a full profile of soil moisture and then rapid, deep root growth ensured full access to this supply. The profile was largely depleted by 7/28 but the next irrigation and the period from 7/28 to 8/12 ensured a buildup of stored soil moisture that allowed this crop to finish very well with minimal irrigation. If the crop was able to be irrigated a few days earlier than the irrigation on 7/28, then an even greater yield may have resulted.



Harvest Results: The "200-12" field produced a 176 bushel per acre corn yield. Irrigation totaled 17.01 inches of which three inches were pre-water. Production from the Control field was 223 bushels per acre. Irrigation was 22.40 inches. Pre-season irrigation was 3.00 inches in both fields and is included in total irrigation listed above. In comparison, the Control field produced 47 more bushels per acre than the "200-12" field. Irrigation was 5.39 inches more. Corn production was 13.23 bushels (747lbs) per inch of irrigation in the "200-12" field compared to 10.35 (579lbs) in the Control. Production from each inch of irrigation, rainfall and net soil water that totaled 21.84 inches was 8.06 bushels (451 lbs) per acre in the "200-12" field. Irrigation, rainfall and net soil water totaled 27.52 inches in the Control field where production was 8.01 bushels (448lbs) per inch. Crop production costs were $51.56 per acre less for the "200-12" field than for the Control from reduced irrigation and harvest expenses. At $5.13 per bushel, the 47 bushel per acre less corn yield in the "200-12" field amounts to $241.11 less per acre. The "200-12" field"s net loss was $189.56 per acre with 5.39 inches less irrigation used, compared to production from the Control field. Net return from the "200-12" field was $489.98 per acre, compared to $679.53 from the Control. Lack of available water in the "200-12" field at dent and grain maturity limited corn yield. A summary of the demonstration results are shown in table 41.

Table 41: Frische Brothers' 2013 Demonstration Results

	Irrigation (in.)	Total Water (in.)	Production		Crop Value @ $5.13/bu		
			bu/ac	lb/ac-in of Irrigation	Per Acre	Acre-in of Irrigation	Acre-in of Total Water
"200-12"	17.01	*21.84	176	579	$902.88	$53.08	$41.34
Control	22.40	†27.52	223	558	$1,143.99	$51.07	$51.57

*Includes -0.02 inches of water added to five feet of soil, plus rainfall, and irrigation.
†Includes 0.27 inches of water removed from five feet of soil, plus rainfall, and irrigation.

Phil Haaland's 2013 Hartley County Demonstration

Planting and Crop Information: For his demonstration, Phil Haaland strip tilled and planted 4 acres (124 to 136 degrees) of corn in the southwest quarter of the 120 acre circle located in the southwest quarter of section 44, for his "200-12" field, "Haaland 200-12". Haaland planted the 4 acres with Pioneer 1151AM at a seeding rate of 28,000 seed/acre. He planted the remaining 116 acres of the circle (136 to 124 degrees), also strip tilled, to P1151AM at 35,000 seeds per acre for his "Control" field, "Haaland Control". Both the "200-12" four acre field and 116 acre Control field were irrigated by the same center pivot. Seasonal water meter readings averaged 550 gpm. The center pivot delivered an average of 1.76 inches of irrigation in a normal 7.2 day revolution. PivoTrac™ provided a text message when the irrigation system entered and departed the "200-12" field. Planting and crop information for "Haaland 200-12" and "Haaland Control" are shown in table 42 below.

Table 42: Planting and Crop Information for Phil Haaland

"200-12" Demonstration Field			
Planted:	*May 15*	**Harvested:**	*October 9*
Hybrid:	*P1151AM*	**Seeding Rate:**	*28,000*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*4*	**GPM Per Acre:**	*4.6*
Total Water:	*23.77 in.*	**Soil Type:**	*Dallam Fine Sandy Loam*
Fertilizer:	*200-39-0*	**Insecticide:**	*Comite*
Herbicide:	*Cinch ATZ, Balance Flex, Roundup*		
Control Demonstration Field			
Planted:	*May 15*	**Harvested:**	*October 9*
Hybrid:	*P1151AM*	**Seeding Rate:**	*35,000*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*116*	**GPM Per Acre:**	*4.6*
Total Water:	*36.94 in.*	**Soil Type:**	*Sherm C L, Gruver L, Dallam FSL*
Fertilizer:	*260-39-0*	**Insecticide:**	*Comite*
Herbicide:	*Cinch ATZ, Balance Flex, Roundup*		

Beginning Soil Water Profile and Growing Season Rainfall

"200-12" Demonstration Field: Preseason irrigation totaled 3.01 inches in March prior to the gypsum blocks being installed. Weekly readings following installation and prior to 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 early-July when the crop used most water from 1 foot and about half from 2 feet, plus irrigation. One inch of beneficial rainfall in June helped for three days. The crop then used partial water from 2, 3 and 4 feet in the soil profile. For the demonstration, Phil chose to periodically skip irrigations on the "200-12" 4 acres. Irrigations were skipped on May 29 at 9 leaves, July 6 at 11 leaves, August 10 at the dough stage and August 24 at dent. However, even with reduced irrigation, the promising corn hybrids, planting dates and other management strategies produced a 191 bushel per acre yield. Rainfall totaled only 5.08 inches from planting until harvest. Several events of ½ to ¾ inches provided limited

needed help. Dallam fine sandy loam soil holds approximately 1.80 inches of available water per foot for potential crop use. Weekly gypsum block readings generally show adequate available soil water levels.

Control Demonstration Field: Soil water was good at 1, 2, 3, 4 and 5 feet in the profile after the gypsum blocks were installed in early May, but following 4.93 inches of pre-water. Weekly gypsum block readings generally show adequate soil water during the growing season. Plants used about 75 percent of available water from 1 and 2 feet and 40 percent from 3 feet in July, plus irrigation and rainfall. Limited water was used from 4 feet in July and again in mid-September. Rainfall totaled 5.08 inches during the growing season. Most helpful amounts were ½ to ¾ inch. Gypsum blocks were installed in Dallam fine sandy loam soil that holds about 1.80 inches of available water per foot.

Table 43: Monthly Rainfall Data for Phil Haaland

	May	June	July	August	September	Total
"200-12"	0.00"	1.02"	1.47"	2.42"	0.17"	**5.08"**
Control	0.00"	1.02"	1.47"	2.42"	0.17"	**5.08"**

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 each Control field. Both the gypsum block sensors and the soil probe were installed in close proximity to each other in the field. Gypsum blocks were installed in the "200-12" fields and most Control fields prior to planting. Each AquaSpy® probe was installed following crop emergence, as well as gypsum blocks in any remaining fields. Installing and reading the gypsum blocks prior to planting provided advanced soil moisture conditions and information to help guide and manage irrigation. 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 same illustrations for the Control field.

Figure 43: Gypsum Block Readings for Phil Haaland's "200-12" Demonstration Field

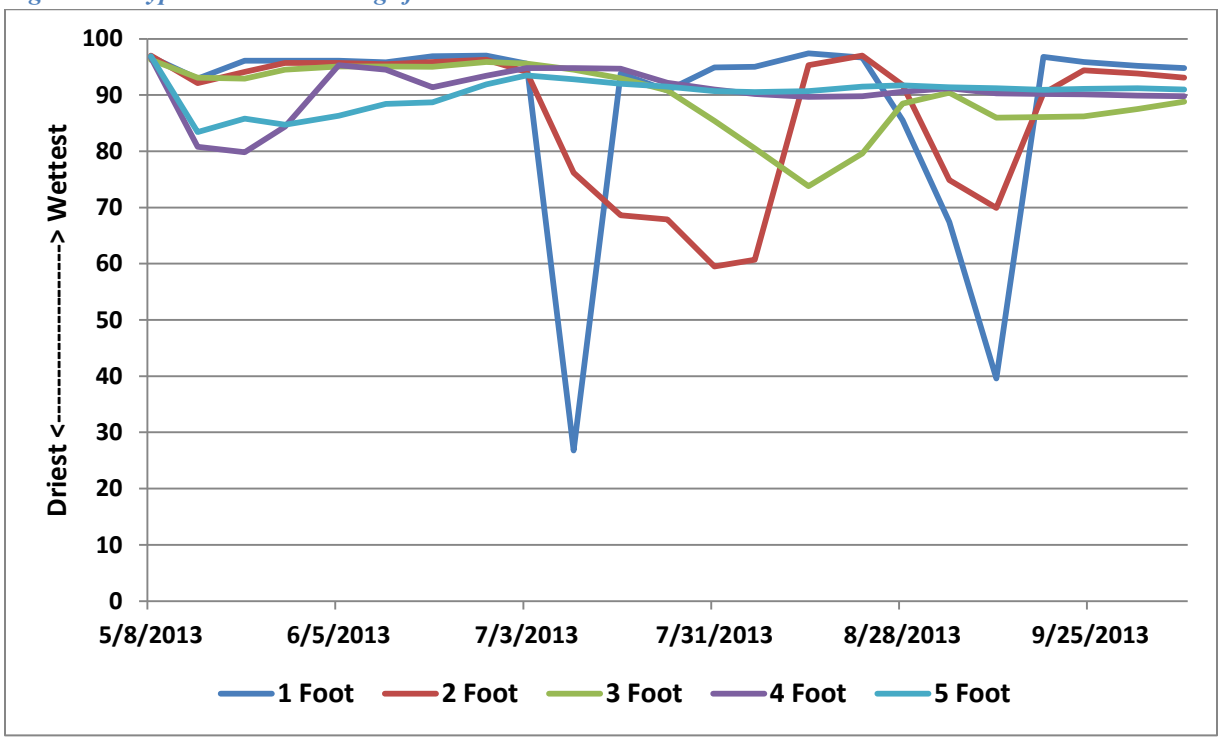


Figure 44: Growing Season Water Tracking for Phil Haaland's "200-12" Demonstration Field (191 bu/ac)

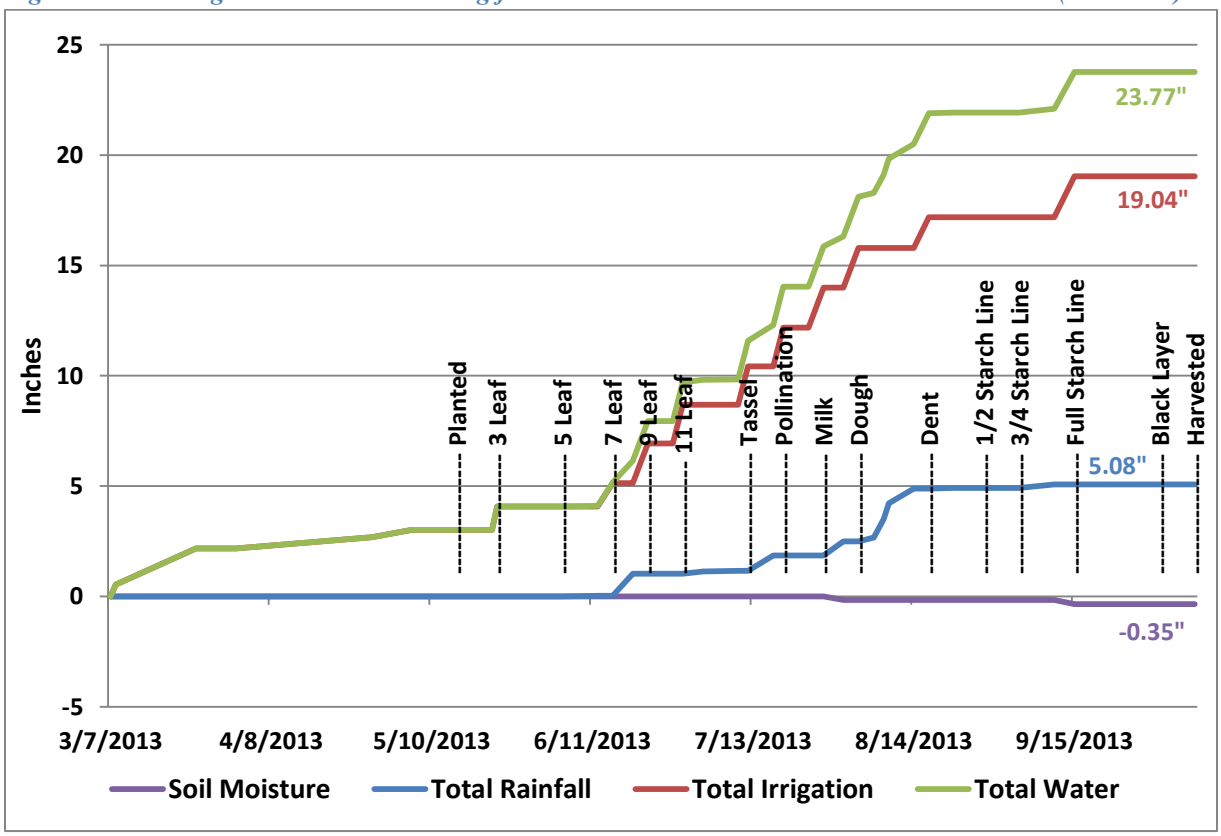


Table 44: Demonstration Field Data for Phil Haaland's "200-12" Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
3/7	No Gauge		157133		No Gypsum Blocks					Prewater	256 Y	425	Randy
3/8		0.53	PivoTrac™							Prewater	281	425	Leon
3/24		1.64	PivoTrac™							Prewater	227	425	Leon
4/1			216151							Prewater	116 N		Randy
4/28		0.51	PivoTrac™							Prewater	168	425	Leon
5/6		0.33	PivoTrac™							Prewater	161	425	Leon
5/8			299901		96.8	97.0	96.3	96.7	96.9	Prewater	161 N		R & L
5/15	No Gauge		299901		92.9	92.1	93.1	80.8	83.4	Planted	141 md		Randy
5/22			328189		96.1	94.1	92.9	79.8	85.8		63 Y	428	R & C
5/23		1.06	PivoTrac™	3 Leaf						Control	122	425	Leon
5/28			365501	3 Leaf	96.1	95.7	94.5	84.4	84.7	Control	88 Y	397	R & C
6/5			401135	5 Leaf	96.1	95.7	95.1	95.3	86.3		127 N		R & C
6/12	0.03		401135	5 Leaf	95.8	95.5	95.1	94.5	88.4		126 N		R & C
6/15		1.06	PivoTrac™	7 Leaf						Split	136	575	Leon
6/19	0.99		431446	7 Leaf	96.9	95.9	95.0	91.4	88.7	Control	321 Y	575	R & C
6/22		1.80	PivoTrac™	9 Leaf						Split	136	575	Leon
6/27			495600	9 Leaf	97.0	96.3	95.9	93.4	91.9	Control	10 Y	554	R & C
6/29		1.75	PivoTrac™	11 Leaf						Split	136	575	Leon
7/3	0.11		543637	11 Leaf	95.6	94.1	95.6	94.8	93.5	Control	329 Y	384	R & C
7/10	0.02		599511	11 Leaf	26.8	76.2	94.5	94.8	92.8	Control	10 Y	580	R & C
7/12		1.75	PivoTrac™	Tassel						Split	136	575	Leon
7/17	0.71		655351	Tassel	93.8	68.6	93.0	94.7	92.0	Control	7 Y	557	R & C
7/19		1.75	PivoTrac™	Pollination						Split	136	575	Leon
7/24			710808	Pollination	90.8	67.9	90.8	92.2	91.5	Control	359 Y	584	R & C
7/27		1.82	PivoTrac™	Milk						Split	136	575	Leon
7/31	0.63		768488	Milk	94.9	59.5	85.4	91.0	90.7	Control	344 Y	570	Randy
8/3		1.79	PivoTrac™	Dough						Split	136	575	Leon
8/6	0.17		817048	Dough	95.0	60.7	80.5	90.2	90.5	Control	286 Y	569	R & C
8/8	0.84												
8/9	0.72												
8/14	0.66		881431	Dough	97.4	95.3	73.8	89.7	90.7	Control	315 Y	544	R & C
8/17		1.40	PivoTrac™	Dent						Split	136	575	Leon
8/22	0.03		947288	Dent	96.7	97.0	79.6	89.8	91.5	Control	315 Y	591	Randy
8/28			995628	1/2 ml	85.5	91.8	88.5	90.6	91.7	Control	311 Y	587	Randy
9/4			51653	3/4 ml	67.4	74.9	90.4	91.2	91.4	Control	314 Y	566	Randy
9/11	0.17		107774	7/8 ml	39.6	69.9	86.0	90.3	91.2	Control	309 Y	529	Randy
9/15		1.85	PivoTrac™	1.0 ml						Split	136	575	Leon
9/18	1.40		149384	1.0 ml	96.8	90.3	86.1	90.2	90.9		119 N		Randy
9/24	0.12		149384	1.0 ml	95.9	94.4	86.2	90.1	91.1		119 N		Randy
10/2			149384	Black Layer	95.2	93.8	87.5	89.9	91.2		119 N		Randy
10/9			149384	Harvested	94.8	93.1	88.8	89.8	91.0		119 N		Randy
10/16	0.05		149384	Harvested	93.9	92.3	89.6	89.8	n/a		119 N		Randy
Total	**5.08**	**19.04**			**-0.21”**	**0.09”**	**0.24”**	**0.27”**	**-0.20”**				
Net Soil Moisture is -0.35"													
Irrigation, Rainfall Plus Net Soil Moisture is 23.77"													

- Numbers in red are not counted in the total

NORTH PLAINS GROUNDWATER Conservation District

2013-Corn Demonstration
Irrigated Medium Season Corn

200-12

Year: *2013* **County:** *Hartley* **Grower:** *Phil Haaland*

No. Acres: *4* **Hybrid:** *P1151AM* **Soil Type:** *Dallam Fine Sandy Loam*

Meter Type: *McCrometer*

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

Fertilizer: *200-39-0* **Seeding:** *28,000*

Planted: *May 15* **Harvest:** *October 9*

Herbicide: *Cinch ATZ, Balance Flex, Roundup* **Insecticide:** *Comite*

Yield: *191 bu/ac* **Prev. crop:** *Wheat* **Row width:** *30 Inch*

Irrigation method: *Center Pivot* **Prewater:** *3.01 in.* **GPM/acre:** *4.6*

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

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

GPS Location of Pivot Pad

Latitude: *36.040321*

Longitude: *-102.437642*

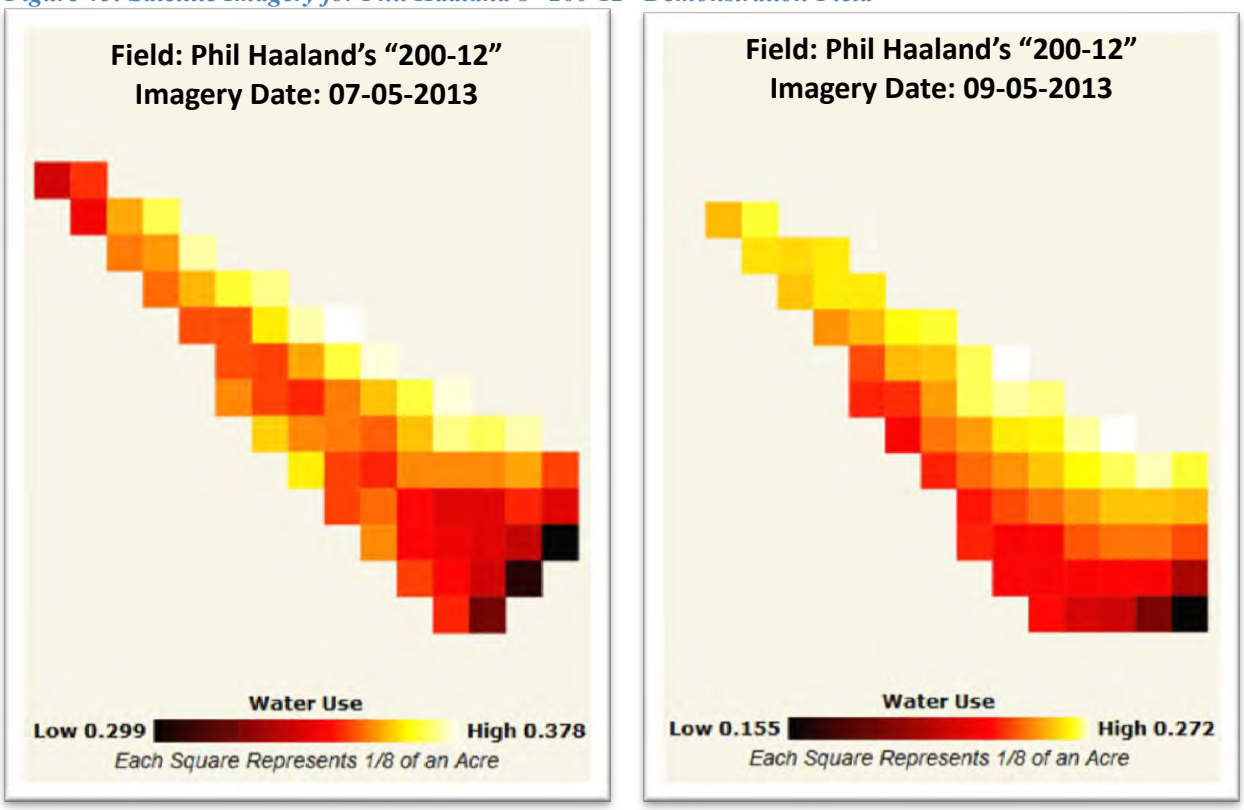
GPS Location of Gypsum Blocks

Latitude: *36.038132*

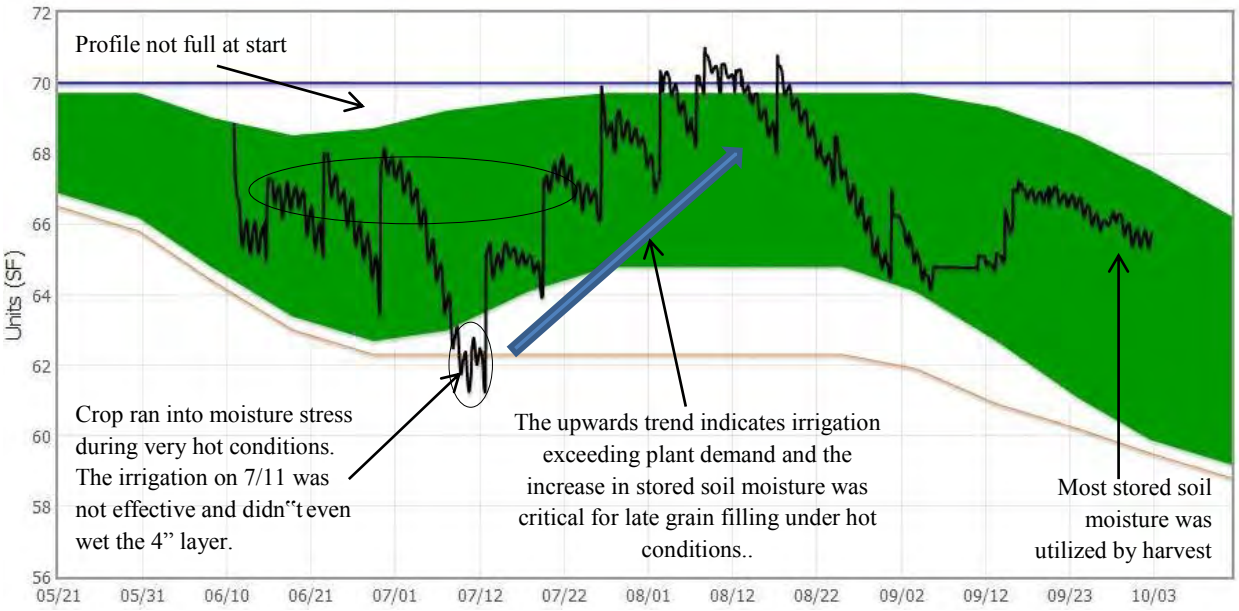
Longitude: *-102.434607*

Satellite Imagery: Satellite imagery was initiated in combination with HydroBio in 2013 and used to learn and evaluate its potential for an irrigation and water management tool for growers. Phil Haaland's "200-12" and Control (L1) fields were two of the ten "200-12" project fields included in 2013. A website was established and made available to project cooperators and District staff. We learned that satellite imagery has potential, but requires additional development, especially in establishing beginning soil moisture and monitoring the soil profile and root zone during the growing season. Two satellite images of Phil Haaland's "200-12" field, one on July 5th at the 11 leaf growth stage and another on September 5th at ¾ grain maturity are shown in figure 45 to illustrate examples of what is displayed on the website. Areas in white are the highest daily water use. The satellite imagery data changes when the next satellite passes, usually in three day increments.

Figure 45: Satellite Imagery for Phil Haaland's "200-12" Demonstration Field



Phil Haaland's "200-12" Field AquaSpy® Probe Summary



This field did not have a full soil moisture profile at the start of the season and this was largely due to drier subsoil (40"-60"). This might also be a reason in why this field did not show any root activity or water uptake below 40". This crop experienced hot conditions and high water demand over the first 10 days of July and the data indicates that the crop experienced moisture stress at the end of this cycle. This period of moisture stress might have hurt the yield potential through shorter ears or pollination problems, otherwise there seemed to be adequate moisture for the remainder of the reproductive period. The crop did, however experience another dry spell during late Aug & early Sept which may have affected test weight.

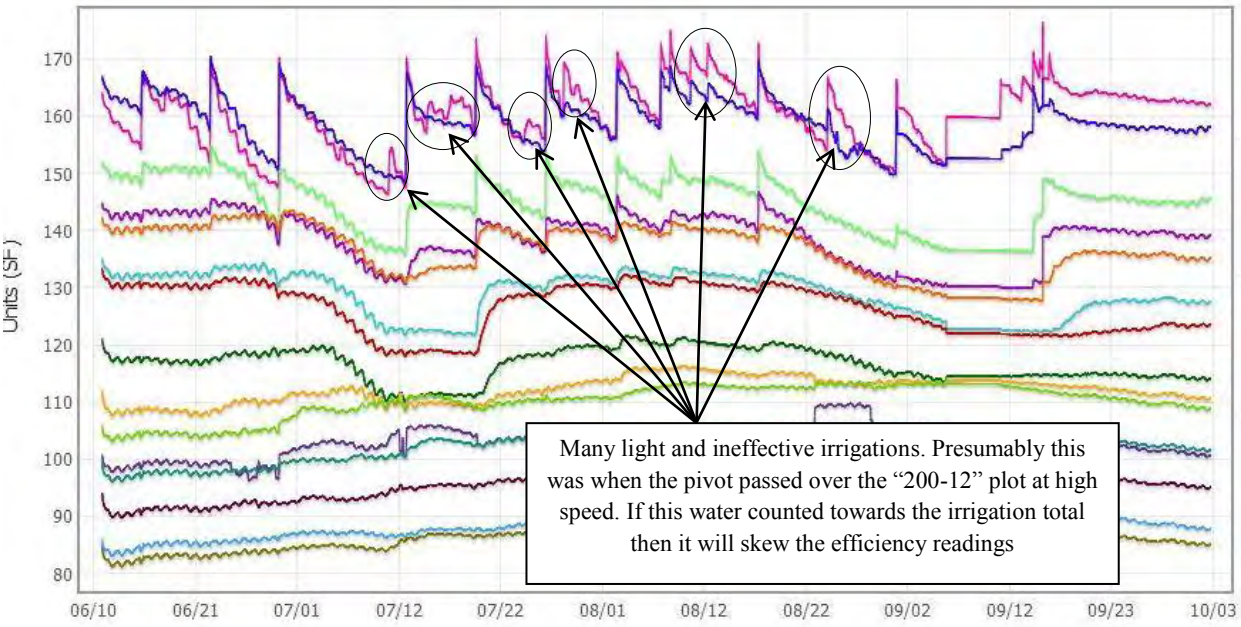


Figure 46: Gypsum Block Readings for Phil Haaland's Control Demonstration Field

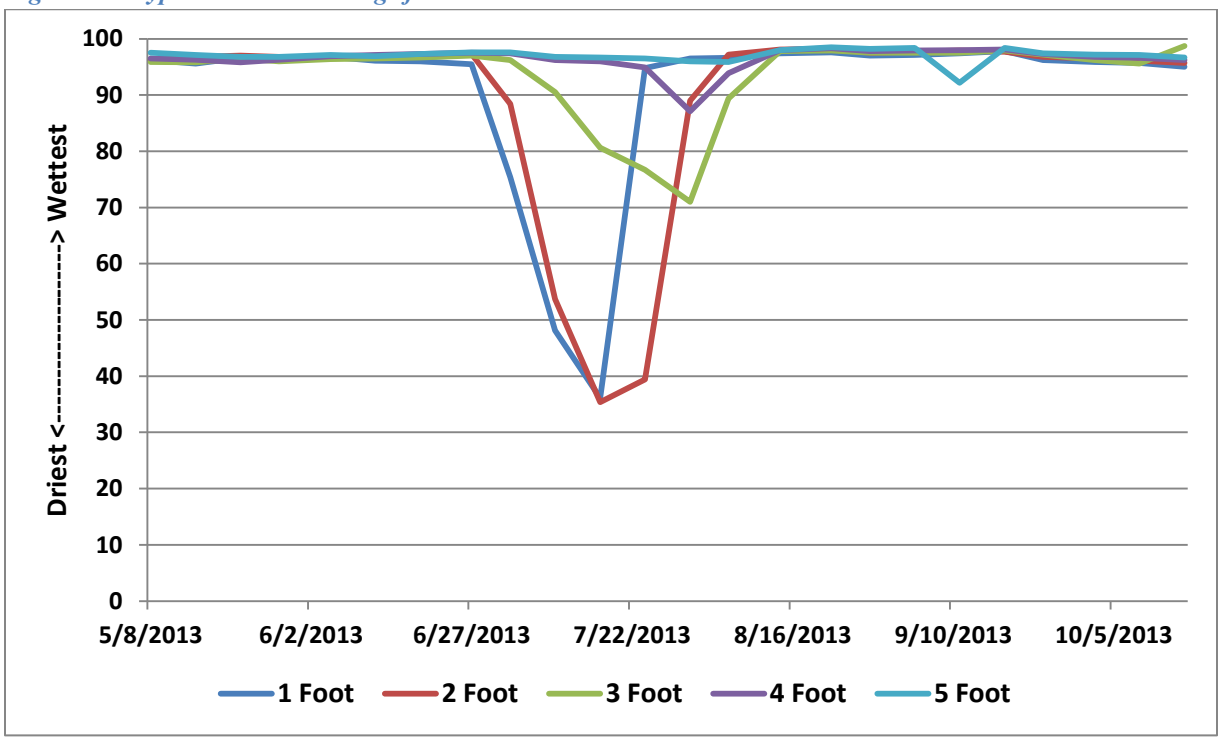


Figure 47: Growing Season Water Tracking for Phil Haaland's Control Demonstration Field (287 bu/ac)

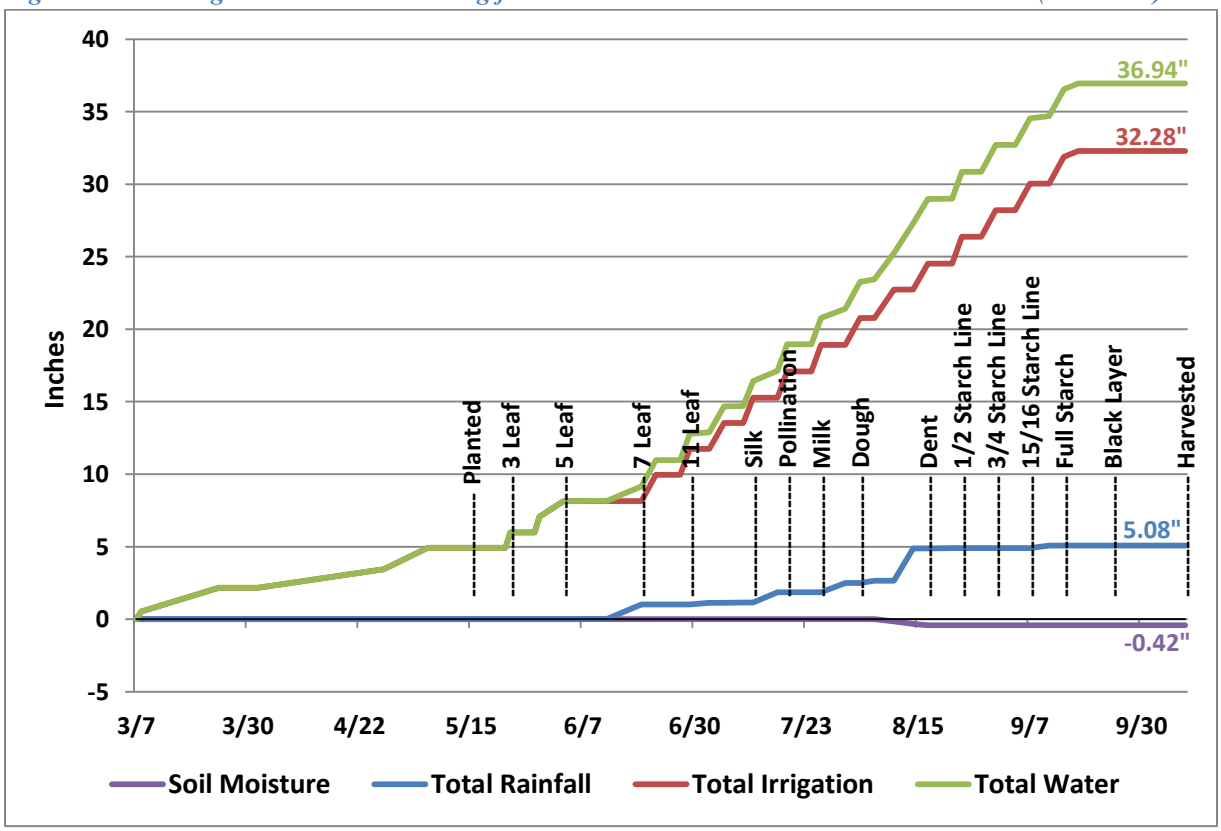


Table 45: Demonstration Field Data for Phil Haaland's Control Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
3/7	No Gauge		157133		No Gypsum Block					Prewater	256 Y	425	Randy
3/8		0.53	PivoTrac™							Prewater	281	425	Leon
3/24		1.64	PivoTrac™							Prewater	227 Y	425	Leon
4/1			216151							Stop	116 N		Randy
4/27		1.28	PivoTrac™							Prewater	110 Y		Leon
5/6		1.48	PivoTrac™							Prewater	112 Y		Leon
5/8			299901		96.2	96.3	95.9	96.5	97.5	Stop	161 N		R & L
5/15			299901		95.6	96.8	95.8	96.3	97.1	Planted	141 md		Randy
5/22			329189		96.6	97	96.5	95.8	96.8	Control	63 Y cw	428	R & C
5/23		1.06	PivoTrac™	3 Leaf						Control	122 Y	425	Leon
5/28			365501	3 Leaf	96.8	96.8	96	96.3	96.8	Control	88 Y	397	R & C
5/29		1.08	PivoTrac™	4 Leaf						Control	122 Y	425	Leon
6/3		1.07	PivoTrac™	5 Leaf						Control	124 N	425	Leon
6/5			401135	5 Leaf	96.8	96.8	96.4	96.9	97.1		127 N		R & C
6/12	0.03		401135	5 Leaf	96.1	96.9	96.5	97.1	96.9		126 N		R & C
6/19	0.99		431446	7 Leaf	96	97.1	96.7	97.3	97.3	Control	321 Y	575	R & C
6/22		1.81	PivoTrac™	10 Leaf						Control	124 Y	575	Leon
6/27			495600	10 Leaf	95.5	97.3	97	97.5	97.6	Control	10 Y	554	R & C
6/29		1.80	PivoTrac™	11 Leaf						Control	124 Y	575	Leon
7/3	0.11		543637	11 Leaf	75.4	88.4	96.2	97.4	97.6	Control	329 Y	384	R & C
7/6		1.79	PivoTrac™	11 Leaf						Control	124 Y	575	Leon
7/10	0.02		599511	11 Leaf	48.1	53.7	90.5	96.2	96.8	Control	10 Y	580	R & C
7/12		1.73	PivoTrac™	Silk						Control	124 Y	575	Leon
7/17	0.71		655351	Silk	36.1	35.4	80.6	96	96.7	Control	7 Y	557	R & C
7/19		1.82	PivoTrac™	Pollination						Control	124 Y	575	Leon
7/24			710808	Pollination	94.8	39.4	76.7	94.9	96.5	Control	359 Y	586	R & C
7/26		1.82	PivoTrac™	Milk						Control	124 Y	575	Leon
7/31	0.63		768488	Milk	96.5	89	71	87.1	96	Control	344 Y	570	Randy
8/3		1.86	PivoTrac™	Dough						Control	124 Y	575	Leon
8/6	0.17		817048	Dough	96.6	97.2	89.4	93.9	95.9	Control	286 Y	570	R & C
8/10		1.97	PivoTrac™	Dough						Control	124 Y	575	Leon
8/14	2.22		881431	Dough	97.4	98.1	97.8	98	98	Control	315 Y	544	R & C
8/17		1.77	PivoTrac™	Dent						Control	124 Y	575	Leon
8/22	0.03		947288	Dent	97.6	98.2	97.9	98.3	98.5	Control	315 Y	591	Randy
8/24		1.86	PivoTrac™	1/2 ml						Control	124 Y	575	Leon
8/28			995628	1/2 ml	97	97.5	97.5	97.8	98.2	Control	311 Y	587	Randy
8/31		1.84	PivoTrac™	3/4 ml						Control	124 Y	575	Leon
9/4			51653	3/4 ml	97.1	97.7	97.5	97.9	98.4	Control	314 Y	566	Randy
9/7		1.83	PivoTrac™	15/16 ml						Control	124 Y	575	Leon
9/11	0.17		107774	15/16 ml	97.4	97.9	97.5	98	92.2	Control	309 Y	529	Randy
9/14		1.85	PivoTrac™	1.0 ml						Control	124 Y	575	Leon
9/17		0.39	PivoTrac™	1.0 ml						Control	124 Y	575	Leon
9/18	1.40		149384	1.0 ml	97.8	97.7	97.9	98.1	98.4		119 N		Randy
9/24	0.12		149384	Black Layer	96.2	96.8	97.2	97.3	97.4		119 N		Randy
10/2			149384	Black Layer	95.9	96.5	96.2	96.8	97.2		119 N		Randy
10/9			149384	Harvested	95.7	96.1	95.6	96.6	97.1		119 N		Randy
10/16	0.05		149384	Harvested	95	95.7	98.7	96.2	96.7		119 N		Randy
Total	**5.08**	**32.28**			**-0.10”**	**-0.06”**	**-0.11”**	**-0.10”**	**-0.05”**				
Net Soil Moisture is -0.42"													
Irrigation, Rainfall Plus Net Soil Moisture is 36.94"													

- Numbers in red are not counted in the total

2013-Corn Demonstration
Irrigated Medium Season Corn

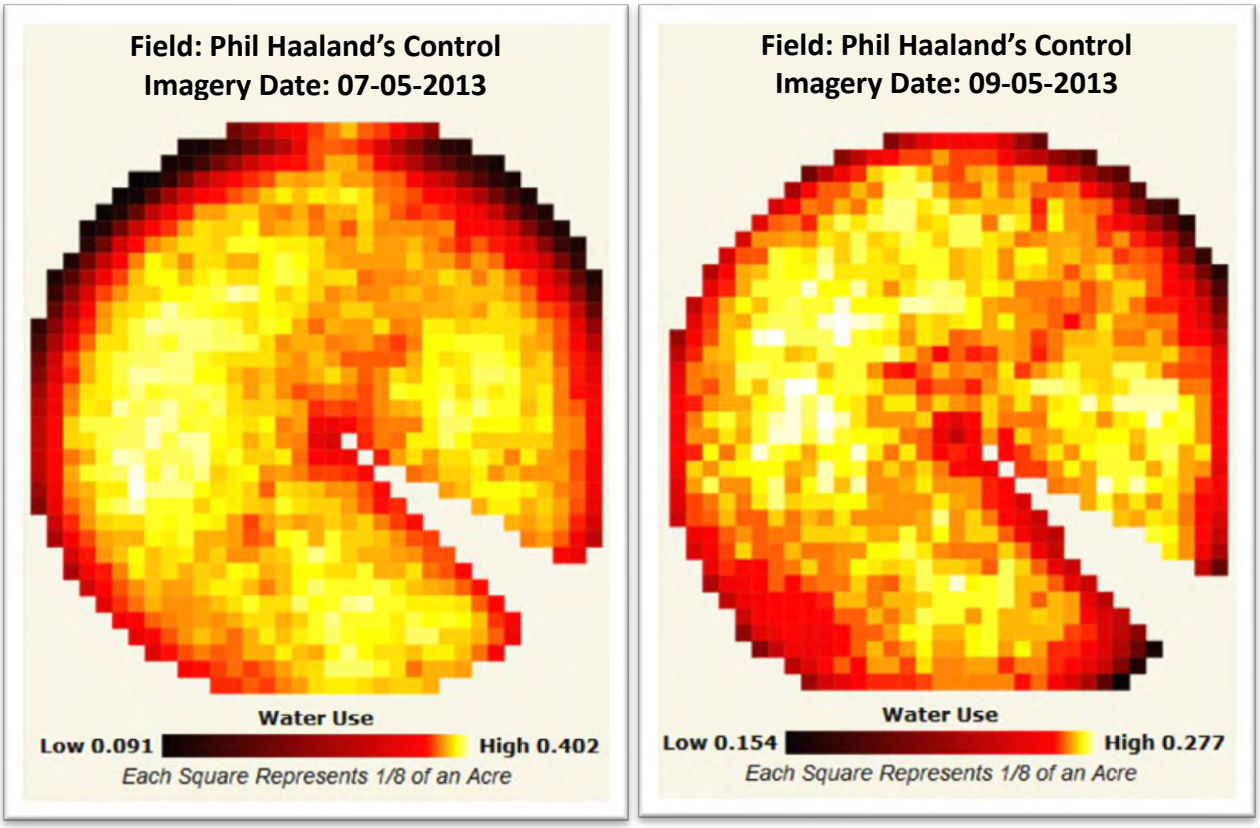
Control

Year:	*2013*	**County:**	*Hartley*	**Grower:**	*Phil Haaland*
No. Acres:	*116*	**Hybrid:**	*P1151AM*	**Soil Type:**	*Sherm Clay Loam, Gruver Loam, Dallam Fine Sandy Loam*
Meter Type:	*McCrometer*				
Meter Mult:	*Gallons X 100*	**Tillage:**	*Strip Till*		
Fertilizer:	*200-39-0*	**Seeding:**	*35,000*		
Planted:	*May 15*	**Harvest:**	*October 25*		
Herbicide:	*Cinch ATZ, Balance Flex, Roundup*	**Insecticide:**	*Comite*		
Yield:	*287 bu/ac*	**Prev. crop:**	*Wheat*	**Row width:**	*30 inch*
Irrigation method:	*Center Pivot*	**Prewater:**	*4.93 in.*	**GPM/acre:**	*4.6*
Distance between drops:	*60"*	**Distance from nozzle to ground:**	*16"*		
Application pattern:	*Spray*	**Crop row direction :**	*Straight*		

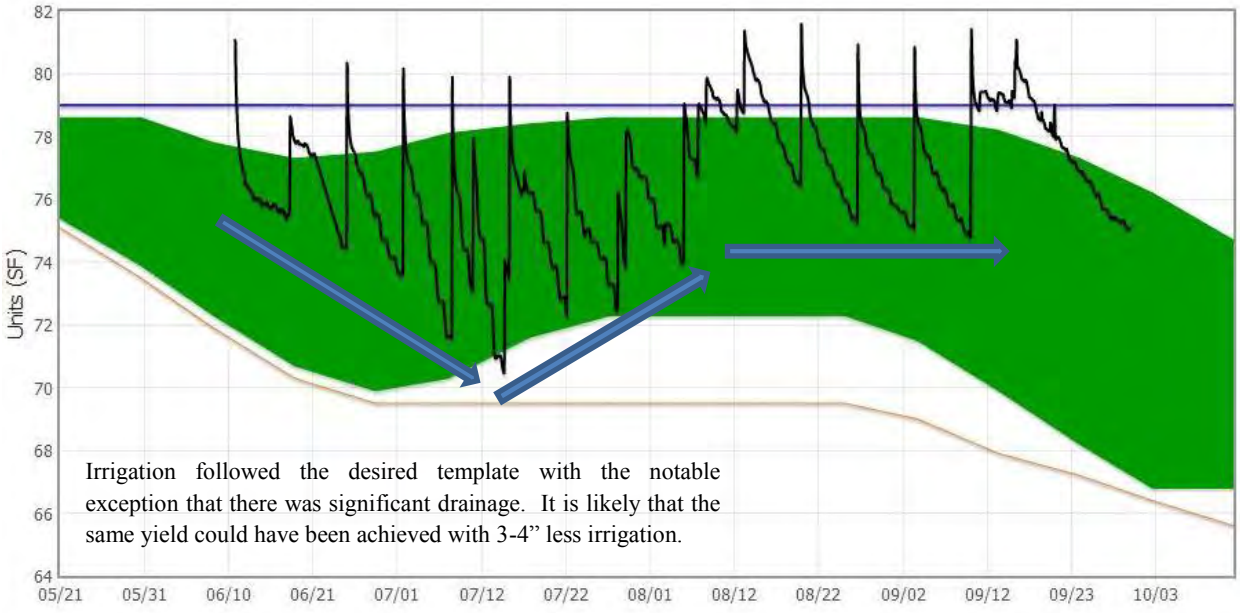
GPS Location of Pivot Pad		**GPS Location of Gypsum Blocks**	
Latitude:	*36.040321*	Latitude:	*36.037127*
Longitude:	*-102.437642*	Longitude:	*-102.436825*

Satellite imagery: Satellite imagery was initiated in combination with HydroBio in 2013 and used to learn and evaluate its potential for an irrigation and water management tool for growers. Phil Haaland"s "200-12" and Control (L1) field were two of ten "200-12" project fields included in 2013. A website was established and made available to project cooperators and District staff. We learned that satellite imagery has potential, but requires additional development, especially in establishing beginning soil moisture and monitoring the soil profile and root zone during the growing season. Two satellite images of Phil Haaland"s Control field, one on July 5 at the 11 leaf growth stage and another on September 5 at ¾ grain maturity are shown in figure 48 to illustrate examples of what is displayed on the website. Areas in white are the highest daily water use. The satellite imagery data changes when the next satellite passes, usually in three day increments.

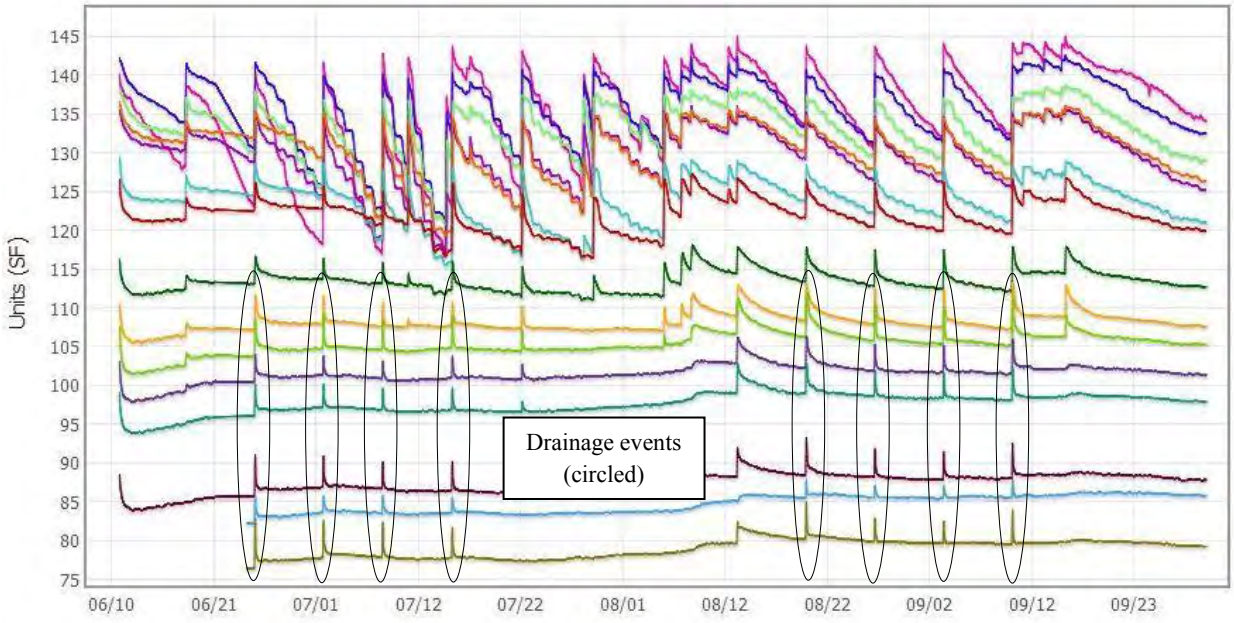
Figure 48: Satellite Imagery for Phil Haaland's Control Demonstration Field



Phil Haaland's Control Field AquaSpy® Probe Summary



This field had the highest yield with almost the lowest water use efficiency and the reason is due to significant drainage. The graphs show drainage at almost every irrigation event and this would not only cause a loss in water but also leaching of nutrients. It is highly likely that at least 2 irrigations could have been saved without any yield reduction and this would have resulted in a 3-4" water saving and increased water use efficiency. The excess irrigation caused a 28"active root zone, limiting nutrient uptake and increasing the possibility of lodging.



Harvest Results: The "200-12" field produced a 191 bushel per acre corn yield. Irrigation totaled 19.04 inches, of which 3.01 were pre-water. Production in the Control field was 287 bushels per acre. Total irrigation was 32.28 inches. Seasonal irrigation was 27.35 inches plus 4.93 inches of pre-water. In comparison, the "200-12" field produced 96 bushels per acre less than the Control and irrigation was 13.24 inches less. Corn production was 10.03 bushels (562lbs) per inch of irrigation in the "200-12" field compared to 8.89 bushels (498lbs) in the Control. Production from each inch of irrigation, rainfall and net soil water that totaled 23.77 inches was 8.04 bushels (450lbs) per acre in the "200-12" field. Irrigation, rainfall and net soil water totaled 36.94 inches in the Control field where production was 7.77 bushels (431lbs) per inch. Crop production costs were $180.23 per acre less for the "200-12" field than for the Control from reduced seed, irrigation and harvest expenses. At $5.13 per bushel, the 96 more bushels per acre corn yield in the Control field amounts to $492.48 more per acre. The Control field"s net gain was $312.25 per acre with 13.24 inches more irrigation used compared to production from the "200-12" field. Net return was $548.43 from the "200-12" field compared to $860.68 from the Control. Net return from the additional 13.24 inches of irrigation was $23.58 per inch. Haaland says, "We could never get any really beneficial rain again, so we had to keep pumping". It just would not rain here. A one inch rain at any time would have really helped, but it never happened". A summary of the demonstration results are shown in table 46.

Table 46: Phil Haaland's 2013 Demonstration Results

	Irrigation (in.)	Total Water (in.)	Production		Crop Value @ $5.13/bu		
			bu/ac	lb/ac-in Irrigation	Per Acre	Acre-in of Irrigation	Acre-in of Total Water
"200-12"	19.04	*23.77	191	562	$979.83	$51.46	$41.22
Control	32.28	†36.94	287	498	$1,472.31	$45.61	$39.86

*Includes -0.35 inches of water added to five feet of soil, plus rainfall, and irrigation.
†Includes -0.42 inches of water added to 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, irrigation amount and other information to help maintain optimum 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" 4 acre field. Irrigation totaled 19.04 inches and rainfall 5.08 inches.

Table 47: 2013 Corn Yields from Different Seeding Rates of P1151AM

Hybrid	Seeding Rate	Yield
P1151AM	24,000	193
P1151AM	28,000	191 ("200-12" Yield)
P1151AM	20,000	187
P1151AM	16,000	180

David Ford's 2013 Hartley County Demonstration

Planting and Crop Information: For his demonstration, David Ford strip tilled and planted 60 acres of corn in the east half circle of the northwest quarter of section 206, for his "200-12" field, "Ford 200-12". Ford planted the east half circle with Pioneer 1151AM at a seeding rate of 28,000 seeds/acre. He planted the west half 60 acres, also strip tilled, in the northwest quarter of section 206 to P1151AM at 28,000 seeds/acre for his "Control" field, "Ford Control". Both the "200-12" east half circle field and west Control field were irrigated using the same center pivot. Seasonal water meter readings averaged 500 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 table 48 below.

Table 48: Planting and Crop Information for David Ford

"200-12" Demonstration Field			
Planted:	*May 15*	**Harvested:**	*October 14*
Hybrid:	*P1151AM*	**Seeding Rate:**	*28,000*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*60*	**GPM Per Acre:**	*4.1*
Total Water:	*27.92 in.*	**Soil Type:**	*Sherm Clay Loam*
Fertilizer:	*150-0-0, 4 Ton Compost*	**Insecticide:**	*Comite*
Herbicide:	*Balance, Roundup, Stratego*		
Control Demonstration Field			
Planted:	*May 15*	**Harvested:**	*October 14*
Hybrid:	*P1151AM*	**Seeding Rate:**	*28,000*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*60*	**GPM Per Acre:**	*4.1*
Total Water:	*31.00 in.*	**Soil Type:**	*Dumas Loam, Gruver Loam*
Fertilizer:	*150-0-0, 4 Ton Compost*	**Insecticide:**	*Comite*
Herbicide:	*Balance, Roundup, Stratego*		

Beginning Soil Water Profile and Growing Season Rainfall

"200-12" Demonstration Field: Preseason gypsum block readings show soil water was good at 1 and 2 feet, about 40 percent at 3 feet and 80 percent at 4 and 5 feet. Additional readings indicate pre-water partially refilled the soil profile at 3 feet prior to planting. Ford chose to apply 2.32 inches of pre-water to the "200-12" field. Gypsum block soil moisture sensors show that plants depleted soil water at 1 and 2 feet in July, but only limited changes in levels at 3 feet and no changes at 4 and 5 feet. This can indicate shallow root development and a reason for reduced corn yield in the "200-12" field. Sherm Clay Loam soil holds approximately 2.00 inches of available water per foot for potential crop use. Rainfall in September refilled the soil profile at 1, 2 and 3 feet, but it was late to help crop production because plants were approaching full grain maturity. Rainfall totaled 7.57 inches from planting until harvest. It was just more than one inch in June and two inches in July and August. Gypsum blocks were installed in Sherm Clay Loam in April prior to planting.

Control Demonstration Field: Early season soil moisture was good at 1, 2, 3, 4, and 5 feet, according to the gypsum block readings. Levels were maintained with irrigation plus 1.10 inches of rainfall in June. Plant roots began to use water from 2 and 3 in July and from 1 and 4 feet in August. The crop emptied the soil profile to 5 feet by early September and used all irrigation and rainfall, too. There was significantly more root growth and water use from the soil profile in the Control field compared to the "200-12" field. Rainfall in mid-September refilled the soil profile to 5 feet. Rainfall totaled 7.27 inches for the growing season. There was no rainfall in May and 1.10 inches in June. July and August rainfall totaled 4.12 inches. Gypsum block soil moisture sensors were installed in Gruver Loam soil that holds 2.0 inches of available water per foot for crop use. Rainfall during the growing season is listed in table 49.

Table 49: Monthly Rainfall Data for David Ford

	May	June	July	August	September	Total
"200-12"	0.00"	1.10"	2.05"	2.07"	2.05"	**7.27"**
Control	0.00"	1.10"	2.05"	2.07"	2.05"	**7.27"**

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 each Control field. Both the gypsum block sensors and the soil probe were installed in close proximity to each other in the field. Gypsum blocks were installed in the "200-12" fields and most Control fields prior to planting. Each AquaSpy® probe was installed following crop emergence, as well as gypsum blocks in any remaining fields. Installing and reading the gypsum blocks prior to planting provided advanced soil moisture conditions and information to help guide and manage irrigation. 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 same illustrations for the Control field.

Figure 49: Gypsum Block Readings for David Ford's "200-12" Demonstration Field

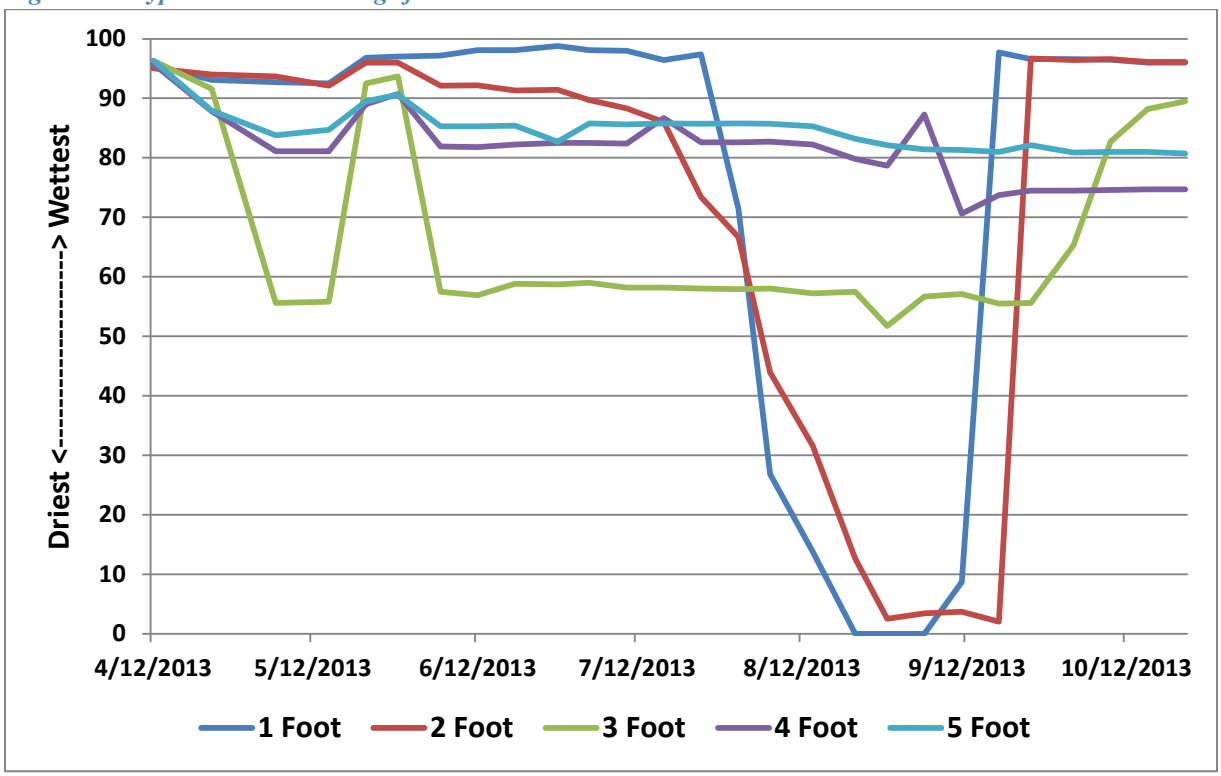


Figure 50: Growing Season Water Tracking for David Ford's "200-12" Demonstration Field (178 bu/ac)

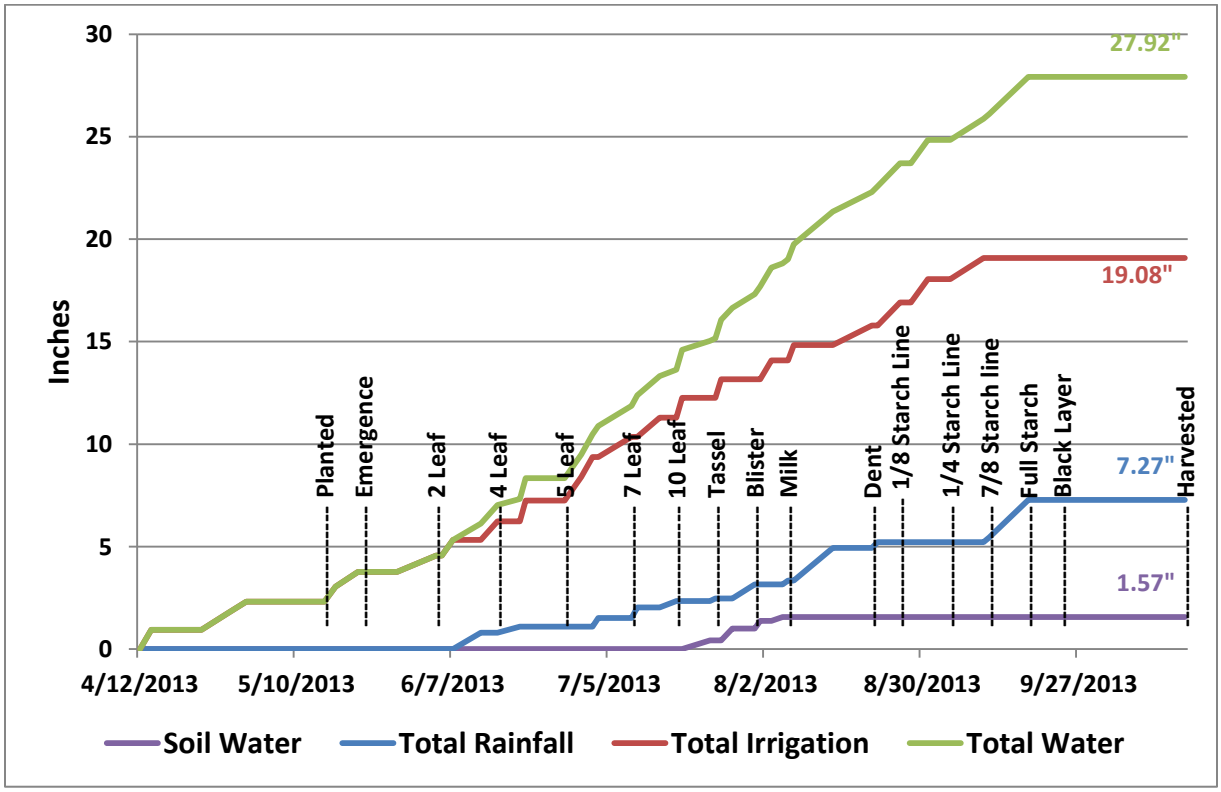


Table 50: Demonstration Field Data for David Ford's "200-12" Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
3/7	0.68		53.75		No Gypsum Blocks						45 N		Randy
4/12			57.32		95.5	95.0	96.3	95.8	96.3		107 N		Randy
4/14		0.94	PivoTrac™							Prewater	360 Y	500	Leon
4/23			67.89		93.1	94.0	91.6	87.8	87.9		31 N		Randy
4/28		0.85	PivoTrac™							Prewater	360 Y	500	Leon
5/1		0.53	PivoTrac™							Prewater	45 N	500	Leon
5/5	0.10		74.73		92.7	93.7	55.6	81.1	83.8		44 N		Randy
5/15	0.26		74.73		92.5	92.1	55.8	81.1	84.7	Planted	34 MD		Randy
5/17		0.73	PivoTrac™							200-12	180 Y	500	Leon
5/21		0.71	PivoTrac™							200-12	180 Y	500	Leon
5/22			89.79	Emergence	96.8	96.0	92.5	89.0	89.5	Control	307 Y	496	R & C
5/28			90.75	Emergence	97.0	96.0	93.7	90.7	90.6		356 N		R & C
6/4		0.8	PivoTrac™	2 Leaf						200-12	360 Y	500	Leon
6/5			102.05	2 Leaf	97.2	92.1	57.5	81.9	85.3	Control	232 Y	500	Randy
6/7		0.76	PivoTrac™	3 Leaf						200-12	360 Y	500	Leon
6/12	0.8		108.4	3 Leaf	98.1	92.2	56.9	81.8	85.3		334 N		R & C
6/15		0.91	PivoTrac™	4 Leaf						200-12	360 Y	500	Leon
6/19	0.3		122.09	4 Leaf	98.1	91.3	58.8	82.2	85.4	200-12	103 Y	442	R & C
6/20		1.01	PivoTrac™	4 Leaf						200-12	360 Y	480	Leon
6/27			135.5	5 Leaf	98.8	91.4	58.7	82.5	82.7	200-12	13 Y	470	R & C
6/30		1.16	PivoTrac™	6 Leaf						200-12	360 Y	470	Leon
7/2		0.97	PivoTrac™	6 Leaf						200-12	360 Y	470	Leon
7/3	0.42		148.13	6 Leaf	98.1	89.7	59.0	82.5	85.8	Control	278 Y	497	R & C
7/9		0.98	PivoTrac™	7 Leaf						200-12	180 Y	480	Leon
7/10	0.51		162.77	8 Leaf	98.0	88.3	58.2	82.4	85.6	Control	249 Y	473	R & C
7/14		0.94	PivoTrac™	9 Leaf						200-12	180 Y	480	Leon
7/17	0.31		177.36	10 Leaf	96.4	86.0	58.2	86.7	85.8	200-12	64 Y	480	R & C
7/18		0.97	PivoTrac™	11 Leaf						200-12	180 Y	480	Leon
7/24	0.13		191.72	Tassel	97.4	73.4	58.0	82.6	85.7	200-12	123 Y	473	R & C
7/25		0.91	PivoTrac™	Tassel						200-12	360	480	Leon
7/31	0.68		201.75	Blister	71.4	66.7	57.9	82.6	85.8		106 N		Randy
8/3		0.92	PivoTrac™	Blister						200-12	360 Y	470	Leon
8/6	0.20		210.44	Milk	26.8	43.9	58.0	82.7	85.7	200-12	153 Y	469	R & C
8/7		0.74	PivoTrac™	Milk						200-12	25 N	470	Leon
8/14	1.59		213.65	Dough	13.8	31.6	57.2	82.2	85.3		25 N		R & C
8/21		0.96	PivoTrac™	Dent						200-12	180 Y	550	Leon
8/22	0.28		221.04	Dent	0.0	12.6	57.5	79.8	83.2	Control	263 Y	559	Randy
8/26		1.12	PivoTrac™	1/8 ml						200-12	180 Y	550	Leon
8/28			235.7	1/8 ml	0.0	2.5	51.7	78.7	82.1	Control	341 Y	547	Randy
8/31		1.14	PivoTrac™	1/8 ml						200-12	180 Y	550	Leon
9/4			246.94	1/4 ml	0.0	3.4	56.7	87.3	81.4		342 N		Randy
9/10		1.03	PivoTrac™	1/2 ml						200-12	360 Y	550	Leon
9/11	0.23		258.11	7/8 ml	8.7	3.7	57.1	70.6	81.3		325 N		Randy
9/18	1.82		258.11	1.0 ml	97.7	2.0	55.5	73.7	81.0		325 N		Randy
9/24	1.39		258.11	Black Layer	96.6	96.7	55.6	74.5	82.1		325 N		Randy
10/2			258.11	Black Layer	96.6	96.4	65.3	74.5	80.9		325 N		Randy
10/9			258.11	Black Layer	96.5	96.6	82.7	74.6	81.0		323 N		Randy
10/16	0.09		258.11	Harvested	96.0	96.1	88.2	74.7	81.0		359 N		Randy
10/23			258.11	Harvested	96.0	96.1	89.5	74.7	80.7		359 N		Randy
Total	**7.27**	**19.08**			**0.00"**	**0.00"**	**0.74"**	**0.38"**	**0.45"**				
Net Soil Moisture is 1.57"													
Irrigation, Rainfall Plus Net Soil Moisture is 27.92"													

- Numbers in red are not counted in the total

2013-Corn Demonstration
Irrigated Medium Season Corn

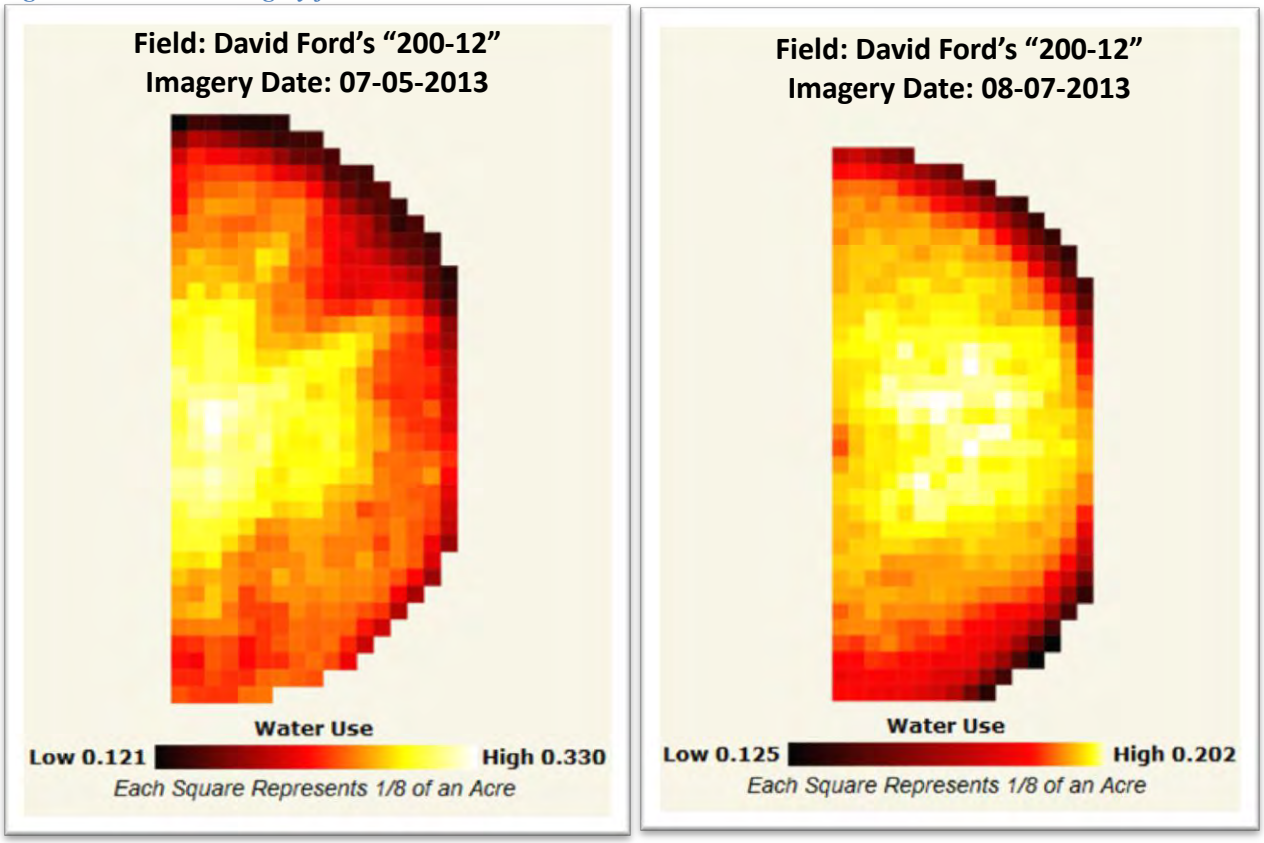
200-12

Year:	*2013*	**County:**	*Hartley*	**Grower:**	*David Ford*
No. Acres:	*60*	**Hybrid:**	*P1151AM*	**Soil Type:**	*Sherm Clay Loam*
Meter Type:	*Seametrics*				
Meter Mult:	*Ac Ft x 1*	**Tillage:**	*Strip Till*		
Fertilizer:	*150-0-0, 4 ton Compost*	**Seeding:**	*28,000*		
Planted:	*May 15*	**Harvest:**	*October 14*		
Herbicide:	*Balance, Roundup, Stratego*	**Insecticide:**	*Comite*		
Yield:	*179 bu/ac*	**Prev. crop:**	*Wheat*	**Row width:**	*30 Inch*
Irrigation method:	*Center Pivot*	**Prewater:**	*2.32*	**GPM/acre:**	*4.1*
Distance between drops:	*60"*	**Distance from nozzle to ground:**		*16"*	
Application pattern:	*Spray*	**Crop row direction :**		*Straight*	

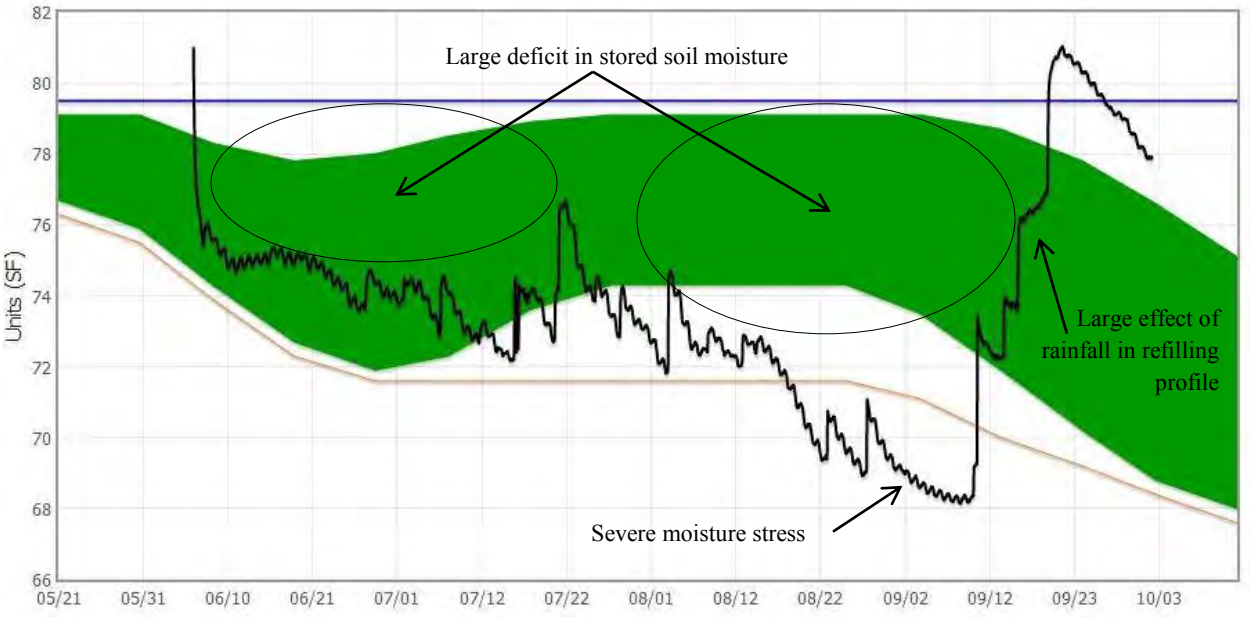
GPS Location of Pivot Pad		**GPS Location of Gypsum Blocks**	
Latitude:	*35.833828*	Latitude:	*35.837*
Longitude:	*-102.173067*	Longitude:	*-102.17382*

Satellite Imagery: Satellite imagery was initiated in combination with HydroBio in 2013 and used to learn and evaluate its potential for an irrigation and water management tool for growers. David Ford's "200-12" and Control fields were two of the ten "200-12" project fields included in 2013. A website was established and made available to project cooperators and District staff. We learned that satellite imagery has potential, but requires additional development, especially in establishing beginning soil moisture and monitoring the soil profile and root zone during the growing season. Two satellite images of David Ford's "200-12" field, one on July 5th at the 6 leaf growth stage and another on August 7th at the milk reproduction stage are shown in figure 51 to illustrate examples of what is displayed on the website. Areas in white are the highest daily water use. The satellite imagery data changes when the next satellite passes, usually in three day increments.

Figure 51: Satellite Imagery for David Ford's "200-12" Demonstration Field



David Ford's "200-12" Field AquaSpy® Probe Summary



The data shows that this field started with only the top 12-18" fully wet, with some moisture in the 20-40" range and it was pretty dry underneath. The irrigation was also only able to penetrate 4-8" but the rainfall late in the season had a massive effect on the soil wetting up. Given the reasonable 178 bu/ac yield, this leads to the conclusion that this probe might not have been seeing all of the irrigation water due to the localized wetting pattern effects of the sprinkler.

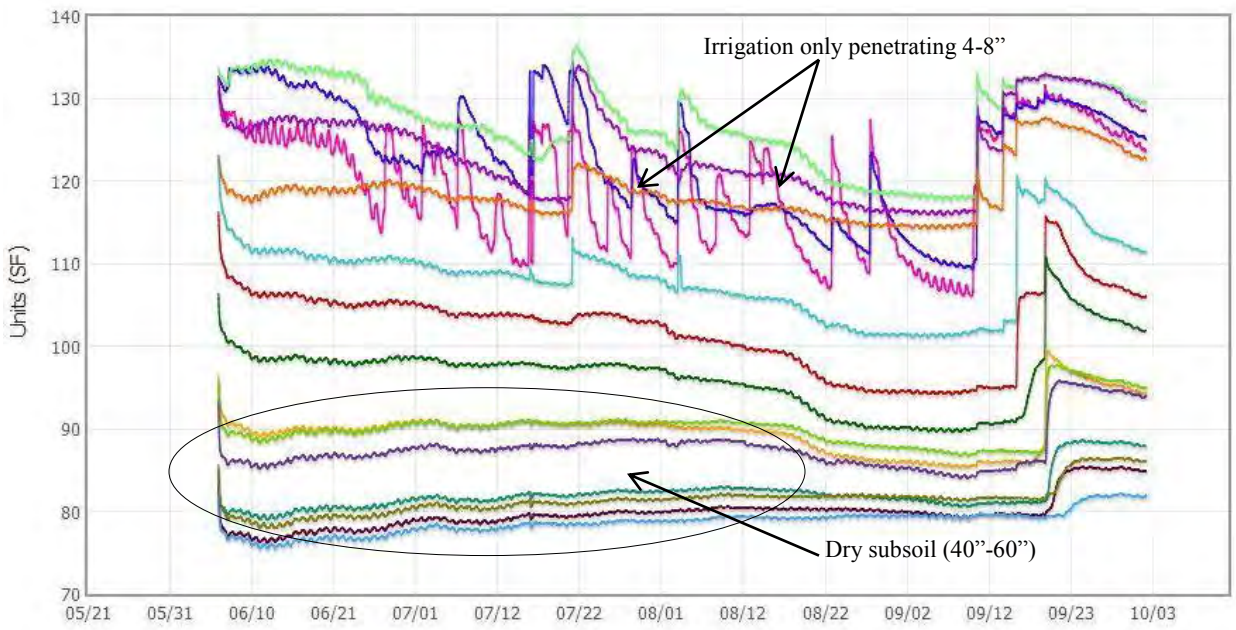


Figure 52: Gypsum Block Readings for David Ford's Control Demonstration Field

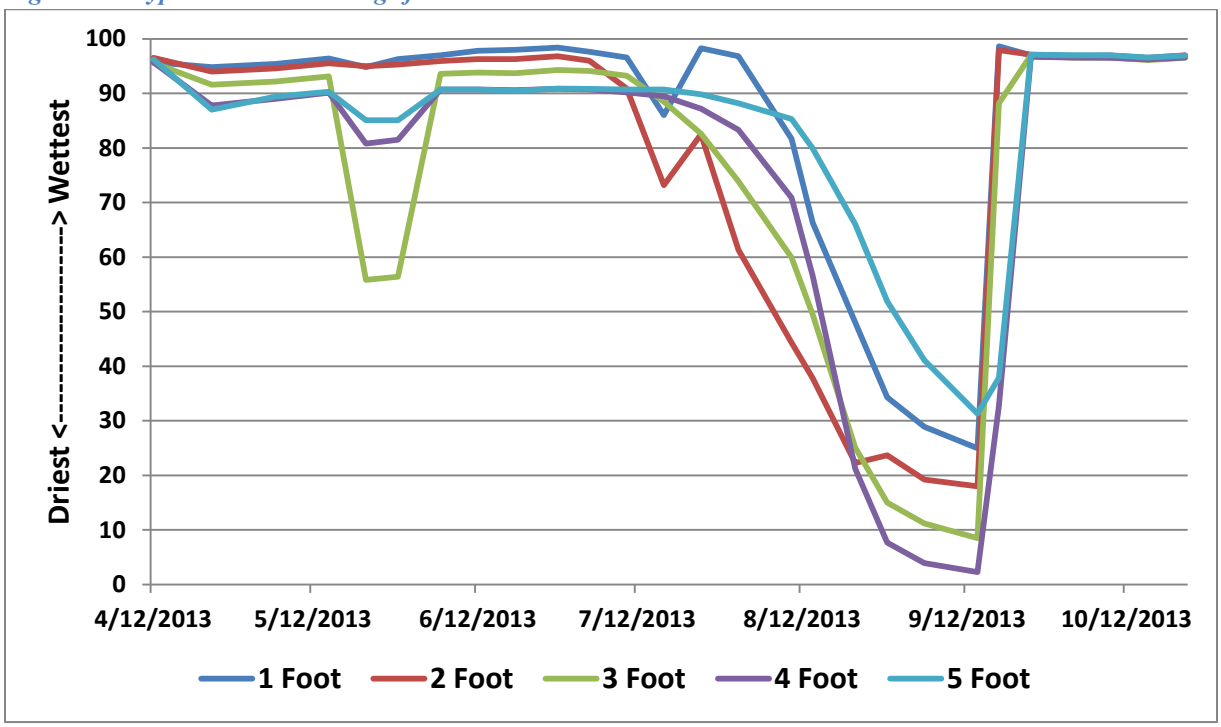


Figure 53: Growing Season Water Tracking for David Ford's Control Demonstration Field (191 bu/ac)

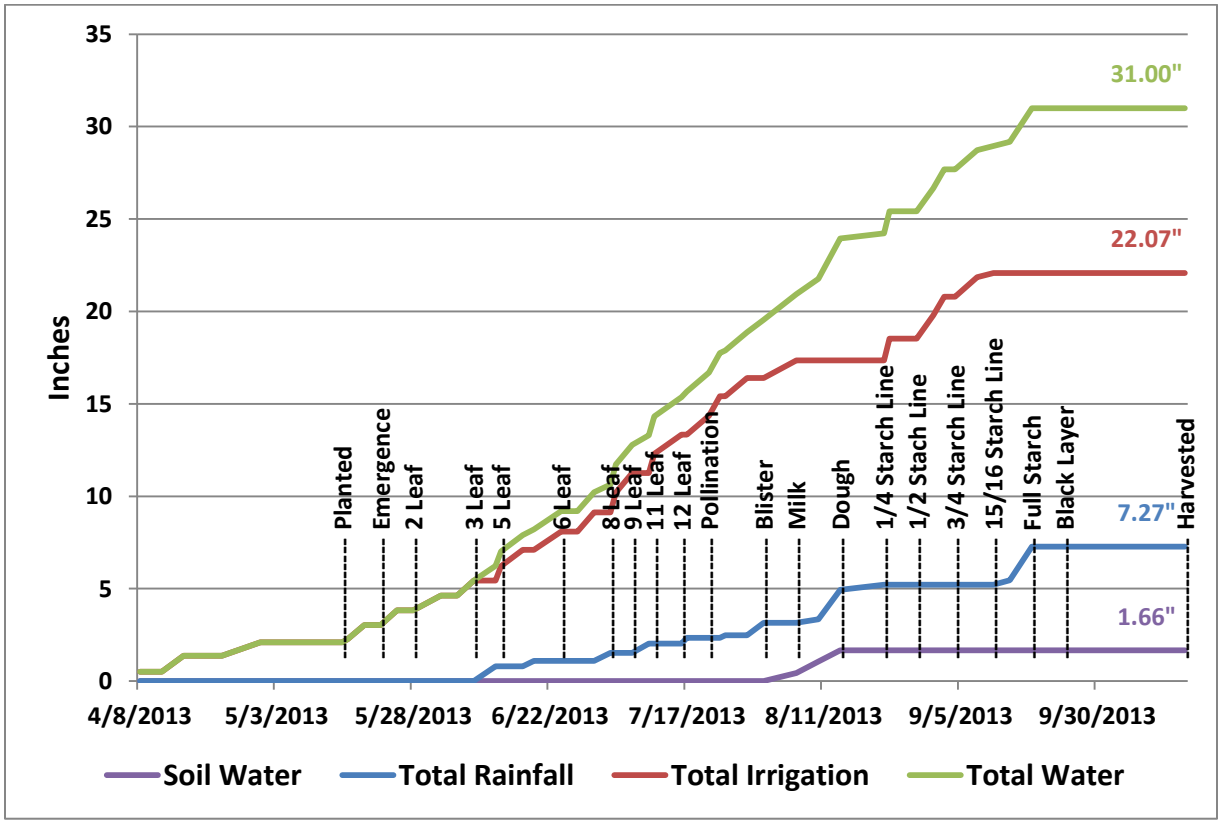


Table 51: Demonstration Field Data for David Ford's Control Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
3/7	0.68		53.75								45 N		Randy
4/8		0.5	PivoTrac™							Prewater	180 Y	500	Leon
4/12			57.32		95.7	96.5	95.6	95.7	96.2		107 N		Randy
4/16		0.87	PivoTrac™							Prewater	180	500	Leon
4/23			67.89		94.8	94.0	91.6	87.8	87.0		31 N		Randy
4/30		0.73	PivoTrac™							Prewater	180 Y	500	Leon
5/5	0.10		74.73		95.4	94.6	92.2	89.0	89.4		44 N		Randy
5/15	0.26		74.73		96.4	95.5	93.1	90.1	90.3	Plant	34 md		Randy
5/16		0.17	PivoTrac™							Control	360 Y	500	Leon
5/19		0.77	PivoTrac™							Control	360 Y	500	Leon
5/22			89.79	Emergence	94.8	95.0	55.8	80.8	85.1	Control	307 Y	496	R & C
5/25		0.78	PivoTrac™	Emergence						Control	356 N	500	Leon
5/28			90.75	2 Leaf	96.3	95.3	56.4	81.5	85.1		356 N		R & C
6/2		0.8	PivoTrac™	2 Leaf						Control	180 Y	500	Leon
6/5			102.05	2 Leaf	97.0	95.9	93.6	90.7	90.7	Control	232 Y	530	R & C
6/8		0.81	PivoTrac™	3 Leaf						Control	180 Y	500	Leon
6/12	0.8		108.4	4 Leaf	97.8	96.3	93.8	90.7	90.7		334 N		R & C
6/13		0.79	PivoTrac™	5 Leaf						Control	180 Y	500	Leon
6/17		0.88	PivoTrac™	5 Leaf						Control	180 Y	480	Leon
6/19	0.3		122.09	5 Leaf	98.0	96.3	93.7	90.6	90.5	200-12	103 Y	442	R & C
6/24		0.99	PivoTrac™	6 Leaf						Control	180 Y	480	Leon
6/27			135.5	6 Leaf	98.4	96.8	94.3	90.8	90.9	200-12	13 Y	470	R & C
6/30		1.03	PivoTrac™	6 Leaf						Control	180 Y	470	Leon
7/3	0.42		148.13	8 Leaf	97.6	96.0	94.1	90.7	90.8	Control	278 Y	497	R & C
7/4		1.08	PivoTrac™	8 Leaf						Control	180 Y	500	Leon
7/7		1.06	PivoTrac™	9 Leaf						Control	360 Y	480	Leon
7/10	0.51		162.77	10 Leaf	96.6	90.9	93.2	90.2	90.7	Control	249 Y	473	R & C
7/11		1.03	PivoTrac™	11 Leaf						Control	360 Y	480	Leon
7/16		1.04	PivoTrac™	12 Leaf						Control	360 Y	480	Leon
7/17	0.31		177.36	12 Leaf	86.0	73.2	88.5	89.5	90.7	200-12	64 Y	480	R & C
7/21		1.03	PivoTrac™	Pollination						Control	360 Y	480	Leon
7/23		1.05	PivoTrac™	Pollination						Control	180 Y	480	Leon
7/24	0.13		191.72	Pollination	98.3	82.5	82.6	87.2	89.8	200-12	123 Y	473	R & C
7/28		0.99	PivoTrac™	Pollination						Control	180 Y	480	Leon
7/31	0.68		201.75	Blister	96.8	61.3	73.9	83.3	88.2		106 N		Randy
8/6		0.95	PivoTrac™	Milk						Control	180 Y	470	Leon
8/10	0.2		210.44	Milk	81.7	44.3	59.9	70.9	85.3	200-12	153 Y	469	R & C
8/14	1.59		213.65	Dough	66.3	37.8	49.5	56.6	79.9		25 N		R & C
8/22	0.28		221.04	1/4 ml	48.0	22.3	25.1	21.2	66.0	Control	263 Y	559	Randy
8/23		1.18	PivoTrac™	1/3 ml						Control	360 Y	550	Leon
8/28			235.7	1/2 ml	34.3	23.7	15.0	7.7	51.9	Control	341 Y	547	Randy
8/31		1.26	PivoTrac™	1/2 ml						Control	360 Y	550	Leon
9/2		1.01	PivoTrac™	1/2 ml						Control	326 N	550	Leon
9/4			246.94	3/4 ml	28.9	19.2	11.2	3.9	41.1		342 N		Randy
9/8		1.05	PivoTrac™	3/4 ml						Control	180 Y	550	Leon
9/11		0.22	PivoTrac™	15/16 ml						Control	325 N	550	Leon
9/14	0.23		258.11	15/16 ml	25.0	18.0	8.5	2.3	31.3		325 N		Randy
9/18	1.82		258.11	1.0 ml	98.6	97.9	88.2	32.8	37.9		325 N		Randy
9/24	1.39		258.11	Black Layer	97.0	97.1	97.0	96.7	97.1		325 N		Randy
10/2			258.11	Black Layer	96.9	96.8	96.5	96.6	97.0		325 N		Randy
10/9			258.11	Black Layer	96.9	96.9	96.6	96.5	97.0		323 N		Randy
10/16	0.09		258.11	Harvested	96.4	96.5	96.1	96.2	96.6		359 N		Randy
10/23			258.11	Harvested	96.9	97.0	96.5	96.6	96.9		359 N		Randy
Total	**7.27**	**22.07**			**0.00"**	**0.50"**	**0.55"**	**0.31"**	**0.30"**				
Net Soil Moisture is 1.66"													
Irrigation, Rainfall Plus Net Soil Moisture is 31.00"													
• Numbers in red are not counted in the total													

2013-Corn Demonstration
Irrigated Medium Season Corn

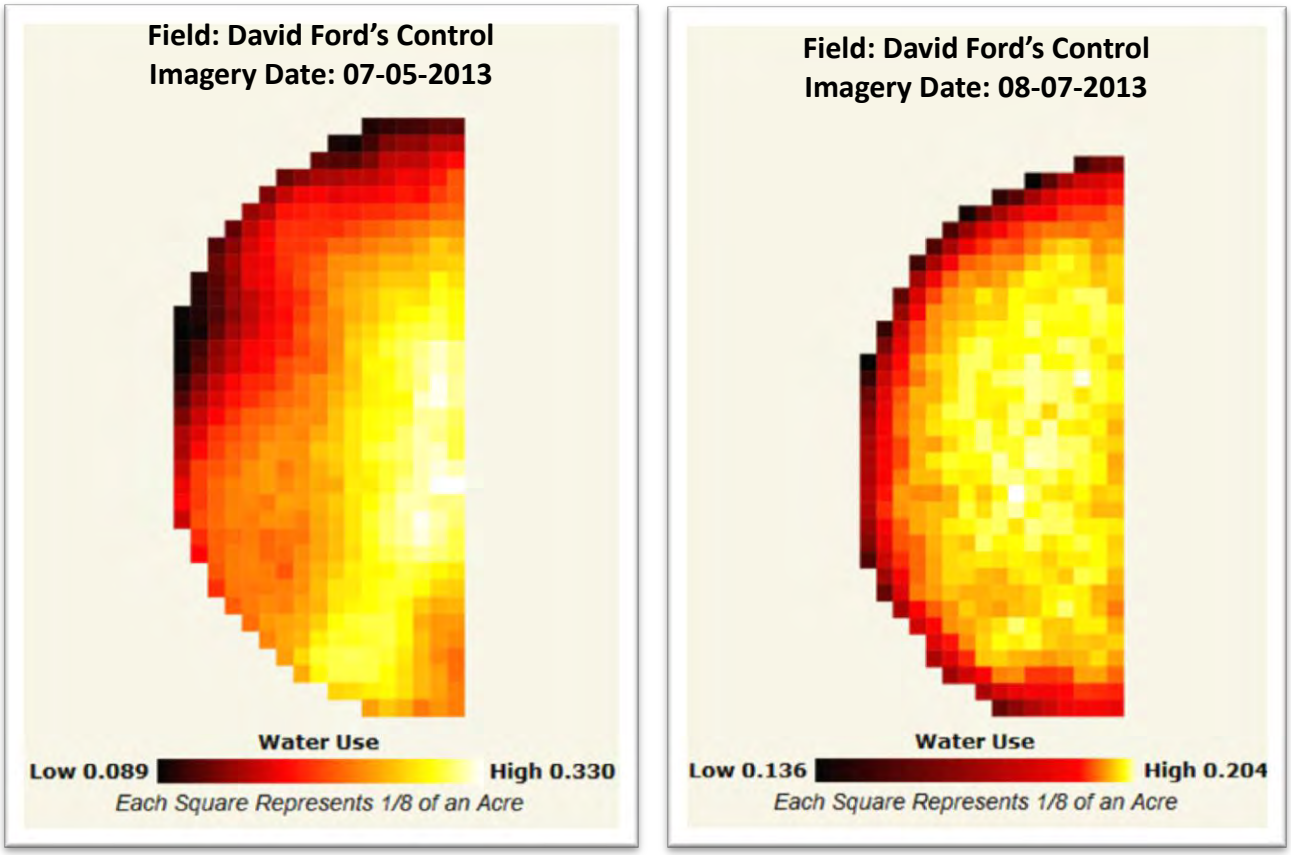
Control

Year:	*2013*	**County:**	*Hartley*	**Grower:**	*David Ford*
No. Acres:	*60*	**Hybrid:**	*P1151AM*	**Soil Type:**	*Dumas Loam, Gruver Loam*
Meter Type:	*Seametrics*				
Meter Mult:	*Ac Ft x 1*	**Tillage:**	*Strip Till*		
Fertilizer:	*150-0-0, 4 ton Compost*	**Seeding:**	*28,000*		
Planted:	*May 15*	**Harvest:**	*October 14*		
Herbicide:	*Balance, Roundup, Stratego*	**Insecticide:**	*Comite*		
Yield:	*191 bu/ac*	**Prev. crop:**	*Wheat*	**Row width:**	*30 Inch*
Irrigation method:	*Center Pivot*	**Prewater:**	*2.10*	**GPM/acre:**	*4.1*
Distance between drops:	*60"*	**Distance from nozzle to ground:**		*16"*	
Application pattern:	*Spray*	**Crop row direction :**		*Straight*	

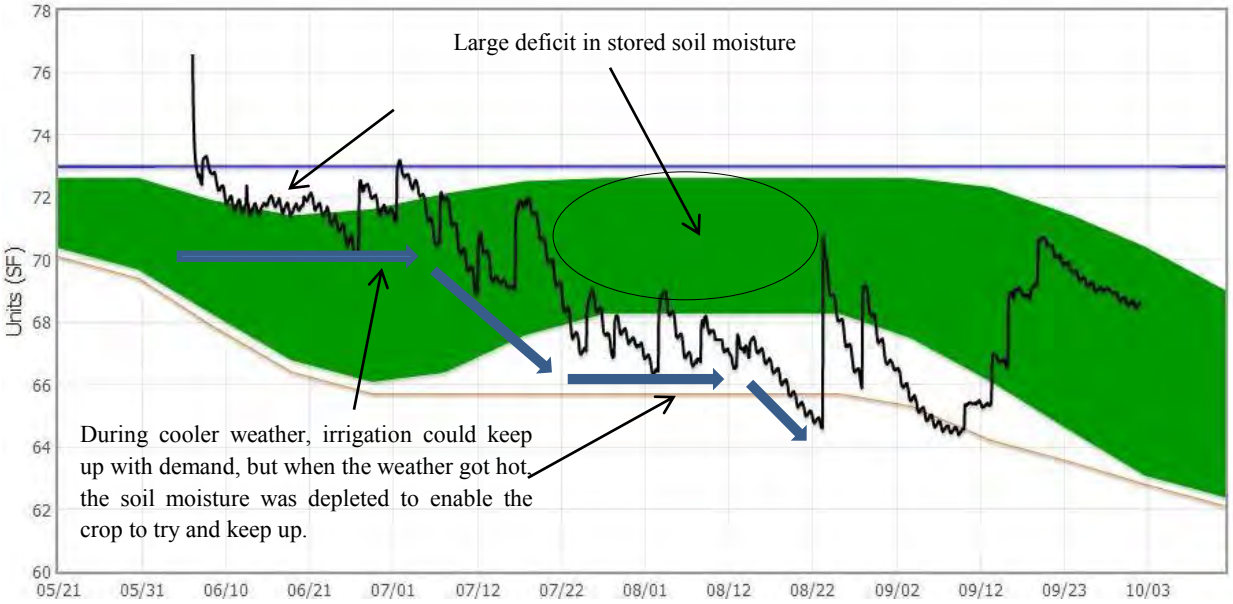
GPS Location of Pivot Pad		**GPS Location of Gypsum Blocks**	
Latitude:	*35.833828*	Latitude:	*35.837024*
Longitude:	*-102.173067*	Longitude:	*-102.172706*

Satellite imagery: Satellite imagery was initiated in combination with HydroBio in 2013 and used to learn and evaluate its potential for an irrigation and water management tool for growers. David Ford's "200-12" and Control fields were two of ten "200-12" project fields included in 2013. A website was established and made available to project cooperators and District staff. We learned that satellite imagery has potential, but requires additional development, especially in establishing beginning soil moisture and monitoring the soil profile and root zone during the growing season. Two satellite images of David Ford's Control field, one on July 5 at the 8 leaf growth stage and another on August 7th at the milk reproduction stage are shown in figure 54 to illustrate examples of what is displayed on the website. Areas in white are the highest daily water use. The satellite imagery data changes when the next satellite passes, usually in three day increments.

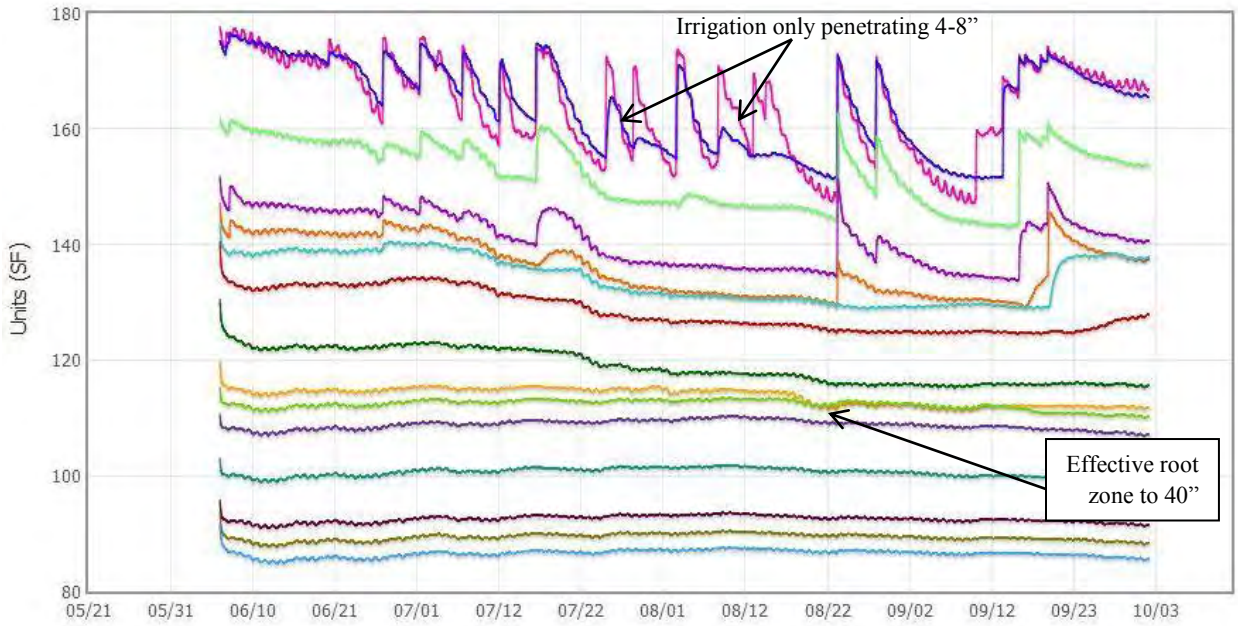
Figure 54: Satellite Imagery for David Ford's Control Demonstration Field



David Ford's Control Field AquaSpy® Probe Summary



The extra 3 inches of irrigation that this field received only produced 13 bu/ac more grain and this is probably due to the fact that the irrigation was not very effective, only penetrating 4-8" into the soil. This field started off with a better profile than the "200-12" field and there were two irrigations in late August that were much more effective and these were probably the main differences between the two fields. Both fields seemed to have a 40" root system and were limited in their effective root zone by the penetration depth of the irrigation. Both fields could probably have benefitted from running the pivot slower to get deeper penetration of irrigation.



Harvest Results: The "200-12" field produced a 178 bushel per acre corn yield. Irrigation totaled 19.08 inches, of which 2.32 inches were pre-water. Production in the Control field was 191 bushels per acre. Total irrigation was 22.07 inches. Pre-season irrigation was 2.10 inches and is included in the total irrigation. In comparison, the "200-12" field produced 13 bushels per acre less than the Control and irrigation was 2.99 inches less. Corn production was 9.33 bushels (522lbs) per inch of irrigation in the "200-12" field compared to 8.65 (484lbs) in the Control. Production from each inch of irrigation, rainfall and net soil water that totaled 27.92 inches was 6.38 bushels (357lbs) per acre in the "200-12" field. Irrigation, rainfall and net soil water totaled 31.00 inches in the Control field where production was 6.16 bushels (345lbs) per inch. Crop production costs were $24.15 per acre less for the "200-12" field than for the Control from reduced irrigation and harvest expenses. At $5.13 per bushel, the 13 bushel per acre reduced corn yield in the "200-12" field amounts to $66.69 less per acre. The "200-12" field‟s net loss was $42.54 per acre with 2.99 inches less irrigation used compared to production from the Control field. Net return per acre was $485.89 from the "200-12" field compared to $528.43 from the Control. Ford states "blowing was a problem early that reduced the stand, especially in a portion of the west Control field. Ford says reduced corn irrigation following a previous cotton crop is not a good farming practice". A summary of the demonstration results are shown in table 52.

Table 52: David Ford's 2013 Demonstration Results

	Irrigation (in.)	Total Water (in.)	Production		Crop Value @ $5.13/bu		
			bu/ac	lb/ac-in Irrigation	Per Acre	Acre-in of Irrigation	Acre-in of Total Water
"200-12"	19.08	*27.92	178	522	$913.14	$47.86	$32.71
Control	22.07	†31.00	191	484	$979.83	$44.40	$31.61

*Includes 1.57 inches of water removed from five feet of soil, plus rainfall, and irrigation.
†Includes 1.66 inches of water removed from five feet of soil, plus rainfall, and irrigation.

Hartley Feeders' 2013 Hartley County Demonstration

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 per acre. Hartley Feeders planted 60 acres, also strip tilled, in the northeast quarter of section 3 to Pioneer 1498HR at 28,000 seeds per 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. The center pivot delivered an average of 1.10 inches of irrigation in a 5.5 day revolution. The center pivot also irrigated wheat in the south half of the circle. Water meter readings averaged 450 gpm for the center pivot that irrigated the Control field and delivered 1.30 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 53 below. Dennis Buss is Farm Manager for Hartley Feeders.

Table 53: Planting and Crop Information for Hartley Feeders

"200-12" Demonstration Field			
Planted:	*May 19*	**Harvested:**	*October 30*
Hybrid:	*P1498HR*	**Seeding Rate:**	*28,000*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*60*	**GPM Per Acre:**	*3.7 w/wheat*
Total Water:	*31.11 in.*	**Soil Type:**	*Dumas Loam, Gruver Loam, and Sherm Clay Loam*
Fertilizer:	*50-0-0*	**Insecticide:**	*Comite*
Herbicide:	*Harness Xtra*		
Control Demonstration Field			
Planted:	*May 19*	**Harvested:**	*October 30*
Hybrid:	*P1498HR*	**Seeding Rate:**	*28,000*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*60*	**GPM Per Acre:**	*3.7*
Total Water:	*28.27 in.*	**Soil Type:**	*Dumas Loam, Sunray Clay Loam*
Fertilizer:	*50-0-0*	**Insecticide:**	*Comite*
Herbicide:	*Harness Xtra, Laudis, Roundup*		

Beginning Soil Water Profile and Growing Season Rainfall

"200-12" Demonstration Field: Due to late tillage, early season irrigation and rainfall, gypsum blocks were not installed until-June, which was late for the project. Initial soil sensor readings show good soil moisture at 1 and 2 feet, but basically none at 3 and 4 feet. Soil water was about 35 percent at 5 feet and remained at that level during the growing season. Plants used soil water from 2 feet in July. 1.02 inches of rainfall on July 31, plus irrigation at the silk stage, provided sufficient water to maintain yield potential. Irrigation that followed plus a timely 1.61 rainfall in mid-August refilled the soil at 1, 2 and 3 feet, and back to about 40 percent at 4 feet. Weekly gypsum block readings show soil water was depleted at 2, 3 and 4 feet, and used to about 35 percent

from 1 foot in September to finish the crop. Rainfall totaled 6.58 inches during the growing season. Soil moisture sensors were installed in Sherm clay loam soil that holds approximately 2.0 inches of available water per foot for potential crop use.

Control Demonstration Field: Soil moisture sensors show good levels at 1, 2, 3, 4 and 5 feet when installed in June following crop emergence. Soil water stored at 1, 2 and 3 feet was gradually used during July and August, plus all irrigation and rainfall. The sensors indicate no root activity into the 4 and 5 feet zone, although moisture was there, which may contribute to the reduced corn yield in the Control field. The soil moisture graph indicates extensive plant root development at 1, 2 and 3 feet. Rainfall in June totaled 1.46 inches, 2.13 in July, 1.77 in August and 1.19 inches in September. Total was 6.58 inches. Five rainfall events of 2/3 inch or more, helped produce the crop. Soil moisture sensors were installed in Dumas loam soil that holds about 2.0 inches of available water per foot for potential plant use. Monthly rainfall is listed in table 54.

Table 54: Monthly Rainfall Data for Hartley Feeders

	May	June	July	August	September	Total
"200-12"	0.03"	1.46"	2.13"	1.77"	1.19"	**6.58"**
Control	0.03"	1.46"	2.13"	1.77"	1.19"	**6.58"**

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 each Control field. Both the gypsum block sensors and the soil probe were installed in close proximity to each other in the field. Gypsum blocks were installed in the "200-12" fields and most Control fields prior to planting. Each AquaSpy® probe was installed following crop emergence, as well as gypsum blocks in any remaining fields. Installing and reading the gypsum blocks prior to planting provided advanced soil moisture conditions and information to help guide and manage irrigation. 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 same illustrations for the Control field.

Figure 55: Gypsum Block Readings for Hartley Feeders' "200-12" Demonstration Field

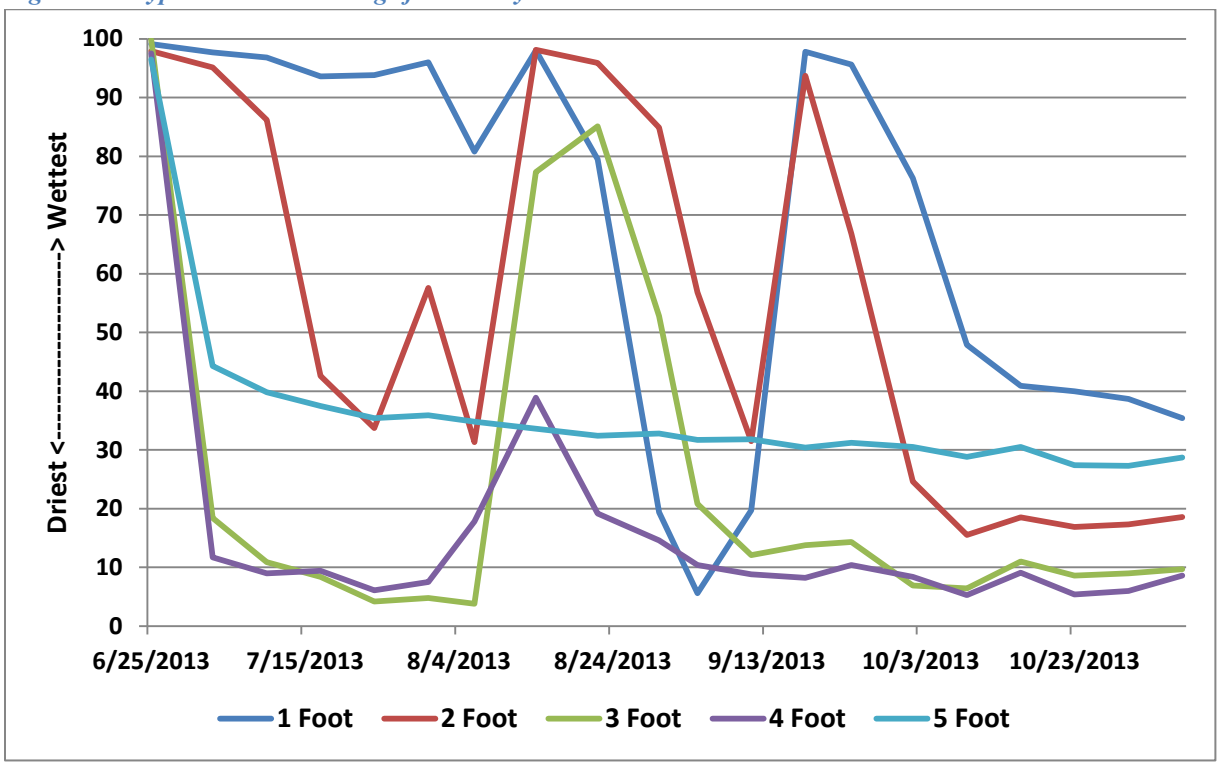


Figure 56: Growing Season Water Tracking for Hartley Feeders' "200-12" Demonstration Field (218 bu/ac)

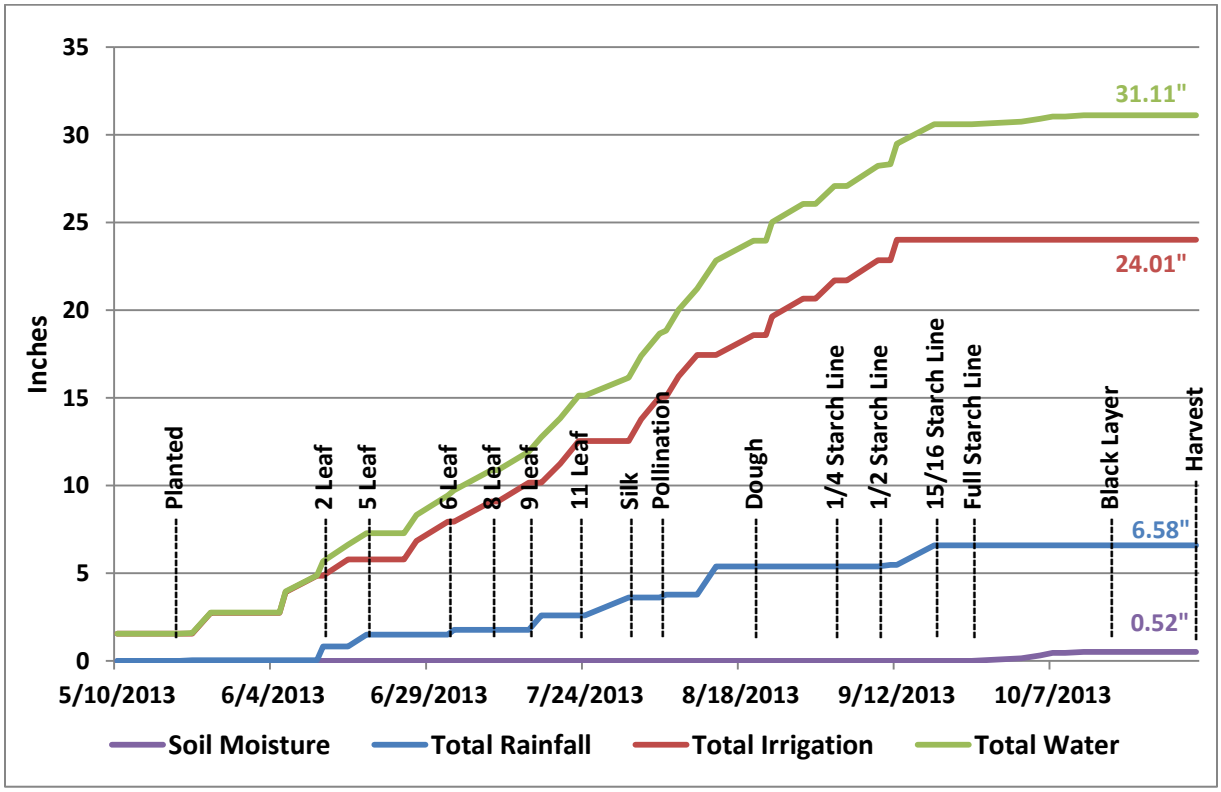


Table 55: Demonstration Field Data for Hartley Feeders' "200-12" Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
3/7	0.50		200.33		Not Located Gypsum Block						96 N		Randy
5/10		1.56	PivoTrac™							Prewater	90	500	Leon
5/19										Planted			
5/22	0.03		256.44		No Gypsum Blocks					Wheat	234 Y	500	R & C
5/25		1.17	PivoTrac™							Corn	90	475	Leon
5/28			268.2		No Gypsum Blocks					Wheat	257 Y	507	R & C
6/5			275.63		No Gypsum Blocks					Corn	14 Y	480	R & C
6/6		1.20	PivoTrac™							Corn	270	450	Leon
6/11		0.92	PivoTrac™	2 Leaf						Corn	270	480	Leon
6/12	0.80		290.21		No Gypsum Blocks					Wheat	207 Y	428	R & C
6/16		0.94	PivoTrac™	5 Leaf						Corn	270	480	Leon
6/19	0.66		301.36	5 Leaf	No Gypsum Blocks						55 N		R & C
6/25			303.4	5 Leaf	99.1	97.9	99.8	97.5	96.5	Corn	18 Y	415	R & C
6/27		1.05	PivoTrac™	6 Leaf						Corn	270	425	Leon
7/2		1.10	PivoTrac™	6 Leaf						Corn	90	425	Leon
7/3	0.29		312.61	8 Leaf	97.7	95.1	18.4	11.7	44.3		88 N		R & C
7/9		1.15	PivoTrac™	8 Leaf						Corn	270	475	Leon
7/10			318.5	9 Leaf	96.8	86.2	10.9	9.0	39.8		262 N		R & C
7/15		1.07	PivoTrac™	10 Leaf						Corn	90	480	Leon
7/17	0.82		329.21	10 Leaf	93.6	42.6	8.4	9.4	37.5	200-12	297 Y	497	R & C
7/20		1.08	PivoTrac™	11 Leaf						Corn	270	480	Leon
7/23		1.29	PivoTrac™	11 Leaf						Corn	90	450	Leon
7/24			384.56	Silk	93.8	33.7	4.2	6.1	35.4	200-12	35 Y	460	R & C
7/31	1.02		389.39	Silk	96.0	57.6	4.8	7.5	35.9		286 N		Randy
8/2		1.24	PivoTrac™	Pollination						Corn	270	450	Leon
8/5		1.28	PivoTrac™	Pollination						Corn	90	450	Leon
8/6	0.16		398.15	Milk	80.8	31.3	3.8	17.8	34.8	200-12	36 Y	397	R & C
8/8		1.18	PivoTrac™	Milk						200-12	270	450	Leon
8/11		1.21	PivoTrac™	Milk						200-12	90	450	Leon
8/14	1.61		409.17	Dough	98.0	98.1	77.3	38.9	33.6		94 N		R & C
8/20		1.13	PivoTrac™	Dough						200-12	270	450	Leon
8/22			418.89	Dent	79.5	95.9	85.1	19.2	32.4	200-12	41 Y	454	Randy
8/23		1.06	PivoTrac™	Dent						200-12	90	450	Leon
8/28		1.03	PivoTrac™	Dent						200-12	90	450	Leon
8/30			431.85	1/4 ml	19.4	84.9	52.8	14.6	32.8	200-12	104 Y	465	Randy
9/2		1.03	PivoTrac™	1/4 ml						200-12	90		Leon
9/4			442.05	1/2 ml	5.6	56.8	20.8	10.4	31.7		97 N		Randy
9/9		1.15	PivoTrac™	1/2 ml						200-12	270	400	Leon
9/11	0.08		452.71	7/8 ml	19.7	31.5	12.1	8.8	31.8	200-12	4 Y	402	Randy
9/12		1.17	PivoTrac™	15/16 ml						200-12	90	400	Leon
9/18	1.11		456.79	1.0 ml	97.8	93.7	13.8	8.2	30.4		130 N		Randy
9/24			456.79	1.0 ml	95.6	66.8	14.3	10.4	31.2		130 N		Randy
10/2			456.79		76.3	24.6	6.9	8.4	30.5		130 N		Randy
10/7				1.0 ml									
10/9			460.71		47.9	15.5	6.4	5.3	28.8	Wheat	265 N		Randy
10/12				Black Layer									
10/16			462.77	Black Layer	40.9	18.5	11.0	9.1	30.5	Wheat	195 N		Randy
10/23			462.77	Harvested	40.0	16.9	8.6	5.4	27.4		195 N		Randy
10/30			462.77	Harvested	38.7	17.3	9.0	6.0	27.3		195 N		Randy
11/6	0.28		462.77		35.4	18.6	9.7	8.6	28.7		195 N		Randy
Total	**6.58**	**24.01**			**0.13”**	**0.15”**	**0.06”**	**0.11”**	**0.07”**				
Net Soil Moisture is 0.52"													
Irrigation, Rainfall Plus Net Soil Moisture is 31.11"													

- Numbers in red are not counted in the totals

NORTH PLAINS GROUNDWATER Conservation District

2013-Corn Demonstration
Irrigated Medium Season Corn

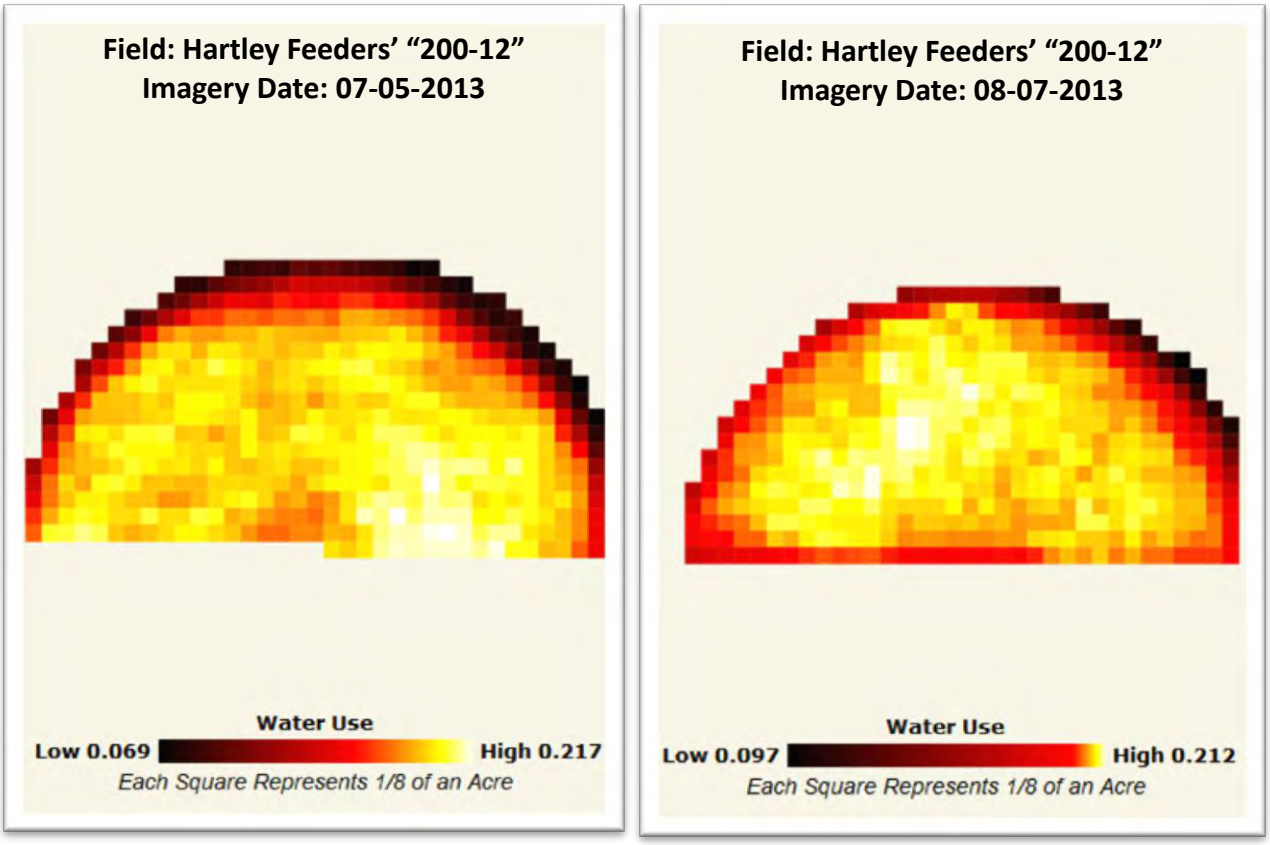
200-12

Year:	*2013*	**County:**	*Hartley*	**Grower:**	*Hartley Feeders*
No. Acres:	*60*	**Hybrid:**	*P1498HR*	**Soil Type:**	*Dumas Loam, Gruver Loam, Sherm Clay Loam*
Meter Type:	*Seametrics*				
Meter Mult:	*Ac Ft x 1*	**Tillage:**	*Strip Till*		
Fertilizer:	*50-0-0*	**Seeding:**	*28,000*		
Planted:	*May 19*	**Harvest:**	*October 30*		
Herbicide:	*Harness Xtra*	**Insecticide:**	*Comite*		
Yield:	*218 bu/ac*	**Prev. crop:**	*Corn*	**Row width:**	*30 Inch*
Irrigation method:	*Center Pivot*	**Prewater:**	*1.56 in.*	**GPM/acre:**	*3.7*
Distance between drops:	*60"*	**Distance from nozzle to ground:**		*16"*	
Application pattern:	*Spray*	**Crop row direction :**	*Straight*		

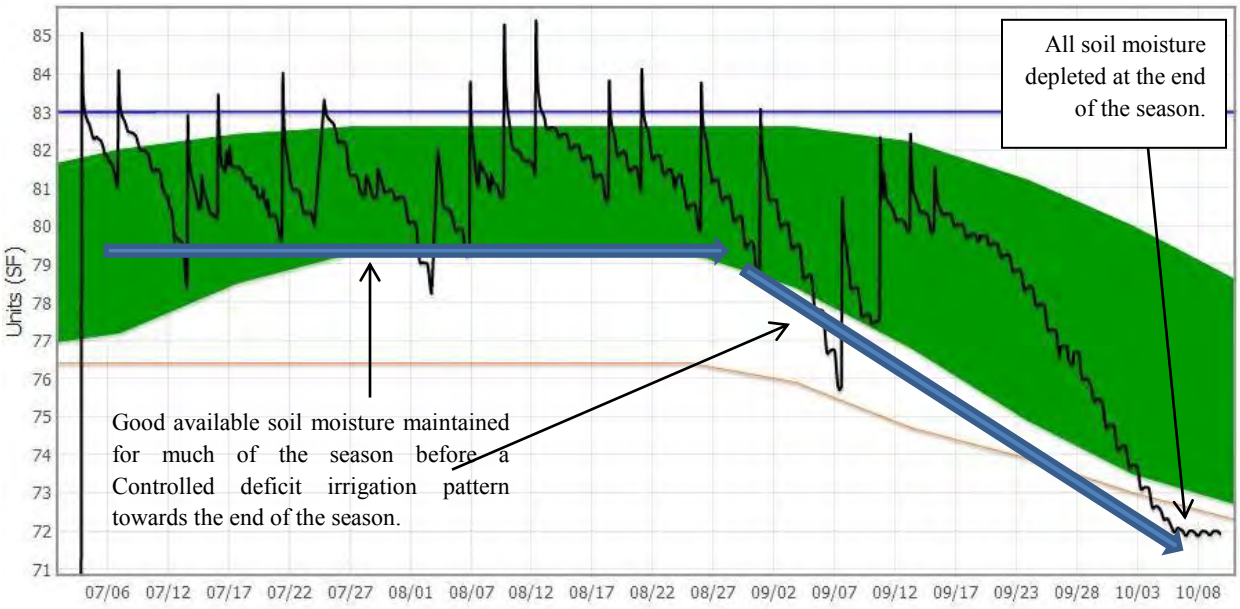
GPS Location of Pivot Pad		**GPS Location of Gypsum Blocks**	
Latitude:	*35.888194*	Latitude:	*35.889887*
Longitude:	*-102.455695*	Longitude:	*-102.452186*

Satellite Imagery: Satellite imagery was initiated in combination with HydroBio in 2013 and used to learn and evaluate its potential for an irrigation and water management tool for growers. Hartley Feeders‟ “200-12” and Control fields were two of ten “200-12” project fields included in 2013. A website was established and made available to project cooperators and District staff. We learned that satellite imagery has potential, but requires additional development, especially in establishing beginning soil moisture and monitoring the soil profile and root zone during the growing season. Two satellite images of Hartley Feeders‟ “200-12” field, one on July 5th at the 8 leaf growth stage and another on August 7th at the Blister reproduction stage are shown in figure 57 to illustrate examples of what is displayed on the website. Areas in white are the highest daily water use. The satellite imagery data changes when the next satellite passes, usually in three day increments.

Figure 57: Satellite Imagery for Hartley Feeders “200-12” Demonstration Field



Hartley Feeders' "200-12" Field AquaSpy® Probe Summary



The data shows that this field had a strategy of short irrigation intervals with the intent being not to let the soil dry out. This strategy was able to get good penetration of moisture, with most irrigations reaching 32"-40" deep. The roots grew to 60" and the effective root zone was 40" deep. While the soil was kept wet, there were only a few drainage events and this would not have unduly affected irrigation efficiency. The soil was dried down effectively at the end of the season, saving 1-2 possible irrigations. It is hard to say if a strategy of running the pivot slower providing fewer, deeper irrigations would have been any more effective on this field.

Figure 58: Gypsum Block Readings for Hartley Feeders' Control Demonstration Field

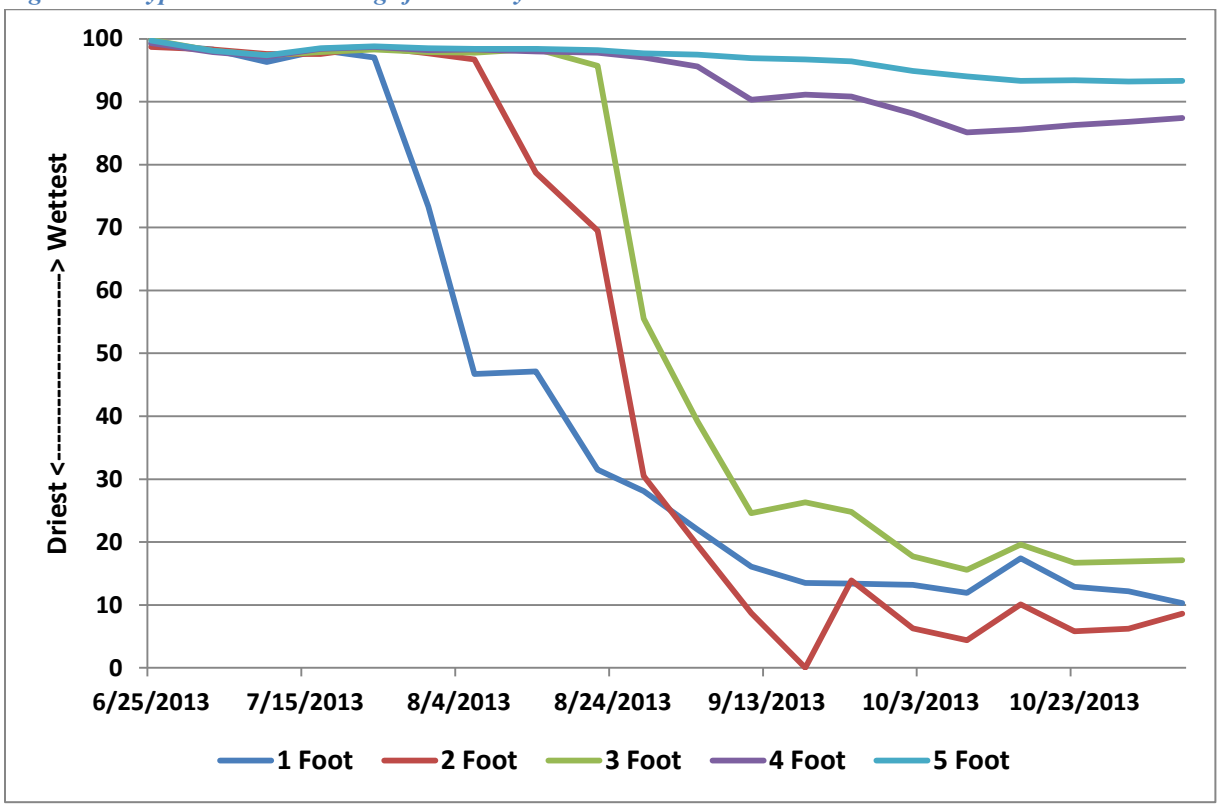


Figure 59: Growing Season Water Tracking for Hartley Feeders' Control Demonstration Field (176 bu/ac)

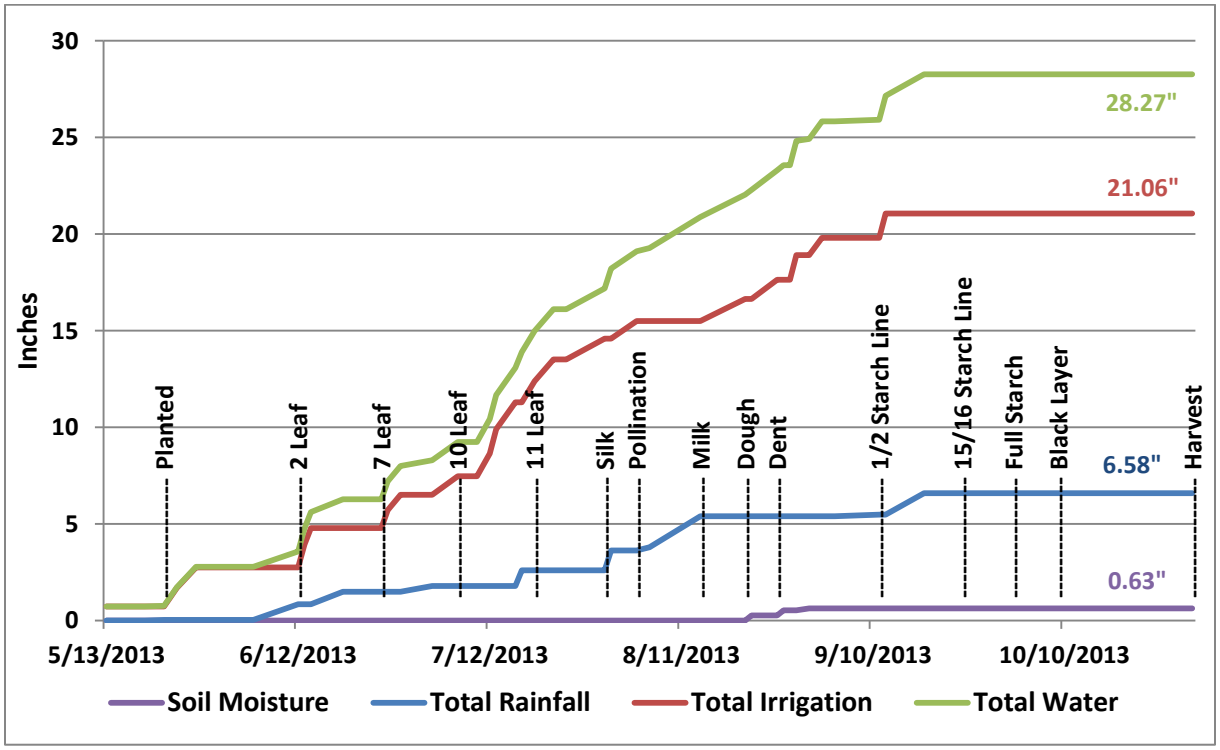


Table 56: Demonstration Field Data for Hartley Feeders' Control Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
3/7	0.50		254.95		Not Located Gypsum Blocks						177 N		Randy
5/13		0.72	PivoTrac™							Prewater		400	Leon
5/19					No Gypsum Blocks					Plant			Dennis
5/22	0.03		315.08							Control	75 Y	379	R & C
5/24		0.97	PivoTrac™		No Gypsum Blocks						270	400	Leon
5/27		1.05	PivoTrac™		No Gypsum Blocks					Control	90	400	Leon
5/28			326.08		No Gypsum Blocks					Control	126 Y	407	R & C
6/5			334.09		No Gypsum Blocks					Control	346 Y	500	R & C
6/12	0.80		337.39	2 Leaf	No Gypsum Blocks					Control	75 Y ccw	491	R & C
6/13		1.19	PivoTrac™		No Gypsum Blocks					Control	90	490	Leon
6/14		0.85	PivoTrac™	5 Leaf	No Gypsum Blocks					Control	270	490	Leon
6/19	0.66		341.75	5 Leaf	No Gypsum Blocks						266 N		R & C
6/25			343.99	7 Leaf	99.2	98.7	99.8	99.3	99.7		2 N		R & C
6/26		0.93	PivoTrac™	7 Leaf						Control	90	480	Leon
6/28		0.80	PivoTrac™	7 Leaf						Control	270	480	Leon
7/3	0.29		350.41	7 Leaf	98.3	98.3	98.1	97.9	98.1		288 N		R & C
7/7		0.95	PivoTrac™	10 Leaf						Control	90	480	Leon
7/10			360.03	10 Leaf	96.3	97.6	97.4	97.2	97.4	Control	268 Y	481	R & C
7/12		1.18	PivoTrac™	10 Leaf						Control	270	480	Leon
7/13		1.25	PivoTrac™	10 Leaf						Control	90	480	Leon
7/16		1.40	PivoTrac™	10 Leaf						Control	270	480	Leon
7/17	0.82		373.64	10 Leaf	98.2	97.6	97.9	98.4	98.5	Control	326 Y	450	R & C
7/19		1.09	PivoTrac™	11 Leaf						Control	90	450	Leon
7/22		1.13	PivoTrac™	11 Leaf						Control	270	450	Leon
7/24			382.78	11 Leaf	97.0	98.7	98.3	98.7	98.8		268 N		R & C
7/30		1.08	PivoTrac™	Silk						Control	90	450	Leon
7/31	1.02		388.3	Silk	73.3	97.7	97.9	98.2	98.5		106 N		Randy
8/4		0.90	PivoTrac™	Pollination						Control	270	450	Leon
8/6	0.16		395.11	Pollination	46.7	96.7	97.8	98.3	98.4		269 N		R & C
8/14	1.61		395.11	Milk	47.1	78.7	98.4	98.0	98.4		269 N		R & C
8/21		1.15	PivoTrac™	Dough						Control	90	450	Leon
8/22			403.27	Dough	31.5	69.5	95.7	97.8	98.2	Control	19 Y	461	Randy
8/26		1.00	PivoTrac™	Dent						Control	270	450	Leon
8/28			410.43	Dent	28.1	30.5	55.5	97.0	97.7	Control	13 Y	447	Randy
8/29		1.26	PivoTrac™	1/4 ml						Control	90	450	Leon
9/2		0.91	PivoTrac™	1/4 ml						Control	270	400	Leon
9/4			425.03	1/4 ml	22.0	19.5	39.2	95.6	97.5	Wheat	166 Y	376	Randy
9/11	0.08		431.35	1/2 ml	16.1	8.7	24.6	90.3	96.9	Control	324 Y	416	Randy
9/12		1.25	PivoTrac™	7/8 ml						Control	270	400	Leon
9/18	1.11		433.35	7/8 ml	13.5	15..8	26.3	91.1	96.7		268 N		Randy
9/24			433.35	15/16 ml	13.4	13.9	24.8	90.8	96.4		268 N		Randy
10/2			444.62	1.0 ml	13.2	6.3	17.7	88.1	94.9	Wheat	211 Y		Randy
10/9			447.6	Black Layer	11.9	4.4	15.6	85.1	94.0	Wheat	112 N		Randy
10/16			448.45	Black Layer	17.4	10.1	19.6	85.6	93.3	Wheat	141 N		Randy
10/23			448.46	Black Layer	12.9	5.8	16.7	86.3	93.4		141 N		Randy
10/30			456.58	Harvested	12.2	6.2	16.9	86.8	93.2	Wheat	102 N		Randy
11/6	0.28		456.58	Harvested	10.3	8.6	17.1	87.4	93.3		102 N		Randy
Total	**6.58**	**21.06**			**0.47”**	**0.16”**	**0.00”**	**0.00”**	**0.00”**				
Net Soil Moisture is 0.63"													
Irrigation, Rainfall Plus Net Soil Moisture is 28.27"													

- Numbers in red are not counted in total

2013-Corn Demonstration
Irrigated Medium Season Corn

Control

Year: *2013* **County:** *Hartley* **Grower:** *Hartley Feeders*

No. Acres: *60* **Hybrid:** *P1498HR* **Soil Type:** *Dumas Loam, Sunray Clay Loam*

Meter Type: *Seametrics*

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

Fertilizer: *50-0-0* **Seeding:** *28,000*

Planted: *May 19* **Harvest:** *October 30*

Herbicide: *Harness Xtra, Laudis, Roundup* **Insecticide:** *Comite*

Yield: *176 bu/ac* **Prev. crop:** *Wheat* **Row width:** *30 Inch*

Irrigation method: *Center Pivot* **Prewater:** *0.72 in.* **Well GPM:** *3.7*

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

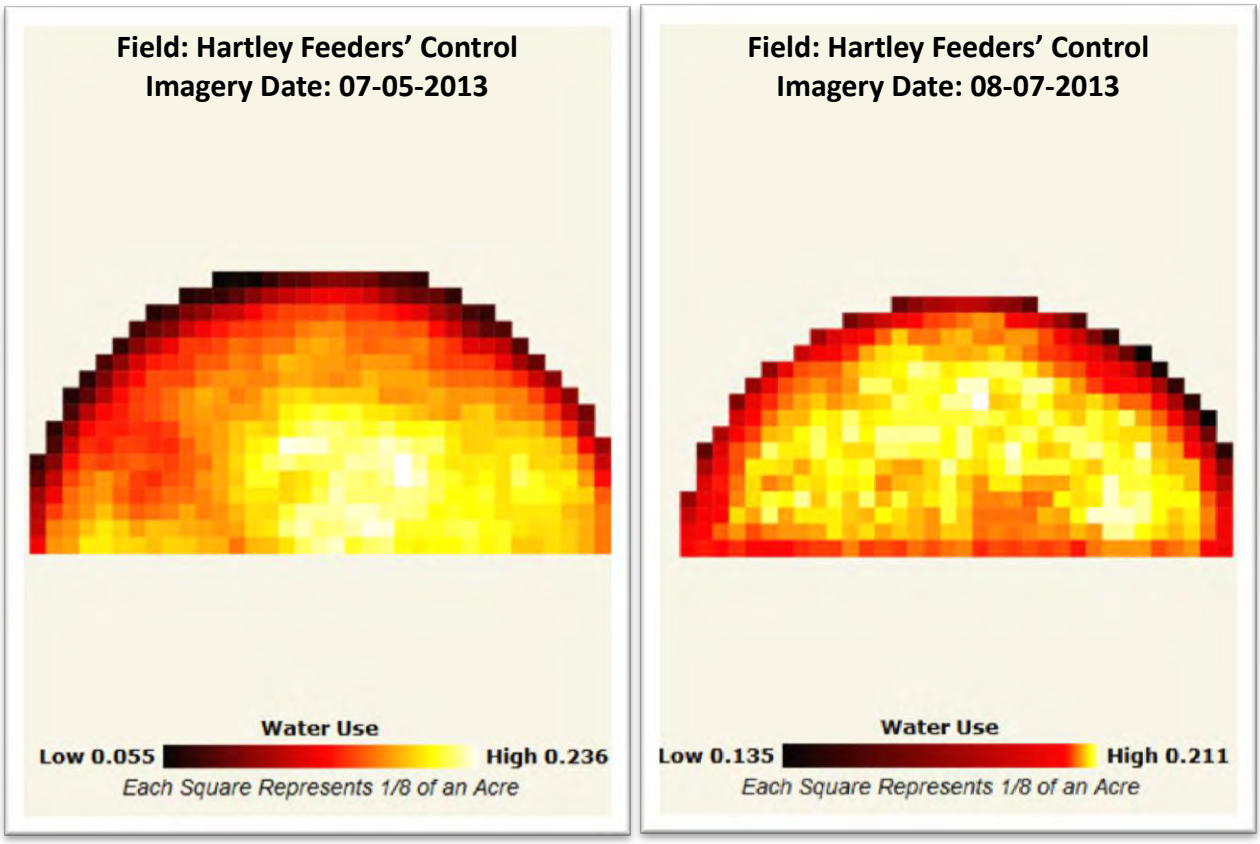
Application pattern: *Spray* **Crop row direction :** *Straight*

GPS Location of Pivot Pad
Latitude: *35.888173*
Longitude: *-102.464733*

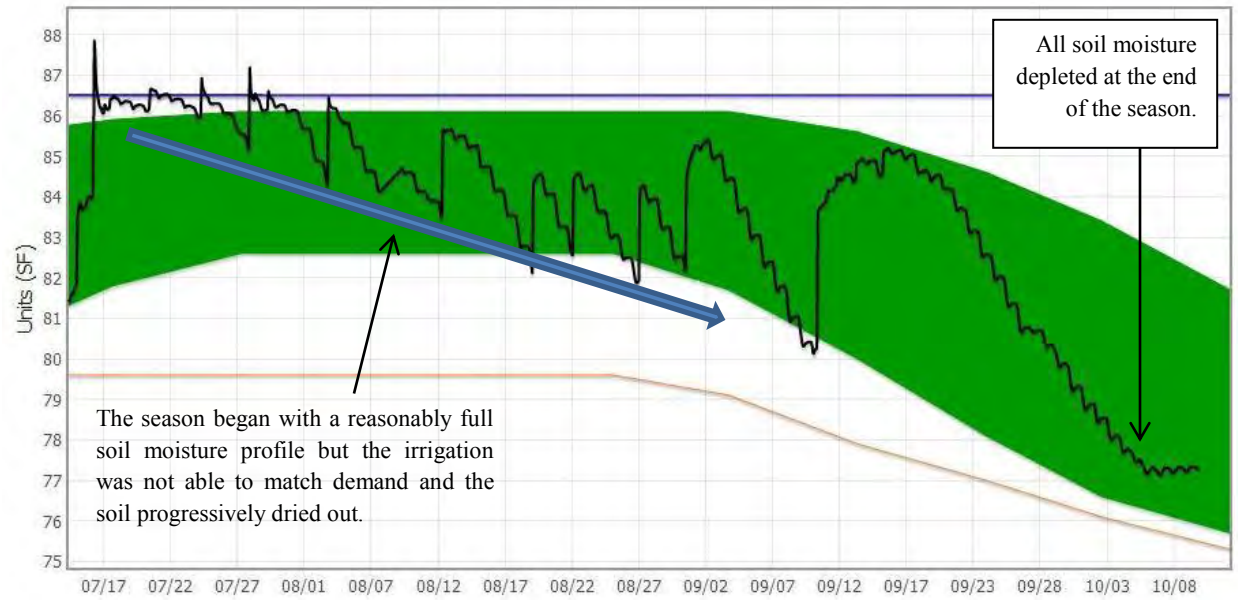
GPS Location of Gypsum Blocks
Latitude: *35.888813*
Longitude: *-102.46869*

Satellite imagery: Satellite imagery was initiated in combination with HydroBio in 2013 and used to learn and evaluate its potential for an irrigation and water management tool for growers. Hartley Feeders‟ "200-12" and Control field were two of ten "200-12" project fields included in 2013. A website was established and made available to project cooperators and District staff. We learned that satellite imagery has potential, but requires additional development, especially in establishing beginning soil moisture and monitoring the soil profile and root zone during the growing season. Two satellite images of Hartley Feeders‟ Control field, one on July 5 at the 8 leaf growth stage and another on August 7th at the pollination reproduction stage are shown in figure 60 to illustrate examples of what is displayed on the website. Areas in white are the highest daily water use. The satellite imagery data changes when the next satellite passes, usually in three day increments.

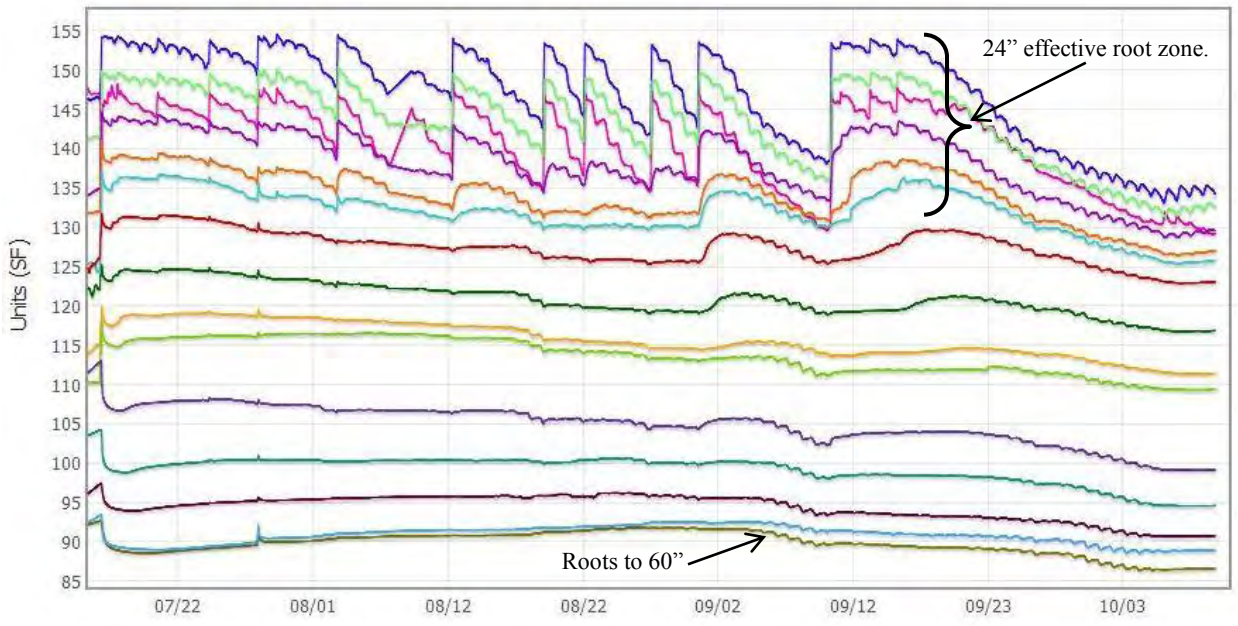
Figure 60: Satellite Imagery for Hartley Feeder's Control Demonstration Field



Hartley Feeders' Control Field AquaSpy® Probe Summary



The Control field got 3" less irrigation and 42 bu/ac less yield than the 200/12 treatment and this is reinforced by the data. The graph shows that irrigation was not keeping up with demand on this field and the effective irrigation depth was only 16-24". While the roots on both fields went to 60", the Control had a less aggressive root system and less water extraction from the subsoil. It is possible that the reason that there was not as much water extracted from the subsoil was because it wasn"t totally full but it is hard to say from the data, since no time through the season did any moisture reach deeper than 32".



Harvest Results: The "200-12" field produced a 218 bushel per acre corn yield. Irrigation totaled 24.01 inches, of which 1.56 was pre-water. Production in the Control field was 176 bushels per acre, where seasonal irrigation totaled 21.06 inches. Pre-season irrigation was 0.72 inches for the Control field and is included in total irrigation. In comparison, the "200-12" field produced 42 more bushels per acre than the Control with 2.95 inches more irrigation. Corn production was 9.08 bushels (508lbs) per inch of irrigation in the "200-12" field compared to 8.36 (468lbs) in the Control. Production from each inch of irrigation, rainfall and net soil water that totaled 31.11 inches was 7.01 bushels (392lbs) per acre in the 200-12 field. Irrigation, rainfall and net soil water totaled 28.27 inches in the Control field where production was 6.23 bushels (349lbs) per inch. Crop production costs were $33.68 per acre more for the "200-12" field than for the Control from additional irrigation and harvest expenses. At $5.13 per bushel, the additional 42 bushel corn yield amounts to $215.46 more per acre. The "200-12" field"s net gain was $181.78 per acre with 2.95 inches more irrigation used compared to production from the Control field. Net return from the "200-12" field was $644.95 compared to $463.18 from the Control field. Net return from the additional 2.95 inches of irrigation was $61.62 per inch. Soil moisture sensors indicate plant roots did not use available soil water from 4 and 5 feet in the Control field. Dennis Buss said "the AquaSpy® soil probe really helped save water. I was able to shut down irrigation for a whole week twice this summer. And, the plant tissue tests by Better Harvest saved a lot of money for fertilizer. Plants were less stressed from not over applying nitrogen fertilizer". A summary of the demonstration results are shown in table 57.

Table 57: Hartley Feeders' 2013 Demonstration Results

	Irrigation (in.)	Total Water (in.)	Production		Crop Value @ $5.13/bu		
			bu/ac	lb/ac-in of Irrigation	Per Acre	Acre-in of Irrigation	Acre-in of Total Water
"200-12"	24.01	*31.11	218	508	$1,118.34	$46.58	$35.95
Control	21.06	†28.27	176	468	$902.88	$42.87	$31.94

*Includes 0.52 inches of water removed from five feet of soil, plus rainfall, and irrigation.
†Includes 0.63 inches of water removed from five feet of soil, plus rainfall, and irrigation.

Tommy Laubhan's 2013 Lipscomb County Demonstration

Planting and Crop Information: For his demonstration, Tommy Laubhan strip tilled and planted 61 acres of corn in the southeast quarter of the northeast half of section 1139, for his "200-12" field, "Laubhan 200-12". Laubhan planted the southeast "200-12" quarter of the circle with Pioneer P1151AM at a seeding rate of 31,700 seeds per acre. He planted the northeast 61 acre quarter, also strip tilled, to Pioneer P1151AM at 31,700 seeds per acre for his "Control" field, "Laubhan Control". Both the southeast quarter "200-12" and northeast quarter Control fields were irrigated using the same center pivot. Seasonal water meter readings averaged 1160 gpm and delivered an average of 1.15 inch of irrigation in a 4.5 day revolution. The southwest half of the circle was planted to corn following a lost wheat crop due to freeze damage. A windstorm on June 3 wrecked the center pivot irrigation system. A replacement system was in operation on June 15. The crop was damaged by hail later in the season. Insurance adjustment from hail damage was 35 percent. Planting and crop information for "Laubhan 200-12" and "Laubhan Control" are shown in table 58 below.

Table 58: Planting and Crop Information for Tommy Laubhan

"200-12" Demonstration Field			
Planted:	*May 12*	**Harvested:**	*October 5*
Hybrid:	*P1151AM*	**Seeding Rate:**	*31,700*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*57*	**GPM Per Acre:**	*4.8*
Total Water:	*35.06 in.*	**Soil Type:**	*Grandfield FSL, Quanah Soils*
Fertilizer:	*240-70-70-50S-5Zn*	**Insecticide:**	*None*
Herbicide:	*Cinch ATZ, Roundup*		
Control Demonstration Field			
Planted:	*May 12*	**Harvested:**	*October 5*
Hybrid:	*P1151AM*	**Seeding Rate:**	*31,700*
Row Width:	*30 in.*	**Tillage:**	*Strip Till*
No. Acres:	*60*	**GPM Per Acre:**	*4.8*
Total Water:	*36.86 in.*	**Soil Type:**	*Acuff Loam, Darrouzett Silty Clay Loam and Grandfield FSL*
Fertilizer:	*240-70-70-50S-5Zn*	**Insecticide:**	*None*
Herbicide:	*Cinch ATZ, Roundup*		

Beginning Soil Water Profile and Growing Season Rainfall

"200-12" Demonstration Field: Initial gypsum block readings show soil water was good at 1, 2, 3, 4, and 5 feet in the profile prior to and following planting. No pre-irrigation was applied. Additional readings show the crop had adequate soil moisture during the growing season. 4.05 inches of rainfall was recorded during the storm on June 3, all of which could not have been beneficial; however, other rainfall did help the crop. Seasonal rainfall was 14.19 inches. Gypsum blocks were in Grandfield fine sandy loam.

Control Demonstration Field: Soil moisture sensors show soil water was good at 1, 2, 3, 4 and 5 feet prior to planting. Weekly gypsum block readings that followed show the profile was

generally maintained at field capacity during the growing season. June rainfall totaled 7.58 inches, which includes the 4.05 inches recorded during the storm on June 3. Rainfall in August totaled 4.62 inches when the crop was in the milk, dough and grain development stages. Rainfall totaled 14.19 inches during the growing season. Monthly rainfall recorded at the demonstration fields are in table 59.

Table 59: Monthly Rainfall Data for Tommy Laubhan

	May	June	July	August	September	Total
"200-12"	0.05"	7.58"	1.71"	4.62"	0.23"	**14.19"**
Control	0.05"	7.58"	1.71"	4.62"	0.23"	**14.19"**

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 each Control field. Both the gypsum block sensors and the soil probe were installed in close proximity to each other in the field. Gypsum blocks were installed in the "200-12" fields and most Control fields prior to planting. Each AquaSpy® probe was installed following crop emergence, as well as gypsum blocks in any remaining fields. Installing and reading the gypsum blocks prior to planting provided advanced soil moisture conditions and information to help guide and manage irrigation. 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 same illustrations for the Control field.

Figure 61: Gypsum Block Readings for Tommy Laubhan's "200-12" Demonstration Field

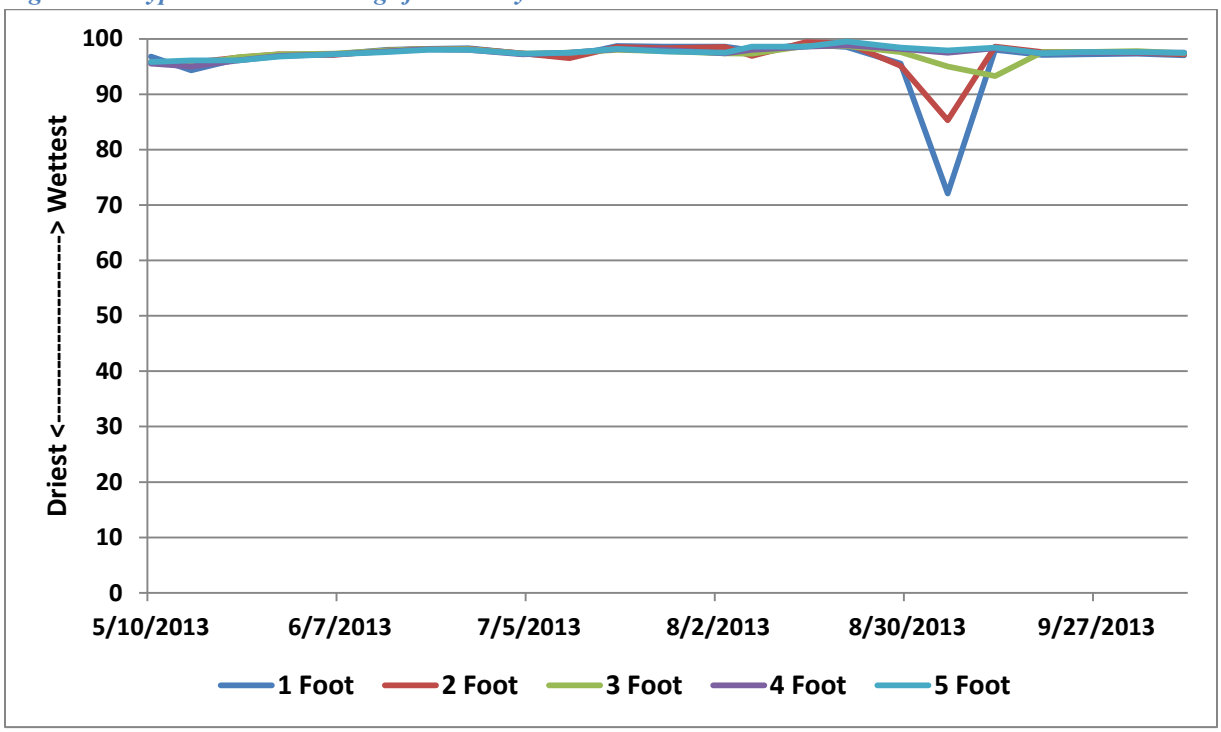


Figure 62: Growing Season Water Tracking for Tommy Laubhan's "200-12" Demonstration Field (189 bu/ac)

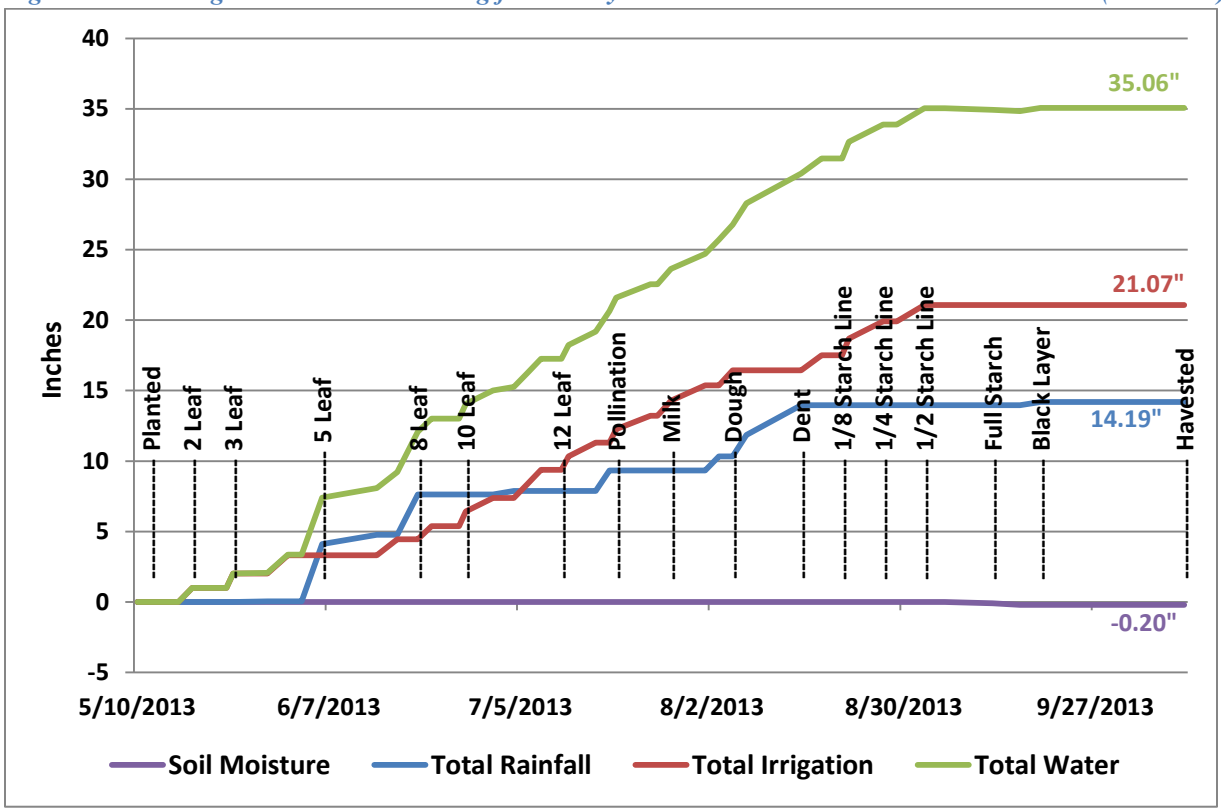


Table 60: Demonstration Field Data for Tommy Laubhan's "200-12" Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
5/10	0.02		22135		96.8	95.8	95.7	95.5	95.8	Wheat	324 Y	1100	Randy
5/12				Planted						200-12			Tommy
5/16			27872		94.3	95.7	95.3	95.0	96.1	Control	6.1 Y	1034	Randy
5/18		1.01	PivoTrac™	2 Leaf						200-12	144 Y	1075	Leon
5/23			36167	2 Leaf	96.4	96.6	96.7	96.1	96.1	200-12	95 Y cw	1082	R & C
5/24		1.01	PivoTrac™	3 Leaf						200-12	144 Y	1075	Leon
5/29	0.05		44537	3 Leaf	97.1	97.2	97.2	96.9	96.8	200-12	119 Y	1022	R & C
6/1		1.29	PivoTrac™	3 Leaf						200-12	144 Y	1075	Leon
6/3	Center Pivot Wrecked during a Strom												Tommy
6/6	4.05		52296	5 Leaf	97.2	97.1	97.3	97.2	97.2		126 down		R & C
6/14	0.68		52296	5 Leaf	98.0	97.9	97.9	97.7	97.6		126 down		R & C
6/17		1.13	PivoTrac™	7 Leaf						200-12	144 Y	1075	Leon
6/20	2.85		59451	8 Leaf	98.2	98.2	98.2	98.1	98.0		133 new		R & C
6/22		0.95	PivoTrac™	8 Leaf						200-12	144 Y	1200	Leon
6/26			64578	9 Leaf	98.3	98.2	98.1	98.0	98.0	200-12	66 Y	1248	R & C
6/27		1.03	PivoTrac™	10 Leaf						200-12	144 Y	1200	Leon
7/1		0.96	PivoTrac™	10 Leaf						200-12	144 Y	1200	Leon
7/4	0.26		79093	10 Leaf	97.3	97.4	97.3	97.2	97.3	200-12	123 Y	1209	Craig
7/6		0.97	PivoTrac™	10 Leaf						200-12	144 Y	1200	Leon
7/8		1.02	PivoTrac™	11 Leaf						200-12	144 Y	1200	Leon
7/11			91366	12 Leaf	96.8	96.5	97.5	97.5	97.5	200-12	67 Y	1297	R & C
7/12		0.97	PivoTrac™	12 Leaf						200-12	144 Y	1200	Leon
7/16		0.96	PivoTrac™	Tassel						200-12	144 Y	1200	Leon
7/18	1.45		103677	Silk	98.7	98.5	98.0	98.1	98.2	Control	359 Y	1214	R & C
7/19		0.96	PivoTrac™	Pollination						200-12	144 Y	1200	Leon
7/24		0.95	PivoTrac™	Pollination						200-12	144 Y	1200	Leon
7/25			115444	Pollination	98.6	98.3	97.8	98.0	97.7	SS	290 Y	1180	R & C
7/27		1.08	PivoTrac™	Milk						200-12	144 Y	1200	Leon
8/1		1.08	PivoTrac™	Milk						200-12	144 Y	1200	Leon
8/3	1.00		126913	Milk	98.6	98.5	97.4	97.4	97.5	SS	177 Y	1116	Randy
8/5		1.07	PivoTrac™	Dough						200-12	144 Y	1200	Leon
8/7	1.52		136441	Dough	97.9	96.9	97.3	98.0	98.6	Control	329 Y	1116	R & C
8/15	2.10		139564	Dent	99.0	99.4	98.7	98.6	98.6		134 N		R & C
8/18		1.07	PivoTrac™	Dent						200-12	144 Y	1200	Leon
8/21			146513	1/8 ml	98.5	99.2	98.7	98.8	99.5	200-12	82 Y	1136	Randy
8/22		1.19	PivoTrac™	1/8 ml						200-12	144 Y	1200	Leon
8/27		1.21	PivoTrac™	1/4 ml						200-12	144 Y	120	Leon
8/29			158189	1/4 ml	95.5	95.1	97.6	98.2	98.4	Control	270 Y	1010	Randy
9/2		1.16	PivoTrac™	1/2 ml						200-12	54 Y	1200	Leon
9/5			167891	3/4 ml	72.1	85.3	95.0	97.5	97.9	SS	190 Y	1109	Randy
9/12			170342	1.0 ml	98.0	98.6	93.3	98.3	98.4		67 N		Randy
9/19	0.23		170342	Black Layer	97.1	97.6	97.6	97.4	97.4		126 N		Randy
9/25	1.44		170342	Black Layer	97.2	97.6	97.6	97.5	97.6		126 N		Randy
10/3	0.65		170342	Black Layer	97.3	97.5	97.8	97.5	97.6		126 N		Randy
10/3	0.65		170342	Black Layer	97.3	97.5	97.8	97.5	97.6		126 N		Randy
10/10			170342	Harvested	97.0	97.2	97.4	97.5	97.5		150 N		Randy
Total	**14.19**	**21.07**			**0.00"**	**-0.09"**	**0.00"**	**-0.05"**	**-0.06"**				
Net Soil Moisture is -0.20"													
Irrigation, Rainfall Plus Net Soil Moisture is 35.06"													

- Numbers in red are not counted in total

2013-Corn Demonstration
Irrigated Medium Season Corn

200-12

Year:	*2013*	**County:**	*Lipscomb*	**Grower:**	*Tommy Laubhan*
No. Acres:	*57*	**Hybrid:**	*P1151AM*	**Soil Type:**	*Grandfield Fine Sandy Loam, Quanah Soils*
Meter Type:	*McCrometer*				
Meter Mult:	*Gallons x 1000*	**Tillage:**	*Strip Till*		
Fertilizer:	*240-70-10-50S-5Zn*	**Seeding:**	*31,700*		
Planted:	*May 12*	**Harvest:**	*October 5*		
Herbicide:	*Cinch ATZ, Roundup*	**Insecticide:**	*None*		
Yield:	*189 bu/ac*	**Prev. crop:**	*Wheat*	**Row width:**	*30 Inch*
Irrigation method:	*Center Pivot*	**Prewater:**	*none*	**GPM/acre:**	*4.8*
Distance between drops:	*60"*	**Distance from nozzle to ground:**	*16"*		
Application pattern:	*Spray*	**Crop row direction :**	*Circle*		

GPS Location of Pivot Pad		**GPS Location of Gypsum Blocks**	
Latitude:	*36.40993*	Latitude:	*36.411845*
Longitude:	*-100.106708*	Longitude:	*-100.101265*

Tommy Laubhan's "200-12" Field AquaSpy® Probe Summary

This field began with a reasonably full soil moisture profile and there were quite frequent irrigations early in the season. The majority of these irrigations only wet the top 12"-16" but there were also some deeper irrigation or rainfall events. This resulted in a little drainage but the crop also failed to extract a lot of moisture below 28-32". Once the storm blew over the sprinkler, the crop was forced to put roots down to 48" but this probably caused a fair amount of tipping back and yield loss. The crop appeared to go into a fair amount of moisture stress at the end of the season which may have caused some premature senescence.

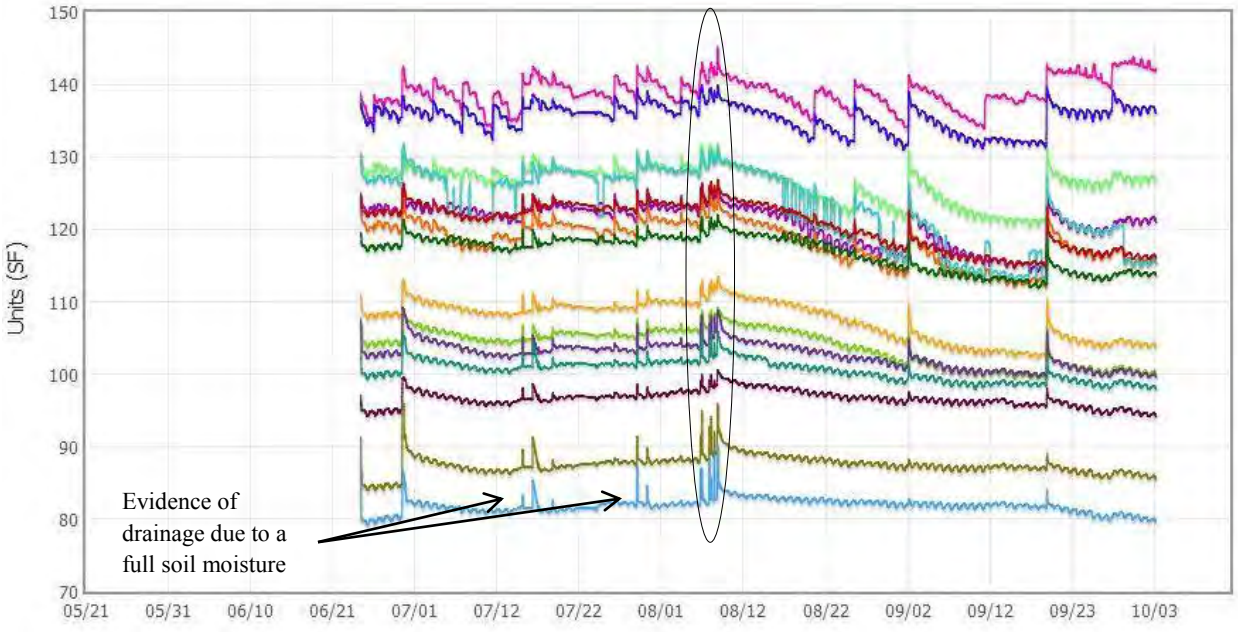


Figure 63: Gypsum Block Readings for Tommy Laubhan's Control Demonstration Field

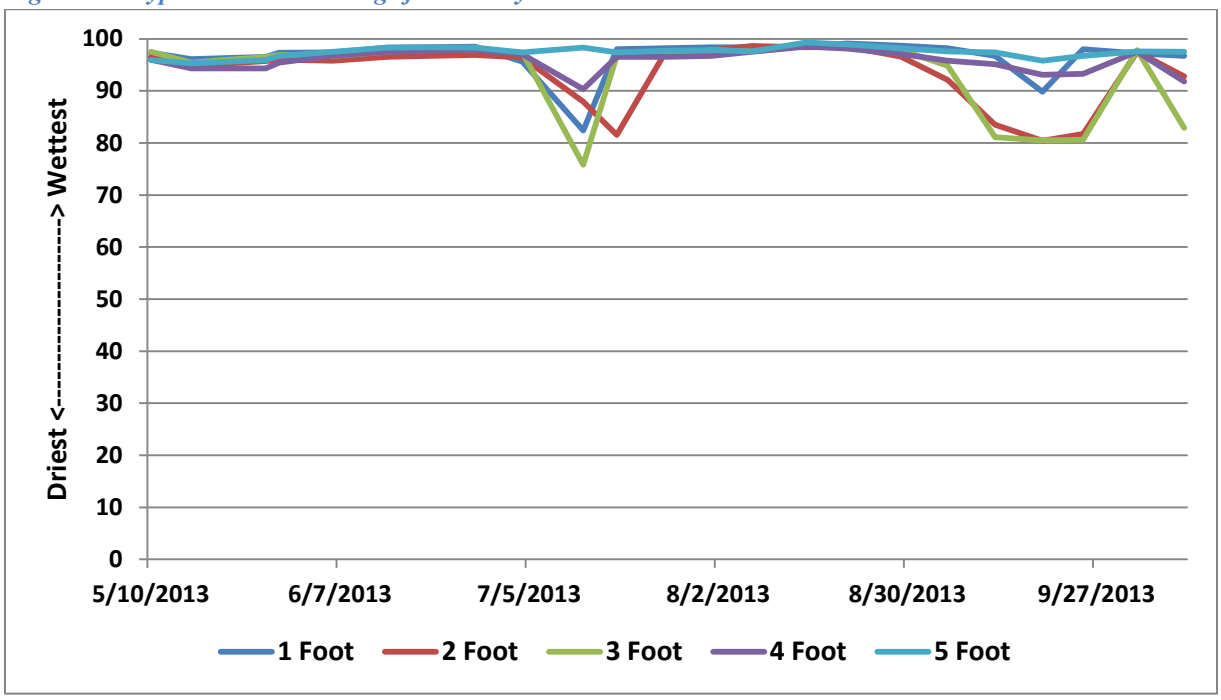


Figure 64: Growing Season Water Tracking for Tommy Laubhan's Control Demonstration Field (191 bu/ac)

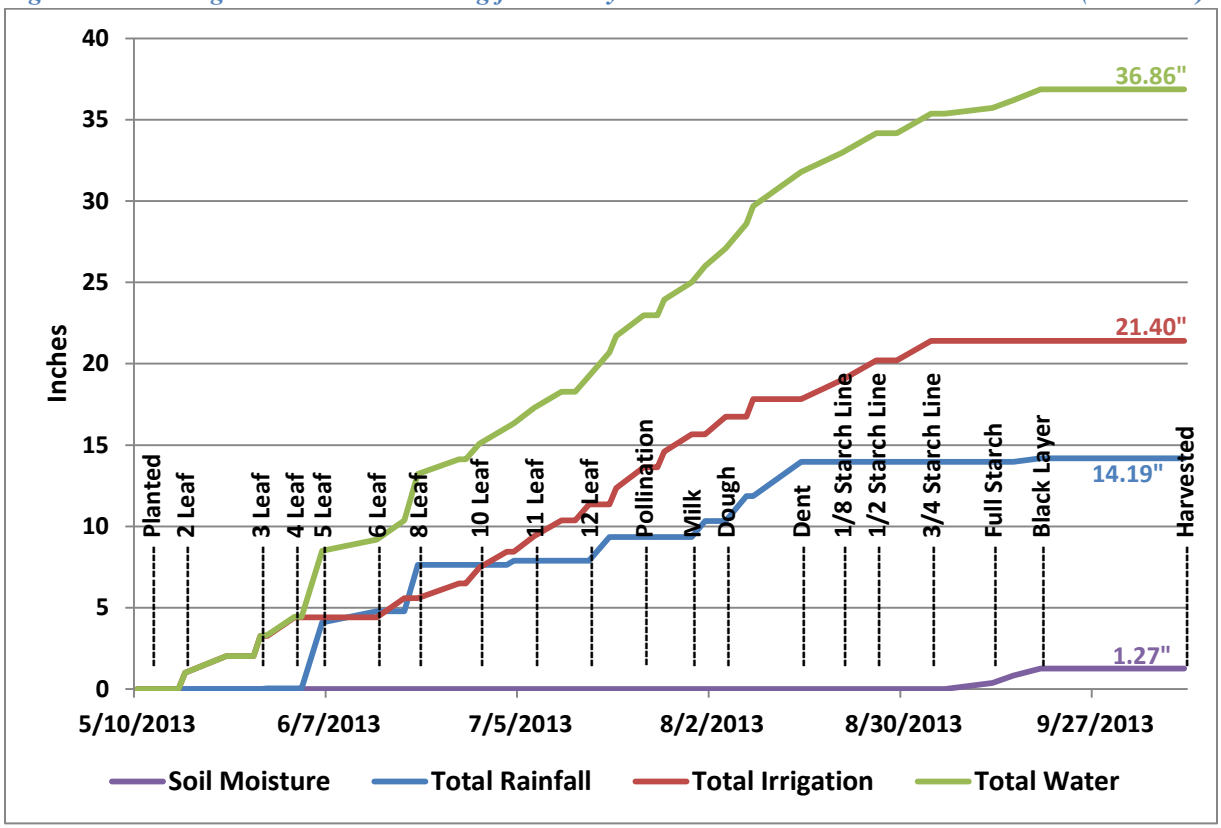


Table 61: Demonstration Field Data for Tommy Laubhan's Control Demonstration Field

Date	Rain Inches	Irrigation Inches	Water Meter	Growth Stage	Soil Moisture					Crop Status	Pivot Position	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
5/10	0.02		22135		97.3	96.5	97.5	96	95.9	Wheat	324 Y cw	1100	Randy
5/12				Planted						Control			Tommy
5/16			27872		96.1	94.8	95.4	94.3	95.3	Control	6.1	1034	Randy
5/17		1.01	PivoTrac™	2 Leaf						Control	54 Y	1075	Leon
5/23		1.02	PivoTrac™	2 Leaf						Control	54 Y	1075	Leon
5/27			36167	2 Leaf	96.5	95.7	96.5	94.3	95.9	200-12	95 Y cw	1082	R & C
5/28		1.25	PivoTrac™	2 Leaf						Control	54 Y	1075	Leon
5/29	0.05		44537	3 Leaf	97.3	96	96.9	95.4	96.7	200-12	119 Y	1011	R & C
6/2		1.13	PivoTrac™	4 Leaf						Control	54 Y	1075	Leon
6/3	Center Pivot Wrecked during a Strom												Tommy
6/6	4.05		52296	5 Leaf	97.4	95.8	96.7	96.8	97.5	Down	126 N		R & C
6/14	0.68		52296	6 Leaf	98.3	96.5	97.5	97.5	98.3	Down	126 N		R & C
6/18		1.19	PivoTrac™	7 Leaf						Control	54 Y	1200	Leon
6/20	2.85		59451	8 Leaf	98.4	96.7	97.8	97.7	98.4	New CP	133 N		R & C
6/26		0.9	PivoTrac™	9 Leaf						Control	54 Y	1200	Leon
6/27			64578	9 Leaf	98.5	96.9	98	97.9	98.3	200-12	66 Y	1248	R & C
6/29		0.97	PivoTrac™	10 Leaf						Control	54 Y	1200	Leon
7/3		0.97	PivoTrac™	10 Leaf						Control	54 Y	1200	Leon
7/4	0.26		79093	10 Leaf	95.6	96.4	97.3	97	97.4	200-12	123 Y	1209	Craig
7/7		0.97	PivoTrac™	11 Leaf						Control	54 Y	1200	Leon
7/11		0.97	PivoTrac™	11 Leaf						Control	54 Y	1200	Leon
7/13			91366	11 Leaf	82.4	87.9	75.8	90.3	98.3	200-12	67 Y	1297	R & C
7/15		0.98	PivoTrac™	12 Leaf						Control	54 Y	1200	Leon
7/18	1.45		103677	Silk	98	81.5	96.8	96.5	97.4	Control	359 Y	1214	R & C
7/19		0.99	PivoTrac™	Silk						Control	54 Y	1200	Leon
7/23		1.29	PivoTrac™	Pollination						Control	54 Y	1200	Leon
7/25			115444	Pollination	98.2	97	97.2	96.5	97.7	SS	290 Y	1180	R & C
7/26		0.96	PivoTrac™	Pollination						Control	54 Y	1200	Leon
7/30		1.07	PivoTrac™	Milk						Control	54 Y	1200	Leon
8/1	1.00		126913	Milk	98.4	97.8	97.8	96.7	97.8	SS	177 Y	1116	Randy
8/4		1.07	PivoTrac™	Dough						Control	54 Y	1200	Leon
8/7	1.52		136441	Dough	98.4	98.6	97.6	97.5	97.6	Control	329 Y	1116	R & C
8/8		1.08	PivoTrac™	Dough						Control	54 Y	1200	Leon
8/15	2.1		139564	Dent	98.5	98.4	98.6	98.5	99.3		134 N		R & C
8/21		1.19	PivoTrac™	1/8 ml						Control	54 Y	1200	Leon
8/21			146513	1/8 ml	99.1	98.5	98.7	98.1	98.9	200-12	82 Y	1136	Randy
8/26		1.19	PivoTrac™	1/2 ml						Control	54 Y	1200	Leon
8/29			158189	1/2 ml	98.7	96.6	97.9	97.1	98.2	SS	270 Y	1010	Randy
9/3		1.2	PivoTrac™	3/4 ml						Control	324 N	1200	Leon
9/5			167891	15/16 ml	98.2	92.1	94.8	95.8	97.6	SS	190 Y	1109	Randy
9/12			170342	1.0 ml	96.7	83.5	81.1	95.1	97.4		67 N		Randy
9/19	0.23		170342	Black Layer	89.8	80.4	80.5	93.1	95.8		126 N		Randy
9/25	1.44		170342	Black Layer	98	81.7	80.6	93.3	96.7		126 N		Randy
10/3	0.65		170342	Black Layer	97.2	97.5	97.8	97.5	97.6		126 N		Randy
10/10			170342	Harvested	96.7	92.8	82.9	91.8	97.5		150 N		Randy
Total	**14.19**	**21.40**			**0.27"**	**0.45"**	**0.49"**	**0.06"**	**0.00"**				
Net Soil Moisture is 1.27"													
Irrigation, Rainfall Plus Net Soil Moisture is 36.86"													

- Number in red are not counted in the total

2013-Corn Demonstration
Irrigated Medium Season Corn

Control

Year: *2013* **County:** *Lipscomb* **Grower:** *Tommy Laubhan*

No. Acres: *60* **Hybrid:** *P1151AM* **Soil Type:** *Grandfield Fine Sandy Loam, Quanah Soils*

Meter Type: *McCrometer*

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

Fertilizer: *240-70-10-50S-5Zn* **Seeding:** *31,700*

Planted: *May 12* **Harvest:** *October 5*

Herbicide: *Cinch ATZ, Roundup* **Insecticide:** *None*

Yield: *191 Bu/Acre* **Prev. crop:** *Corn* **Row width:** *30 Inch*

Irrigation method: *Center Pivot* **Prewater:** *None* **Well GPM:** *4.8*

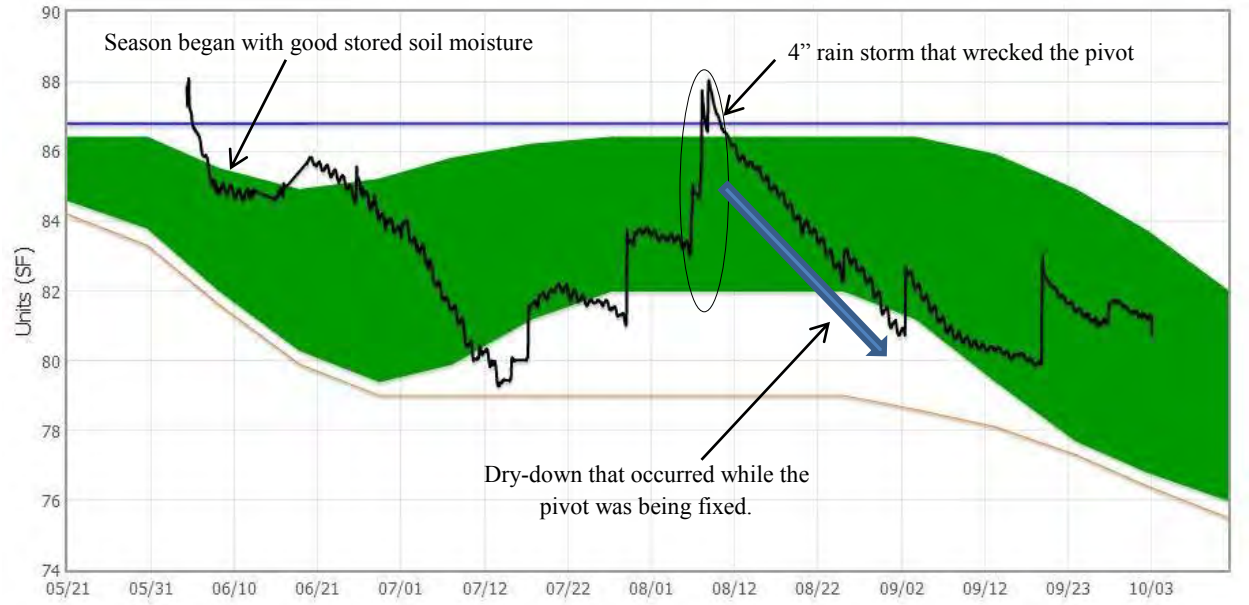
Distance between drops: *60"* **Distance from nozzle to ground:** *16"*

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

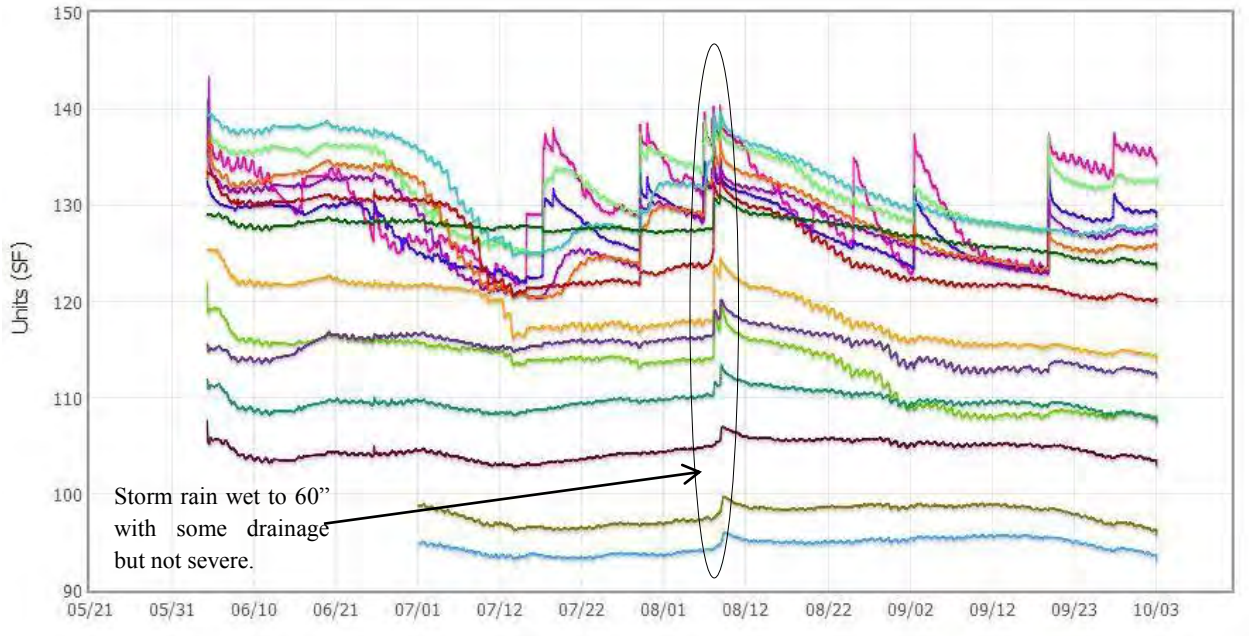
GPS Location of Pivot Pad
Latitude: *36.40993*
Longitude: *-100.106708*

GPS Location of Gypsum Blocks
Latitude: *36.413153*
Longitude: *-100.12285*

Tommy Laubhan's Control Field AquaSpy® Probe Summary



Both the Control and the "200-12" fields began with reasonably good stored soil moisture, however unlike the "200-12" field, the Control had a hard time keeping up with demand during the hot conditions in late June and early July. As a result there was rapid root growth to about 40" and the top 3" dried out considerably. The subsequent change to cooler weather allowed the profile to be built up again before a 4" storm completely filled the profile and wrecked the pivot. This resulted in a rapid draw-down of stored soil moisture and evidence of root activity all the way to 60". The field finished with a relatively empty soil profile, with most of the soil moisture consumed by the crop. Both treatments ended up using the same amount of irrigation for the same yield.



Harvest Results: The "200-12" field produced a 189 bushel per acre corn yield. Irrigation totaled 21.07 inches. Production in the Control field was 191 bushels per acre. Seasonal irrigation totaled 21.40 inches. There was no pre-season irrigation. The Control field produced two more bushels per acre than the "200-12" and irrigation was 0.33 inches more. Corn production was 8.97 bushels (502lbs) per inch of irrigation in the "200-12" field compared to 8.93 (500lbs) in the Control. Production from each inch of irrigation, rainfall and net soil water that totaled 35.06 inches was 5.39 bushels (302lbs) per acre in the "200-12" field. Irrigation, rainfall and net soil water totaled 36.86 inches in the Control field where production was 5.18 bushels (290lbs) per inch. Crop production costs were $2.86 per acre less for the "200-12" field than for the Control from reduced irrigation and harvest expenses. At $5.13 per bushel, the two bushel per acre increased corn yield in the Control field amounts to $10.26 more per acre. The Control field‟s net gain was $7.40 per acre with 0.33 inches additional irrigation used, compared to production from the "200-12" field. Net return from the "200-12" field was $493.63 per acre, compared to $501.03 from the Control field. To say the growing season environment was unstable at the Laubhan fields in 2013 is an understatement. They were downright destructive. The center pivot irrigation system was wrecked in a wind storm on June 3. A new replacement system was erected to continue. The center pivot was irrigating the "200-12" field when it was wrecked. Four acres of the field was destroyed replacing the center pivot with a new one. Then two hail storms damaged plants in both the "200-12" and Control fields. Insurance adjustment for the crop damage was 35 percent. Total rainfall measured is what is reported in the District‟s "200-12" project. 4.05 inches were recorded during the windstorm on June 3, which obviously was not all beneficial for corn production. The good news is Laubhan harvested 189 bushels per acre from his "200-12" field and 191 bushels from his Control. A summary of the demonstration results are shown in table 62.

Table 62: Tommy Laubhan's 2013 Demonstration Results

	Irrigation (in.)	Total Water (in.)	Production		Crop Value @ $5.13/bu		
			bu/ac	lb/ac-in Irrigation	Per Acre	Acre-in of Irrigation	Acre-in of Total Water
"200-12"	21.07	*35.06	189	502	$969.57	$46.02	$27.65
Control	21.40	†36.86	191	500	$979.83	$45.79	$26.58

*Includes -0.20 inches of water added to five feet of soil, plus rainfall, and irrigation.
†Includes 1.27 inches of water removed from five feet of soil, plus rainfall, and irrigation.

Variable Rate Irrigation (VRI) For Tommy Laubhan's "200-12" Field: Variable Rate Irrigation (VRI) by center pivot speed control was prepared for Tommy Laubhan‟s "200-12" field. A prescription was written using the dual EM subsoil layer obtained from a preseason electromagnetic (EM 38) soil survey using Crop Metrics Virtual Agronomist software. An Image of the dual EM survey is in Figure 65. The EM survey map includes both Laubhan‟s "200-12" and Control fields. The "200-12" field is from 54 to 133 degrees in the circle. The VRI prescription is based on a 4.5 day revolution and 1250 gpm that applies an average of 1.25 inches of irrigation. Laubhans‟ prescription is written to apply more irrigation on the southeast portion of the "200-12" field and less on the northeast portion. Actual irrigation varies from 1.10 inches to 1.42 inches in prescribed areas of the field as shown in Figure 66. Center pivot variable speed

control in fifteen, 6-degree increments was to be accomplished by PivoTrac™ using the VRI prescription. The prescription is shown in Table 63. Although planned and ready, VRI was never initiated due to the storm on June 3 that wrecked the center pivot and created delays in irrigation. Laubhan‟s VRI is one of four planned for the 2013 growing season to continue the VRI process following it‟s initiation in 2012.

Figure 65: Dual EM Subsoil Image of Tommy Laubhan's "200-12" and Control Demonstration Field

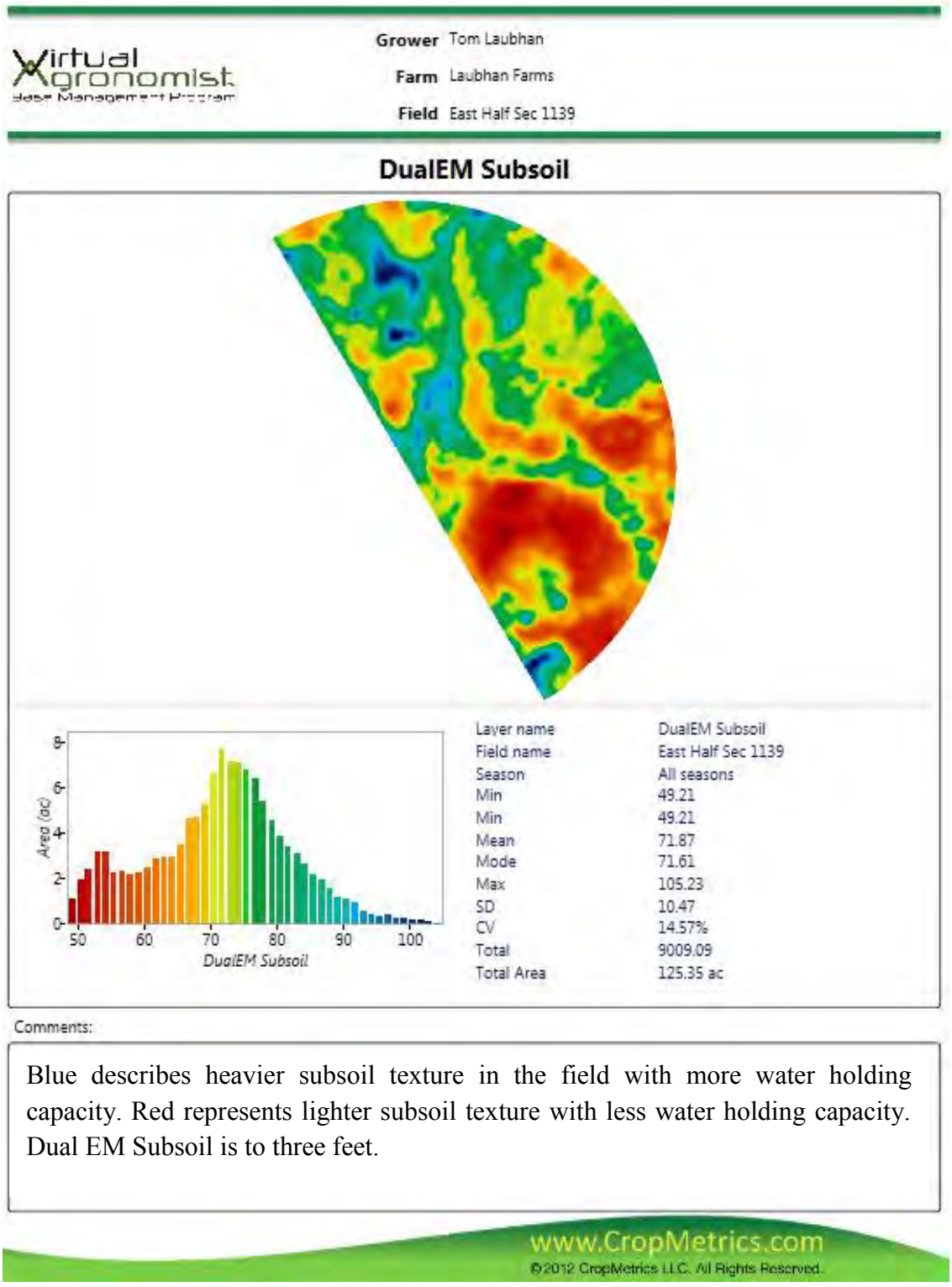


Figure 66: Variable Rate Irrigation (VRI) For Tom Laubhan's "200-12" Demonstration Field

Virtual Agronomist
Base Management Program

Grower Tom Laubhan
Farm Laubhan Farms
Field East Half Sec 1139

Pivot VRI by Sector Report

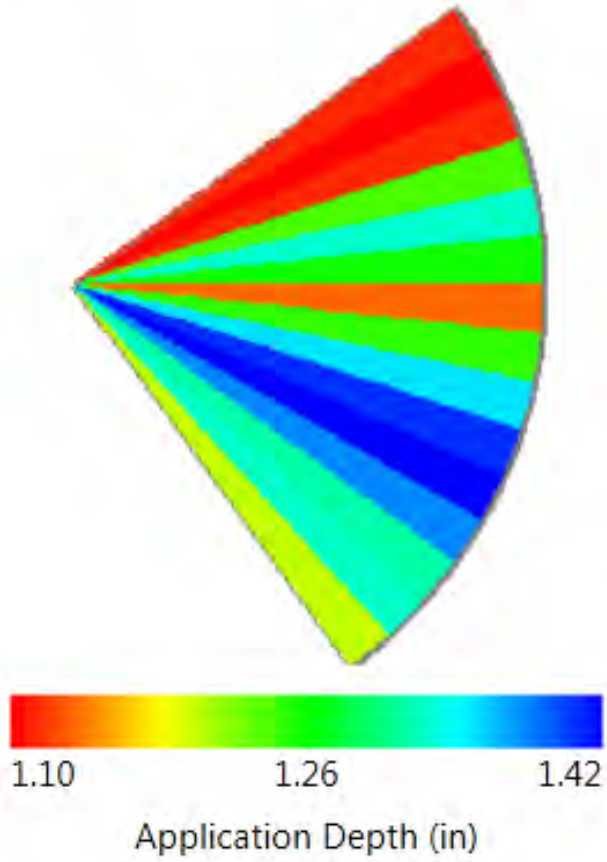
Base Application Depth: 1.25 in

Base Walk Rate: 15.00 (%)

Total Area: 62.39 ac **Total Time:** 1d 0hr 10min

Total Flat Rate Water Amount: 2,117,666.6 gal

Total VRI Water Amount: 2,132,603.2gal (1.26in/ac)



www.CropMetrics.com

Table 63: Variable Rate Irrigation by Six Degree Sectors for Tommy Laubhan's "200-12" Demonstration Field

Virtual Agronomist
Base Management Program

Grower Tom Laubhan
Farm Laubhan Farms
Field East Half Sec 1139

Pivot VRI by Sector Report

Start Angle	Stop Angle	Area (ac)	Application (in)	Speed (%)	Slope	DualEM Subsoil
54	60	4.16	1.11	16.84	3.73	74.33
60	66	4.16	1.10	17.03	3.63	75.16
66	72	4.16	1.11	16.83	3.55	74.32
72	78	4.16	1.24	15.16	3.35	66.94
78	84	4.16	1.32	14.18	2.96	62.61
84	90	4.02	1.25	14.95	2.52	66.02
90	96	4.29	1.13	16.54	2.13	73.03
96	102	4.16	1.24	15.07	2.40	66.52
102	108	4.16	1.35	13.94	2.93	61.53
108	114	4.16	1.40	13.38	3.16	59.05
114	120	4.16	1.42	13.25	3.27	58.48
120	126	4.16	1.37	13.65	3.11	60.24
126	132	4.16	1.31	14.30	3.00	63.15
132	138	4.16	1.32	14.21	3.26	62.73
138	144	4.16	1.20	15.63	3.37	69.00

www.CropMetrics.com

Conclusion

The "200-12" Project demonstrates how water conservation technologies and irrigation management practice adjustments combined with high efficiency irrigation systems and improved plant genetics 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 22 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 38 more bushels per acre in the Control field than the "200-12" field with 15.71 more inches of irrigation. Crop production costs were $176.80 more per acre for the Control field than the "200-12" field. Net return from the Control field was $678.31 per acre compared to $660.17 from the "200-12". Net gain from the Control field was $18.14 per acre. Value of the additional 15.71 inches of irrigation is $1.15 per inch. **Harold Grall** produced 3 more bushels per acre in the "200-12" field than the Control with 7.95 less inches of irrigation. Crop production costs were $34.26 per acre less for the "200-12" field than for the Control. Net return from the "200-12" field was $625.43 per acre compared to $575.79 from the Control. The "200-12" field‟s net gain was $49.64 per acre. **Brent Clark** produced 20 more bushels per acre in the Control field compared to the "200-12" with 2.95 inches more irrigation. Crop production costs were $60.67 per acre less for the "200-12" field than for the Control from reduced seed, fertilizer, irrigation, and harvest expenses. Net return from the Control field was $736.23 compared to $694.30 from the "200-12" field. The Control field‟s net gain was $41.93 per acre. **Danny Krienke** produced 9 more bushels per acre in the Control field than the "200-12". Crop production costs were $43.39 per acre less for the "200-12" field than for the Control from reduced irrigation and harvest expenses. Net return from the "200-12" field was $740.03 compared to $742.81 from the Control field. The Control field‟s net gain was $2.78 per acre with 6.11 inches more irrigation used compared to production from the "200-12" field. The "200-12" field produced 30 more bushels per acre than the Short Season field. Production costs were $26.27 more for the Short Season field. Net return from the "200-12" field was $740.03 per acre compared to $590.58 for the Short Season. Net gain from the "200-12" field is $149.45 per acre. **Brian Bezner** produced 68 bushels per acre more in his Control field compared to the "200-12" field. Crop production costs were $92.12 more for the Control field than the "200-12" from additional seed, irrigation and harvest expenses. Net return from the Control field was $886.39 compared to $629.67 from the "200-12" field. The Control field‟s net gain is $256.72 per acre with 3.94 inches more irrigation used compared to production from the "200-12". **Richard Schad** produced 34 more bushels per acre in the Control field than the "200-12" with 1.57 inches less irrigation. Crop production costs were $52.77 per acre more for the Control field than for the "200-12" from increased seed, fertilizer, and harvest expenses. Net return was $711.73 from the Control field compared to $590.10 from the "200-12". The Control field‟s net gain was $121.62 per acre with 1.57 inches less irrigation. **Frische Brothers** produced 47 bushels per acre more in the Control field than the "200-12" field. Crop production costs were $51.56 per acre more for the Control field than for the "200-12" from additional irrigation and harvest expenses. Net return from the Control field was $679.53 per acre, compared to $489.98 from the "200-12". The Control field‟s

net gain was $189.55 per acre with 5.39 inches more irrigation used compared to the “200-12” field**. Phil Haaland** produced 96 bushels per acre more in the Control field than the “200-12” with 13.24 inches more irrigation. Crop production costs were $180.23 per acre more for the Control field than for the “200-12” from increased seed, irrigation and harvest expenses. Net return from the Control field was $860.68 per acre compared to $548.43 from the “200-12” field. The Control field‟s net gain was $312.25 per acre with 13.24 inches more irrigation used compared to production from the **“**200-12” field**.** The value of the additional 13.24 inches of irrigation for the Control field is $23.58 per inch**. David Ford** produced 13 bushels per acre more in the Control field compared to the “200-12”. Crop production costs were $24.15 per acre less for the “200-12” field than for the Control from reduced irrigation and harvest expenses. Net return from the “200-12” field was $485.89 compared to $528.43 for the Control. The “200-12” field‟s net loss was $42.54 per acre with 2.99 inches less irrigation used compared to the Control field. **Hartley Feeders & Dennis Buss** produced 42 bushels per acre more in the “200-12” field than the Control with 2.95 inches more irrigation. Crop production costs were $33.68 per acre more for the “200-12” field than for the Control from increased irrigation and harvest expenses. Net return from the “200-12” field was $644.96 compared to $463.18 from the Control. The “200-12” field‟s net gain was $181.78 per acre with 2.95 inches more irrigation used compared to net return from the Control field. **Tommy Laubhan** produced two bushels per acre more in the Control field than the “200-12”. Crop production costs were $2.86 per acre less for the “200-12” field than for the Control from reduced irrigation and harvest expenses. Net return from the “200-12” field was $493.63 per acre compared to $501.03 from the Control. The Control field‟s net gain was $7.40 per acre with 0.33 inches more irrigation used compared to the “200-12” field. **Summary:** Corn production averaged 200 bushels per acre in the 200-12 fields compared to 226 bushels per acre in the Control fields. Irrigation averaged 18.36 inches in the “200-12” fields compared to 23.28 inches in the Control. Corn production averaged 11.17 bushels (625 lbs) per inch of irrigation in the “200-12” fields compared to 9.84 bushels (551 lbs) per inch in the Control. Net return averaged $594.32 per acre from the “200-12” fields compared to $669.48 from the Control. Average net gain from the Control fields is $75.16 per acre. Net return per inch of irrigation average $33.73 for the “200-12” fields compared to $30.09 for the Control fields. Average value of the additional 4.92 inches of irrigation applied to Control fields is $15.27. Irrigation, rainfall plus net soil water averaged 26.25 inches in the “200-12” fields compared to 31.34 inches in the Control. Irrigation plus rainfall averaged 26.14 inches but soil water only 0.10 inches in 200-12 fields. Average rainfall of 7.78 inches approached the “200-12” project goal of 8.0 inches, but 0.10 inches of soil water is much less than the goal of 6 inches, so irrigation had to be increased. **Appendix A** is a summary of water and harvest results**. Appendix B** lists corn hybrids and planting information**. Appendix C** describes net return per acre**. Appendix D** is a polynomial that indicates the water management and corn production practices used in nine of the eleven “200-12” fields in 2013 can potentially produce more Net return dollars per acre than those used in the Control fields. Two of the practices used for the “200-12” fields are only slightly less than those used in the Control fields. **Appendix E** is a comparison of net return per inch of irrigation for the “200-12” fields compared to the Control fields for 2013.

We learned that high efficiency LEPA center pivot irrigation systems are needed to help stretch available water 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. Overall, 2013 was an improved corn production year with more rainfall and cooler temperatures, but beginning soil moisture was low following 2012. 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: Summary of the 2013 Demonstration Results

Producer	Field	Planted	Pre-Water (in.)	Irrigation (in.)	Total Irrigation (in.)	Rainfall (in.)	Total Rainfall & Irrigation (in.)	Net Soil Water (in.)	Total Water (in.)	Yield (bu/ac)	Net Profit ($/ac)	bu/ac-in of Irrigaton	bu/ac-in of Total Water
Joe Reinart	"200-12"	Jun 12	1.12	11.43	12.55	6.58	19.13	-0.72	18.41	200	$660.17	15.94	10.86
	Control	May 5	4.15	24.11	28.26	6.97	35.23	-4.00	31.23	238	$678.30	8.42	7.62
Harold Grall	"200-12"	Jun 4	0.00	15.06	15.06	4.49	19.55	3.98	23.53	198	$625.42	13.15	8.41
	Control	Jun 2	6.26	16.75	23.01	3.85	26.86	0.75	27.61	195	$575.78	8.47	7.06
Brent Clark	"200-12"	Apr 25	0.00	17.26	17.26	7.62	24.88	-1.36	23.52	219	$694.29	12.69	9.31
	Control	Apr 25	0.00	20.21	20.21	7.62	27.83	0.91	28.74	239	$736.22	11.83	8.32
Danny Krienke	"200-12"	May 18	0.00	19.04	19.04	8.56	27.60	3.95	31.55	231	$740.03	12.13	7.32
	Control	May 18	0.00	25.15	25.15	8.56	33.71	0.00	33.71	240	$742.81	9.54	7.12
	Short Season	Jun 25	0.00	19.96	19.96	8.02	27.98	2.15	30.13	201	$590.58	10.07	6.67
Brian Bezner	"200-12" W	May 20	0.00	18.92	18.92	10.21	29.13	-5.14	23.99	206	$629.67	10.89	8.59
	Control	May 17	0.00	22.86	22.86	10.07	32.93	1.88	34.81	274	$886.38	11.99	7.87
Richard Schad	"200-12"	May 18	3.20	15.76	18.96	10.14	29.10	-1.10	28.00	196	$590.10	10.34	7.00
	Control	May 17	2.80	14.59	17.39	9.82	27.21	0.84	28.05	230	$711.73	13.23	8.20
Frische Brothers	"200-12"	May 7	3.00	14.01	17.01	4.85	21.86	-0.02	21.84	176	$489.97	10.35	8.06
	Control	May 7	3.00	19.40	22.40	4.85	27.25	0.27	27.52	223	$679.53	9.96	8.10
Phil Haaland	"200-12"	May 15	3.01	16.03	19.04	5.08	24.12	-0.35	23.77	191	$548.43	10.03	8.04
	Control	May 15	4.93	27.35	32.28	5.08	37.36	-0.42	36.94	287	$860.68	8.89	7.77
David Ford	"200-12"	May 15	2.32	16.76	19.08	7.27	26.35	1.57	27.92	178	$485.89	9.33	6.38
	Control	May 15	2.10	19.97	22.07	7.27	29.34	1.66	31.00	191	$528.43	8.65	6.16
Hartley Feeders	"200-12"	May 19	1.56	22.45	24.01	6.58	30.59	0.52	31.11	218	$644.95	9.08	7.01
	Control	May 19	0.72	20.34	21.06	6.58	27.64	0.63	28.27	176	$463.24	8.36	6.23
Tommy Laubhan*	"200-12"	May 12	0.00	21.07	21.07	14.19	35.26	-0.20	35.06	189	$493.63	8.97	5.39
	Control	May 12	0.00	21.40	21.40	14.19	35.59	1.27	36.86	191	$501.03	8.93	5.18
Average	**"200-12"**	**May 17**	**1.29**	**17.07**	**18.36**	**7.78**	**26.14**	**0.10**	**26.25**	**200**	**$600.23**	**11.17**	**7.85**
	Control	**May 13**	**2.18**	**21.10**	**23.28**	**7.71**	**31.00**	**0.34**	**31.34**	**226**	**$669.47**	**9.84**	**7.24**

Note: Ranked from high to low bushels per acre-inch of irrigation for the "200-12" field.

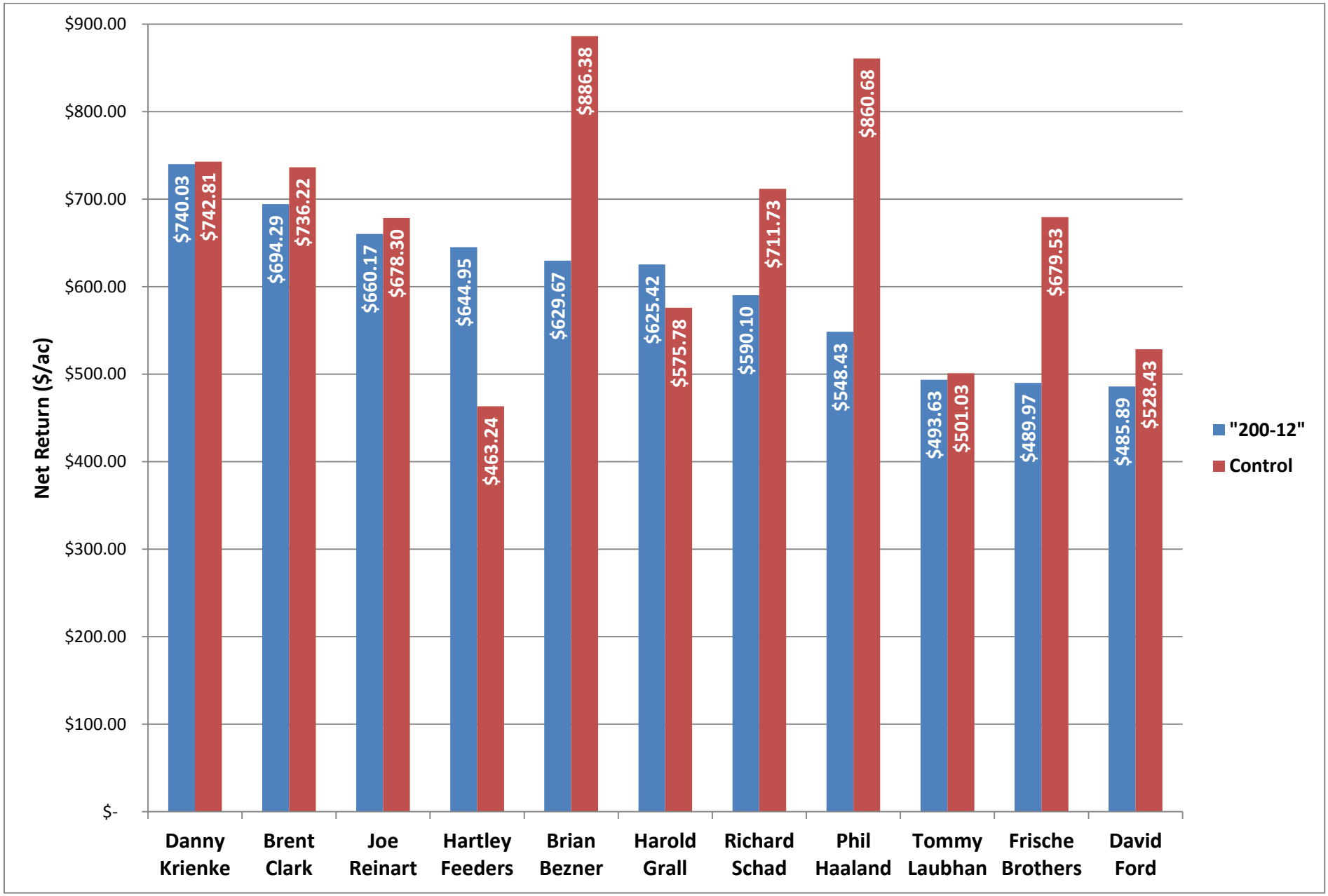
*Laubhan center pivot destroyed by a storm on June 3. The storm delivered 4.05 inches of rainfall, included. The crop received two additional hail storms.

Appendix B: Corn Hybrid and Planting Information for the 2013 "200-12" Project

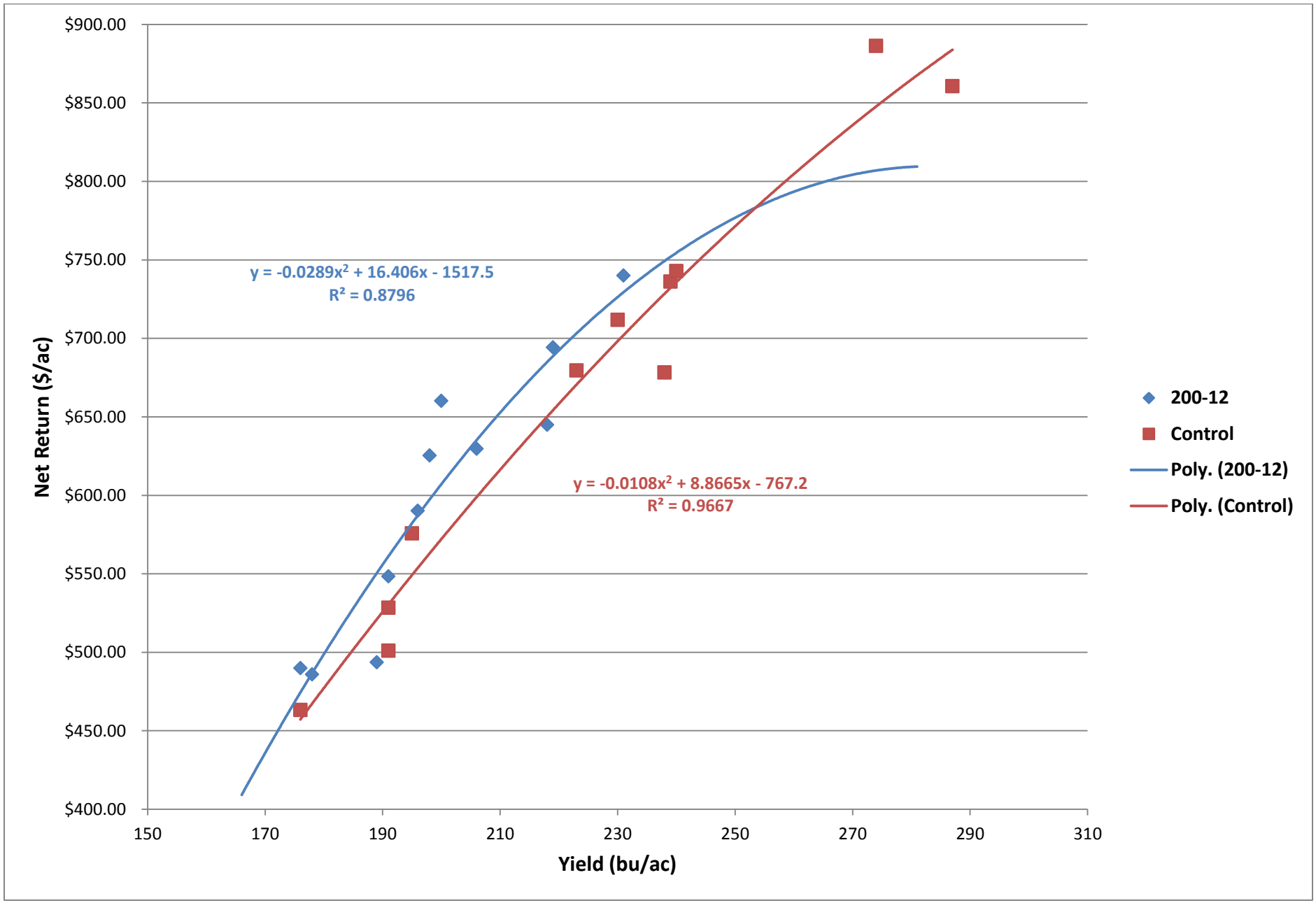
Producer	County	Field	Planted	Corn Hybrid	Seeding Rate	Yield (bu/ac)	Total Irrigation (in.)	bu/ac-in of Irrigation	Previous Crop	Acres
Joe Reinart	Sherman	"200-12"	Jun 12	Ch197-67	25,000	200	12.55	15.94	Milo	27
		Control	May 5	Ch215-52	32,000	238	28.26	8.42	Corn	65
Harold Grall	Moore	"200-12"	Jun 4	P1151AM	26,000	198	15.06	13.15	Corn	120
		Control	Jun 2	P1151AM	24,000	195	23.01	8.47	Corn	120
Brent Clark	Hartley	"200-12"	Apr 25	P1151AM	28,000	219	17.26	12.69	Corn	122
		Control	Apr 25	Ch214-14	32,000	239	20.21	11.83	Corn	122
Danny Krienke	Ochiltree	"200-12"	May 18	P33B54	28,000	231	19.04	12.13	Wheat	40
		Control	May 18	P33B54	28,000	240	25.15	9.54	Wheat	40
		Short Season	Jun 25	P35F40	36,000	201	19.96	10.07	Wheat	40
Brian Bezner	Dallam	"200-12" W	May 20	N78S3111	27,000	206	18.92	10.89	Corn	98
		Control	May 17	N78N3000G	32,000	274	22.86	11.99	Corn	124
Richard Schad	Hansford	"200-12"	May 18	Ch211-99	26,000	196	18.96	10.34	Milo	41
		Control	May 17	Ch215-52	32,000	230	17.39	13.23	Corn	124
Frische Brothers	Moore	"200-12"	May 7	P1151AM	28,000	176	17.01	10.35	Milo	54
		Control	May 7	P1151AM	28,000	223	22.40	9.96	Milo	53
Phil Haaland	Hartley	"200-12"	May 15	P1151AM	28,000	191	19.04	10.03	Wheat	4
		Control	May 15	P1151AM	35,000	287	32.28	8.89	Wheat	116
David Ford	Hartley	"200-12"	May 15	P1151AM	28,000	178	19.08	9.33	Wheat	60
		Control	May 15	P1151AM	28,000	191	22.07	8.65	Wheat	60
Hartley Feeders	Hartley	"200-12"	May 19	P1498HR	28,000	218	24.01	9.08	Corn	60
		Control	May 19	P1498HR	28,000	176	21.06	8.36	Corn	60
Tommy Laubhan*	Lipscomb	"200-12"	May 12	P1151AM	31,700	189	21.07	8.97	Corn	61
		Control	May 12	P1151AM	31,700	191	21.40	8.93	Corn	61
Average		**"200-12"**	**May 17**		**27,609**	**200**	**18.36**	**11.17**	**"200-12" Total**	**687**
		Control	**May 13**		**30,064**	**226**	**23.28**	**9.84**	**Control Total**	**945**
									Project Total	**1672**

Note: Ranked from high to low bushels per acre-inch of irrigation for the "200-12" field. The Demonstration project was located in 7 of the 8 counties in the District.
*Laubhan center pivot destroyed by a storm on June 3. The storm delivered 4.05 inches of rainfall, included. The crop received two additional hail storms.

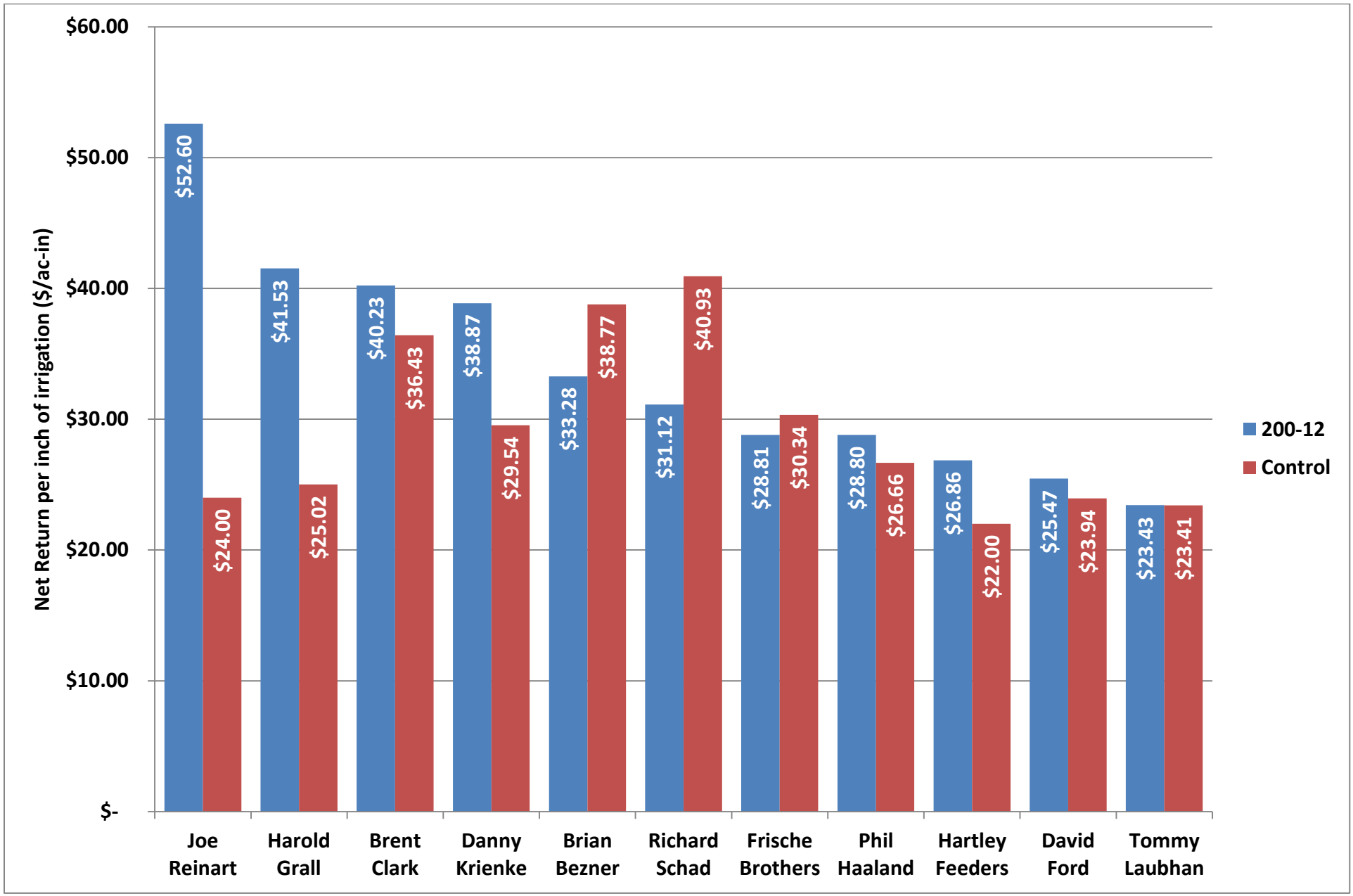
Appendix C: Net Return per Acre for Each "200-12" and Control Demonstration Field



Appendix D: Corn Yield vs. Net Return per Acre



Appendix E: Net Return per Inch of Irrigation for Each "200-12" and Control Field



Appendix F-1: Dual EM Subsoil Map for Brian Bezner's "200-12" (L10) Demonstration

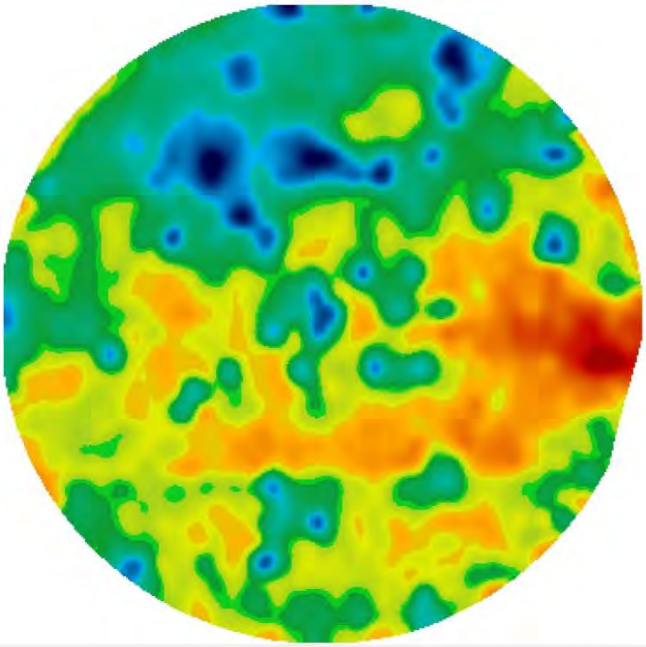
Virtual Agronomist Base Management Program

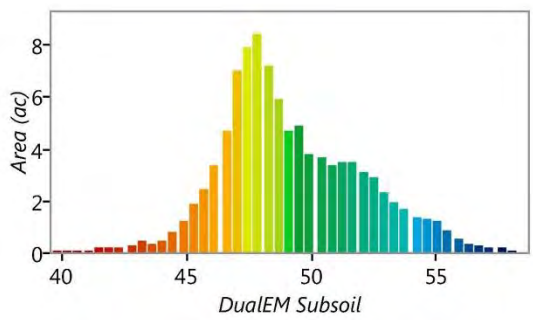
Grower Brian Benzer

Farm Benzer Farms

Field NE 1 4 Sec 67

DualEM Subsoil





Layer name	DualEM Subsoil
Field name	NE 1 4 Sec 67
Season	All season
Min	39.8
Min	39.8
Mean	49.36
Mode	47.83
Max	58.82
SD	2.86
CV	5.79%
Total	4888.7
Total Area	99.03 ac

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Comments:

Dual EM Subsoil is a map generated by the EM or EC data collection. The subsoil indicated that it is a deep soil survey (0-3'). As you can see there is a range of colors from dark red to dark blue. The blue represents the heavier textured soil in the field. The red represents the lighter textured soil in the field. Lighter soils most generally will have a lower water holding capacity than the heavier soils.

Brian Bezner's field has a majority of the heavier soils located in the north half, indicating the north half has a higher water holding capacity than the south half.

Appendix F-2: Dual EM Topsoil Map for Brian Bezner's "200-12" (L10) Field

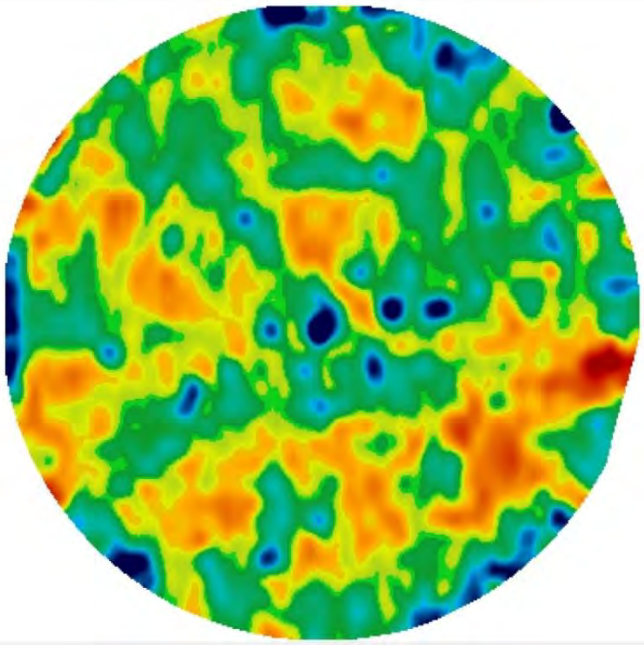
Virtual Agronomist Base Management Program

Grower Brian Benzer

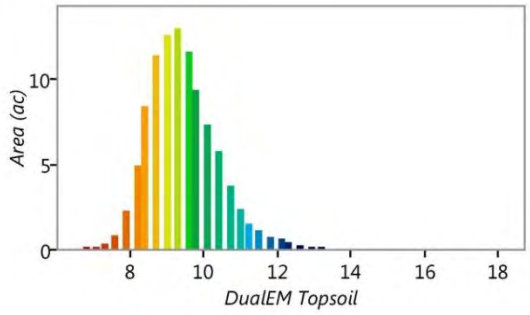
Farm Benzer Farms

Field NE 1 4 Sec 67

DualEM Topsoil



Powered by pct-ag.com



Layer name	DualEM Topsoil
Field name	NE 1 4 Sec 67
Season	All seasons
Min	6.22
Min	6.22
Mean	9.58
Mode	9.28
Max	18.75
SD	0.99
CV	10.31%
Total	948.65
Total Area	99.03 ac

Comments:

Dual EM Topsoil is a map generated by the EM or EC data collection. The Topsoil indicated that it is a shallow soil survey (0-12"). As you can see there is a range of colors from dark red to dark blue. The blue represents the heavier textured soil in the field. The red represents the lighter textured soil in the field. Lighter soils most generally will have a lower water holding capacity than the heavier soils.

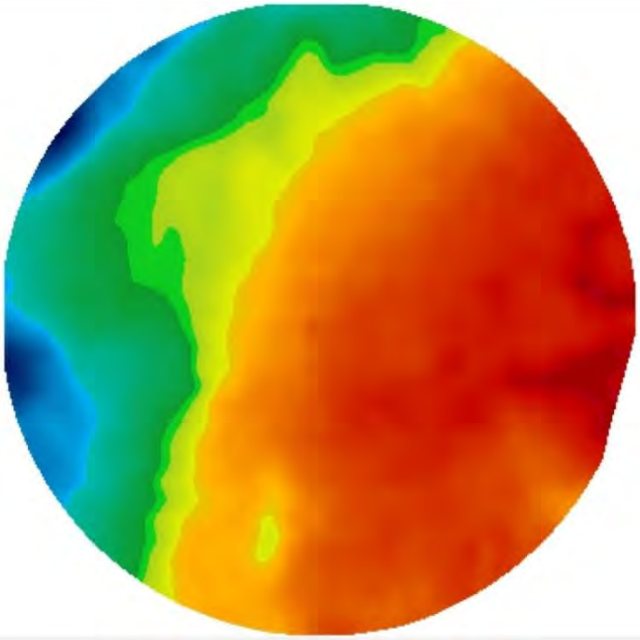
The map indicates within the first foot of Brian Bezner's field, the soil texture is relatively similar across the field.

Appendix F-3: Elevation Map for Brian Bezner's "200-12" (L10) Demonstration Field

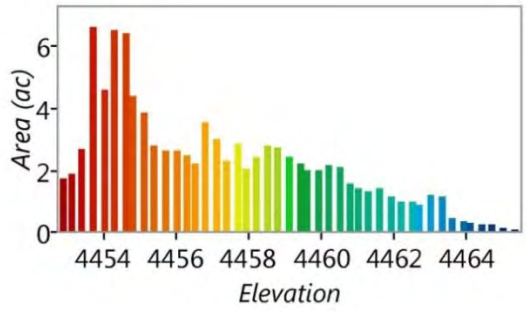
Virtual Agronomist™
Base Management Program

Grower Brian Benzer
Farm Benzer Farms
Field NE 1 4 Sec 67

Elevation



Powered by pct-ag.com



Layer name	Elevation
Field name	NE 1 4 Sec 67
Season	All seasons
Min	14609.14
Min	14609.14
Mean	14623.18
Mode	14611.91ft
Max	14650.78
SD	2.93
CV	0.07%
Total	441410.45
Total Area	99.03 ac

Comments:

(Real Time Kinematic) Elevation Data, also known as RTK Elevation Data is collected for the purpose of providing us with extremely accurate changes in elevation. On the map red represents the lowest elevation whereas blue represents the highest elevation. RTK accuracy gives us Sub Centimeter accuracy on a Vertical and Horizontal plane. This is important because we need accuracy for water infiltration and water runoff management. It is also important in fine tuning our seeding Rx's.

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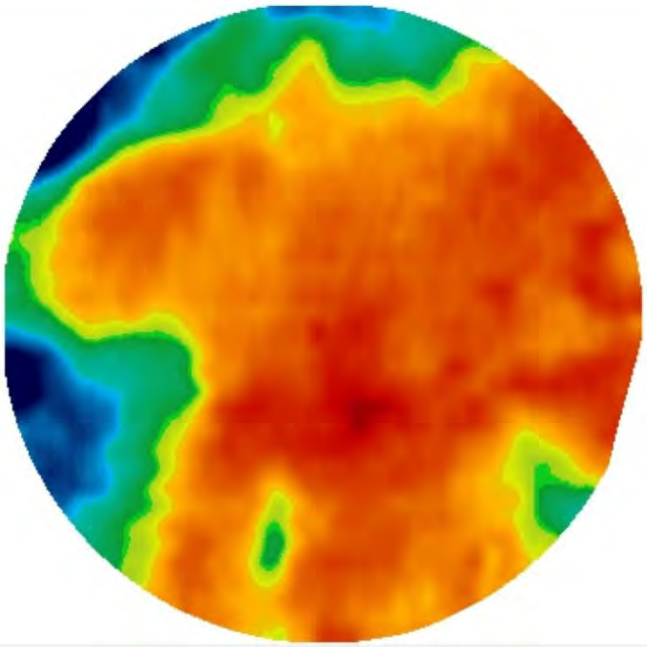
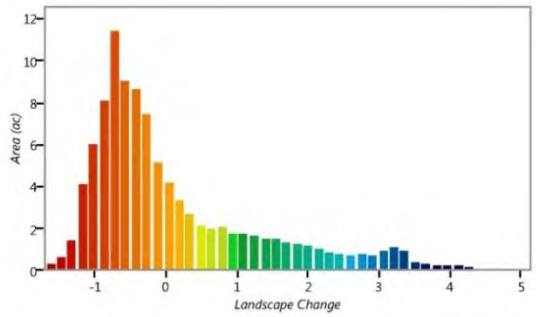
Appendix F-4: Landscape Change Map for Brian Bezner's "200-12" (L10) Demonstration Field

Virtual Agronomist
Base Management Program

Grower Brian Benzer
Farm Benzer Farms
Field NE 1 4 Sec 67

Landscape Change





Layer name	Landscape Change
Field name	NE 1 4 Sec 67
Season	All seasons
Min	-5.33
Min	-5.33
Mean	0.54
Mode	-2.36ft
Max	16.97
SD	1.21
CV	728.85%
Total	16.42
Total Area	99.03 ac

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Comments:

RTK Elevation Data will allow us to generate maps like the one seen above. If you look at the bar graph you will see that the orange bars have a value of 0. This means that the orange areas in the map will represent an average "zero" plane for that field. For instance look at the dark blue areas on the map. This represents the highest point in the field. In this example that point is 16.97' above the "zero" plane. The dark red areas then represent the lowest areas in the field. In this example the lowest point in the field is 5.33' below the "zero" plane. Landscape Change will show more defined breaks in elevation than an elevation map alone.

Appendix F-5: Slope Map for Brian Bezner's "200-12" (L10) Demonstration Field

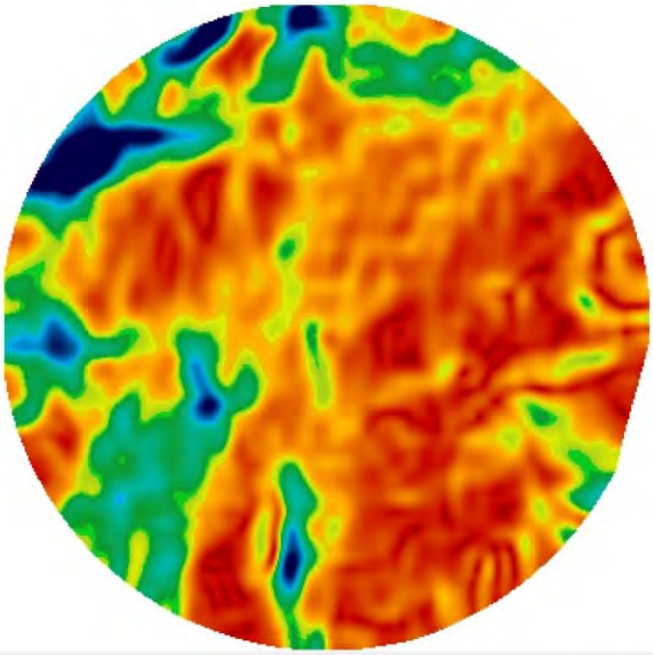
Virtual Agronomist
Base Management Program

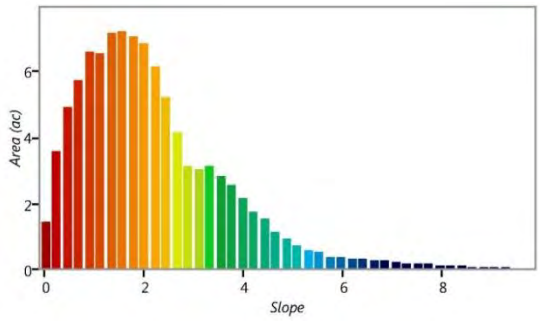
Grower Brian Benzer

Farm Benzer Farms

Field NE 1 4 Sec 67

Slope





Layer name	Slope
Field name	NE 1 4 Sec 67
Season	All seasons
Min	0.01
Min	0.01
Mean	2.28
Mode	1.55
Max	9.94
SD	1.5
CV	65.89%
Total	226.18
Total Area	99.03 ac

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Comments:

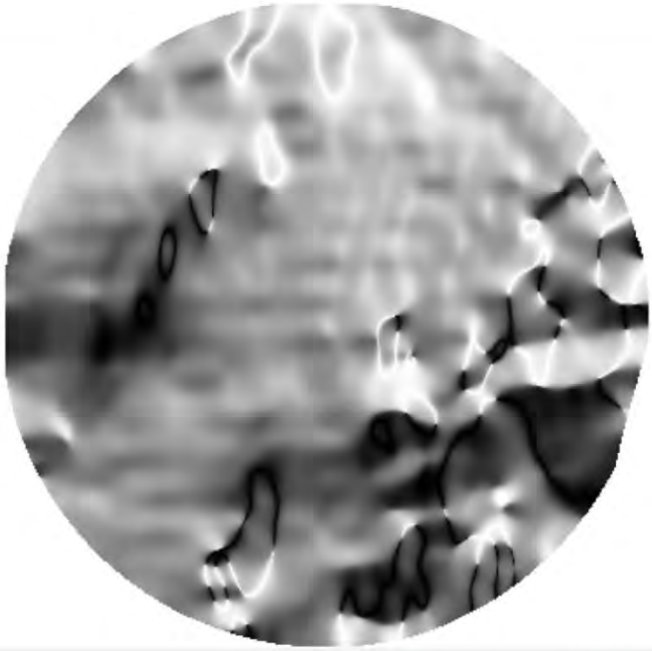
Slope is a map that is also generated using the RTK Elevation collected data. It will help us to identify a percentage of slope in any location of the field. On the bar graph, dark red indicates that there is no slope. It is flat and level. On the other end of the spectrum is the dark blue. The dark blue represents areas of more extreme slope. For example there is a very small area in this field that has a 9.94 percent slope represented by the darkest blue area on the map.

Appendix F-6: Aspect Map for Brian Bezner's "200-12" (L10) Demonstration Field

Virtual Agronomist
Base Management Program

Grower Brian Benzer
Farm Benzer Farms
Field NE 1 4 Sec 67

Aspect



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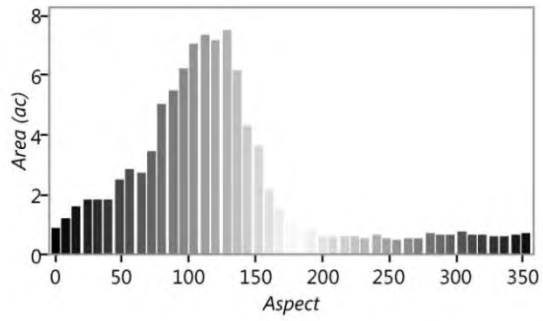


Layer name	Aspect
Field name	NE 1 4 Sec 67
Season	All seasons
Min	0.02
Min	0.02
Mean	127.8
Mode	128.01
Max	360
SD	71.15
CV	55.67%
Total	12656.5
Total Area	99.03 ac

Comments:

Aspect is generated using the RTK Elevation Data. It represents the North/South facing layout of the field. It works off the 360 degree circle. For instance, the white areas represent landscape facing the north. Whereas the dark black represent a south facing landscape.

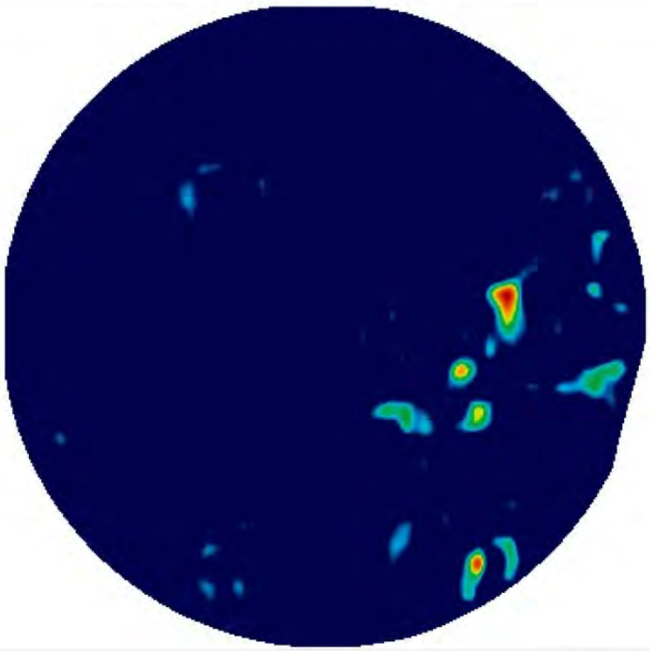
The majority of Brian Benzer's field faces southeast.

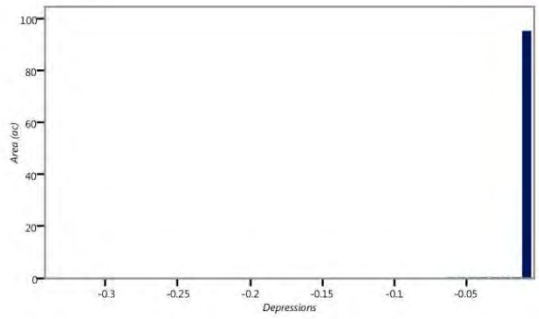
Appendix F-7: Depressions Map for Brian Bezner's "200-12" (L10) Demonstration Field

Virtual Agronomist™
Base Management Program

Grower Brian Benzer
Farm Benzer Farms
Field NE 1 4 Sec 67

Depressions





Layer name	Depressions
Field name	NE 1 4 Sec 67
Season	All seasons
Min	-1.11
Min	-1.11
Mean	-0.01
Mode	-0.02ft
Max	0
SD	0.02
CV	649.99%
Total	-0.3
Total Area	99.03 ac

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Comments:

Depressions represents areas within the field that is lower than the surrounding area. The lighter color indicates depressions.

The majority of depressions in Brian Bezner's field are located in the southeast quarter.


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