“3-4-5 Gallon Production Maximization” Corn Demonstration Project | 2016

200 Bushels per Acre Corn with
2.50 GPM per Acre Irrigation Capacity

NORTH PLAINS
GROUNDWATER
Conservation District

Soil moisture probes, an advanced technology management tool, provides 24/7 on-site soil water levels to 4-feet in 4-inch increments, plant root development, movement of rainfall into the soil profile, and other valuable information via website to guide water management and crop production.

Principal Participants:

Harold Grall - Moore County Cooperator (NPGCD Director)

Danny Krienke - Ochiltree County Cooperator (NPGCD Director)

Zac Yoder - Dallam County Cooperator (NPGCD Director)

Dennis Buss - Hartley County Cooperator (JBS Hartley Feeders)

Stan Spain - Moore County Cooperator (NPGCD Farm Operator)

Principal Staff:

Leon New - Agricultural Engineer (District Conservationist)

Curtis Schwertner - Natural Resource Specialist (NPGCD)

Additional Funding Provided By:

Texas Water Development Board - Agricultural Water Conservation Grant

A special thanks goes out to all those not mentioned above who helped make the "3-4-5 Gallon Production Maximization" demonstrations possible.

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Executive Summary

The "3-4-5 Gallon Production Maximization" project is a 3 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 limited and/or diminishing groundwater resources.

In 2015, the District planned and initiated the "3-4-5 Gallon Production Maximization" field demonstrations based on applying 1.10 inches of irrigation weekly using an irrigation capacity of 3 gallons per minute (GPM) per acre, 1.49 inches using 4 GPM, and 1.85 inches from 5 GPM irrigation capacity. These weekly amounts of irrigation represent one 120-acre center pivot correctly nozzled and pressured to apply 360 gallons per minute (3 GPM), 480 (4 GPM), and 600 gallons (5 GPM) as managed by any grower. Similarly, a 500-acre half mile center pivot nozzled to apply 1500 gallons (3 GPM), 2000 gallons (4 GPM), and 2500 (5 GPM). Following results and data from the previous 5 years of the "200-12" project, the "3-4-5" project was established to provide information on where to put your groundwater to provide its most profitable use. Field data collected and tabulated from grower's fields in the "200-12" project showed promising optimum corn yields and profitability where center pivot irrigation systems were nozzled for 3.00 and 4.00 GPM per acre. That data showed that some "200-12" project fields were overwatered managing 4.00 GPM per acre, especially when excessive pre-water was pumped. Likewise, some corn production fields were significantly overwatered, where center pivots were nozzled for 5.00 GPM per acre. Advanced technology and management tools can be conveniently utilized to improve efficiency and increase conservation for both 4.00 and 5.00 GPM per acre corn production. In **2015**, the "3-4-5 Gallon Production Maximization" project's first year, 5 cooperating growers committed 700 acres to achieve initial field demonstration results.

In **2016,** the project's second year, 5 cooperating growers dedicated 654 acres to obtain additional demonstration results. **Danny Krienke** used 180 acres in Ochiltree county, **Harold Grall** dedicated 241 acres in Moore county, **Zac Yoder** 99 acres in Dallam county, **Dennis Buss** 60 acres in Hartley county, and **Stan Spain** 74 acres, of which 19 acres were Sub-surface Drip Irrigation (SDI) in Moore county. **Krienke, Grall**, and **Spain** demonstrated the use of high efficiency water application LEPA and PMDI center pivot systems within the "3-4-5 Gallon Production Maximization" project.

Appendix A is a summary of demonstration corn hybrids planted, seeding rates, irrigation amounts, and harvest results. **Appendix B** shows corn yield per inch of irrigation applied by all cooperating growers in each 3, 4, and 5 GPM field. **Appendix C** describes bushels produced by each field from each inch of irrigation for 3, 4, and 5 GPM fields. **Appendix D** lists net return from each inch of irrigation by field and grower plus water and harvest data. **Appendix E** describes net return from each inch of irrigation, rainfall, and soil water for all growers and for each 3, 4, and 5 GPM field. A**ppendix F** describes net return per acre for each grower and each 3, 4, and 5 GPM field. Results from each **2016** cooperating producer's fields follow.

Danny Krienke, in Ochiltree County, produced 5 more bushels per acre in the 4 GPM field than the 3 GPM field, and irrigation was 0.27 inches less. The 5 GPM field produced 10 more bushels per acre than the 3 GPM with the same 11.07 inches of irrigation. The 5 GPM yield was 5 more bushels per acre than

that from 4 GPM field with 0.27 additional inches of irrigation. Corn production was 18.70 bushels (1122 lb) per inch of irrigation in the 3 GPM field compared to 19.63 bushels (1177 lb) in the 4 GPM and 19.60 bushels (1176 lb) from the 5 GPM field. The 4 GPM field's net gain is $3.25 per acre with 0.27 inches less irrigation used compared to production from the 3 GPM field. The 5 GPM field's net loss compared to the 3 GPM field is $3.11 per acre with the same 11.07 inches of irrigation. Net loss for the 5 GPM field compared to the 4 GPM is $6.36 per acre with 0.27 inches more of irrigation. Net return from each inch of irrigation is $31.14 for the 3 GPM field compared to $32.22 from the 4 GPM and $30.86 for the 5 GPM field. Net return from each inch of total water is $12.90 for his 3 GPM field, $14.02 for the 4 GPM and $14.22 for the 5 GPM field. Krienke's 3 GPM-Early planted (April 25) field produced 231 bushels per acre. The 3 GPM-Early produced 24 bushels more per acre than his 3 GPM, 19 bushels more than the 4 GPM, and 14 bushels more than the 5 GPM. Irrigation was 13.11 inches, being 2.04 inches more than the 3 GPM and 5 GPM and 2.31 inches more than 4 GPM. Net return from each inch of irrigation was $29.00 for the 3 GPM-Early, $31.14 for 3 GPM, $32.22 for 4 GPM, and $30.86 for 5 GPM. Net return per acre was $380.29 for the 3 GPM-Early, $344.79 for 3 GPM, $348.04 for 4 GPM, and $341.68 for 5 GPM.

Harold Grall-PMDI in Moore County produced 16 less bushels per acre in his 4 GPM field than the 3 GPM field, and irrigation was 1.28 inches more. The 5 GPM field produced 18 less bushels per acre than the 3 GPM with 2.25 more inches of irrigation. The 5 GPM yield was 2 fewer bushels per acre than that from the 4 GPM field with 0.97 additional inches of irrigation. Corn production was 15.91 bushels (954 lb) per inch of irrigation in the 3 GPM field compared to 13.47 bushels (808 lb) in the 4 GPM and 12.51 bushels (751 lb) from the 5 GPM field. The 4 GPM field's net loss is $47.72 per acre with 1.28 inches more irrigation used compared to production from the 3 GPM field. The 5 GPM field's net loss compared to the 3 GPM field is $58.52 per acre with 1.28 additional inches of irrigation. Net loss for the 5 GPM field compared to the 4 GPM is $10.80 per acre with 0.97 inches more irrigation. Net return from each inch of irrigation is $24.79 for the 3 GPM field compared to $19.44 from the 4 GPM and $17.56 for the 5 GPM field. Net return from each inch of total water is $12.75 for Grall's 3 GPM PMDI, $11.29 for the 4 GPM, and $11.29 for his 5 GPM PMDI field.

Harold Grall-LEPA in Moore County produced 12 less bushels per acre in his 4 GPM field than the 3 GPM field, and irrigation was 1.28 inches more. The 5 GPM field produced 13 less bushels per acre than the 3 GPM with 2.25 more inches of irrigation. The 5 GPM yield was 1 bushel per acre less than that from 4 GPM field with 0.97 additional inches of irrigation. Corn production was 14.96 bushels (897 lb) per inch of irrigation in the 3 GPM field compared to 12.86 bushels (771 lb) in the 4 GPM and 12.01 bushels (720 lb) from the 5 GPM field. The 4 GPM field's net loss is $37.54 per acre with 1.28 inches more irrigation used compared to production from the 3 GPM field. The 5 GPM field's net loss compared to the 3 GPM field is $45.85 per acre with 1.28 additional inches of irrigation. Net loss for the 5 GPM field compared to the 4 GPM is $8.31 per acre with 0.97 inches more irrigation. Net return from each inch of irrigation is $22.39 for the 3 GPM field compared to $17.93 from the 4 GPM and $16.31 for the 5 GPM field. Net return from each inch of total water is $12.73 for Grall's 3 GPM LEPA, $10.45 for the 4 GPM, and $9.82 for his 5 GPM LEPA field.

Harold Grall-LEPA and PMDI (in Moore County) The 3 GPM PMDI field produced 13 more bushels per acre than the 3 GPM LEPA field. Irrigation in each field was 13.57 inches. The 4 GPM PMDI field produced 9 more bushels per acre than the 4 GPM LEPA field, and irrigation was 14.85 inches for each field. The 5 GPM PMDI field produced 8 more bushels per acre than the 5 GPM LEPA. Irrigation was 15.82 inches for both fields. Corn production was 15.91 bushels (955 lb) per inch of irrigation in the 3 GPM PMDI field compared to 14.96 bushels (897 lb) in the 3 GPM LEPA. In the 4 GPM fields, production was 13.47 bushels (808 lb) per inch of irrigation for PMDI and 12.86 bushels (772 lb) for 4 GPM LEPA. Production in the 5 GPM PMDI field was 12.51 bushels (751 lb) from each inch of irrigation and from the 5 GPM LEPA was 12.01 bushels (720 lb) per inch. Irrigation, rainfall, and net soil water totaled to 26.37 inches in the 3 GPM PMDI field and 23.87 inches in the 3 GPM LEPA field. Production from each inch of total water is 8.19 bushels (491 lb) for the 3 GPM PMDI and 8.50 bushels (510 lb) for the 3 GPM LEPA. Production from 25.56 inches of total water in the 4 GPM PMDI field is 7.82 bushels (495 lb) compared to 7.50 bushels (450 lb) from 25.47 inches for the 4 GPM LEPA field. Total water was 24.60 inches for the 5 GPM PMDI field from which production was 8.05 bushels (483 lb) per inch. Total water in the 5 GPM LEPA was 26.27 inches from which production was 7.23 bushels (434 lb) per inch. Net return from each inch of irrigation is $24.79 for the 3 GPM PMDI field and $22.39 per inch for the 3 GPM LEPA field. For the 4 GPM PMDI, net return per inch of irrigation is $19.44 per inch and $17.93 for 4 GPM LEPA. Net return for the 5 GPM PMDI field is $17.56 from each inch of irrigation and $16.31 per inch from the 5 GPM LEPA field. Net return per acre was $336.41 for the 3 GPM PMDI field and $303.83 for the 3 GPM LEPA field. Net return for the 4 GPM PMDI field was $288.69 per acre and $266.29 for the 4 GPM LEPA field. For the 5 GPM PMDI field, net return was $277.89 per acre compared to $257.98 per acre for the 5 GPM LEPA field.

Stan Spain-SDI in Moore County produced 21 more bushels per acre in his 4 GPM field than the 3 GPM field. Irrigation was 2.70 inches more. The 5 GPM field produced 55 more bushels per acre than the 3 GPM with 3.68 more inches of irrigation. The 5 GPM yield was 35 more bushels per acre than that from the 4 GPM field with 0.98 additional inches of irrigation. Corn production was 13.88 bushels (833 lb) per inch of irrigation in the 3 GPM field compared to 12.82 bushels (769 lb) in the 4 GPM and 14.10 bushels (846 lb) from the 5 GPM field. The 4 GPM field's net gain is $36.07 per acre with 2.70 inches more irrigation used compared to production from the 3 GPM field. The 5 GPM field's net gain compared to the 3 GPM field is $114.81 per acre with 3.68 additional inches of irrigation. Net gain for the 5 GPM field is $78.74 per acre more than the 4 GPM with .98 inches more of irrigation. Net return from each inch of irrigation is $19.24 for the 3 GPM field compared to $18.28 from the 4 GPM and $21.77 for the 5 GPM field. Net return from each inch of total water is $10.08 for the 3 GPM field, $10.93 for the 4 GPM, and $14.31 for the 5 GPM field.

Zac Yoder, in Dallam County, produced 36 more bushels per acre in his 4 GPM field than the 3 GPM, and irrigation was 5.06 inches more. The 5 GPM field produced 49 more bushels per acre than the 3 GPM with 10.35 more inches of irrigation. The 5 GPM yield was 13 more bushels per acre than that from 4 GPM field with 5.29 additional inches of irrigation. Corn production was 13.68 bushels (820 lb) per inch of irrigation in the 3 GPM field compared to 12.01 bushels (720 lb) in the 4 GPM and 10.00 bushels (600 lb) from the 5 GPM field. The 4 GPM field's net gain is $43.26 per acre with 5.06 inches more irrigation used compared to production from the 3 GPM field. The 5 GPM field's net gain compared

to the 3 GPM field is $31.61per acre with 10.35 additional inches of irrigation. Net gain for the 5 GPM field is -$11.65 per acre less than the 4 GPM with 5.29 inches more of irrigation. Net return from each inch of irrigation is $19.42 for the 3 GPM field compared to $16.65 from the 4 GPM and $12.69 for the 5 GPM field. Net return from each inch of irrigation, rainfall, and net soil water is $10.68 for the 3 GPM field, $10.92 from the 4 GPM, and $9.35 for the 5 GPM field.

Stan Spain-LEPA in Moore County produced 21 more bushels per acre in his 4 GPM field than the 3 GPM field. Irrigation was 3.28 inches more. The 5 GPM field produced 64 more bushels per acre than the 3 GPM with 4.09 more inches of irrigation. The 5 GPM yield was 64 more bushels per acre than that from the 4 GPM field with 4.09 additional inches of irrigation. Corn production was 13.22 bushels (793 lb) per inch of irrigation in the 3 GPM field compared to 11.99 bushels (719 lb) in the 4 GPM and 13.75 bushels (825 lb) from the 5 GPM field. The 4 GPM field's net gain is $32.57 per acre with 3.28 inches more irrigation used compared to production from the 3 GPM field. The 5 GPM field's net gain compared to the 3 GPM field is $134.75 per acre with 4.09 additional inches of irrigation. Net gain for the 5 GPM field is $102.18 per acre more than the 4 GPM with 0.81 inches more of irrigation. Net return from each inch of irrigation is $18.28 for the 3 GPM field compared to $16.76 from the 4 GPM and $21.45 for the 5 GPM field. Net return from each inch of total water is $9.82 for the 3 GPM field, $11.75 for the 4 GPM, and $13.74 for the 5 GPM field.

Stan Spain-LEPA and SDI (in Moore County) The 3 GPM LEPA field produced 5 more bushels per acre than the 3 GPM SDI field. Irrigation in the LEPA field was 14.82 inches and 13.76 in the SDI field. The 4 GPM LEPA field produced 6 more bushels per acre than the 4 GPM SDI field. Irrigation was 18.10 inches for the LEPA field and 16.46 for the SDI. The 5 GPM LEPA field produced 14 more bushels per acre than the 5 GPM SDI. Irrigation was 18.91 inches for the LEPA field and 17.44 for the SDI field. Corn production was 13.22 bushels (793 lb) per inch of irrigation in the 3 GPM LEPA field compared to 13.88 bushels (833 lb) in the 3 GPM SDI. In the 4 GPM fields, production was 11.99 bushels (719 lb) per inch of irrigation for LEPA and 12.82 bushels (769 lb) for 4 GPM SDI. Production in the 5 GPM LEPA field was 13.75 bushels (825 lb) from each inch of irrigation and that from the 5 GPM SDI was 14.10 bushels (846 lb) per inch. Irrigation, rainfall, and net soil water totaled 27.58 inches in the 3 GPM LEPA field and 23.87 inches in the 3 GPM SDI field. Production from each inch of total water is 7.10 bushels (426 lb) for the 3 GPM LEPA and 7.27 bushels (436 lb) for 3 GPM SDI. Production from 25.82 inches of total water in the 4 GPM LEPA field is 8.40 bushels (504 lb) compared to 7.66 bushels (460 lb) from each of 27.52 inches for the 4 GPM SDI field. Total water was 29.52 inches for the 5 GPM LEPA field from which production was 8.81 bushels (528 lb) per inch. Total water in the 5 GPM SDI was 26.52 inches from which production was 9.27 bushels (556 lb) per inch. Net return from each inch of irrigation is $18.28 for the 3 GPM LEPA field and $19.24 per inch for the 3 GPM SDI field. For the 4 GPM LEPA, net return per inch of irrigation is $16.76 per inch compared to $18.28 for 4 GPM SDI. Net return for the 5 GPM LEPA field is $21.45 from each inch of irrigation compared to $21.77 per inch from the 5 GPM SDI field. Net return per acre was $270.91 for the 3 GPM LEPA field and $264.83 for the 3 GPM SDI field. Net return for the 4 GPM LEPA field was $303.48 per acre and $300.90 for the 4 GPM SDI field. For the 5 GPM LEPA field, net return was $405.66 per acre compared to $379.64 per acre for the 5 GPM SDI field.

Dennis Buss in Hartley County produced 36 more bushels per acre in his 4 GPM field than the 3 GPM, and irrigation was 1.84 inches more. The 5 GPM field produced 73 more bushels per acre than the 3 GPM with 1.34 more inches of irrigation. The 5 GPM yield was 37 more bushels per acre than that from 4 GPM field with 0.50 less inches of irrigation. Corn production was 10.38 bushels (623 lb) per inch of irrigation in the 3 GPM field compared to 11.73 bushels (704 lb) in the 4 GPM and 15.29 bushels (917 lb) from the 5 GPM field. The 4 GPM field's net gain is $78.56 per acre with 1.84 inches more irrigation used compared to production from the 3 GPM field. The 5 GPM field's net gain compared to the 3 GPM field is $95.10 per acre with 1.34 additional inches of irrigation. Net gain for the 5 GPM field is $95.10 per acre more than the 4 GPM with 0.50 inches less irrigation. Net return from each inch of irrigation is $9.36 for the 3 GPM field compared to $14.26 from the 4 GPM and $22.75 for the 5 GPM field. Net return from each inch of irrigation, rainfall and net soil water is $4.54 for the 3 GPM field, $7.82 from the 4 GPM, and $11.46 for the 5 GPM field. The crop did not receive sufficient, timely water to produce a representative corn yield for the "3-4-5 Gallon Production Maximization" project.

Harold Grall T-L PMDI in Moore County produced 8.27 bushels (496 lb) from each inch of irrigation. Net return from each inch of irrigation is $8.12. Net return per acre is $130.61. Irrigation capacity became less than 2 GPM per acre due to well production decline during the daily high temperatures, especially in July. Rainfall was insufficient to maintain representative corn yields for the "3-4-5 Gallon Production Maximization" project.

Introduction

In 2015, the District planned and initiated a field demonstration identified as the "3-4-5 Gallon Production Maximization" project that would use the latest water conservation technologies and practices to grow corn irrigated at 3 different amounts weekly as needed. The project is based on applying 1.10 inches of irrigation weekly using an irrigation capacity of three (3) gallons per minute (GPM) per acre, 1.49 inches using four (4 GPM), and 1.85 inches from five (5 GPM). These weekly amounts of irrigation represent one 120-acre center pivot correctly nozzled to apply 360 gallons per minute (3 GPM), 480 (4 GPM), and 600 gallons (5 GPM). Similarly, a 500-acre half mile center pivot would be nozzled to apply 1500 (3 GPM) gallons per minute (GPM), 2000 gallons (4 GPM), and 2500 (5 GPM). The "3-4-5 Gallon Production Maximization" project is planned for a 3-year period.

Following results and data from the previous 5-year 200-12 project, the "3-4-5 Gallon Production Maximization" project was established to provide information on "where to put your groundwater" to provide its most profitable use. Field data collected and tabulated from growers' fields in the 200-12 project show promising optimum corn yields and profitability where center pivot irrigation systems are nozzled for 3.00 and 4.00 GPM per acre. The data shows some project fields were overwatered managing 4.00 GPM per acre, especially when excessive pre-water was pumped. Where center pivots were nozzled for 5.00 GPM per acre, some corn production fields were significantly overwatered, for which advanced technology can be conveniently utilized for both 4 and 5 GPM per acre corn production to improve groundwater use efficiency.

The "200-12" project was a 5-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. The previous "200-12" project was conducted on 6,247 acres by 13 cooperating growers in 2010 through 2014. Corn irrigation averaged 21.00 inches per acre, while irrigation, rainfall, and net soil water averaged 31.00 inches over the 10-year Agri-Partner field demonstration project conducted by AgriLife Extension from 1998-2007. The Agri-Partner project included 129 field scale corn demonstrations on 18,815 acres with approximately 150 cooperating growers over the 10-year period. NPGCD has stepped up to the next level, based on what was learned from the "200-12" and Agri-Partner projects. That is to arrange and demonstrate corn production using center pivot systems to apply managed 3, 4, and 5 GPM per acre irrigation capacity, or similar, with no, or only limited, pre-water. The "3-4-5 Gallon Production Maximization" project demonstrates how water conservation technologies and irrigation management practices can reduce water use and allow agricultural irrigation producers to remain financially viable with restricted and diminishing groundwater resources. The demonstrations must utilize high efficiency center pivot irrigation systems combined with strip or no till and crop residue management farming practices. The "3-4-5 Gallon Production Maximization" project is designed as a 3-year initiative that provides field-scale profitability and feasibility demonstrations of variable rate irrigation (VRI) by speed control to apply 1.10 inches (3 GPM), 1.49 inches (4 GPM), and 1.85 inches (5 GPM) of groundwater weekly as needed for corn production combined with seasonal rainfall and available water within the crop's root zone.

In **2015**, the "3-4-5 Gallon Production Maximization" project's first year, 5 cooperating growers committed 700 acres to achieve initial field demonstration results. In 2016, **Harold Grall** dedicated 241 acres in Moore county, **Danny Krienke** used 180 acres in Ochiltree county, **Zac Yoder** 99 acres in Dallam county, **Dennis Buss** 60 acres in Hartley county, and **Stan Spain** 74 acres, of which 19 acres were Sub-surface Drip Irrigation (SDI) in Moore county. Information was compiled in 2015 for the "3-4-5 Gallon Production Maximization" project and for the previous "200-12" project, which can be obtained from the website: northplainsgcd.org/conservationprograms/agricultural-conservation/. The District office is located at 603 East 1st street, Dumas, Texas, and can be contacted at (806) 935-6401.

Methods

Each of the 5 cooperators individually selected 3, 4, and 5 GPM acres, also described as sectors of a circle, within fields irrigated by one center pivot system for his demonstration. Irrigation within the selected acres/sectors/fields was managed to apply 1.10 inches (3 GPM), 1.49 inches (4 GPM), and 1.85 inches (5 GPM) according to NPGCD's "3-4-5 Gallon Production Maximization" project protocols and guidelines. Each cooperator established and wrote a variable center pivot travel speed prescription to apply the different irrigation amounts no more than once a week. Center pivot travel speed was programmed and managed by either Pivotrac® or Lindsey Mfg. Field Net™ telemetry. Individual irrigation amounts were achieved by slowing travel speed down when the system exited the 3 GPM acres/sector and entered the 4 GPM to apply 1.49 inches of irrigation. Travel speed was reduced again as the system exited the 4 GPM and entered the 5 GPM sector/field to apply 1.85 inches. When the system exited the 5 GPM sector into the 3 GPM, travel speed was increased to apply 1.10 inches of irrigation. Actual individual center pivot travel speed is dependent on the system's nozzle package's gallons per minute. The district's project lead received pre-programmed text notifications when each center pivot entered and departed individual acres/sectors or fields, which was recorded and used to calculate individual 3, 4, and 5 GPM sector/field irrigation amounts.

Each cooperator individually chose commercially available corn hybrids based on their experience as growers. Planting dates, seeding and fertilizer rates, as well as pesticide and herbicide applications, were also selected by each cooperator. At each center pivot demonstration site, the District installed water meters to record and verify the amount of irrigation applied on each field; rain gauges to measure rainfall; gypsum block moisture sensors at 1, 2, 3, 4, and 5-foot depths in the crop's root zone to monitor soil water content, and Aquaspy® continuous soil water monitoring probes down to 48 inches. Each irrigation system was equipped with Pivotrac® or Lindsey Mfg. Field Net™ to provide continuous remote tracking and control to manage and monitor irrigation application. Each cooperator was provided soil and plant leaf sampling for each 3, 4, and 5 GPM sector/field 4 times during the growing season by Better Harvest, Inc. to monitor and guide fertility levels. During the growing season, District personnel recorded water amounts, soil moisture, crop growth, and other data to maintain data weekly in each demonstration field. The District's tabulated demonstration field data is included with each cooperator's individual report that follows. Cooperators and the District's conservationist used the real-time data from Aquaspy®, Pivotrac®, and Lindsey Mfg. Field Net™ websites along with the data collected at least weekly from each demonstration field to monitor crop and soil moisture conditions, as well as to monitor and manage irrigation frequency and volumes in the 3, 4, and 5 GPM fields/sectors. Individual irrigation

amounts were calculated using text messages from Pivotrac® to the District conservationist who recorded when irrigation stopped in one sector and began in the next sector. The time the irrigation system was in the 3, 4, and 5 GPM sectors/fields in combination with weekly gallons per minute (GPM) water meter readings, it 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 each 3, 4, and 5 GPM sector/field for each grower, and to that of other cooperators in the project. Yields for each field were adjusted to reflect 15.00% 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 $3.44 per bushel. A common crop production expense relating to irrigation, seed, fertilizer, and harvest costs was established for the comparison. The common price for seed is $4.00 per thousand, irrigation is $6.00 per inch applied, and harvest is $0.36 per bushel. Fertilizer costs were calculated for each field based on basic nutrients removed to produce the corn yield harvested. The method of calculation and nutrient prices was provided by Better Harvest, Inc. 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 same information required to prepare a normal center pivot precipitation chart. The following discussion provides detailed growing season data, results, and information for each grower's 3, 4 and 5 GPM acres/sectors/fields measured and recorded in 2016, in the second year of the "3-4-5 Gallon Production Maximization" project.

Danny Krienke's 2016 Ochiltree County Demonstration

Planting and Crop Information: Danny Krienke strip tilled and planted 180 acres of corn in 3 quarters of a 240-acre circle in Section 47, for his "3-4-5 Gallon Production Maximization" demonstration. The 180 acres were divided to strategically manage available irrigation water for his 3 GPM-Early, 3 GPM, 4 GPM, and 5 GPM fields. One hundred eighty to 90 degrees was his 3 GPM-Early planted field, 90 to 330 was the 3 GPM field, 330 to 300 was his 4 GPM field, and 300 to 270 degrees was the 5 GPM field. Wheat was produced from 270 to 180 degrees. Krienke planted his 3 GPM-Early field to Golden Acres hybrid GA4173DG at 29,000 seeds per acre on April 25, 2016. His "3-4-5 Gallon Production Maximization" fields were planted to GA4678DG on May 30, 2016. Seeding rates were 26,000 for the 3 GPM acres, 29,000 seeds per acre for the 4 GPM field, and 33,000 seeds per acre for the 5 GPM field. Center pivot travel speed was by Lindsey Mfg. Field Net. Krienke used 2 irrigation plans to rotate 1.10 inches per week between his 3 GPM-Early planted acres and the 3 GPM late planted acres. Travel speed was programmed to apply 1.49 inches on the 4 GPM field and 1.85 inches on the 5 GPM field each week. Irrigation plans were modified during the late growing season to apply reduced irrigation amounts when needed, especially for the 5 GPM acres. Soil moisture sensors guided reduced irrigation amounts. Seasonal water meter readings averaged 564 GPM. Irrigation was with the Senninger LEPA shroud with drops spaced 30 inches apart. Timely rainfall allowed less than normal hours of irrigation during the growing season. Planting and crop information for "Krienke 3 GPM-Early", "Krienke 3 GPM", "Krienke 4 GPM", and "Krienke 5 GPM" fields are shown in Table 1 below.

Table 1: Planting and Crop Information for Danny Krienke

3 GPM-Early Demonstration Site: 180-90 degrees					
Planted		April 25	**Harvested**		September 21
Hybrid		GA4173DG	**Seeding Rate**		29,000
Row Width		30 inches	**Tillage**		Strip Till
No. Acres		60.00	**GPM per acre**		2.82
Total Water		31.16 inches	**Soil Type**		Sherman silty clay loam
Irrigation		13.11 inches	**Insecticide**		None
3 GPM Demonstration Site: 90-330 degrees					
Planted		May 30	**Harvested**		October 8
Hybrid		GA4678DG	**Seeding Rate**		26,000
Row Width		30 inches	**Tillage**		Strip Till
No. Acres		80.00	**GPM per acre**		2.82
Total Water		26.73 inches	**Soil Type**		Sherman silty clay loam
Irrigation		11.07 inches	**Insecticide**		None
4 GPM Demonstration Site: 330-300 degrees					
Planted		May 30	**Harvested**		October 8
Hybrid		GA4678DG	**Seeding Rate**		29,000
Row Width		30 inches	**Tillage**		Strip Till
No. Acres		20.00	**GPM per acre**		3.76
Total Water		24.82 inches	**Soil Type**		Sherman silty clay loam
Irrigation		10.80 inches	**Insecticide**		None

Table 1: Planting and Crop Information for Danny Krienke (continued)

5 GPM Demonstration Site: 300-270 degrees					
Planted	May 30		**Harvested**		October 8
Hybrid	GA4678DG		**Seeding Rate**		33,000
Row Width	30 inches		**Tillage**		Strip Till
No. Acres	20.00		**GPM per acre**		4.71
Total Water	24.03 inches		**Soil Type**		Lazbuddie clay loam
Irrigation	11.07 inches		**Insecticide**		None

Soil Water Profile and Growing Season Rainfall

"3 GPM-Early" Demonstration Site: Rainfall prior to planting April 25, 2016 provided a good beginning to soil water levels at 5 feet. Plants developed root systems to use soil water from 2 feet by the end of June in addition to irrigation and rainfall. Plant roots grew into the 3-foot root zone by mid-July depleting available soil water stored at 1, 2, and 3 feet plus rainfall and irrigation. About 20% of soil water was used from 4 feet indicating superior plant root development, especially considering good rainfall. Periodic, timely rainfall totaled 13.86 inches from planting until grain maturity in mid-September. Soil moisture sensors show the plants had adequate water during the growing season. The soil is Sherm silty clay loam that stores 2.00 inches of available water per foot.

"3 GPM" Demonstration Site: The beginning soil water was good at 1, 2, 3, 4 and 5 feet. Weekly gypsum block readings indicated the crop rooted deep and used 3.35 inches of soil water from 1, 2, 3 and 4 feet, plus 11.07 inches of irrigation and 12.31 inches of rainfall during the growing season. Only limited soil water was used from 5 feet, likely because sufficient water was available from the upper root zone. Plant roots began to use soil water from 2 feet in late July and 3 feet in early August. Roots developed to 4 feet in September finishing the crop. Soil moisture sensors showed the crop had adequate soil water during the growing season. Rainfall from planting until grain black layer totaled 12.31 inches. Gypsum blocks were installed in early June following planting. The soil is Sherm silty clay loam that provides 2.00 inches of available water from each foot of the soil profile for potential plant use.

"4 GPM" Demonstration Site: Early season soil water was good at 1, 2, 3, 4 and 5 feet in the crop root zone. The plants began to require more water than rainfall and irrigation provided in late July and early August, using significant amounts of available soil water from both 1 and 2 feet. Roots developed into 3 feet of the soil profile in September using about 30% of the available water. Soil water sensors showed plants did not use water from 4 and 5 feet. Weekly gypsum block readings showed good soil moisture levels were maintained at 1, 2, 3, 4, and 5 feet during the growing season from timely, beneficial rainfall and periodic irrigation as needed. The crop used 2.28 inches of soil water mostly from 1, 2, and 3 feet, in addition to rainfall and irrigation. Soil moisture sensors showed the crop had sufficient soil water during the growing season. Rainfall from planting through black layer totaled to 11.74 inches. The crop was produced in Sherm silty clay loam soil that holds approximately 2.00 inches available water per foot for potential crop use.

"5 GPM" Demonstration Site: The beginning soil water was good at 1, 2, 3, 4 and 5 feet at planting. Soil moisture sensors showed plants needed more water than irrigation and rainfall could provide in late July and early August, using additional amounts from 2 and 3 feet from the root zone. Weekly irrigation amounts were reduced to 70% in late August and down to 50% in September, guided by soil moisture sensors. Weekly gypsum block moisture sensors showed the crop had sufficient available soil water during the entire growing season. The sensors showed that crop roots extracted 1.22 inches of soil water from mostly 2 and 3 feet plus irrigation and rainfall producing the corn yield. Rainfall was 11.74 inches. Irrigation totaled to 11.07 inches. The crop was produced in Lazbuddie clay soil that holds 2.00 inches of available water per foot for potential crop use.

Table 2: Monthly Rainfall Data for Danny Krienke

GPM	May (in)	June (in)	July (in)	August (in)	September (in)	Total (in)
3-Early	2.12	1.61	5.89	4.24	0.00	13.86
3	0.00	1.52	5.74	4.11	0.94	12.31
4	0.00	1.61	5.45	3.83	0.85	11.74
5	0.00	1.61	5.45	3.83	0.85	11.74

Growing Season Water Tracking: The District tracked total water and crop growth throughout the growing season using rain gauges, water meters, and both gypsum blocks and Aquaspy® soil moisture sensors. One set of 5 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 4 feet in the root zone at 1 location to monitor soil water levels in the 3 GPM-Early field. Another set of the same type of sensors was installed in each 3, 4, and 5 GPM field. Both the gypsum block sensors and the soil probe were installed in close proximity to each other in each field. Gypsum blocks, water meters, rain gauges, and crop growth were read, recorded, and utilized weekly by district personnel. A 24/7 Aquaspy® probe website shows soil moisture at 4-inch increments to 48 inches and monitors plant root growth. The website lists all Aquaspy® soil probes in the "3-4-5 Gallon Production Maximization" project and is available to all cooperators and district personnel. Another 24/7 Pivotrac® website tracks each center pivot, monitors system position and travel, and provides information to make irrigation management strategies. Both the cooperating grower and District "3-4-5 Gallon Production Maximization" project leader collectively monitored, controlled, and managed irrigation from the Pivotrac® website.

Following this paragraph, a series of graphs and tables show weekly gypsum block readings for the season; the growing season's water, including rainfall, irrigation, and soil moisture at various growth stages; and the order of irrigation and rainfall events for each "3-4-5 Gallon Production Maximization" field. Finally, a form describes the protocols for each field. "Total Water," as shown on the graph for "Growing Season Water Tracking" is the sum of seasonal irrigation, rainfall, and net soil water. Graphs and tables for the 3 GPM-Early acres are shown first, followed by the same illustrations for each 3, 4 and 5 GPM.

Figure 1: Gypsum Block Readings for Danny Krienke's "3 GPM-Early" Demonstration Site, 231 bu/ac, LEPA

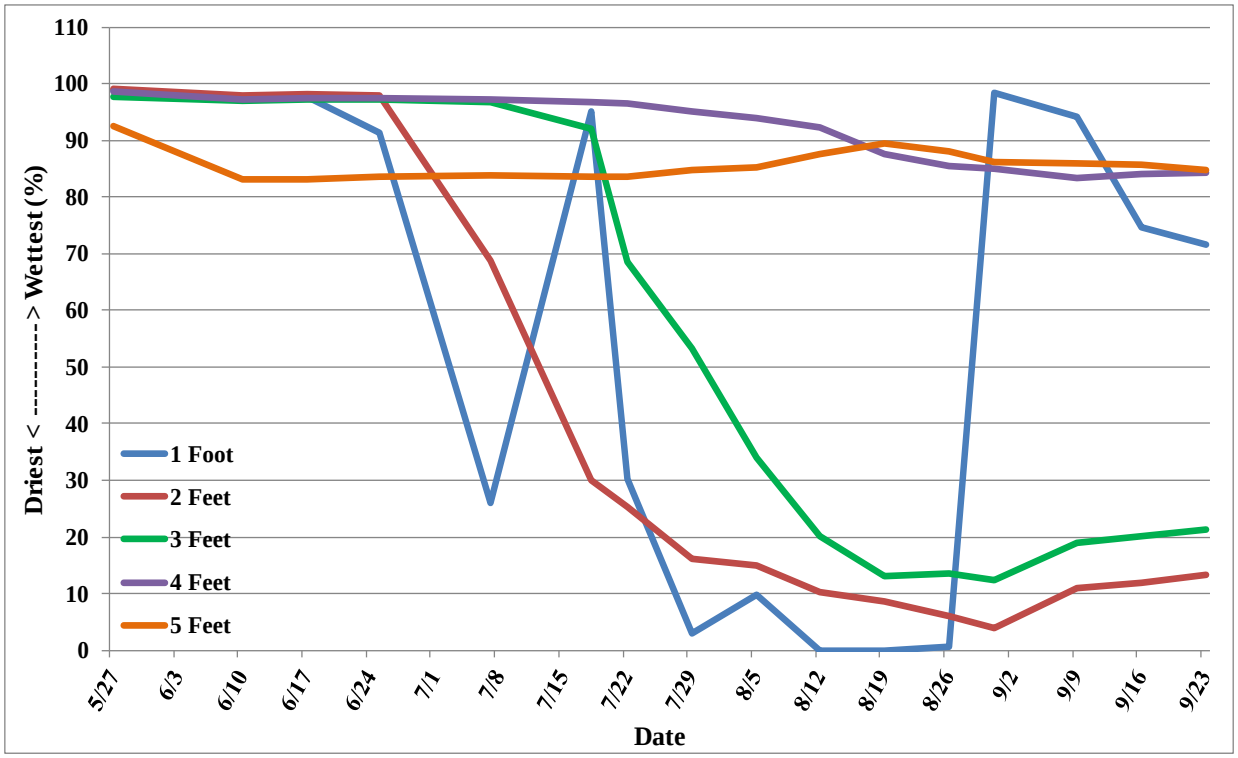


Figure 2: Growing Season Water Tracking for Danny Krienke's "3 GPM-Early" Demonstration Site, 231 bu/ac, LEPA

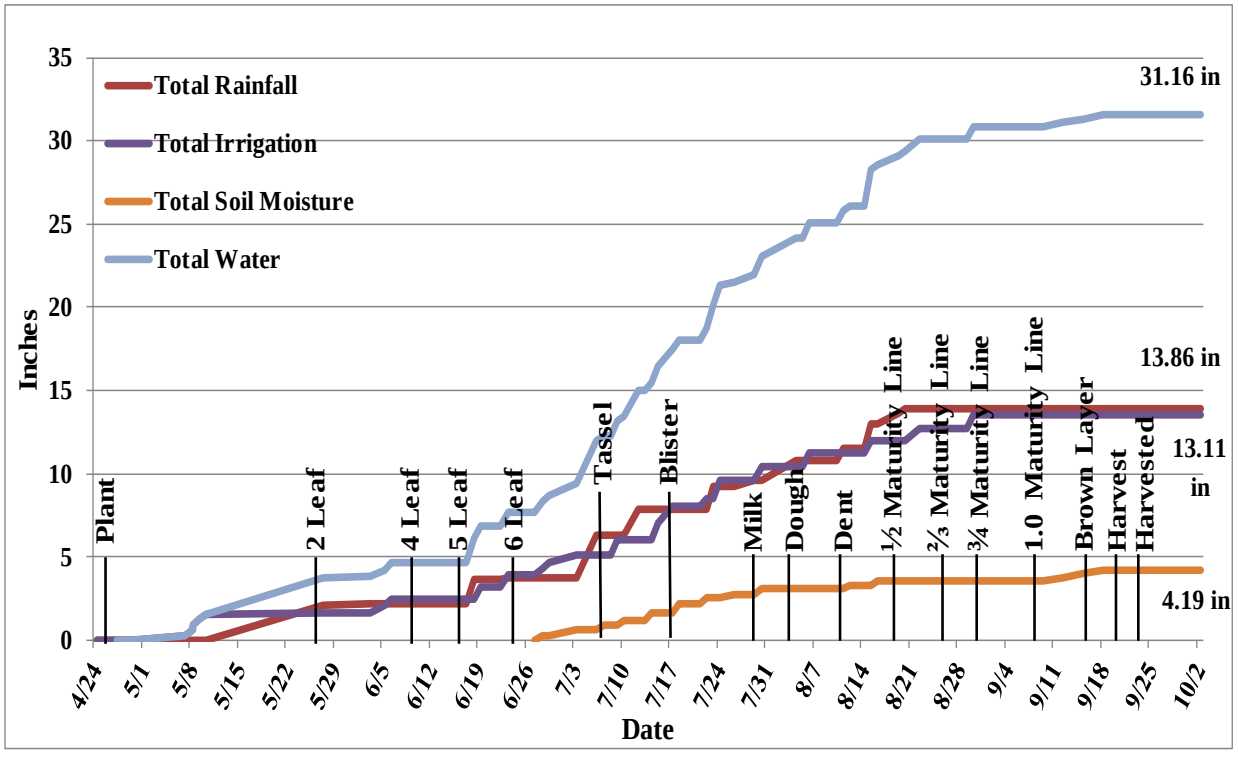


Table 3: Field Data for Danny Krienke's "3 GPM-Early" Demonstration Site, 231 bu/ac, LEPA

Date	Rainfall (inches)	Irrigation (inches)	Water Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
4/9	0.61												Pivotrac
4/25				plant									Danny
4/29													Danny
5/6										180	start ccw		Pivotrac
5/7		0.28	12.5 hrs							90	3-E	600	reverse
5/7		0.32	15.7 hrs							180	3-E	550	reverse
5/8		0.32	15.7 hrs							90	3-E	550	reverse
5/9		0.33	16.1 hrs							180	3-E	550	reverse
5/9		0.32	15.6 hrs							90	3-E	550	reverse
5/9		0.05	2.3 hrs							100	3-E	550	stop
5/27	2.12		814.25	2 leaf	98.9	99.1	97.7	98.6	92.5	300		off	C & L
6/3	0.06		816.99	2 leaf	97.2	97.8	96.9	96.9	82.8	35	3	625	C & L
6/4			819.66							90	into 3-E	565	Pivotrac
6/5		0.42	821.78							180	reverse		Pivotrac
6/5		0.43	823.92							90	into 3	565	Pivotrac
6/10			830.98	4 leaf	97.5	98.0	97.1	97.2	83.2	90		off	C & L
6/17			830.98	5 leaf	97.7	98.3	97.3	97.4	83.1	90		off	C & L
6/18	1.48		832.42								start 3-E		Pivotrac
6/19		0.74	836.12							180	3-E	550	stop
6/22			836.12							180	start 3-E		Pivotrac
6/23	0.07	0.71	839.68							90	into 3	550	Pivotrac
6/25			842.16	6 leaf	91.5	98.1	97.2	97.5	83.7	273	5	566	C & L
6/27			846.71							90	start 3-E		Pivotrac
6/28		0.38	848.64							180	reverse	565	Pivotrac
6/28		0.38	850.52							90	into 3	560	Pivotrac
7/6	2.57									180	start 3-E		Pivotrac
7/7			856.50	tassel	25.9	68.9	96.8	97.3	83.8	125	3-E	557	C & L
7/7										109	stop 3-E		Pivotrac
7/8										109	start 3-E		Pivotrac
7/8		0.94	859.05							90	into 3	565	Pivotrac
7/12	1.52		868.35							90	into 3-E		Pivotrac
7/13										143	stop 3-E		Pivotrac
7/14										143	start 3-E		Pivotrac
7/15		1.00	873.38							180	reverse	565	Pivotrac
7/17		0.99	878.30	blister						90	into 3	565	Pivotrac
7/18			879.93	blister	95.1	30.1	92.0	96.9	83.7	358	3	565	C & L
7/21			884.79							90	into 3-E		Pivotrac
7/22		0.48	890.18							180	reverse	560	Pivotrac
7/22	1.36		889.80	blister	30.3	25.2	68.6	96.6	83.7	168	3-E	558	C & L
7/24		1.13	895.85							90	into 3	560	Pivotrac
7/28											move dry		Pivotrac
7/28	0.44		904.99							180	start 3-E		Pivotrac
7/29			906.19	milk	3.0	16.2	53.4	95.2	84.9	113	3-E	547	P & L
7/29		0.78	908.89							90	into 3	560	Pivotrac
8/4	1.14		923.15	dough						`80	start 3-E		Pivotrac
8/5			922.80	dough	9.8	15.0	34.0	93.9	85.2	124	3-E	552	C & L
8/6		0.85	927.41							90	into 3	550	Pivotrac
8/10			938.73							180	start 3-E		Pivotrac
8/11	0.75									127	stop 3-E		Pivotrac
8/12			937.83	dent	0	10.3	20.2	92.3	87.7	127		off	C & L
8/14										127	start 3-E		Pivotrac
8/15	1.50	0.75	942.48							90	into 3	555	Pivotrac
8/19	0.63		950.31	½ mat line	0	8.6	13.1	87.7	89.5	296	5	560	C & L
8/20	0.22		955.70							270	start 3-E		Pivotrac
8/22		0.75	959.49							90	into 3	555	Pivotrac
8/26			963.30	⅔ mat line	0.6	6.1	13.6	85.6	88.2	350	3	564	C & L
8/28			971.13							270	move dry		Pivotrac
8/28			971.13							180	start 3-E		Pivotrac
8/30		0.76	974.94							90	stop 3-E	560	Pivotrac
8/31			971.95	¾ mat line	98.4	3.9	12.3	85.1	86.3	90		off	C & L
9/9			971.95	1.0 mat line	94.3	11.0	19.0	83.5	86.1	90		off	Danny
9/16			973.57	brown layer	74.8	12.0	20.1	84.0	85.8	57	3	566	C & L
9/21				harvest									C & L
9/23			980.86	harvested	71.7	13.4	21.2	84.4	84.9	272		off	
9/30			980.86	harvested								off	
Total	13.86	13.11			0.67	1.65	1.41	0.46	0.00				
Net soil moisture is 4.19 inches.													
Rainfall (13.86 in), irrigation (13.11 in), and net soil moisture (4.19 in) is total water (31.16 in).													
*Numbers in red are not counted in the total.													

Figure 3: Gypsum Block Readings for Danny Krienke's "3 GPM" Demonstration Site, 207 bu/ac, LEPA

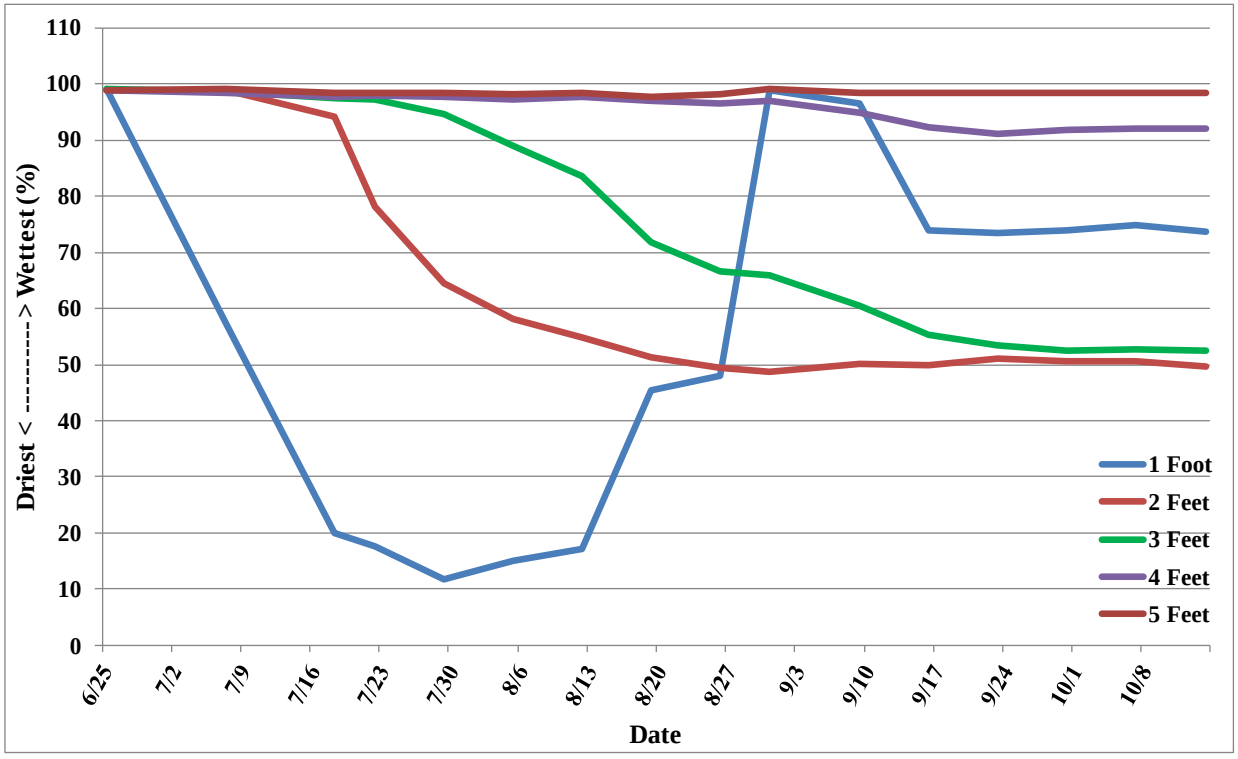


Figure 4: Growing Season Water Tracking for Danny Krienke's "3 GPM" Demonstration Site, 207 bu/ac, LEP

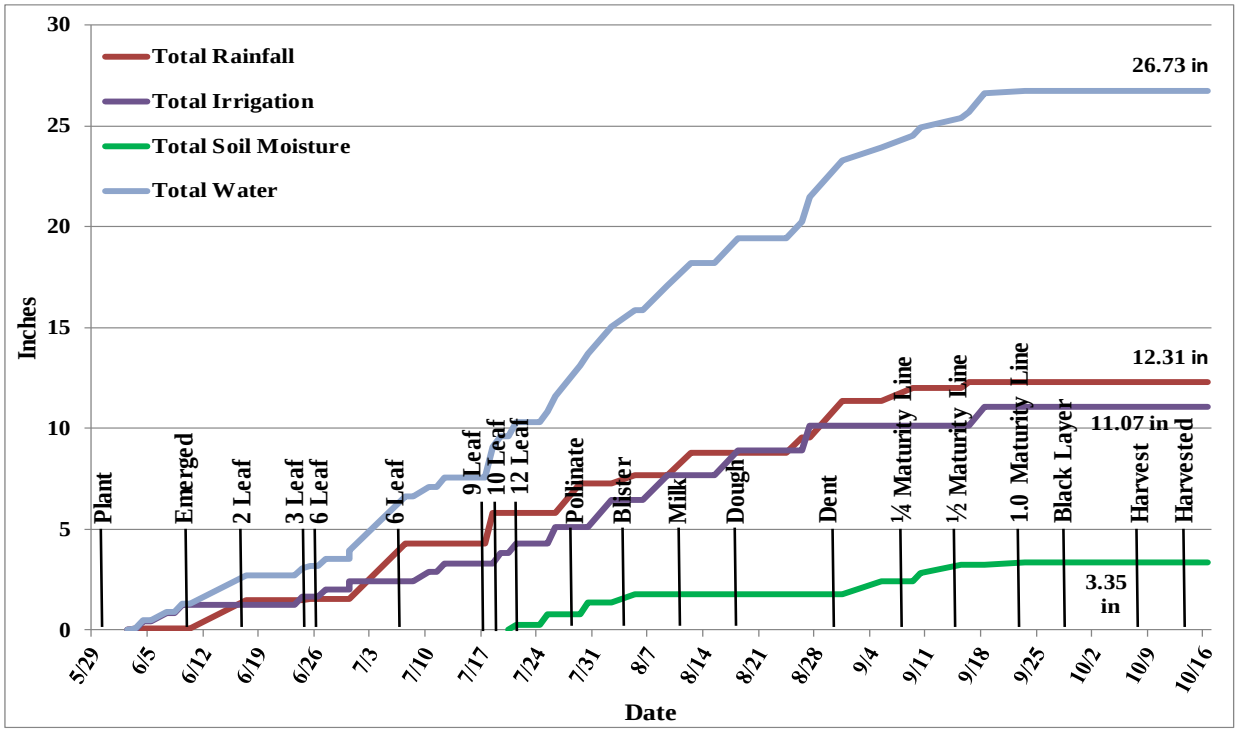


Table 4: Field Data for Danny Krienke's "3 GPM" Demonstration Site, 207 bu/ac, LEPA

Date	Rainfall (inches)	Irrigation (inches)	Water Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
4/9	0.61												Pivotrac
4/29	2.00												Danny
5/27			814.25							300	off		C & L
5/30				plant									Danny
6/2										330	into 3	575	Pivotrac
6/3	0.05		816.99							35	3	625	C & L
6/3										47	stop		Pivotrac
6/3										47	start		Pivotrac
6/4		0.40	819.66							90	into 3-E	565	Pivotrac
6/5			823.92							90	into 3		Pivotrac
6/7		0.42	826.74							330	into 4	565	Pivotrac
6/8			829.60							330	into 3	565	Pivotrac
6/9		0.42	832.42							90	stop		Pivotrac
6/10			830.98	emerged						90	off		C & L
6/17	1.40		830.98	2 leaf						90	off		C & L
6/23			839.68							90	into 3		Pivotrac
6/24		0.38	842.24							330	into 4	550	Pivotrac
6/25	0.07		842.16	3 leaf	99.0	98.8	99.0	98.8	98.8	273	5	566	C & L
6/25			844.18	6 leaf						330	into 3	565	Pivotrac
6/27		0.38	846.71								stop	560	Pivotrac
6/28			850.52							90	into 3		Pivotrac
6/29										47	stop		Pivotrac
6/29										47	start		Pivotrac
6/30		0.38	853.07							330	into 4	560	Pivotrac
7/7	2.74		856.5	6 leaf	57.3	98.8	98.6	98.5	99.2	125	3-E	557	C & L
7/8			859.05							90	into 3		Pivotrac
7/10		0.47	862.18							330	into 4	565	Pivotrac
7/11			865.27							330	into 3		Pivotrac
7/12		0.46	868.35							90	into 3-E	565	Pivotrac
7/17			878.30	9 leaf						90	into 3		Pivotrac
7/18	1.52		879.93	10 leaf	20.1	94.2	97.5	97.8	98.4	358	3	565	C & L
7/18		0.49	881.59							330	into 4	560	Pivotrac
7/20			884.67							330	into 3		Pivotrac
7/21		0.47	887.79							90	into 3-E	560	Pivotrac
7/22			889.80	12 leaf	17.7	78.2	97.2	97.9	98.5	168	3-E	558	C & L
7/24			895.85							90	into 3		Pivotrac
7/26		0.80	901.20							330	into 4	560	Pivotrac
7/29	1.48		906.19	pollinate	11.7	64.5	94.7	97.6	98.3	113	3-E	547	P & L
7/29			908.89							90	into 3		Pivotrac
8/2		1.36	917.99							330	into 4	550	Pivotrac
8/5	0.38		922.80	blister	15.0	58.1	89.1	97.3	98.1	124	3-E	552	C & L
8/6			927.41							90	into 3		Pivotrac
8/9		1.22	935.58							330	into 4	550	Pivotrac
8/12	1.14		937.83	milk	17.2	54.8	83.6	97.7	98.3	127	off		C & L
8/15			942.48								into 3		Pivotrac
8/18		1.24	950.76							330	into 4	555	Pivotrac
8/19			950.31	dough	45.4	51.2	71.8	96.9	97.8	296	5	560	C & L
8/22			959.49							90	into 3		Pivotrac
8/22										62	stop 3		Pivotrac
8/24										62	start 3		Pivotrac
8/26	0.78		963.30	dough	47.9	49.4	66.6	96.5	98.1	350	3	564	C & L
8/27		1.23	967.69							330	into 4	555	Pivotrac
8/31	1.81		971.95	dent	98.8	48.6	65.8	97.1	99.0	90	off		C & L
9/9	0.62		971.63	¼ mat line	96.5	50.2	60.5	94.8	98.5	90	off		C & L
9/15										90	start 3		Pivotrac
9/16	0.32		973.57	½ mat line	73.9	50.0	55.2	92.2	98.5	57	3	566	C & L
9/18		0.95	981.32							330	into 4		Pivotrac
9/23			980.86	1.0 mat line	73.4	51.0	53.5	91.2	98.5	272	off		C & L
9/30			980.86	black layer	73.8	50.6	52.5	91.8	98.5	272	off		Danny
10/7			980.86	black layer	74.8	50.7	52.7	92.1	98.5	234	off		Curtis
10/8				harvest									
10/14			980.86	harvested	73.7	49.6	52.5	92.1	98.5	234	off		
Total	12.31	11.07			0.78	1.10	1.07	0.40	0.00				
Net soil moisture is 3.35 inches.													
Rainfall (12.31 in), irrigation (11.07 in), and net soil moisture (3.35 in.) is total water (26.73 in).													
*Numbers in red are not counted in the total.													

Figure 5: Gypsum Block Readings for Danny Krienke's "4 GPM" Demonstration Site, 212 bu/ac, LEPA

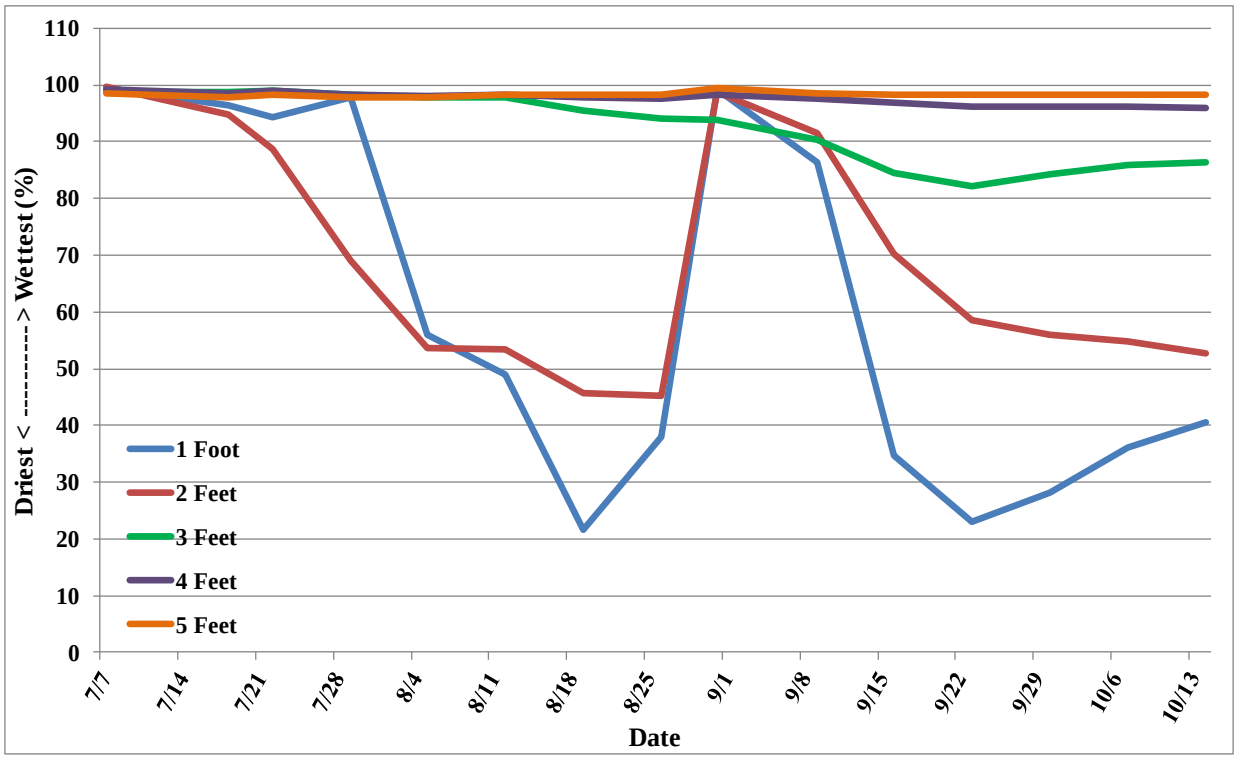


Figure 6: Growing Season Water Tracking for Danny Krienke's "4 GPM" Demonstration Site, 212 bu/ac, LEPA

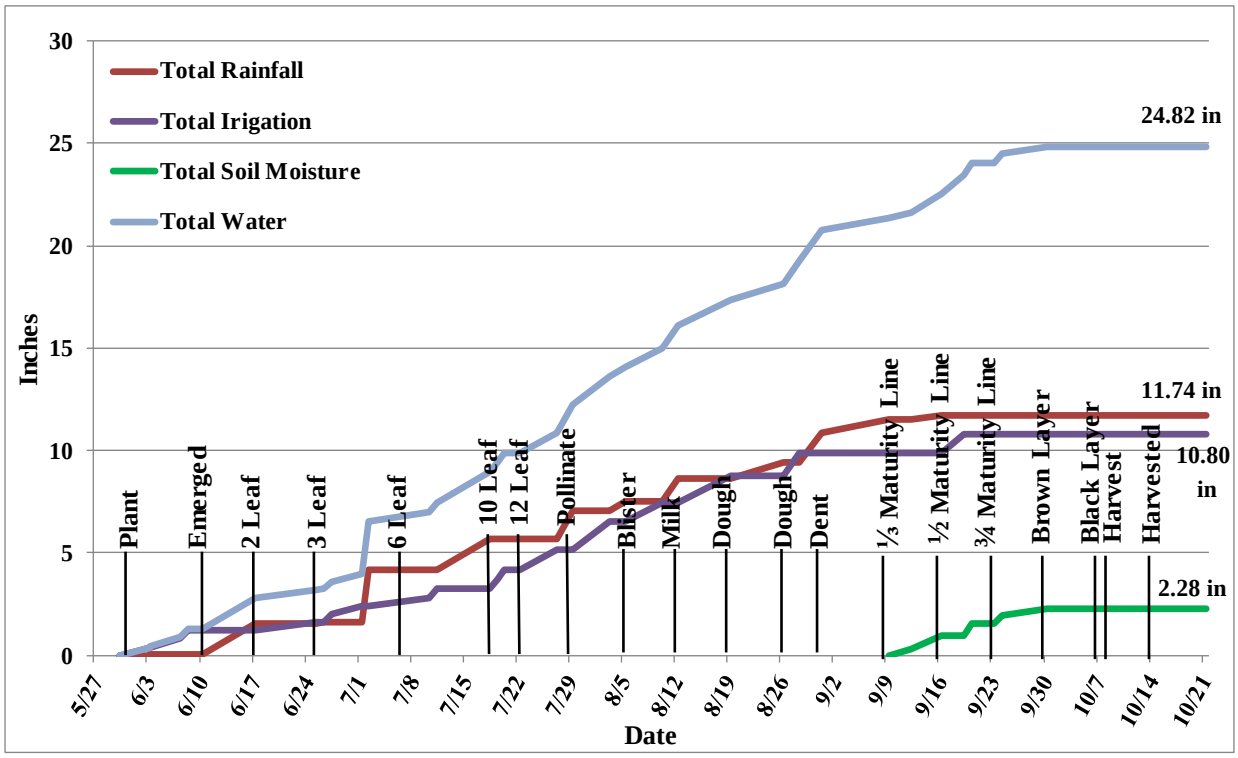


Table 5: Field Data for Danny Krienke's "4 GPM" Demonstration Site, 212 bu/ac, LEPA

Date	Rainfall (inches)	Irrigation (inches)	Water Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
4/9	0.61												Pivotrac
4/29	2.00												Danny
5/27			814.25							300			C & L
5/30				plant							off		Danny
6/2			814.90							300		575	Pivotrac
6/2		0.40	815.58							330	into 4	575	Pivotrac
6/3	0.06		816.99							35	into 3	625	C & L
6/7			826.74							330	3	565	Pivotrac
6/7		0.42	827.46							300	into 4	565	Pivotrac
6/7			828.88							300	into 5	565	Pivotrac
6/8		0.42	829.60							330	into 4	565	Pivotrac
6/10			830.98	emerged						90	into 5		C & L
6/17	1.48		830.98	2 leaf						90	off		C & L
6/24			842.24							330	off		Pivotrac
6/25		0.38	842.89							300	into 4	550	Pivotrac
6/25	0.07		842.16	3 leaf						273	into 5	566	C & L
6/25			843.55							300	5		Pivotrac
6/25		0.37	844.18							330	into 4	565	Pivotrac
6/30			853.07							330	into 3		Pivotrac
6/30		0.38	853.71							300	into 4	560	Pivotrac
7/7	2.57		856.50	6 leaf	99.5	99.7	98.8	99.3	98.5	125	into 5	557	C & L
7/10			862.18							330	3-E		Pivotrac
7/10		0.45	862.95							300	into 4	565	Pivotrac
7/10			864.49							300	into 5		Pivotrac
7/11		0.45	865.27							330	into 4	565	Pivotrac
7/18	1.52		879.93	10 leaf	96.5	94.8	98.7	98.6	97.9	358	into 3	565	C & L
7/18			881.59							330	3		Pivotrac
7/19		0.45	882.36							300	into 4	560	Pivotrac
7/19			883.90							300	into 5		Pivotrac
7/20		0.46	884.67							330	into 4	560	Pivotrac
7/22			889.80	12 leaf	94.3	88.6	98.9	98.9	98.3	168	into 3	558	C & L
7/26			901.20							330	3-E		Pivotrac
7/27		0.98	902.85							300	into 4	560	Pivotrac
7/29	1.36		906.19	pollinate	97.9	69.1	98.3	98.3	97.9	113	into 5	547	C & L
8/2			917.99							330	3-E		Pivotrac
8/3		1.40	920.35							300	into 4	560	Pivotrac
8/5	0.44		922.80	blister	55.9	53.7	97.9	98.1	97.9	124	into 5	552	C & L
8/9			935.58							330	3-E		Pivotrac
8/10		0.92	937.14							300	into 4	555	Pivotrac
8/12	1.14		937.83	milk	49.0	53.5	97.9	98.3	98.4	127	into 5		Curtis
8/18			950.76								off		Pivotrac
8/19		1.27	952.91							300	into 4	555	Pivotrac
8/19			950.31	dough	21.6	45.6	95.6	97.9	98.2	296	into 5	560	C & L
8/26	0.75		963.30	dough	37.9	45.2	94.0	97.7	98.3	350	5	564	C & L
8/27			967.69							330	3		Pivotrac
8/27		1.10	969.56							300	into 4	555	Pivotrac
8/31	1.50		971.95	dent	99.2	98.8	93.9	98.4	99.5	90	into 5		C & L
9/9	0.63		971.95	⅓ mat line	86.4	91.4	90.4	97.6	98.5	90	off		C & L
9/16	0.22		973.57	½ mat line	34.6	70.2	84.6	96.8	98.3	57	off	566	C & L
9/18			981.32							330	3		Pivotrac
9/18		0.95	982.92							300	into 4	560	Pivotrac
9/23			980.86	¾ mat line	23.1	58.5	82.1	96.2	98.3	272	into 5		C & L
9/30			980.86	brown layer	28.1	56.0	84.2	96.1	98.4	272	off		C & L
10/7			980.86	black layer	36.1	54.8	85.8	96.2	98.3	272	off		C & L
10/8				harvest							off		Danny
10/14			980.86	harvested	40.6	52.6	86.4	96.0	98.2	234			Curtis
Total	11.74	10.80			1.14	0.74	0.40	0.00	0.00		off		
Net soil moisture is 2.28 inches.													
Rainfall (11.74 in), irrigation (10.80 in), and net soil moisture (2.28 in) is total water (24.82 in).													
*Numbers in red are not counted in the total.													

Figure 7: Gypsum Block Readings for Danny Krienke's "5 GPM" Demonstration Site, 217 bu/ac, LEPA

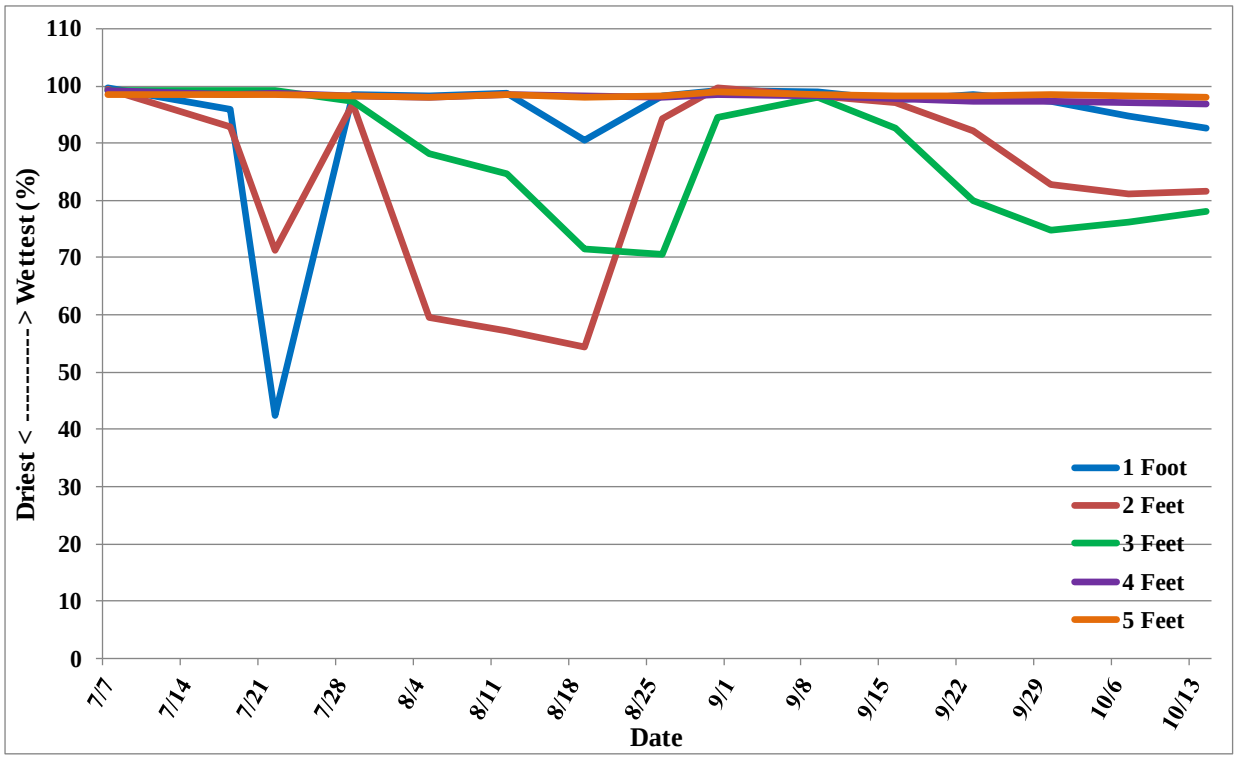


Figure 8: Growing Season Water Tracking for Danny Krienke's "5 GPM" Demonstration Site, 217 bu/ac, LEPA

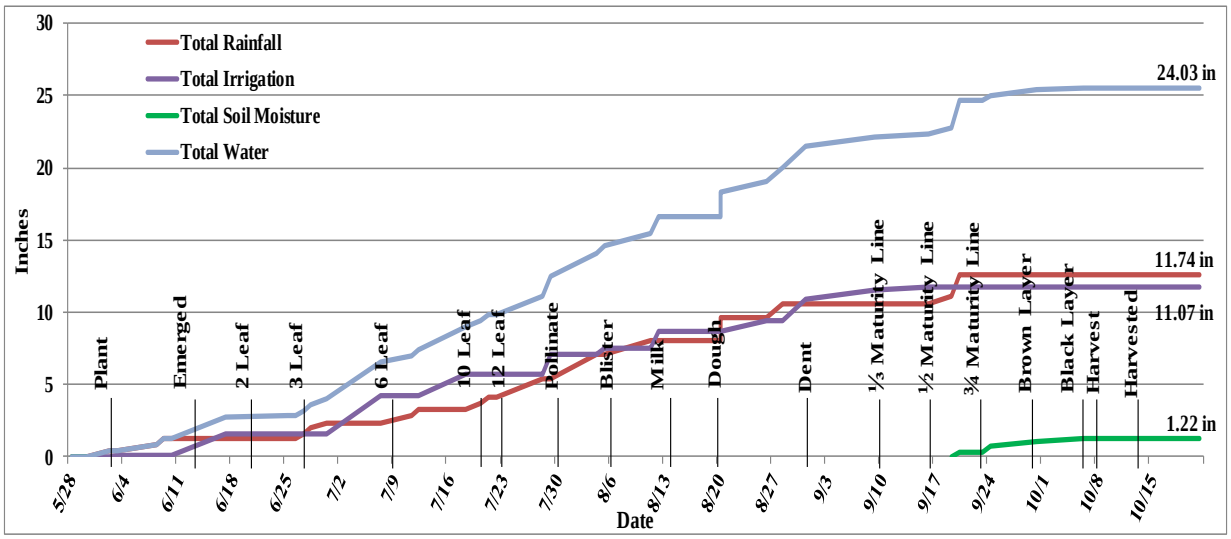


Table 6: Field Data for Danny Krienke's "5 GPM" Demonstration Site, 217 bu/ac, LEPA

Date	Rainfall (inches)	Irrigation (inches)	Water Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well GPM	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
4/19	0.61												Pivotrac
4/29	2.00												Danny
5/27			814.25							300	off		C & L
5/30				plant									Danny
6/2			814.25							270	start 5		Pivotrac
6/2		0.38	814.90							300	5	575	Pivotrac
6/3	0.06		816.99							35	3	625	C & L
6/7			827.46							330	into 5	565	Pivotrac
6/7		0.41	828.16							270	5	565	reverse
6/7		0.42	828.88							300	into 4	565	Pivotrac
6/10			830.98	emerged						90	off		C & L
6/17	1.48		830.98	2 leaf						90	off		C & L
6/25	0.07		842.89	3 leaf						300	into 5		Pivotrac
6/25			842.16	3 leaf						273	5	566	C & L
6/25		0.38	842.92							270	5	565	reverse
6/25		0.37	843.55							300	into 4	565	Pivotrac
6/30			853.71							300	into 5		Pivotrac
6/30		0.38	854.36							270	stop	565	Pivotrac
7/7	2.57		856.50	6 leaf	99.6	99.5	99.3	99.1	98.5	125	3-E	557	C & L
7/10			862.95							300	into 5		Pivotrac
7/10		0.45	863.72							270	reverse	565	Pivotrac
7/10		0.45	864.49							300	into 4	565	Pivotrac
7/18	1.52		879.93	10 leaf	95.8	92.9	99.2	98.5	98.6	358	3	565	C & L
7/19			882.36							300	into 5		Pivotrac
7/19		0.45	883.12							270	reverse	560	Pivotrac
7/19		0.46	883.90							300	into 4	560	Pivotrac
7/22			889.80	12 leaf	42.4	71.2	99.3	98.7	98.6	168	3-E	558	C & L
7/27			902.85							300	into 5		Pivotrac
7/28		1.26	904.99							270	stop	560	Pivotrac
7/29	1.36		906.19	pollinate	98.4	96.8	97.2	98.2	98.2	113	3-E	547	C & L
8/3			920.35							300	into 5		Pivotrac
8/4		1.65	923.15							270	move dry	560	Pivotrac
8/5	0.44		922.80	blister	98.3	59.6	88.1	98.1	98.1	124	3-E	552	C & L
8/10			937.14							300	into 5		Pivotrac
8/10		0.94	938.73							270	move dry	555	Pivotrac
8/12	1.14		937.83	milk	98.8	57.2	84.6	98.6	98.4	127	off		Curtis
8/19			952.91	dough						300	into 5		Pivotrac
8/19			950.31	dough	90.4	54.5	71.4	98.3	98.1	296	5	560	C & L
8/20		1.65	955.70							270	move dry	555	Pivotrac
8/26	0.75		963.30	dough	98.2	94.2	70.6	97.9	98.2	350	3	564	C & L
8/27			969.56							300	into 5		Pivotrac
8/28		0.92	971.13							270	move dry	555	Pivotrac
8/31	1.50		971.95	dent	99.3	99.6	94.4	98.5	99.0	90	off		C & L
9/9	0.63		971.95	⅓ mat line	98.9	98.3	98.0	98.3	98.6	90	off		C & L
9/16	0.22		973.57	½ mat line	97.5	97.1	92.7	97.7	98.2	57	57	566	C & L
9/18			982.92							300	into 5		Pivotrac
9/19		0.50	983.77							270	stop 5	560	Pivotrac
9/23			980.86	¾ mat line	98.5	92.2	80.0	97.2	98.3	272	off		C & L
9/30			980.86	brown layer	97.4	82.8	74.7	97.2	98.4	272	off		C & L
10/7			980.86	black layer	94.7	81.2	76.1	97.0	98.2	234	off		C & L
10/8				harvest									Danny
10/14			980.86	harvested	92.7	81.7	78.0	96.9	98.0	234	off		Curtis
Total	11.74	11.07			0.06	0.32	0.76	0.08	0.00				
Net soil moisture is 1.22 inches.													
Rainfall (11.74), irrigation (11.07 in), and net soil moisture (1.22 in) is total water (24.03 in).													

*Numbers in red are not counted in the total.

Harvest Results: The 3 GPM-Early field produced a 231 bushel per acre corn yield. Irrigation totaled to 13.11 inches. Production in the 3 GPM field was 207 bushels per acre. Seasonal irrigation totaled 11.07 inches. Corn yield was 212 bushels per acre for the 4 GPM field. Irrigation totaled to 10.80 inches. Production in the 5 GPM field was 217 bushels per acre. Total irrigation was 11.07 inches. There was no pre-season irrigation.

The 3 GPM-Early field produced 24 more bushels per acre more than the 3 GPM field, and irrigation was 2.04 inches more. The 4 GPM field produced 5 more bushels per acre than the 3 GPM with 0.27 less inches of irrigation. The 5 GPM yield was 5 more bushels per acre than that from 4 GPM field with 0.27 additional inches of irrigation.

Corn production was 17.62 bushels (1057 lb) per inch of irrigation in the 3 GPM-Early field compared to 18.70 bushels (1122 lb) in the 3 GPM, 19.63 bushels (1177 lb) in the 4 GPM, and 19.60 bushels (1176 lb) from the 5 GPM field. Production from each inch of irrigation, rainfall, and net soil water that totaled 31.16 inches was 7.41 bushels (445 lb) per acre in the 3 GPM-Early field.

Irrigation, rainfall, and net soil water totaled 26.73 inches in the 3 GPM field where production was 7.74 bushels (464 lb) per inch. In the 4 GPM field, irrigation, rainfall, and net soil water totaled 24.82 inches, where the production was 8.54 bushels (512 lb) per inch of total water. Irrigation, rainfall, and net soil water totaled 24.03 inches in the 5 GPM field, where the production was 9.03 bushels (52 lb) per inch.

Crop production costs were $47.06 per acre more for the 3-Early GPM field than for the 3 GPM from increased irrigation, seed, fertilizer, and harvest expenses. At $3.44 per bushel, the 24 bushels per acre increased corn yield in the 3-Early GPM field amounts to $82.56 more per acre than from the 3 GPM field. The 3 GPM-Early field's net gain is $35.50 per acre with 2.04 inches more irrigation used compared to production from the 3 GPM field. At $3.44 per bushel, the 19 bushels per acre increased yield from the 3 GPM-Early field compared to the 4 GPM amounts to $65.36. Crop production costs were $33.83 more for the 3 GPM-Early field. The 3-Early GPM field's net gain compared to the 4 GPM field is $31.53 per acre with 2.31 additional inches of irrigation.

The value of the 14 additional bushels produced in the 3 GPM-Early field compared to the 5 GPM field is $48.16. Production costs were $9.55 more for the 3 GPM-Early field than the 5 GPM field. Net gain for the 3 GPM-Early field is $38.61 per acre with 2.04 inches more irrigation.

Net return from the 3 GPM-Early field is $380.29 per acre compared to $344.79 for the 3 GPM field, $348.76 per acre for the 4 GPM field, and $341.68 from the 5 GPM field. Net return from each inch of irrigation is $29.00 for the 3 GPM-Early field compared to $31.14 from the 3 GPM field, $32.29 for the 4 GPM field, and $30.86 for the 5 GPM field.

Unfortunately, plants in the 3, 4 and 5 GPM fields suddenly quit/died prematurely in mid-September eliminating a potential superior harvest and yield comparison. When the plants quit, the grain dried too quickly losing the yield that was there. A summary of the demonstration results is shown in Table 7 and Appendix B

Table 7: Danny Krienke's 2016 Demonstration Results

GPM	Irrigation (in)	Total Water (in)	Production		Gross Crop Value @ $3.44/bu		
			bu/ac	lb/ac-in of Irrigation	per acre ($)	Acre-in of Irrigation ($)	Acre-in of Total Water ($)
3-Early	13.11	[a]31.16	231	1057	794.64	60.61	25.50
3	11.07	[b]26.73	207	1122	712.08	64.32	26.64
4	10.80	[c]24.82	212	1778	729.28	67.52	29.38
5	11.07	[d]24.03	217	1176	746.48	67.43	31.06

[a]Includes 4.19 inches of net soil water removed within 5 feet of soil plus rainfall and irrigation.

[b]Includes 3.35 inches of net soil water removed within 5 feet of soil plus rainfall and irrigation.

[c]Includes 2.28 inches of net soil water removed within 5 feet of soil plus rainfall and irrigation.

[d]Includes 1.22 inches of net soil water removed within 5 feet of soil plus rainfall and irrigation.

Harold Grall's 2016 Moore County LEPA Shroud and T-L Mobile Drip Irrigation (PMDI) Demonstration

Planting and Crop Information: Harold Grall strip tilled and planted 120 acres of corn in the NW ¼ of Section 328 circle for his "3-4-5 Gallon Production Maximization" and "LEPA Shroud and T-L PMDI Irrigation System" demonstration. Senninger LEPA Shroud applicators were installed 30 inches apart in spans 2, 3, 4, 5, 7, 8, and the end section prior to the 2015 growing season. T-L PMDI drag lines were installed 30 inches apart in span 6. LDN LESA spray applicators remain in span 1. Grall planted the LEPA Shroud and PMDI fields with Pioneer 1151AMX hybrid. Seeding rate for the LEPA Shroud and PMDI fields was 30,000 seeds per acre. Center pivot travel was tracked by Pivotrac®. Seasonal water meter readings averaged 295 GPM. Irrigation capacity averaged 0.91 inches in a 7-day circle revolution. Planting and crop information for "Grall LEPA Shroud" and "Grall T-L PMDI" are shown in the Table 8 below.

Table 8: Planting and Crop Information for Harold Grall

3 GPM LEPA Shroud Demonstration Site: Spans 2, 3, 4, 5, 7, 8 and End Section, 270-210 degrees					
Planted		May 25		**Harvested**	October 8
Hybrid		Pioneer P1151AMX		**Seeding Rate**	30,000
Row Width		30 inches		**Tillage**	Strip Till
No. Acres		79.50		**GPM per acre**	2.24
Total Water		23.87 inches		**Soil Type**	Sherm silty clay loam
Irrigation		13.57 inches		**Insecticide**	Comite, Stratego fungicide
3 GPM T-L PMDI Demonstration Site: Span 6; 270-210 degrees					
Planted		May 25		**Harvested**	October 8
Hybrid		Pioneer P1151AMX		**Seeding Rate**	30,000
Row Width		30 inches		**Tillage**	Strip Till
No. Acres		16.90		**GPM per acre**	2.24
Total Water		26.37 inches		**Soil Type**	Sherm silty clay loam
Irrigation		13.57 inches		**Insecticide**	Comite, Stratego fungicide
4 GPM LEPA Shroud Demonstration Site: Spans 2, 3, 4, 5, 7, 8 and End Section, 210-240 degrees					
Planted		May 25		**Harvested**	October 8
Hybrid		Pioneer P1151AMX		**Seeding Rate**	30,000
Row Width		30 inches		**Tillage**	Strip Till
No. Acres		8.00		**GPM per acre**	2.99
Total Water		25.47 inches		**Soil Type**	Sherm silty clay loam
Irrigation		14.85 inches		**Insecticide**	Comite, Stratego fungicide
4 GPM T-L PMDI Demonstration Site: Span 6; 210-240 degrees					
Planted		May 25		**Harvested**	October 8
Hybrid		Pioneer P1151AMX		**Seeding Rate**	30,000
Row Width		30 inches		**Tillage**	Strip Till
No. Acres		1.70		**GPM per acre**	2.99
Total Water		25.56 inches		**Soil Type**	Sherm silty clay loam
Irrigation		14.85 inches		**Insecticide**	Comite, Stratego fungicide

Table 8: Planting and Crop Information for Harold Grall 3 GPM, LEPA Shroud, and PMDI (continued)

5 GPM LEPA Shroud Demonstration Site: Spans 2, 3, 4, 5, 7, 8 and 3nd Section, 240-270 degrees			
Planted	May 25	**Harvested**	October 8
Hybrid	Pioneer P1151AMX	**Seeding Rate**	30,000
Row Width	30 inches	**Tillage**	Strip Till
No. Acres	8.00	**GPM per acre**	3.73
Total Water	26.27 inches	**Soil Type**	Sherm silty clay loam
Irrigation	15.82 inches	**Insecticide**	Comite, Stratego fungicide
5 GPM T-L PMDI Demonstration Site: Span 6; 240-270 degrees			
Planted	May 25	**Harvested**	October 8
Hybrid	Pioneer P1151AMX	**Seeding Rate**	30,000
Row Width	30 inches	**Tillage**	Strip Till
No. Acres	1.70	**GPM per acre**	3.73
Total Water	24.60 inches	**Soil Type**	Sherm silty clay loam
Irrigation	15.82 inches	**Insecticide**	Comite, Stratego fungicide

Soil Water Profile and Growing Season Rainfall

"LEPA Shroud" Demonstration Site: Pre-season soil water was good at 1, 2, 3, 4, and 5 feet in the 3, 4, and 5 GPM LEPA fields. Soil for each field was Sherm silty clay loam that can store approximately 2.00 inches of available water per foot for potential crop use. Soil moisture sensors show the crop in each GPM field had adequate soil water during the growing season. Rainfall totaled to 8.78 inches from planting until grain maturity in late September.

"3 GPM" Demonstration Site: Plants used more water than rainfall and irrigation provided beginning in early July at 5 leaves during the 100-degree temperatures. Additional soil water was used from 2 feet in mid-July, 3 feet in late July, 4 feet in early August, and 5 feet in September. Net soil water use was 1.52 inches.

"4 GPM" Demonstration Site: Plant roots used soil water from 1 foot the first week in July, 2 feet in mid-July, 3 feet in late July at the 10-leaf growth stage, and 4 feet in late August in addition to rainfall and irrigation. Very little water was used from 4 and 5 feet. Net soil water was 1.84 inches.

"5 GPM" Demonstration Site: Plants used water primarily from 1, 2, and 3 feet. Soil moisture sensors showed water use from 1 foot beginning in early July, 2 feet in mid-July, limited use from 3 feet in September, and no significant use from 4 and 5 feet during the growing season. Net soil water use was 1.67 inches.

"T-L PMDI" Demonstration Site: Soil water was good at 1, 2, 3, 4, and 5 feet prior to planting in each 3, 4 and 5 GPM T-L PMDI field. Soil moisture sensors showed the crop had sufficient soil water during the growing season. Total rainfall from planting through black layer totaled to 8.78 inches. The crop was produced in Sherm silty clay loam soil that holds approximately 2.00 inches available water per foot for potential crop use.

"3 GPM" Demonstration Site: Weekly gypsum block readings showed that plants used significant water from 1 foot in the soil profile the first week of July, most of the water stored at 2 feet the second

week, and depleted water at 3 feet the third week in July. Plants also used most of the water from 4 feet in mid to late July in addition to rainfall and irrigation. About 40% of the water was used from 5 feet in mid-August. Net soil water totaled to 4.04 inches, the most in any of Grall's demonstration fields.

"4 GPM" Demonstration Site: Plants used all soil water from 1 and 2 feet in the soil profile by mid-July and most from 3 feet by August 1. Fifteen percent to 20% of the water stored at 4 feet was used in September. No significant amount was used from 5 feet, indicating sufficient water was available. Net soil water use was 1.84 inches.

"5 GPM" Demonstration Site: Roots began to use water from 1 foot in the soil profile the first week in July and from 2 feet beginning the third week at the 8-leaf growth stage in addition to rainfall and irrigation. Plant roots moved into 3 feet the first week in August at crop pollination. Soil moisture sensors show no water was used from 4 and 5 feet of the soil profile. Late season irrigation and rainfall refilled the 1, 2, and 3 feet root zones, resulting in no net soil water.

Table 9: Monthly Rainfall Data for Harold Grall

System	June (in)	July (in)	August (in)	September (in)	Total (in)
LEPA, PMDI	2.50	0.75	2.70	2.83	8.78

Growing Season Water Tracking: The District tracked total water and crop growth throughout the growing season using rain gauges, water meters, and both gypsum blocks and Aquaspy® soil moisture sensors. One set of 5 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 4 feet in the root zone at 1 location to monitor soil water levels in the 3 GPM-Early field. Another set of the same type of sensors was installed in each 3, 4, and 5 GPM field. Both the gypsum block sensors and the soil probe were installed in close proximity to each other in each field. Gypsum blocks, water meters, rain gauges, and crop growth were read, recorded, and utilized weekly by district personnel. A 24/7 Aquaspy® probe website shows soil moisture at 4-inch increments to 48 inches and monitors plant root growth. The website lists all Aquaspy® soil probes in the "3-4-5 Gallon Production Maximization" project and is available to all cooperators and district personnel. Another 24/7 Pivotrac® website tracks each center pivot, monitors system position and travel, and provides information to make irrigation management strategies. Both the cooperating grower and District "3-4-5 Gallon Production Maximization" project leader collectively monitored, controlled, and managed irrigation from the Pivotrac® website.

Following this paragraph, a series of graphs and tables show weekly gypsum block readings for the season; the growing season's water, including rainfall, irrigation, and soil moisture at various growth stages; and the order of irrigation and rainfall events for each "3-4-5 Gallon Production Maximization" field. Finally, a form describes the protocols for each field. "Total Water," as shown on the graph for "Growing Season Water Tracking" is the sum of seasonal irrigation, rainfall, and net soil water. Graphs and tables for the 3 GPM acres are shown first, followed by the same illustrations for each 4 GPM and 5 GPM LEPA and PMDI acres.

Figure 9: Gypsum Block Readings for Harold Grall's "3 GPM" Demonstration Site, 216 bu/ac, T-L PMDI

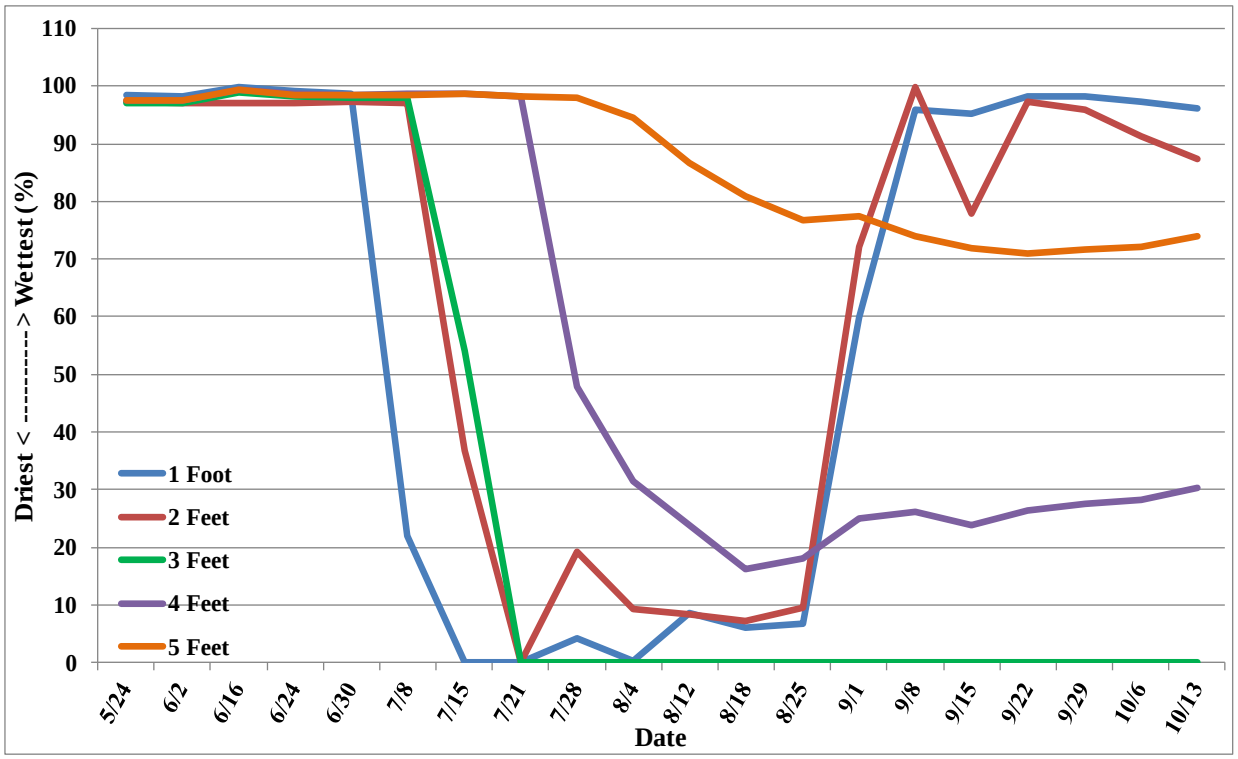


Figure 10: Growing Season Water Tracking for Harold Grall's "3 GPM" Demonstration Site, 216 bu/ac, T-L PMDI

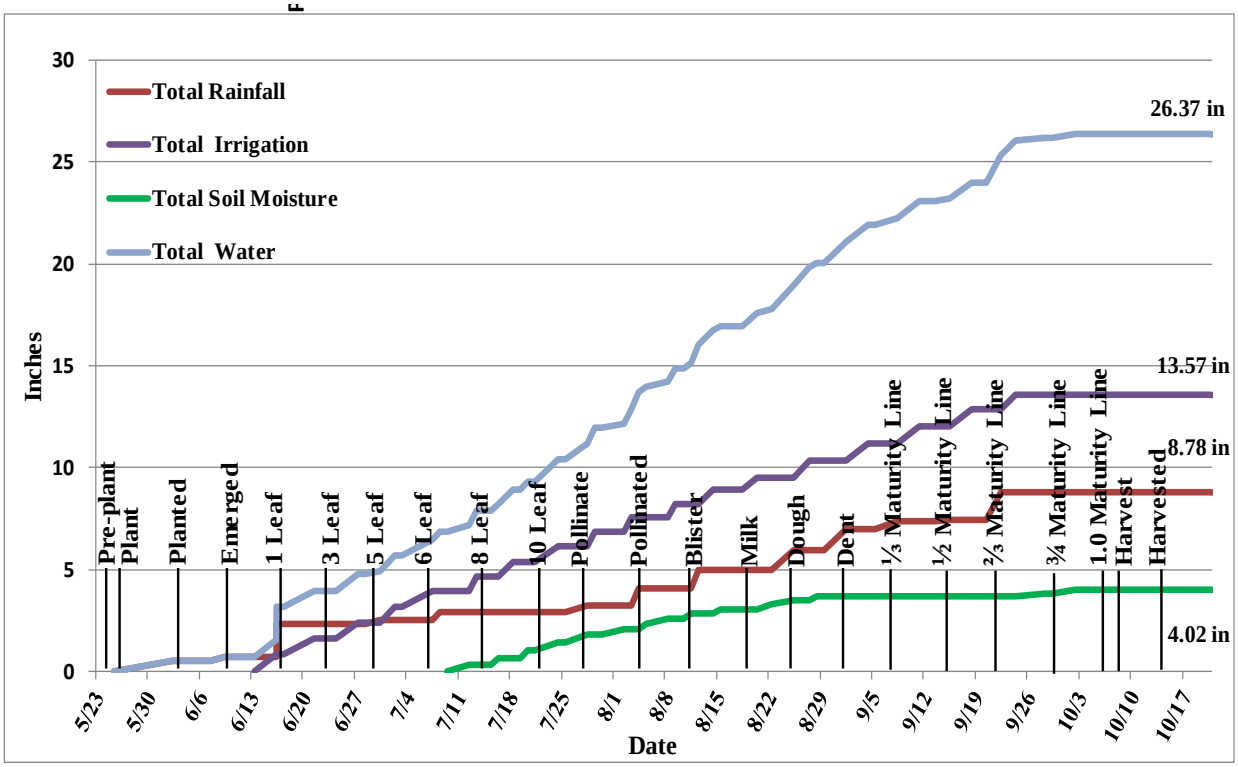


Table 10: Field Data for Harold Grall's "3 GPM" Demonstration Site, 216 bu/ac, T-L PMDI

Date	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well GPM	Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
4/16	0.44													Pivotrac
4/17	0.13													Pivotrac
4/19	0.69													Pivotrac
4/29	1.19													Pivotrac
5/12	0.71													Pivotrac
5/16	0.88													Pivotrac
5/24			116.08	27941.10	pre-plant	98.4	97.3	97.1	97.5	97.6	180			C & L
5/25					plant									Harold
6/2	0.55		116.14	27943.70	planted	98.3	97.0	97.0	97.4	97.6	220	stop		C & L
6/7			117.37								270	into 3		Pivotrac
6/9	0.20		119.38	27994.90	emerged						3	3	283	C & L
6/10											23	stop in 3		Pivotrac
6/13											23	start 3		Pivotrac
6/16		0.83	124.37								210	into 4	335	Pivotrac
6/17	1.60		124.64	28079.00	1 leaf	99.9	97.1	98.9	99.3	99.4	232	4	332	C & L
6/17			125.72								270	into 3		Pivotrac
6/21		0.80	132.49								210	into 4	335	Pivotrac
6/22			133.84								270	into 3		Pivotrac
6/24			136.29	28270.50	3 leaf	99.1	97.0	98.2	98.6	98.5	42	3	327	C & L
6/27		0.80	140.62								210	into 4	340	Pivotrac
6/28			141.97								270	into 3		Pivotrac
6/30	0.15		144.88	28413.60	5 leaf	98.6	97.2	98.0	98.4	98.4	79	3	323	C & L
7/2		0.77	148.51									into 4	330	Pivotrac
7/3											270	into 3		Pivotrac
7/7		0.75	156.15								210	into 4	315	Pivotrac
7/8	0.39		156.32	28609.10	6 leaf	22.0	97.1	97.9	98.6	98.4	264	5	314	C & L
7/8			157.43								270	into 3		Pivotrac
7/13		0.72	163.56								210	into 4		Pivotrac
7/14			164.78									into 3		Pivotrac
7/15					8 leaf	0	36.7	54.2	98.7	98.7	3	3		C & L
7/16			167.32								75	3	310	C & L
7/18		0.72	170.93								210	into 4	310	Pivotrac
7/19			172.15								270	into 3		Pivotrac
7/21			174.12	28918.00	10 leaf	0	0	0	98.1	98.3	52	3	306	C & L
7/24		0.73	178.34								210	into 4	305	Pivotrac
7/24			179.58								270	into 3		Pivotrac
7/28	0.36		183.43	29082.60	pollinate	4.1	19.3	0	47.8	98.0	153	3	310	P & L
7/29		0.73	185.78								210	into 4		Pivotrac
7/30			187.02								270	into 3		Pivotrac
8/3		0.71	193.01								210	into 4	300	Pivotrac
8/4	0.80		192.79	29252.10	pollinated	0.3	9.3	0	31.5	94.6	264	5	290	C & L
8/4			194.22								270	into 3		Pivotrac
8/9		0.67	199.87								210	into 4	285	Pivotrac
8/10			201.03								270	into 3		Pivotrac
8/12	0.91		202.84	29437.10	blister	8.5	8.4	0	23.9	86.7	56	3	287	Curtis
8/14		0.68	206.78								210	into 4	285	Pivotrac
8/15			208.07								270	into 3		Pivotrac
8/18			210.89	29582.50	milk	6.0	7.1	0	16.3	80.8	109	3	266	C & L
8/20		0.61	213.24								210	into 4	265	Pivotrac
8/22			214.85								270	into 3		Pivotrac
8/25	0.99		219.36	29743.80	dough	6.7	9.6	0	18.1	76.7	94	3	290	C & L
8/27		0.85	221.34								210	into 4	290	Pivotrac
8/29			223.47								270	into 3		Pivotrac
9/1	1.06		228.11	29911.20	dent	59.8	72.1	0	24.9	77.5	77	3	272	C & L
9/4		0.84	230.60								210	into 4	280	Pivotrac
9/5			232.68								270	into 3		Pivotrac
9/8	0.34		236.87	30079.20	⅓ mat line	95.9	99.9	0	26.2	73.9	55	3	281	C & L
9/11		0.84	239.75								210	into 4	280	Pivotrac
9/13			241.85								270	into 3		Pivotrac
9/15	0.09		245.50	30247.30	½ mat line	95.3	77.8	0	23.9	71.8	36	3	277	C & L
9/18		0.83	248.90								210	into 4	280	Pivotrac
9/20			250.38								270	into 3		Pivotrac
9/22	1.34		253.78	30408.70	⅔ mat line	98.2	97.2	0	26.3	71.0	32	3	259	C & L
9/24		0.69	256.32								127	stop	275	Pivotrac
9/29			256.81	30467.80	¾ mat line	98.1	96.0	0	27.5	71.7	160	off		C & L
10/6			256.81	30467.80	1.0 mat line	97.3	91.3	0	28.3	72.2	160	off		C & L
10/8					harvest									Harold
10/13			256.84	30469.20	harvested	96.1	87.4	0	30.4	73.9	180	off	3049	Curtis
Total	8.78	13.57				0.06	0.26	1.84	1.24	0.62			295	
Net soil moisture is 4.02 inches.														
Rainfall (8.78 in), irrigation (13.57 in), and net soil moisture (4.02 in) is total water (26.37 in).														
*Numbers in red are not counted in the total rainfall.														

Figure 11: Gypsum Block Readings for Harold Grall's "4 GPM" Demonstration Site, 200 bu/ac, T-L PMDI

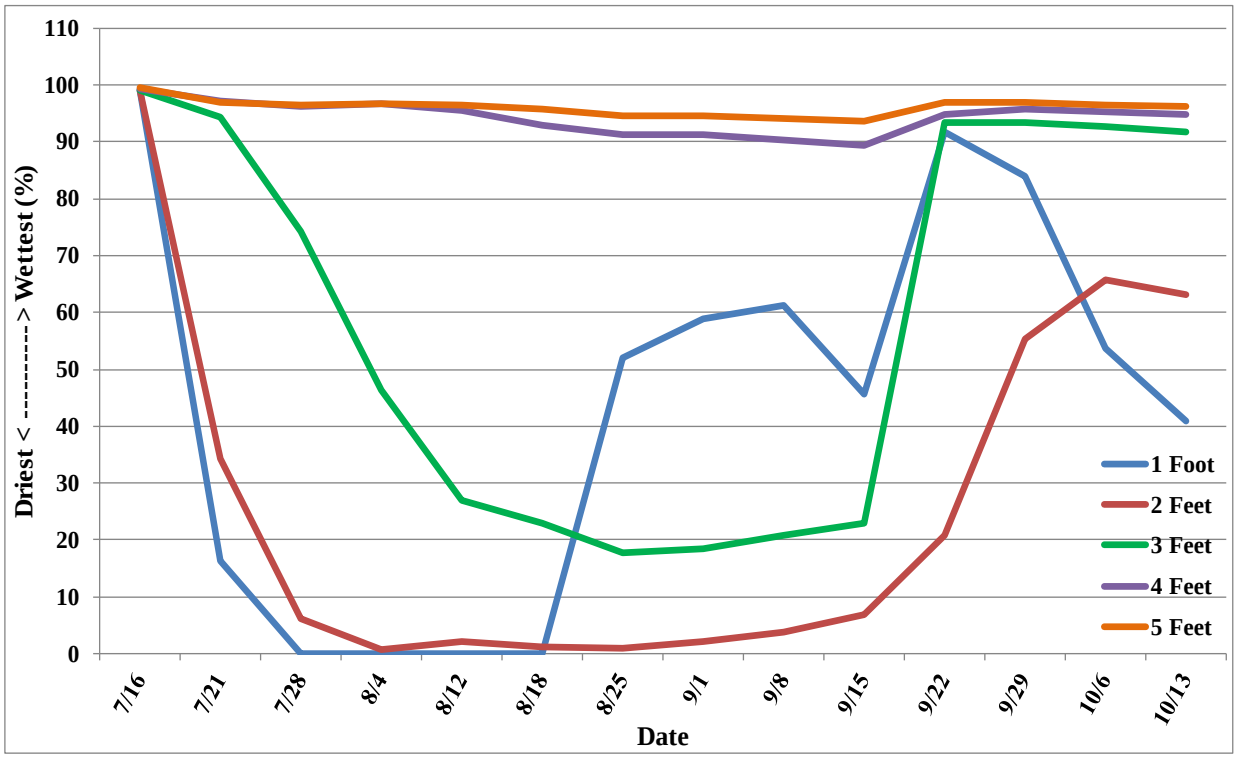


Figure 12: Growing Season Water Tracking for Harold Grall's "4 GPM" Demonstration Site, 200 bu/ac, T-L PMDI

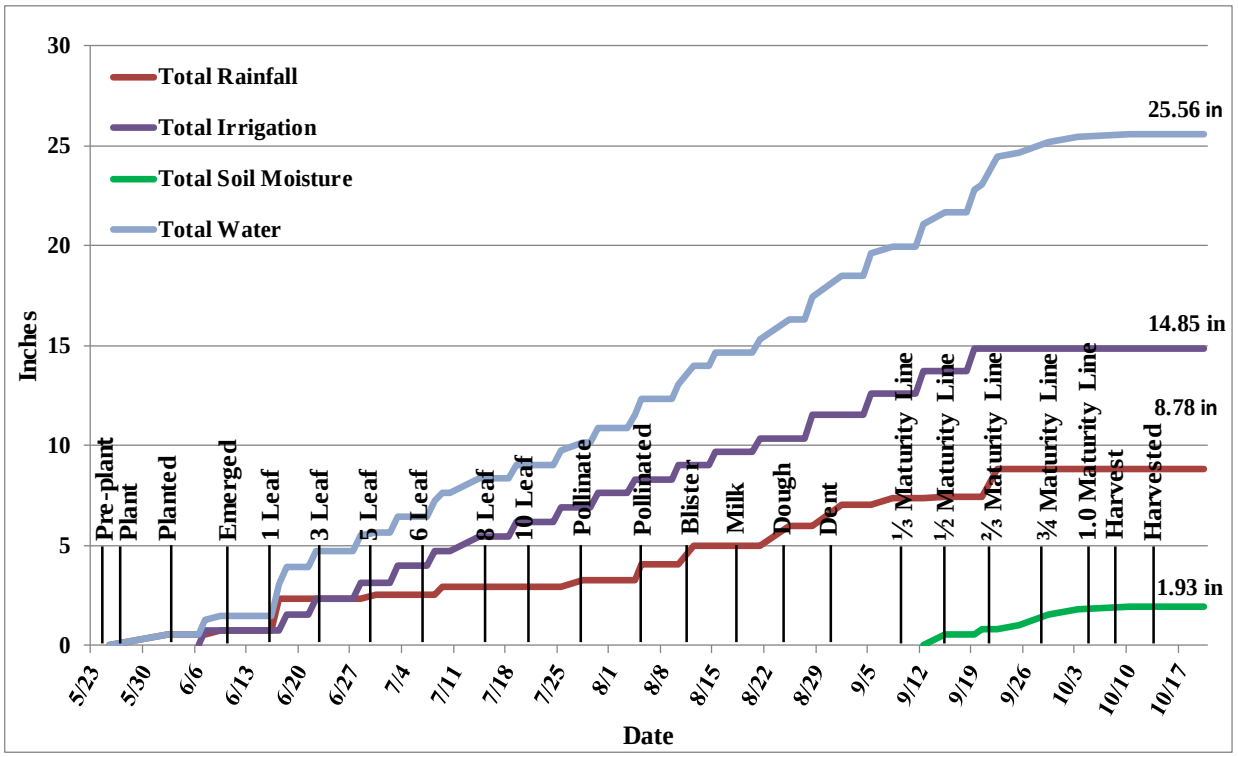


Table 11: Field Data for Harold Grall's "4 GPM" Demonstration Site, 200 bu/ac, T-L PMDI

Date	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well GPM	Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
4/16	0.44													Pivotrac
4/17	0.13													Pivotrac
4/19	0.69													Pivotrac
4/29	1.19													Pivotrac
5/12	0.71													Pivotrac
5/16	0.88													Pivotrac
5/24			116.08	27941.10	preplant						180			C & L
5/25					plant									Harold
6/2	0.55		116.14	27943.70	planted						220	stop		C & L
6/6			116.14	23943.70							220	start 4		Pivotrac
6/7		0.73	116.69								240	into 5	350	Pivotrac
6/9	0.20		119.38	27994.90	emerged						3	3	283	C & L
6/16			124.37								210	into 4		Pivotrac
6/16	1.60		124.64	28079.00	1 leaf						232	4	332	C & L
6/16		0.80	125.04								240	into 5	335	Pivotrac
6/21			132.49								210	into 4		Pivotrac
6/22		0.80	133.16								240	into 5	340	Pivotrac
6/24			136.29	28270.50	3 leaf						42	3	327	C & L
6/27			140.62								210	into 4		Pivotrac
6/27		0.80	141.30								240	into 5	335	Pivotrac
6/30	0.15		144.88	28413.60	5 leaf						79	3	323	C & L
7/2			148.51								210	into 4		Pivotrac
7/3		0.82	149.20								240	into 5	330	Pivotrac
7/7			156.15								210	into 4		Pivotrac
7/8		0.76	156.79								240	into 5	315	Pivotrac
7/8	0.39		156.32	28608.10	6 leaf						264	5	314	C & L
7/13			163.56								210	into 4		Pivotrac
7/13		0.72	164.17								240	into 5	310	Pivotrac
7/16					8 leaf	99.2	99.1	99.1	99.4	99.5	75	3	310	C & L
7/18			170.93								210	into 4	310	Pivotrac
7/19		0.71	171.54								240	into 5	310	Pivotrac
7/21			174.12	28918.00	10 leaf	16.2	34.2	94.3	97.1	96.9	52	3	306	C & L
7/24			178.34								210	into 4	305	Pivotrac
7/24		0.72	178.96								240	into 5	305	Pivotrac
7/28	0.36		183.43	29082.60	pollinate	0	6.1	74.3	96.3	96.6	153	3	310	P & L
7/29			185.78								210	into 4		Pivotrac
7/29		0.73	186.39								240	into 5	305	Pivotrac
8/3			193.01								210	into 4	300	Pivotrac
8/4		0.71	193.61								240	into 5	290	Pivotrac
8/4	0.80		192.79	29252.10	pollinated	0	0.7	46.4	96.8	96.8	264	5	290	C & L
8/9			199.87								210	into 4		Pivotrac
8/9		0.69	200.45								240	into 5	285	Pivotrac
8/12	0.91		202.84	29437.10	blister	0	2.0	26.9	95.6	96.4	56	3	287	Curtis
8/14			206.78								210	into 4		Pivotrac
8/15		0.69	207.36								240	into 5	285	Pivotrac
8/18			210.89	29582.50	milk	0	1.1	22.8	93.0	95.7	109	3	266	C & L
8/20			213.24								210	into 4		Pivotrac
8/21		0.68	213.82								240	into 5	265	Pivotrac
8/25	0.99		219.36	29743.80	dough	52.1	0.9	17.8	91.4	94.7	94	3	290	C & L
8/27			221.34								210	into 4		Pivotrac
8/28		1.14	222.30								240	into 5	290	Pivotrac
9/1	1.06		228.11	29911.20	dent	58.9	2.2	18.4	91.4	94.5	77	3	272	C & L
9/4			230.60								210	into 4		Pivotrac
9/5		1.10	231.54								240	into 5	280	Pivotrac
9/8	0.34		236.87	30079.20	⅓ mat line	61.2	3.8	20.8	90.4	94.1	55	3	281	C & L
9/11			239.75								210	into 4		Pivotrac
9/12		1.09	240.67								240	into 5	280	Pivotrac
9/15	0.09		245.50	30247.30	½ mat line	45.7	6.8	23.0	89.4	93.6	36	3	277	C & L
9/18			248.90								210	into 4		Pivotrac
9/19		1.16	249.88								240	into 5	280	Pivotrac
9/22	1.34		253.78	30408.70	⅔ mat line	91.8	20.8	93.4	94.9	97.0	32	3	259	C & L
9/29			256.81	30467.80	¾ mat line	84.0	55.3	93.5	95.8	97.0	160	stop		C & L
10/6			256.81	30467.80	1.0 mat line	53.7	65.8	92.8	95.2	96.4	160	stop		C & L
10/8					harvest									Harold
10/13			256.84	30469.20	harvested	40.8	63.2	91.8	94.8	96.2	180	stop		Curtis
Total	8.78	14.85				0.97	0.83	0.04	0.09	0.00				
Net soil moisture is 1.93 inches.														
Rainfall (8.78 in), irrigation (14.85 in), and net soil moisture (1.93 in) is total water (25.56 in).														
*Numbers in red are not counted in the total rainfall.														

Figure 13: Gypsum Block Readings for Harold Grall's "5 GPM" Demonstration Site, 198 bu/ac, T-L PMDI

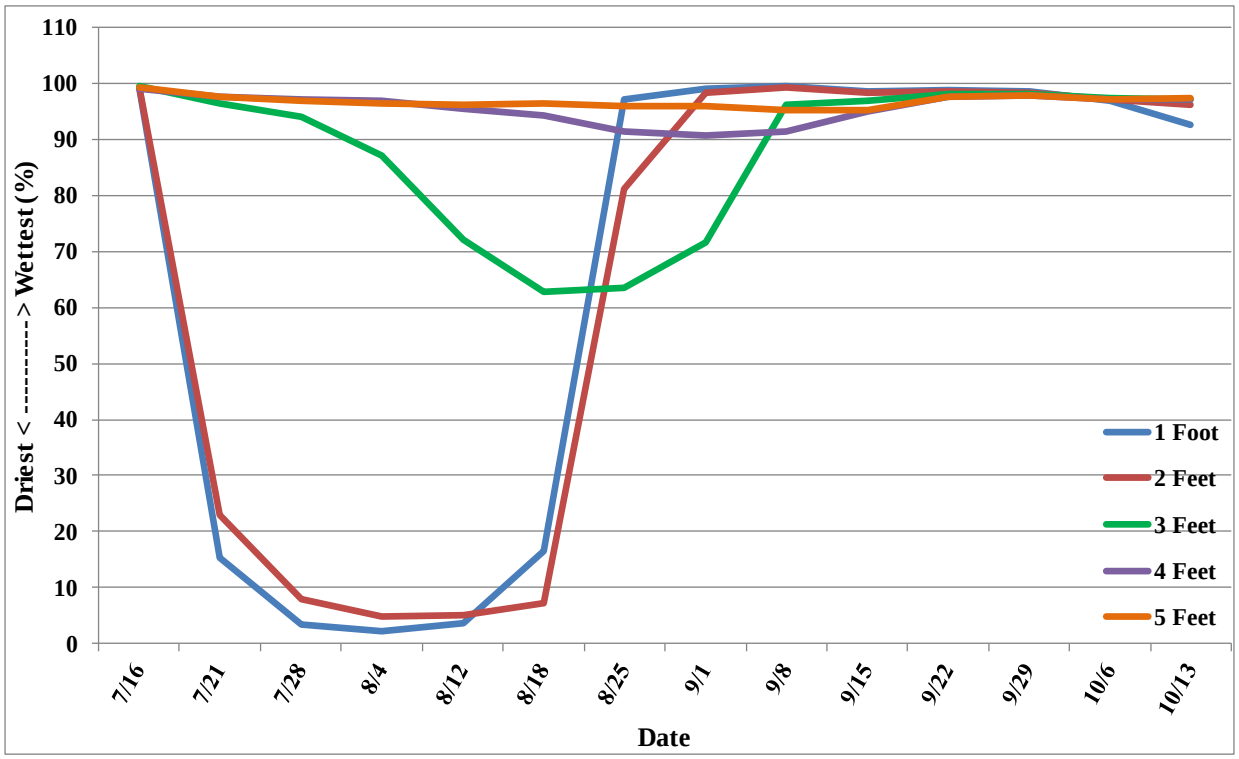


Figure 14: Growing Season Water Tracking for Harold Grall's "5 GPM" Demonstration Site, 198 bu/ac, T-L PMDI

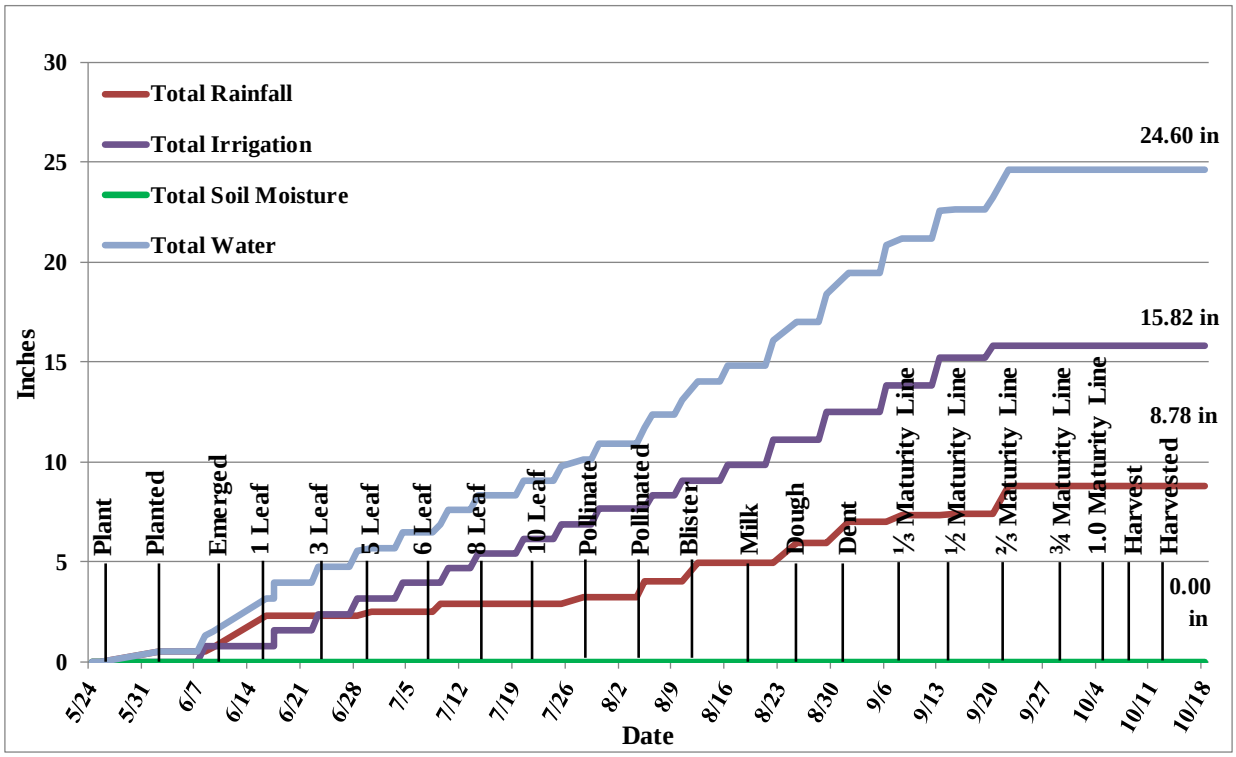


Table 12: Field Data for Harold Grall's "5 GPM" Demonstration Site, 198 bu/ac, T-L PMDI

Date	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well GPM	Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
4/16	0.44													Pivotrac
4/17	0.13													Pivotrac
4/19	0.69													Pivotrac
4/29	1.19													Pivotrac
5/12	0.71													Pivotrac
5/16	0.88													Pivotrac
5/24			116.08	27941.10							180	off		C & L
5/25					plant									Harold
6/2	0.55		116.14	27943.70	planted						220	stop		C & L
6/7			116.69								240	into 5		Pivotrac
6/7		0.80	117.37								270	into 3	350	Pivotrac
6/9	0.20		119.38	27994.90	emerged						3	3	283	C & L
6/16	1.60		124.64	28079.00	1 leaf						232	4	332	C & L
6/16			125.04								240	into 5	335	Pivotrac
6/17		0.80	125.72								270	into 3	340	Pivotrac
6/22			133.16								240	into 5		Pivotrac
6/22		0.80	133.84								270	into 3	350	Pivotrac
6/24			136.29	28270.50	3 leaf						42	3	327	C & L
6/27			141.30								240	into 5		Pivotrac
6/28		0.80	141.97								270	into 3	335	Pivotrac
6/30	0.15		144.88	28413.60	5 leaf						79	3	323	C & L
7/3			149.20								240	into 5		Pivotrac
7/3		0.77	149.85								270	into 3	330	Pivotrac
7/8			156.79								240	into 5		Pivotrac
7/8	0.39		156.32	28608.10	6 leaf						264	5	314	C & L
7/8		0.76	157.43								270	into 3	315	Pivotrac
7/13			164.17								240	into 5		Pivotrac
7/14		0.73	164.78								270	into 3	310	Pivotrac
7/16			167.32	28797.80	8 leaf	99.0	99.2	99.5	99.1	99.2	75	3	310	C & L
7/19			171.54								240	into 5		Pivotrac
7/19		0.72	172.15								270	into 3	310	Pivotrac
7/21			174.12	28918.00	10 leaf	15.4	22.9	96.4	97.5	97.5	52	3	306	C & L
7/24			178.96								240	into 5	305	Pivotrac
7/24		0.73	179.58								270	into 3	305	Pivotrac
7/28	0.36		183.43	29082.60	pollinate	3.4	8.0	94.0	97.1	96.8	153	3	310	P & L
7/29			186.39								240	into 5	305	Pivotrac
7/30		0.74	187.02								270	into 3	305	Pivotrac
8/4			193.61								240	into 5		Pivotrac
8/4	0.80		192.79	29252.10	pollinated	2.1	4.9	87.0	96.8	96.4	264	5	290	C & L
8/4		0.71	194.22								270	into 3	290	Pivotrac
8/9			200.45								240	into 5		Pivotrac
8/10		0.69	201.03								270	into 3	285	Pivotrac
8/12	0.91		202.84	29437.10	blister	3.7	5.0	72.0	95.5	96.1	56	3	287	Curtis
8/15			207.36								240	into 5		Pivotrac
8/15	pm	0.83	208.07								270	into 3	285	Pivotrac
8/18			210.89	29582.50	milk	16.4	7.2	62.8	94.3	96.5	109	3	266	C & L
8/21			213.82								240	into 5		Pivotrac
8/22		1.22	214.85								270	into 3	265	Pivotrac
8/25	0.99		219.36	29743.80	dough	97.2	81.1	63.6	91.5	95.9	94	3	290	C & L
8/28			222.30								240	into 5		Pivotrac
8/29		1.39	223.47								270	into 3	290	Pivotrac
9/1	1.06		228.11	29911.20	dent	99.1	98.3	71.5	90.8	95.9	77	3	272	C & L
9/5			231.54								240	into 5		Pivotrac
9/5		1.35	232.68								270	into 3	280	Pivotrac
9/8	0.34		236.87	30079.20	⅓ mat line	99.4	99.2	96.2	91.3	95.3	55	3	281	C & L
9/12			240.67								240	into 5		Pivotrac
9/13		1.39	241.85								270	into 3	280	Pivotrac
9/15	0.09		245.50	30247.30	½ mat line	98.6	98.3	97.0	95.0	95.3	36	3	277	C & L
9/19			249.88								240	into 5		Pivotrac
9/20		0.59	250.38								270	into 3	280	Pivotrac
9/22	1.34		253.78	30408.70	⅔ mat line	98.7	98.6	98.0	97.7	97.6	32	3	259	C & L
9/29			256.81	30467.80	¾ mat line	98.6	98.4	98.0	97.8	97.8	160	stop		C & L
10/6			256.81	30467.80	1.0 mat line	97.0	97.2	97.3	97.2	97.2	160	stop		C & L
10/8					harvest									Harold
10/13			256.84	30469.20	harvested	92.5	96.1	97.2	97.2	97.3	180	stop		Curtis
Total	8.78	15.82				0.00	0.00	0.00	0.00	0.00				
Net soil moisture is 0.00 inches.														
Rainfall (8.78 in), irrigation (15.82 in), and net soil moisture (0.00 in) is total water (24.60 in).														
*Numbers in red are not counted in the total rainfall.														

Figure 15: Gypsum Block Readings for Harold Grall's "3 GPM" Demonstration Site, 203 bu/ac, LEPA Shroud

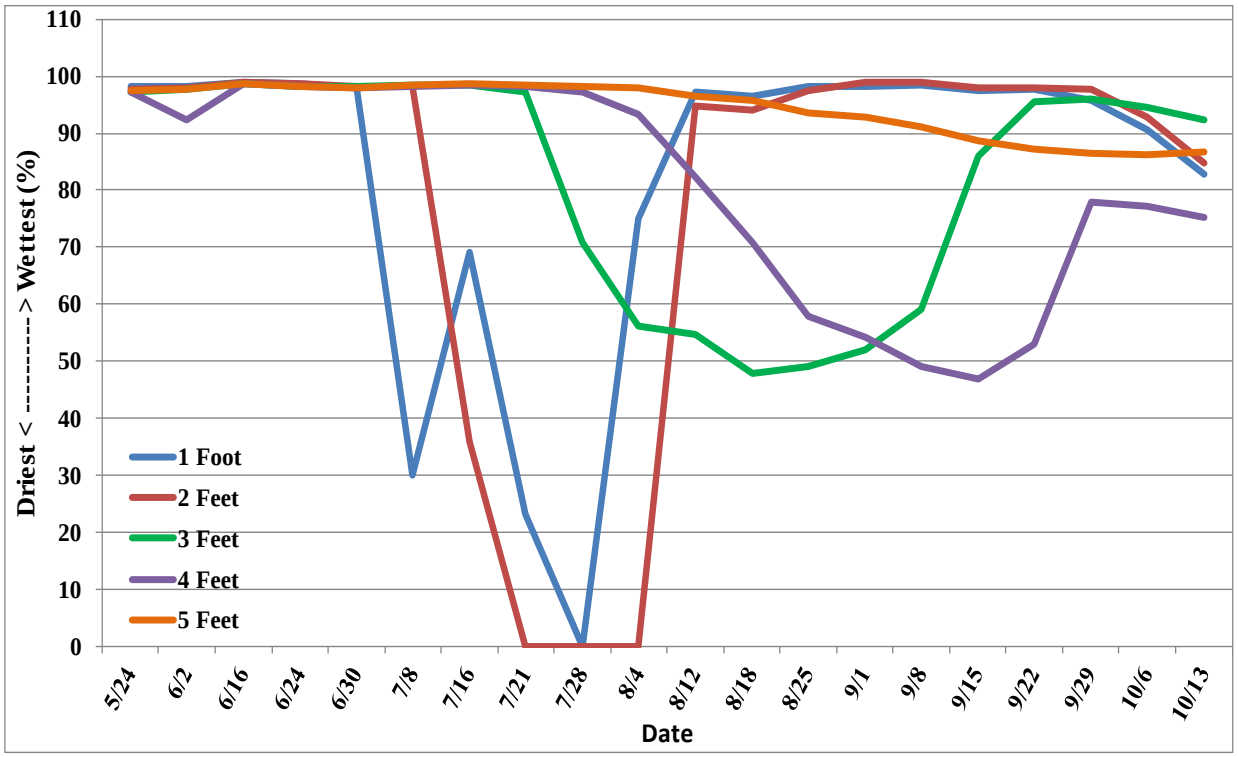


Figure 16: Growing Season Water Tracking for Harold Grall's "3 GPM" Demonstration Site, 203 bu/ac, LEPA Shroud

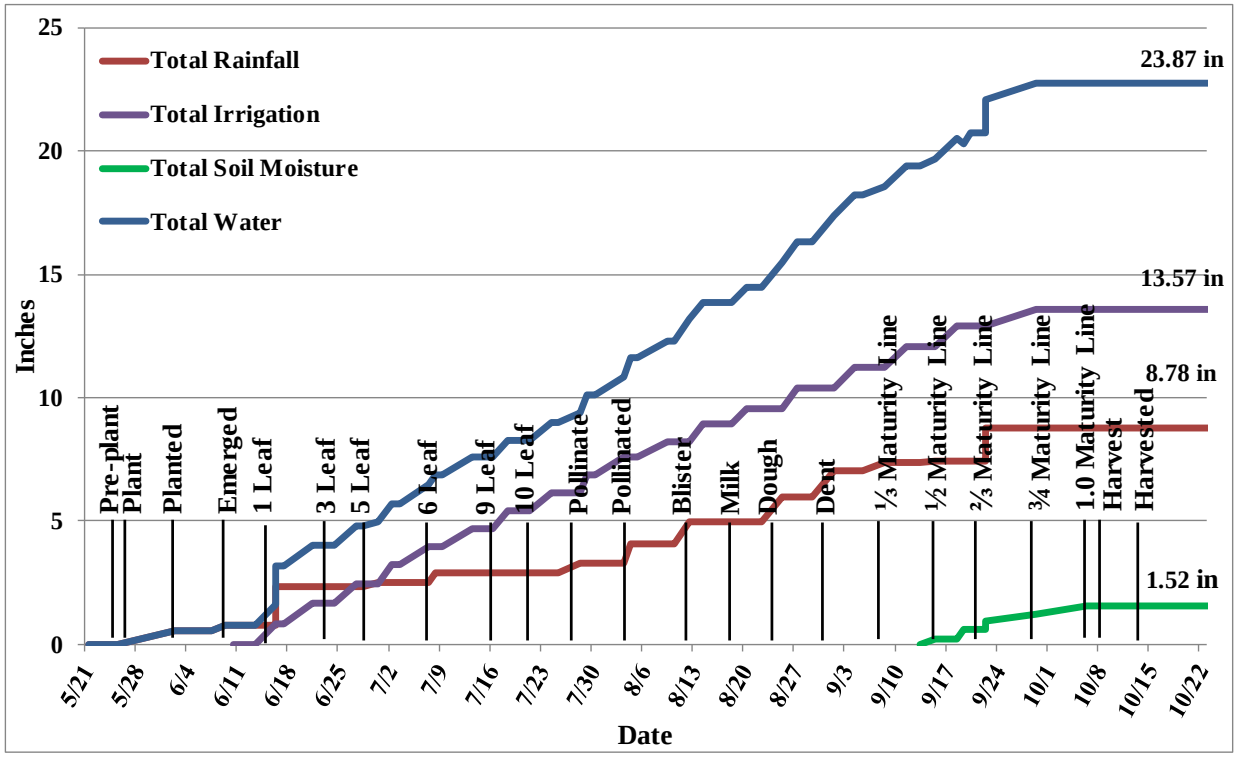


Table 13: Field Data for Harold Grall's "3 GPM" Demonstration Site, 203 bu/ac, LEPA Shroud

Date	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well GPM	Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
4/16	0.44													Pivotrac
4/17	0.13													Pivotrac
4/19	0.69													Pivotrac
4/29	1.19													Pivotrac
5/12	0.71													Pivotrac
5/16	0.88													Pivotrac
5/24			116.08	27,941.10	pre-plant	98.1	97.8	97.1	97.1	97.5	180			C & L
5/25					plant									Harold
6/2	0.55		116.14	27,943.70	planted	98.2	98.0	97.7	92.3	97.6	220	stop		C & L
6/7			117.37								270	into 3		Pivotrac
6/9	0.20		119.38	27,994.90	emerged						3	3	283	C & L
6/10											23	stop in 3		Pivotrac
6/13											23	start 3		Pivotrac
6/16		0.83	124.37								210	into 4	335	Pivotrac
6/16	1.60		124.64	28,079.0	1 leaf	98.9	98.8	98.6	98.6	98.7	232	4	332	C & L
6/17			125.72								270	into 3		Pivotrac
6/21		0.80	132.49								210	into 4	335	Pivotrac
6/22			133.84								270	into 3		
6/24			136.29	28,270.50	3 leaf	98.6	98.6	98.3	98.2	98.3	42	3	327	C & L
6/27		0.80	140.62								210	into 4	340	Pivotrac
6/28			141.97								270	into 3		Pivotrac
6/30	0.15		144.88	28,413.6	5 leaf	98.0	98.3	98.1	97.9	98.0	79	3	323	C & L
7/2		0.77	148.51								210	into 4	330	Pivotrac
7/3											270	into 3		Pivotrac
7/7		0.75	156.15								210	into 4	315	Pivotrac
7/8	0.39		156.32	28608.1	6 leaf	30.1	98.3	98.4	98.2	98.4	264	5	314	C & L
7/8			157.43								270	into 3		Pivotrac
7/13		0.72	163.56								210	into 4		Pivotrac
7/14			164.78									into 3		Pivotrac
7/16			167.32	28,797.8	9 leaf	69.1	36.0	98.5	98.5	98.7	75	3	310	C & L
7/18		0.72	170.93								210	into 4	310	Pivotrac
7/19			172.15								270	into 3		Pivotrac
7/21			174.12	28,918.0	10 leaf	23.1	0	97.1	98.1	98.5	52	3	306	C & L
7/24		0.73	178.34								210	into 4	305	Pivotrac
7/24			179.58								270	into 3		Pivotrac
7/28	0.36		183.43	29,082.6	pollinate	0	0	70.9	97.3	98.2	153	3	310	P & L
7/29		0.73	185.78								210	into 4		Pivotrac
7/30			187.02								270	into 3		Pivotrac
8/3		0.71	193.01								210	into 4	300	Pivotrac
8/4	0.80		192.79	29,252.1	pollinated	75.0	0	56.2	93.2	97.9	264	5	290	C & L
8/4			194.22								270	into 3		Pivotrac
8/9		0.67	199.87								210	into 4	285	Pivotrac
8/10			201.03								270	into 3		Pivotrac
8/12	0.91		202.84	29,437.1	blister	97.3	94.7	54.6	82.2	96.6	56	3	287	C & L
8/14		0.68	206.78								210	into 4	285	Pivotrac
8/15			208.07								270	into 3		Pivotrac
8/18			210.89	29,582.5	milk	96.6	94.0	47.8	70.8	95.7	109	3	266	C & L
8/20		0.61	213.24								210	into 4	265	Pivotrac
8/22			214.85								270	into 3		Pivotrac
8/25	0.99		219.36	29,743.8	dough	98.1	97.4	49.0	58.0	93.6	94	3	290	C & L
8/27		0.85	221.34								210	into 4	290	Pivotrac
8/29			223.47								270	into 3		Pivotrac
9/1	1.06		228.11	29,911.2	dent	98.1	98.8	51.9	54.3	92.8	77	3	272	C & L
9/4		0.84	230.60								210	into 4	280	Pivotrac
9/5			232.68								270	into 3		Pivotrac
9/8	0.34		236.87	30,079.2	⅓ mat line	98.5	98.9	59.2	49.0	91.0	54	3	281	C & L
9/11		0.84	239.75								210	into 4	280	Pivotrac
9/13			241.85								270	into 3		Pivotrac
9/15	0.09		245.50	30,247.3	½ mat line	97.4	98.0	86.0	46.8	88.7	36	3	277	C & L
9/18		0.83	248.90								210	into 4	280	Pivotrac
9/20			250.38								270	into 3		Pivotrac
9/22	1.34		253.78	30,408.7	⅔ mat line	97.6	98.0	95.6	53.0	87.1	32	3	259	C & L
9/24		0.69	256.32								127	stop	275	Pivotrac
9/29			256.81	30,467.8	¾ mat line	95.8	97.6	95.9	77.9	86.4	160	off		Harold
10/6			256.81	30,467.8	1.0 mat line	90.7	92.8	94.5	77.1	86.2	160	off		Curtis
10/8			256.81		harvest									
10/13			256.84	30,469.20	harvested	82.7	84.8	92.3	75.3	86.6	180	off		
Total	8.78	13.57				0.36	0.26	0.16	0.31	0.43				
Net soil moisture is 1.52 inches.														
Rainfall (8.78 in), irrigation (13.57 in), and net soil moisture (1.52 in) is total water (23.87 in).														
*Numbers in red are not counted in the total rainfall.														

Figure 17: Gypsum Block Readings for Harold Grall's "4 GPM" Demonstration Site, 191 bu/ac, LEPA Shroud

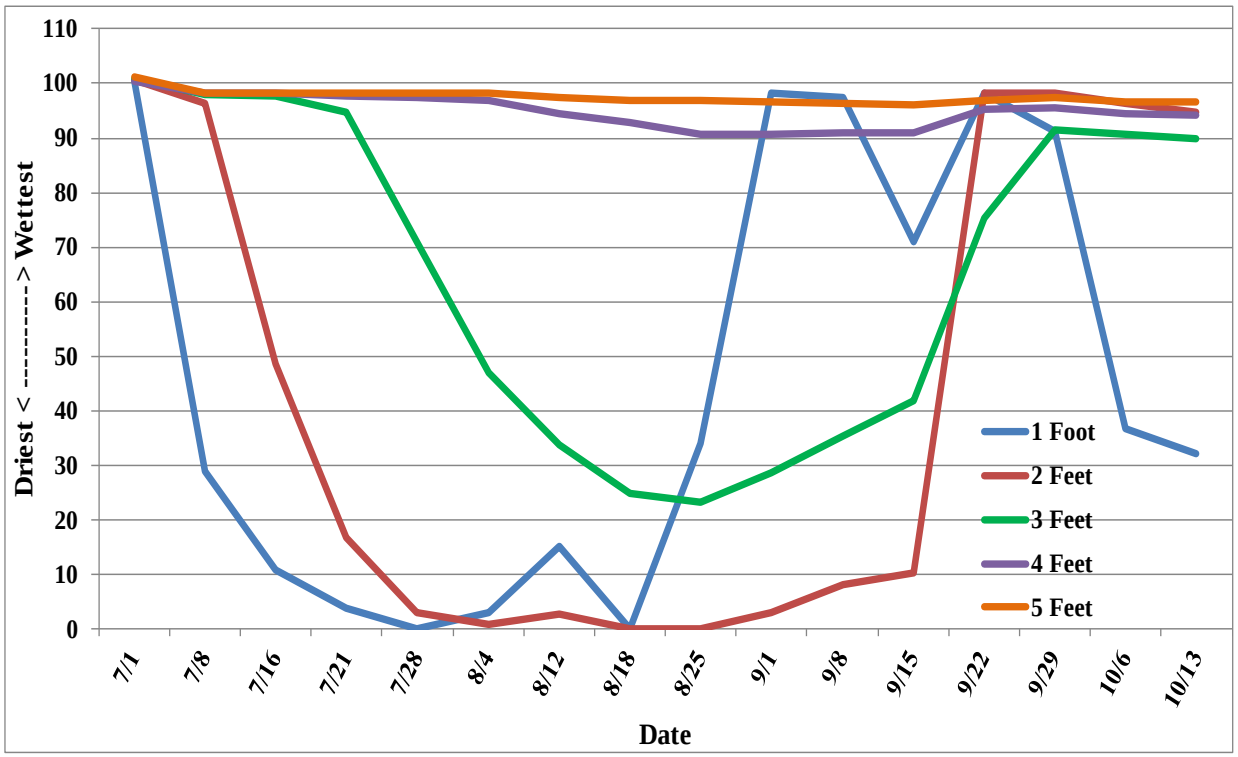


Figure 18: Growing Season Water Tracking for Harold Grall's "4 GPM" Demonstration Site, 191 bu/ac, LEPA Shroud

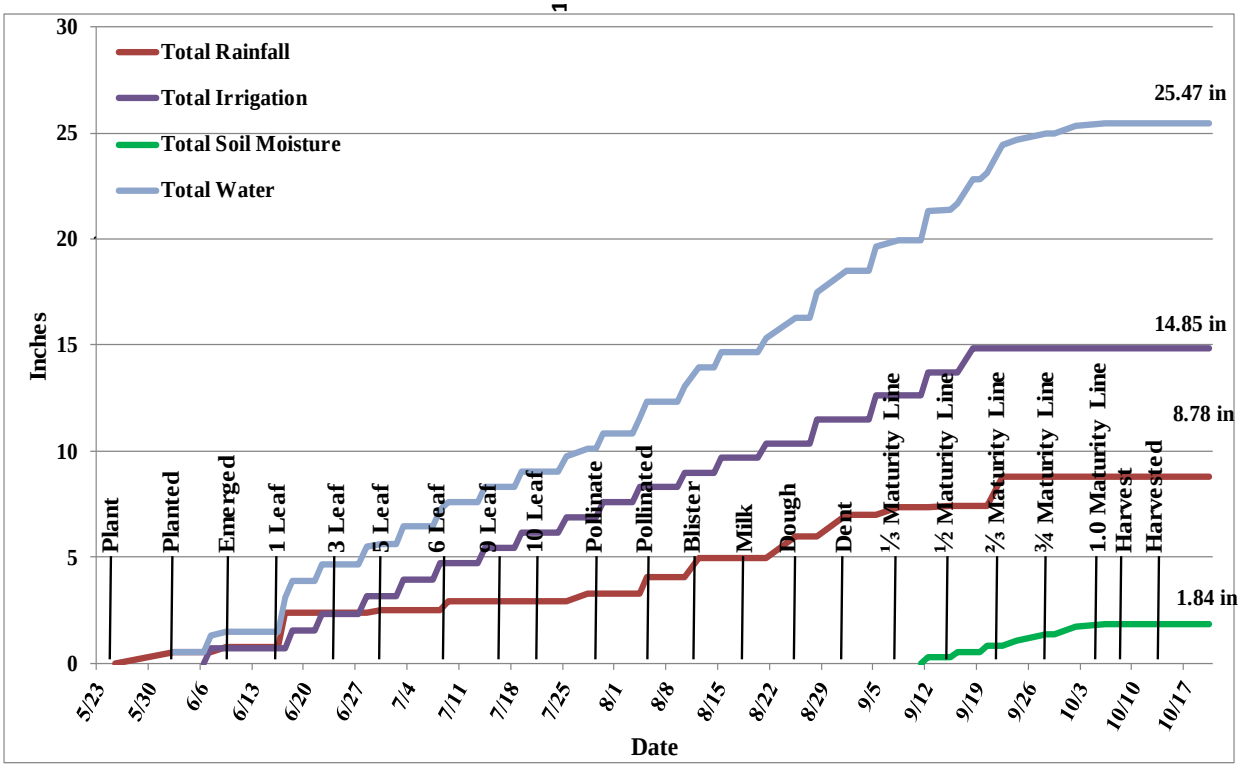


Table 14: Field Data for Harold Grall's "4 GPM" Demonstration Site, 191 bu/ac, LEPA Shroud

Date	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well GPM	Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
4/16	0.44													Pivotrac
4/17	0.13													Pivotrac
4/19	0.69													Pivotrac
4/29	1.19													Pivotrac
5/12	0.71													Pivotrac
5/16	0.88													Pivotrac
5/24			116.08	27941.10							180			C & L
5/25					plant									Harold
6/2	0.55		116.14	27943.70	planted						220	off		C & L
6/6			116.14								220	start 4		Pivotrac
6/7		0.73	116.69								240	into 5	350	Pivotrac
6/9	0.20		119.38	27994.90	emerged						3	3	283	C & L
6/16			124.37		1 leaf						210	into 4		Pivotrac
6/16	1.60		124.64	28079.00	1 leaf						232	4	332	C & L
6/16		0.80	125.04								240	into 5	335	Pivotrac
6/21			132.49								210	into 4		Pivotrac
6/22		0.80	133.16								240	into 5	340	Pivotrac
6/24			136.29	28270.50	3 leaf						42	3	327	C & L
6/27			140.62								210	into 4		Pivotrac
6/27		0.80	141.30								240	into 5	335	Pivotrac
6/30	0.15		144.88	28413.60	5 leaf						79	3	323	C & L
7/1					5 leaf	100.3	100.6	100.8	100.5	101.1				C & L
7/2			148.51								210	into 4		Pivotrac
7/3		0.82	149.20								240	into 5	330	Pivotrac
7/7			156.15								210	into 4		Pivotrac
7/8		0.76	156.79								240	into 5	315	Pivotrac
7/8	0.39		156.32	28608.10	6 leaf	29.0	96.3	97.9	98.1	98.3	264	5	330	C & L
7/13			163.56								210	into 4		Pivotrac
7/13		0.72	164.17								240	into 5	310	Pivotrac
7/16			167.32	28797.80	9 leaf	10.7	48.6	97.8	98.1	98.3	75	3	310	C & L
7/18			170.93								210	into 4	310	Pivotrac
7/19		0.71	171.54								240	into 5	310	Pivotrac
7/21			174.12	28918.00	10 leaf	3.9	16.7	94.7	97.8	98.2	52	3	306	C & L
7/24			178.34								210	into 4	305	Pivotrac
7/24		0.72	178.96								240	into 5	305	Pivotrac
7/28	0.36		183.43	29082.60	pollinate	0	2.9	71.0	97.5	98.1	153	3	310	P & L
7/29			185.78								210	into 4		Pivotrac
7/29		0.73	186.39								240	into 5	305	Pivotrac
8/3			193.01								210	into 4	300	Pivotrac
8/4		0.71	193.61								240	into 5	290	Pivotrac
8/4	0.80		192.79	29252.10	pollinated	2.9	0.9	47.0	96.9	98.3	264	5	290	C & L
8/9			199.87								210	into 4		Pivotrac
8/9		0.69	200.45								240	into 5	285	Pivotrac
8/12	0.91		202.84	29437.10	blister	15.2	2.7	33.8	94.5	97.4	56	3	287	Curtis
8/14			206.78								210	into 4		Pivotrac
8/15		0.69	207.36								240	into 5	285	Pivotrac
8/18			210.89	29582.50	milk	0	0	24.9	92.8	97.0	109	3	266	C & L
8/20			213.24								210	into 4		Pivotrac
8/21		0.68	213.82								240	into 5	265	Pivotrac
8/25	0.99		219.36	29743.80	dough	34.0	0	23.3	90.8	96.9	94	3	290	C & L
8/27			221.34								210	into 4		Pivotrac
8/28		1.14	222.30								240	into 5	290	Pivotrac
9/1	1.06		228.11	29911.20	dent	98.1	3.1	28.6	90.8	96.6	77	3	272	C & L
9/4			230.60								210	into 4		Pivotrac
9/5		1.10	231.54								240	into 5	280	Pivotrac
9/8	0.34		236.87	30079.20	⅓ mat line	97.4	8.1	35.3	91.0	96.3	54	3	284	C & L
9/11			239.75								210	into 4		Pivotrac
9/12		1.09	240.67								240	into 5	280	Pivotrac
9/15	0.09		245.50	30247.30	½ mat line	71.1	10.3	41.9	90.9	96.0	36	3	277	C & L
9/18			248.90								210	into 4		Pivotrac
9/19		1.16	249.88								240	into 5	280	Pivotrac
9/22	1.34		253.78	30408.70	⅔ mat line	98.2	98.1	75.2	95.4	96.8	32	3	259	C & L
9/29			256.81	30467.80	¾ mat line	91.1	98.2	91.4	95.6	97.5	160	stop		C & L
10/6			256.81	30467.80	1.0 mat line	36.8	96.4	90.8	94.5	96.7	160	stop		C & L
10/8					harvest									Harold
10/13			256.84	30469.20	harvested	32.1	94.7	90.0	94.2	96.5	180	stop		Curtis
Total	8.78	14.85				1.07	0	0.31	0.20	0.26				
Net soil moisture is 1.84 inches.														
Rainfall (8.78 in), irrigation (14.85 in), and net soil moisture (1.84 in) is total water (25.47 in).														
*Numbers in red are not counted in the total rainfall.														

Figure 19: Gypsum Block Readings for Harold Grall's "5 GPM" Demonstration Site, 190 bu/ac, LEPA Shroud

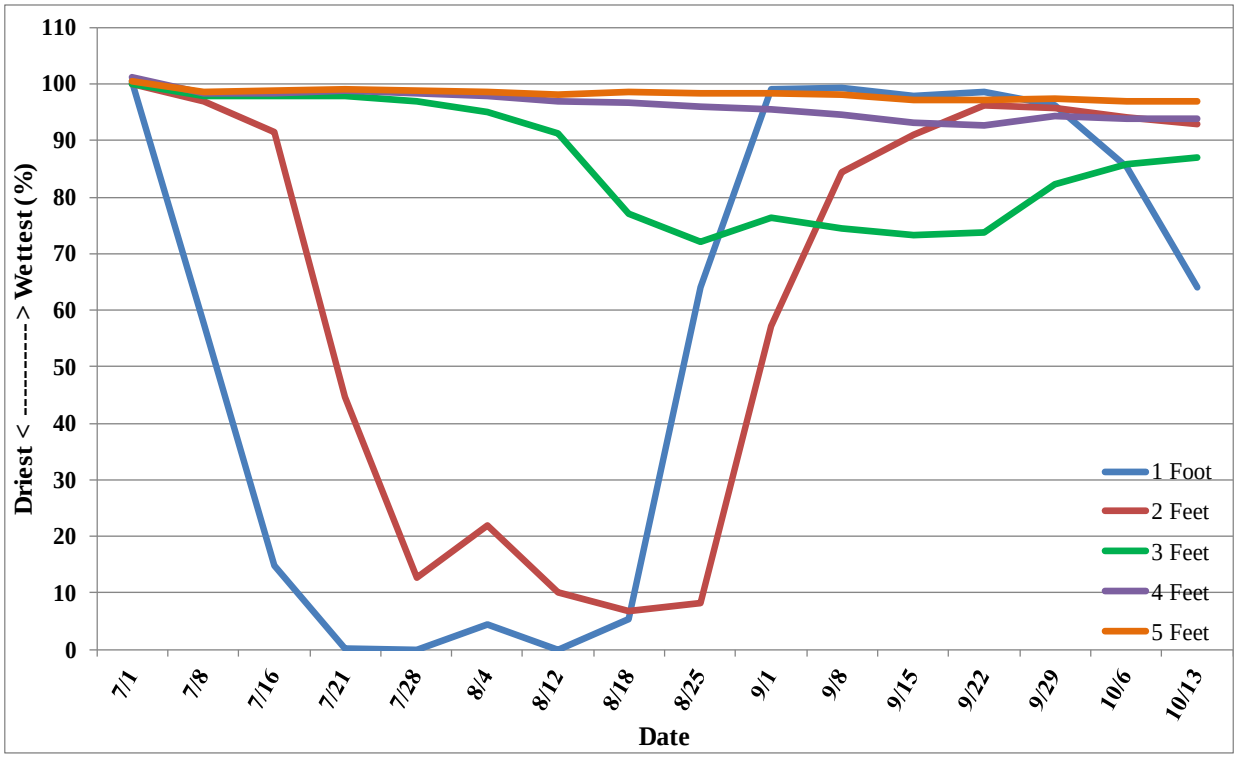


Figure 20: Growing Season Water Tracking for Harold Grall's "5 GPM" Demonstration Site, 190 bu/ac, LEPA Shroud

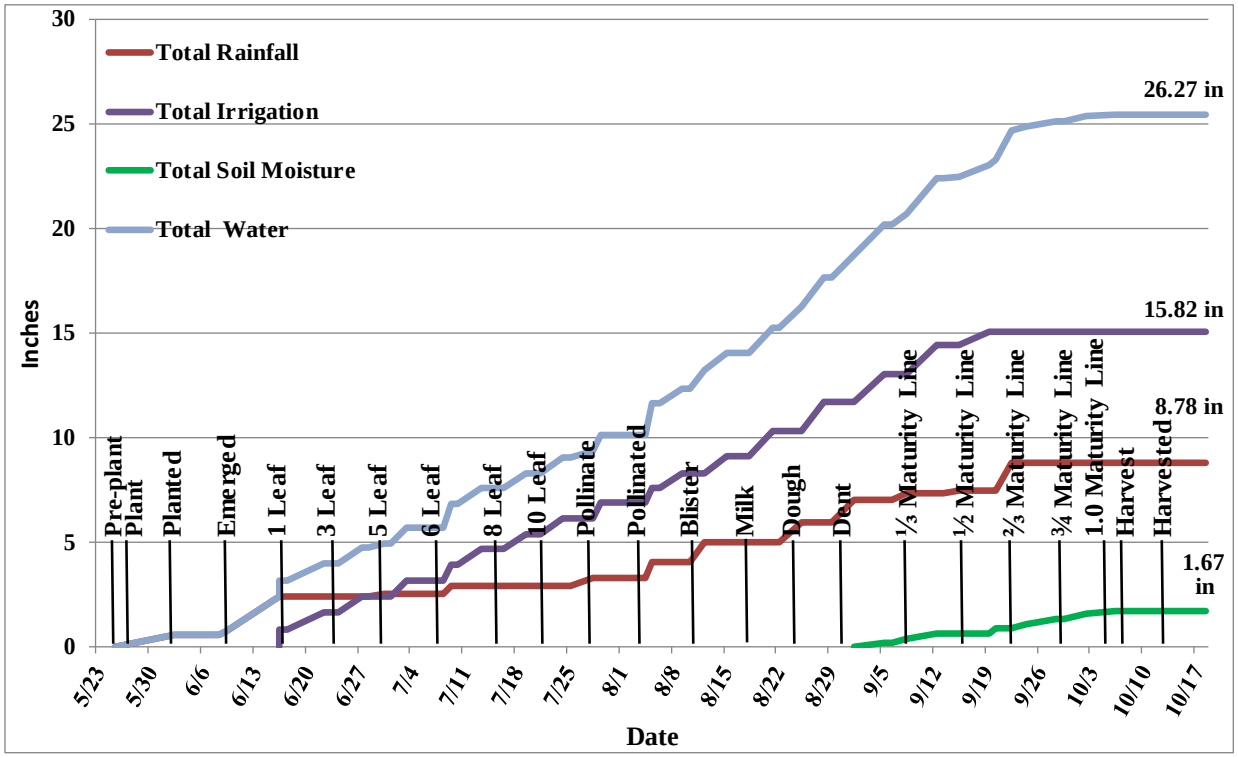


Table 15: Field Data for Harold Grall's "5 GPM" Demonstration Site, 190 bu/ac, LEPA Shroud

Date	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Pivot Position	Well GPM	Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
4/16	0.44													Pivotrac
4/17	0.13													Pivotrac
4/19	0.69													Pivotrac
4/29	1.19													Pivotrac
5/12	0.71													Pivotrac
5/16	0.88													Pivotrac
5/24			116.08	27941.10	preplant						180			C & L
5/25					plant									Harold
6/2	0.55		116.14	27943.70	planted						stop			C & L
6/7			116.69								240	into 5		Pivotrac
6/7		0.80	117.37								270	into 3	350	Pivotrac
6/9	0.20		119.38	27994.90	emerged						3	3	283	C & L
6/16	1.60		124.64	28079.00	1 leaf						232	4	332	C & L
6/16			125.04								240	into 5	335	Pivotrac
6/17		0.80	125.72								270	into 3	340	Pivotrac
6/22			133.16								240	into 5		Pivotrac
6/22		0.80	133.84								270	into 3	350	Pivotrac
6/24			136.29	28270.50	3 leaf						42	3	327	C & L
6/27			141.30								240	into 5		Pivotrac
6/28		0.80	141.97								270	into 3	335	Pivotrac
6/30	0.15		144.88	28413.60	5 leaf						79	3	323	C & L
7/1					5 leaf	100.5	100.1	100.1	101.2	100.6				C & L
7/3			149.20								240	into 5		Pivotrac
7/3		0.77	149.85								270	into 3	330	Pivotrac
7/8			156.79								240	into 5		Pivotrac
7/8	0.39		156.32	28608.10	6 leaf	57.6	96.9	97.8	98.4	98.7	264	5	314	C & L
7/8		0.76	157.43								270	into 3	315	Pivotrac
7/13			164.17								240	into 5		Pivotrac
7/14		0.73	164.78								270	into 3	310	Pivotrac
7/16			167.32	28797.80	8 leaf	14.9	91.6	97.9	98.4	98.8	75	3	310	C & L
7/19			171.54								240	into 5		Pivotrac
7/19		0.72	172.15								270	into 3	310	Pivotrac
7/21			174.12	28918.00	10 leaf	0.2	44.6	98.0	98.8	99.2	52	3	306	C & L
7/24			178.96								240	into 5	305	Pivotrac
7/24		0.73	179.58								270	into 3	305	Pivotrac
7/28	0.36		183.43	29082.60	pollinate	0	12.7	96.9	98.3	98.9	153	3	310	P & L
7/29			186.39								240	into 5	305	Pivotrac
7/30		0.74	187.02								270	into 3	305	Pivotrac
8/4			193.61								240	into 5	290	Pivotrac
8/4	0.80		192.79	29252.10	pollinated	4.4	21.8	95.0	97.8	98.6	264	5	290	C & L
8/4		0.71	194.22								270	into 3		Pivotrac
8/9			200.45								240	into 5		Pivotrac
8/10		0.69	201.03								270	into 3	285	Pivotrac
8/12	0.91		202.84	29437.10	blister	0	10.0	91.3	97.0	98.2	56	3	287	Curtis
8/15			207.36								240	into 5		Pivotrac
8/15	pm	0.83	208.07								270	into 3	285	Pivotrac
8/18			210.89	29582.50	milk	5.3	6.8	77.1	96.8	98.5	109	3	266	C & L
8/21			213.82								240	into 5		Pivotrac
8/22		1.22	214.85								270	into 3	265	Pivotrac
8/25	0.99		219.36	29743.80	dough	64.1	8.2	72.0	95.9	98.4	94	3	290	C & L
8/28			222.30								240	into 5		Pivotrac
8/29		1.39	223.47								270	into 3	290	Pivotrac
9/1	1.06		228.11	29911.20	dent	99.0	57.1	76.3	95.5	98.4	77	3	272	C & L
9/5			231.54								240	into 5		Pivotrac
9/5		1.35	232.68							.	270	into 3	280	Pivotrac
9/8	0.34		236.87	30079.20	1/3mat ln	99.3	84.3	74.5	94.5	98.2	54	3	284	C & L
9/12			240.67								240	into 5		Pivotrac
9/13		1.39	241.85								270	into 3	280	Pivotrac
9/15	0.09		245.50	30247.30	1/2mat ln	97.9	91.0	73.4	93.1	97.1	36	3	277	C & L
9/19			249.88								240	into 5		Pivotrac
9/20		0.59	250.38								270	into 3	280	Pivotrac
9/22	1.34		253.78	30408.70	⅔ mat line	98.6	96.3	73.7	92.6	97.1	32	3	259	C & L
9/29			256.81	30467.80	¾ mat line	96.2	95.7	82.2	94.3	97.5	160	stop		C & L
10/6			256.81	30467.80	1.0 mat line	85.4	94.2	85.9	93.8	96.9	160	stop		C & L
10/8					harvest									Harold
10/13			256.84	30469.20	harvested	64.1	93.0	86.9	93.8	97.0	180	stop		Curtis
Total	8.78	15.82				0.51	0.14	0.48	0.21	0.33				
Net soil moisture is 1.67 inches.														
Rainfall (8.78 in), irrigation (15.82 in), and net soil moisture (1.67 in) is total water (26.27 in).														
*Numbers in red are not counted in the total rainfall.														

Harvest Results-LEPA and T-L PMDI: The 3 GPM LEPA Shroud field produced a 203 bushel per acre corn yield. Irrigation totaled to 13.57 inches. Production in the 3 GPM T-L PMDI field was 216 bushels per acre. The 3 GPM T-L PMDI field produced 13 more bushels per acre with the same 13.57 inches of irrigation.

Corn production was 14.96 bushels (897 lb) per inch of irrigation in the 3 GPM LEPA Shroud and 15.91 bushels (955 lb) in the T-L PMDI field. Yield was 191 bushels per acre in the 4 GPM LEPA field with 14.85 inches of irrigation. Production in the 4 GPM T-L PMDI field was 200 bushels per acre with the same irrigation. Production was 12.86 bushels (771 lb) from each inch of irrigation for the 4 GPM LEPA and 13.47 (808 lb) for the T-L PMDI. Yield was 190 bushels per acre in the 5 GPM LEPA field with 15.82 inches of irrigation and 198 bushels in the T-L PMDI. Production was 12.01 bushels (720 lb) from each inch of irrigation for the 5 GPM LEPA and 12.49 bushels (749 lb) for the 5 GPM T-L PMDI. There was no pre-season irrigation.

Production from each inch of irrigation, rainfall, and net soil water that totaled 23.87 inches was 8.50 bushels (510 lb) per acre for the 3 GPM LEPA Shroud. Irrigation, rainfall, and net soil water totaled 26.37 inches for the 3 GPM T-L PMDI field from which production was 8.19 bushels (491 lb) per inch. In the 4 GPM LEPA field, irrigation, rainfall, and soil water totaled 25.47 inches from which production was 7.50 bushels (450 lb) from each inch. Irrigation, rainfall, and soil water totaled 25.56 inches for the 4 GPM T-L PMDI where production was 7.82 bushels (469 lb) per inch. Irrigation, rainfall plus net soil water was 26.27 inches for the 5 GPM LEPA field. Production was 7.23 bushels (434 lb) from each inch of total water. Total water was 24.60 inches for the 5 GPM T-L PMDI from which production was 8.05 bushels (483 lb) per inch.

Crop production costs for irrigation, seed, fertilizer, and harvest costs were $394.49 per acre for the 3 GPM LEPA Shroud and $406.63 for the 3 GPM T-L PMDI fields. At $3.44 per bushel, value of the 13 bushels per acre additional yield for the T-L PMDI is $44.72 per acre. Net return from the 3 GPM T-L PMDI field was $32.58 per acre. Net return from each inch of irrigation is $24.79 for the T-L PMDI field and $22.39 for 3 GPM LEPA. Production costs totaled $390.75 for 4 GPM LEPA and $399.31 for T-L PMDI. Value of the 9 more bushels per acre at $3.44 per bushel is $30.96. Net return is $22.40 per acre more for 4 GPM T-L PMDI. Net return from each inch of irrigation is $19.44 for the T-L PMDI and $17.93 for 4 GPM LEPA. Production costs were $395.62 for the 5 GPM LEPA and $403.23 for T-L PMDI. At $3.44 per bushel, the value of the 8 additional bushels were $27.52 per acre. Net additional return for the T-L PMDI is $19.91 per acre. Net return from each inch of irrigation is $17.56 for 5 GPM T-L PMDI and $16.31 for the LEPA Shroud. Net return from each inch of irrigation, rainfall, and net soil water that totaled to 23.87 inches is $12.73 per inch for the 3 GPM LEPA Shroud and $12.75 from T-L PMDI where total water is 26.37 inches. In the 4 GPM fields, irrigation, rainfall, and net soil water totaled to 25.47 inches in the LEPA field from which net return was $10.45. Total water was 25.56 inches in the 4 GPM T-L PMDI, and net return was $11.29 from each inch. For 5 GPM LEPA, irrigation, rainfall, and net soil water totaled to 26.27 inches from which net return is $9.82 per inch. Total water was 24.60 inches in T-L PMDI from which net return is $11.29 per inch.

The 2016 LEPA Shroud and T-L PMDI demonstration is an excellent comparison of two high efficiency water application center pivot irrigation systems. Both currently existing center pivot systems, when properly equipped and managed, can extend the profitability of irrigated crop production in combination with advanced management tools and technology utilized and demonstrated by the "3-4-5 Gallon Production Maximization" Project. The demonstration is being repeated by Harold Grall at this site in 2017 to develop additional information for potential grower ready adoption. A summary of the 2016 LEPA Shroud and T-L PMDI demonstration results are shown in Tables 16 and 17 below and in Appendix B.

Table 16: Harold Grall's 2016 T-L PMDI Demonstration Results

GPM	Irrigation (in)	Total Water (in)	Production		Gross Crop Value @ $3.44/bu		
			bu/ac	lb/ac-in of Irrigation	per acre ($)	Acre-in of Irrigation ($)	Acre-in of Total Water
3 GPM PMDI	13.57	[a]26.37	216	955	743.04	54.75	28.17
4 GPM PMDI	14.85	[b]25.56	200	808	688.00	46.73	26.91
5 GPM PMDI	15.82	[c]24.60	198	751	681.12	43.05	27.68

[a]Includes 4.02 inches of soil water removed within 5 feet of soil, plus rainfall and irrigation.

[b]Includes 1.93 inches of soil water removed within 5 feet of soil, plus rainfall and irrigation.

[c]Includes 0.00 inches of soil water removed within 5 feet of soil, plus rainfall and irrigation.

Table 17: Harold Grall's 2016 LEPA Shroud Demonstration Results

GPM	Irrigation (in)	Total Water (in)	Production		Gross Crop Value @ $3.44/bu		
			bu/ac	lb/ac-in of	per acre ($)	Acre-in of Irrigation ($)	Acre-in of Total Water
3 GPM LEPA	13.57	[a]23.87	203	897	698.32	51.46	29.25
4 GPM LEPA	14.85	[b]25.47	191	771	657.04	44.24	25.79
5 GPM LEPA	15.82	[c]26.27	190	720	653.60	41.31	24.88

[a]Includes 1.52 inches of soil water removed within 5 feet of soil, plus rainfall and irrigation.

[b]Includes 1.84 inches of soil water removed within 5 feet of soil, plus rainfall and irrigation.

[c]Includes 1.67 inches of soil water removed within 5 feet of soil, plus rainfall and irrigation.

Harvest Results "3-4-5 Gallon Production Maximization" T-L PMDI: The 3 GPM T-L PMDI field produced a 216 bushel per acre corn yield. Irrigation totaled to 13.57 inches. Production in the 4 GPM field was 200 bushels per acre. Irrigation was 14.85 inches. Corn yield was 198 bushels per acre for the 5 GPM field. Irrigation totaled to 15.82 inches. There was no pre-season irrigation. The 3 GPM field produced 16 more bushels per acre than the 4 GPM field, and irrigation was 1.28 inches less.

The 3 GPM field produced 18 more bushels per acre than the 5 GPM with 2.25 less inches of irrigation. The 4 GPM yield was 2 more bushels per acre than that from the 5 GPM field with 0.97 less inches of

irrigation. Corn production was 15.91 bushels (955 lb) per inch of irrigation in the 3 GPM field compared to 13.47 bushels (808 lb) in the 4 GPM and 12.51 bushels (751 lb) from the 5 GPM field.

Production from each inch of irrigation, rainfall, and net soil water that totaled to 26.37 inches was 8.19 bushels (491 lb) per acre in the 3 GPM field. Irrigation, rainfall, and net soil water totaled to 25.56 inches in the 4 GPM field where production was 7.82 bushels (469 lb) per inch. In the 5 GPM field, irrigation, rainfall, and net soil water totaled to 24.60 inches where production was 8.05 bushels (483 lb) per inch of total water. Crop production costs were $7.32 per acre more for the 3 GPM field than for the 4 GPM from increased fertilizer and harvest expenses. At $3.44 per bushel, the 16 bushels per acre increased corn yield in the 3 GPM field amounts to $55.04 more per acre than from the 4 GPM field.

The 3 GPM field's net gain is $47.72 per acre with 1.28 inches less irrigation used compared to production from the 4 GPM field. Value of the additional 18 bushels produced in the 3 GPM field compared to the 5 GPM is $61.92 per acre. Production costs were $3.40 more for the 3 GPM field. Net gain for the 3 GPM field is $58.52 per acre more than from the 5 GPM with 2.25 inches less irrigation. At $3.44 per bushel, the 2 bushels per acre increased yield from the 4 GPM field compared to the 5 GPM amounts to $6.88. Crop production costs were $3.92 more for the 5 GPM field from increased irrigation costs. The 4 GPM field's net gain compared to the 5 GPM field is $10.80 per acre with 0.97 less inches of irrigation.

Net return from the 3 GPM field was $336.41 per acre compared to $288.69 from the 4 GPM field and $277.89 from the 5 GPM field. Net return from each inch of irrigation is $24.79 for the 3 GPM field compared to $19.44 from the 4 GPM and $17.56 for the 5 GPM field. Net return from each inch of irrigation, rainfall and net soil water is $12.75 for the 3 GPM field, $11.29 from the 4 GPM, and $11.29 for the 5 GPM field. A summary of the demonstration results is shown in Table 16 and Appendix B.

Harvest Results "3-4-5 Gallon Production Maximization" LEPA: The 3 GPM LEPA field produced a 203 bushel per acre corn yield. Irrigation totaled to 13.57 inches. Production in the 4 GPM field was 191 bushels per acre. Irrigation was 14.85 inches. Corn yield was 190 bushels per acre for the 5 GPM field. Irrigation totaled to 15.82 inches. There was no pre-season irrigation.

The 3 GPM field produced 12 more bushels per acre than the 4 GPM field, and irrigation was 1.28 inches less. The 3 GPM field produced 13 more bushels per acre than the 5 GPM with 2.25 less inches of irrigation. The 4 GPM yield was 1 more bushel per acre than that from the 5 GPM field with 0.97 less inches of irrigation.

Corn production was 14.99 bushels (897 lb) per inch of irrigation in the 3 GPM field compared to 12.86 bushels (771 lb) in the 4 GPM and 12.01 bushels (720 lb) from the 5 GPM field. Production from each inch of irrigation, rainfall, and net soil water that totaled 23.87 inches was 8.50 bushels (510 lb) per acre in the 3 GPM field. Irrigation, rainfall, and net soil water totaled 25.47 inches in the 4 GPM field where production was 7.50 bushels (450 lb) per inch. In the 5 GPM field, irrigation, rainfall, and net soil water totaled 26.27 inches where production was 7.23 bushels (434 lb) per inch of total water.
Crop production costs were $3.74 per acre more for the 3 GPM field than for the 4 GPM from increased fertilizer and harvest expenses. At $3.44 per bushel, the 12 bushels per acre increased corn yield in the 3 GPM field amounts to $41.28 more per acre than from the 4 GPM field. The 3 GPM field's net gain is

$37.54 per acre with 1.28 inches less irrigation used compared to production from the 4 GPM field. Value of the additional 13 bushels produced in the 3 GPM field compared to the 5 GPM is $44.72 per acre. Production costs were $1.13 more for the 5 GPM field. Net gain for the 3 GPM field is $45.85 per acre more than from the 5 GPM with 2.25 inches less irrigation. At $3.44 per bushel, the 1 bushel per acre increased yield from the 4 GPM field compared to the 5 GPM amounts to $3.44. Crop production costs were $4.87 more for the 5 GPM field from increased irrigation costs. The 4 GPM field's net gain compared to the 5 GPM field is $8.31 per acre with 0.97 less inches of irrigation.

Net return from the 3 GPM field was $303.83 per acre compared to $266.29 from the 4 GPM field and $257.98 from the 5 GPM field. Net return from each inch of irrigation is $22.39 for the 3 GPM field compared to $17.93 from the 4 GPM and $16.31 for the 5 GPM field. Net return from each inch of irrigation, rainfall, and net soil water is $12.73 for the 3 GPM field, $10.50 from the 4 GPM, and $9.82 for the 5 GPM field. A summary of the demonstration results is shown in Table 17 and Appendix B**.**

Stan Spain's 2016 Moore County SDI Demonstration

Planting and Crop Information: Stan Spain strip tilled and planted 38.50 acres of corn in the south half of Section 47 for his "3-4-5 Gallon Production Maximization" SDI demonstration. The SDI acres are positioned between two center pivot irrigation systems. There are 16 irrigation zones in the SDI system divided in the north and south by a field road. Each north zone is 2.43 acres. Zone 3 was Spain's 3 GPM field, zone 4 was the 4 GPM, and zone 5 was the 5 GPM. An irrigation plan was developed and run by Field Net. The plan irrigated 2 zones simultaneously and 3 times each week. The plan applied 0.38 inches each 56-hour cycle to apply 1.14 inches per week for the 3 GPM field; 0.50 inches each cycle to apply 1.50 inches for the 4 GPM field; and 0.62 inches to apply 1.86 inches for the 5 GPM field. The south SDI acres were planted to corn and irrigated in sequence with the north acres. Spain planted each "3-4-5 Gallon Production Maximization" field to Dynagro D54DC94RIB hybrid. Seeding rate was 32,000 seeds per acre for the 3 GPM, 4 GPM and 5 GPM acres. Seasonal water meter readings averaged 155 GPM (2 zones). Irrigation was with Netafim 13 mil Typhoon 875 series SDI tape laterals spaced 30 inches apart with 0.18 GPH TurbONet emitters spaced 24 inches apart. Planting and crop information for "Spain 3 GPM", "Spain 4 GPM", and "Spain 5 GPM" SDI are shown in Table 18 below.

Table 18: Planting and Crop Information for Stan Spain SDI

3 GPM Demonstration Site: Zone 3					
Planted		May 27		**Harvest**	October 21
Hybrid		Dynagro D54DC94RIB		**Seeding Rate**	32,000
Row Width		30 inches		**Tillage**	Strip Till
No. Acres		2.43		**GPM per acre**	3.00
Total Water		26.26 inches		**Soil Type**	Sherm silty clay loam
Irrigation		13.76 inches		**Insecticide**	Comite, Warhark, Cide Trak
4 GPM Demonstration Site: Zone 4					
Planted		May 27		**Harvest**	October 21
Hybrid		Dynagro D54DC94RIB		**Seeding Rate**	32,000
Row Width		30 inches		**Tillage**	Strip Till
No. Acres		2.43		**GPM per acre**	4.00
Total Water		27.52 inches		**Soil Type**	Sherm sitly clay loam
Irrigation		16.46 inches		**Insecticide**	Prevathon, Warhawk, Rifle
5 GPM Demonstration Site: Zone 5					
Planted		May 27		**Harvest**	October 21
Hybrid		Dynagro D54DC94RIB		**Seeding Rate**	32,000
Row Width		30 inches		**Tillage**	Strip Till
No. Acres		2.43		**GPM per acre**	5.00
Total Water		26.52 inches		**Soil Type**	Sherm sitly clay loam
Irrigation		17.44 inches		**Insecticide**	Prevathon, Warhawk, Rifle

Soil Water Profile and Growing Season Rainfall

"3 GPM" Demonstration Site: Pre-season soil water was good at 1, 2, 3, 4 and 5 feet. Weekly gypsum block readings indicate the crop used more than irrigation and rainfall provided and removed stored water from 1 and 2 feet by mid-July at the 8-leaf growth stage. Plant roots developed into 3 feet the third

week in July at the 11-leaf growth stage. Soil water was used from 4 and 5 feet in the root zone beginning in mid-September during grain maturity. The crop used 5.49 inches of soil water from 1, 2, 3, 4 and 5 feet in addition to irrigation and rainfall. Soil moisture sensors show the crop had adequate soil water during the growing season. The crop was produced in Sherm silty clay loam that can store approximately 2.00 inches of available water per foot for potential crop use. Total rainfall from planting until grain black layer totaled to 7.01 inches.

"4 GPM" SDI Demonstration Site: Soil water was good at 1, 2, 3, 4, and 5 feet prior to planting. Soil moisture sensors show plant roots began using water from 1 foot in the root zone at the 7-leaf growth stage in early July and from 2 feet in mid-July at 8 leaves. Water was used from 3 feet the third week in July at pollination. Plant roots used about 25% of the water available from 4 feet in October and 15% of the water stored at 5 feet during grain maturity. Weekly gypsum block readings showed the crop had adequate soil moisture during the growing season. The crop used 4.05 inches of soil water mostly from 1, 2, 3, 4, and 5 feet in addition to rainfall and irrigation producing the crop. A total of 7.01 inches of rainfall was recorded from planting through black layer. The crop was produced in Sherm silty clay loam that holds approximately 2.00 inches available water per foot for potential crop use.

"5 GPM" SDI Demonstration Site: Beginning soil water was good at 1, 2, 3, 4, and 5 feet at planting. Soil moisture sensors show plant roots began to remove water from 1 foot the first week in July at the 5-leaf growth stage in addition to irrigation and rainfall. No additional soil water was used until mid-September during grain maturity when about 20% of soil water stored at both 4 and 5 feet was used in October for maintaining plants and grain maturity. Weekly gypsum block moisture sensors show the crop had sufficient available soil water during the entire growing season. Total rainfall was 7.01 inches. Irrigation totaled to 17.44 inches. The crop was produced in Sherm silty clay loam soil that holds 2.00 inches of available water per foot for potential crop use.

Table 19: Monthly Rainfall Data for Stan Spain SDI

GPM	June (in)	July (in)	August (in)	September (in)	October (in)	Total (in)
3, 4, 5	2.50	1.01	2.66	0.70	0.14	7.01

Growing Season Water Tracking: The District tracked total water and crop growth throughout the growing season using rain gauges, water meters, and both gypsum blocks and Aquaspy® soil moisture sensors. One set of 5 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 4 feet in the root zone at 1 location to monitor soil water levels in the 3 GPM-Early field. Another set of the same type of sensors was installed in each 3, 4, and 5 GPM field. Both the gypsum block sensors and the soil probe were installed in close proximity to each other in each field. Gypsum blocks, water meters, rain gauges, and crop growth were read, recorded, and utilized weekly by district personnel. A 24/7 Aquaspy® probe website shows soil moisture at 4-inch increments to 48 inches and monitors plant root growth. The website lists all Aquaspy® soil probes in the "3-4-5 Gallon Production Maximization" project and is available to all cooperators and district personnel. Another 24/7 Pivotrac® website tracks each center pivot, monitors system position and travel, and provides information to make irrigation management strategies. Both the

cooperating grower and District “3-4-5 Gallon Production Maximization” project leader collectively monitored, controlled, and managed irrigation from the Pivotrac® website.

Following this paragraph, a series of graphs and tables show weekly gypsum block readings for the season; the growing season’s water, including rainfall, irrigation, and soil moisture at various growth stages; and the order of irrigation and rainfall events for each “3-4-5 Gallon Production Maximization” field. Finally, a form describes the protocols for each field. “Total Water,” as shown on the graph for “Growing Season Water Tracking” is the sum of seasonal irrigation, rainfall, and net soil water. Graphs and tables for the 3 GPM acres are shown first, followed by the same illustrations for each 4 GPM and 5 GPM.

Figure 21: Gypsum Block Readings for Stan Spain's "3 GPM" Demonstration Site, 191 bu/ac, SDI

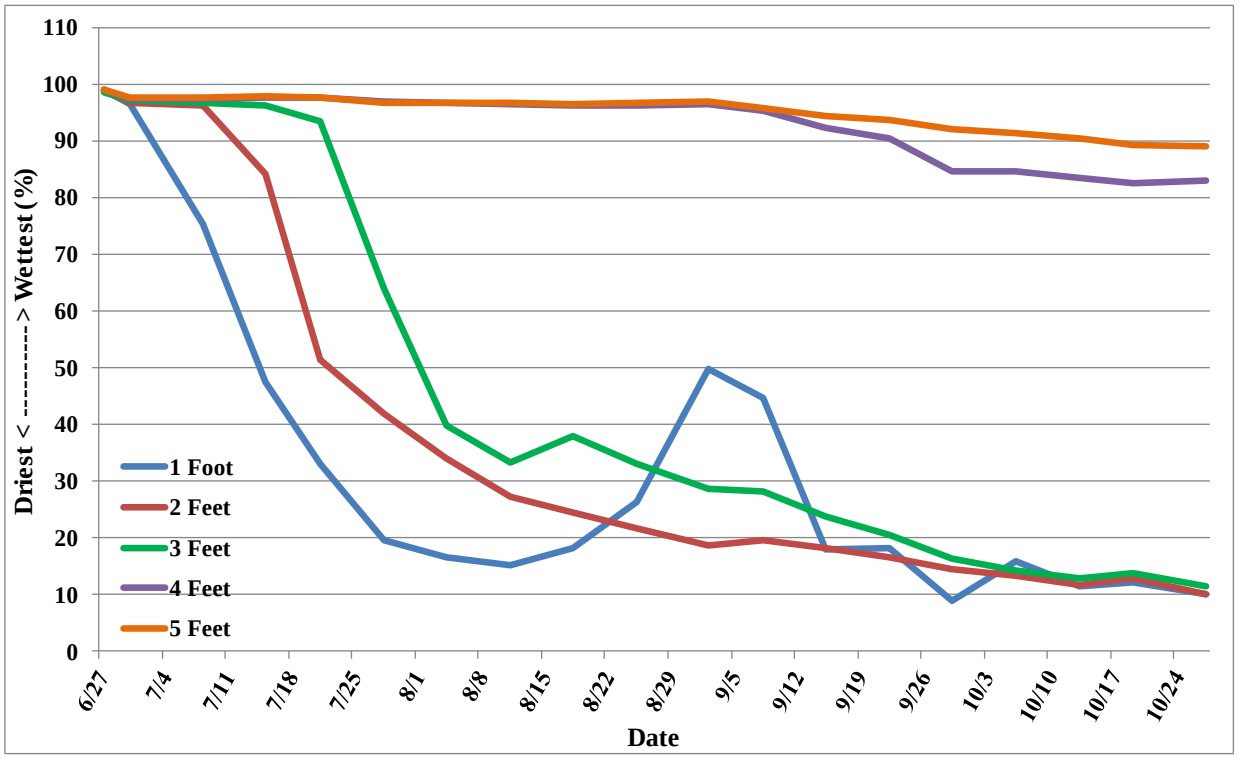


Figure 22: Growing Season Water Tracking for Stan Spain's "3 GPM" Demonstration Site, 191 bu/ac, SDI

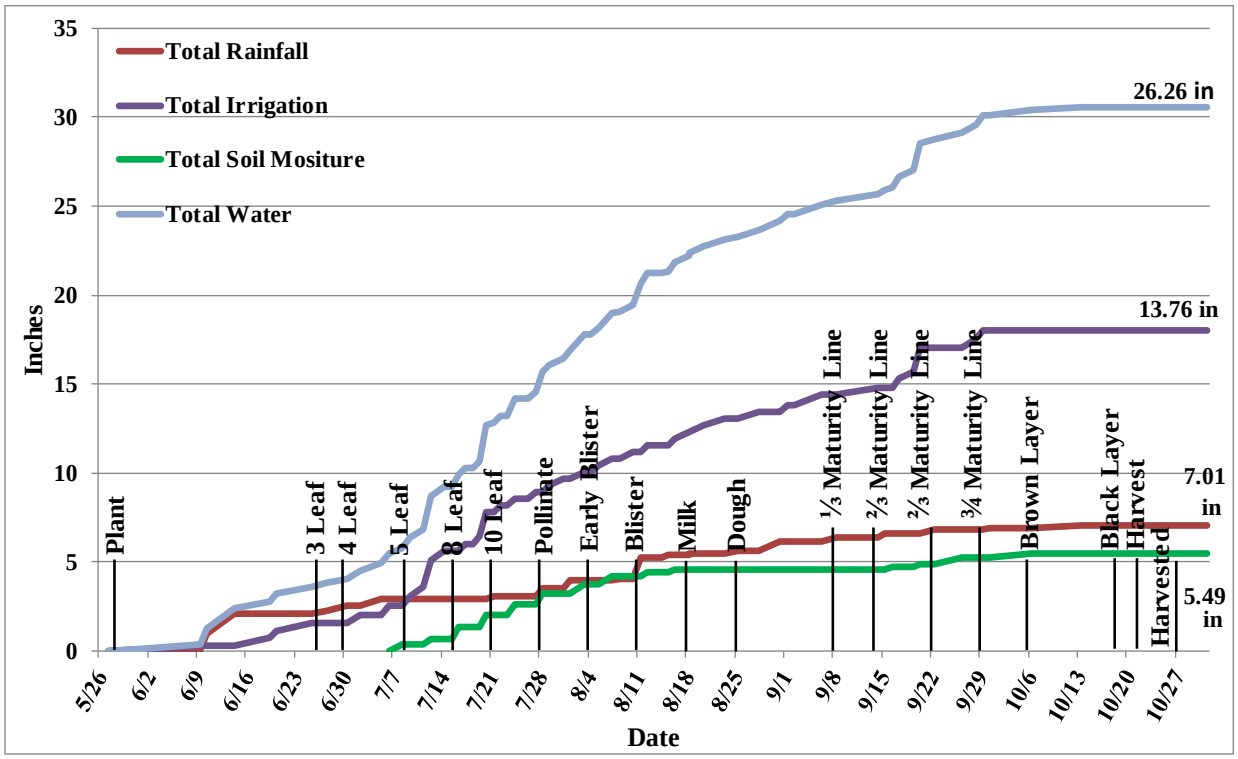


Table 20: Field Data for Stan Spain's "3 GPM" Demonstration Site, 191 bu/ac, SDI

Date	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well GPM	Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
2/1	0.19													Curtis
4/16	0.97													Pivotrac
4/17	0.34													Pivotrac
4/19	0.40													Pivotrac
4/28	1.48													Curtis
4/30	0.17													Pivotrac
5/12	0.60													Pivotrac
5/16	0.93													Pivotrac
5/17	0.14													Pivotrac
5/27					plant									Stan
5/30	0.02													Pivotrac
6/6			0.49	0.10										L & J
6/7														Pivotrac
6/9		0.31	1.08	0.61							3,4,5	3,4,5		Leon
6/10	0.95													Pivotrac
6/14	1.09		1.08	0.61										Curtis
6/18			2.39	0.61										Stan
6/18		0.41	2.72	0.94							3,4	3,4	300	Stan
6/19			3.05	1.26							3,4	3,4	290	Stan
6/19		0.40	3.37	1.58							3,4	3,4	290	Stan
6/20			3.69	1.90									off	Curtis
6/23													repair	Jerry
6/24			4.61	2.13							3,4	3,4	175	Vieto
6/25		0.40	4.77	2.29							3,4	3,4	175	Vieto
6/27	0.20		5.09	2.62	3 leaf	99.1	98.8	98.6	99.0	99.0			off	C & L
6/30	0.24		5.10	2.63	4 leaf	96.6	96.8	97.1	97.5	97.6			off	C & L
7/1			5.10	2.63										Leon
7/4			5.10	2.63							3,4			Stan
7/2		0.49	5.50	3.03							3,4	3,4	305	Stan
7/5			6.71	3.42							3,4	3,4		Stan
7/5	0.42		6.82	3.54								3,4	310	Curtis
7/5		0.50	7.12	3.83									315	Stan
7/6			8.33	4.24										Leon
7/8			8.36	4.24	5 leaf	75.3	96.2	96.8	97.5	97.6	South		153	C & L
7/8											1,2	South		Paul
7/8			8.59	4.47							3,4	1,2	175	Field Net
7/9		0.57	8.82	4.70							3,4	3,4	175	Field Net
7/11			10.18	5.27							3,4	3,4	160	Field Net
7/11			10.44	5.46							3,4	3,4	150	Curtis
7/11		0.52	10.38	5.48							3,4	3,4	160	Field Net
7/13			11.82	6.08							3,4	3,4	160	Field Net
7/13		0.52	12.03	6.29							3,4	3,4	160	Field Net
7/15			13.36	7.05	8 leaf	47.6	84.2	96.2	97.7	97.8	south	3,4	146	C & L
7/16			13.46	6.81							3,4,5,6	south	160	Field Net
7/16		0.38	13.88	7.33							3,4,5,6	3,4,5,6	160	Field Net
7/18			15.08	7.75							3,4,5,6	3,4,5,6	160	Field Net
7/19		0.38	15.50	8.17							3,4,5,6	3,4,5,6	160	Field Net
7/20			16.72	8.60							3,4,5,6	3,4,5,6	160	Field Net
7/21	0.10		17.28	9.72	10 leaf	33.2	51.4	93.5	97.7	97.7	3,4	3,4,5,6	160	C & L
7/21		0.38	17.14	9.02							3,4,5,6	3,4	160	Field Net
7/23			18.35	9.44							3,4,5,6	3,4,5,6	160	Field Net
7/24		0.38	18.78	9.87							3,4,5,6	3,4,5,6	160	Field Net
7/26			19.99	10.29							3,4,5,6	3,4,5,6	160	Field Net
7/26		0.38	20.41	10.71							3,4,5,6	3,4,5,6	160	Field Net
7/28	0.49		22.00	11.36	pollinate	19.5	42.0	63.9	97.0	96.8	1,2	3,4,5,6	156	P & L
7/28			21.63	11.13							3,4,5,6	1,2	160	Field Net
7/29		0.38	22.05	11.56							3,4,5,6	3,4,5,6	160	Field Net
7/30			23.25	11.98							3,4,5,6	3,4,5,6	160	Field Net
7/31		0.38	23.68	12.40							3,4,5,6	3,4,5,6	160	Field Net
8/1	0.46		24.80	12.84							South	3,4,5,6	150	Curtis
8/2			24.89	12.82							3,4,5,6	South	160	Field Net
8/2		0.38	25.31	13.25							3,4,5,6	3,4,5,6	160	Field Net
8/4	0.02		26.76	13.74	E. blister	16.6	34.0	39.8	96.8	96.7	1,2	3,4,5,6	158	C & L
8/4			26.98	13.67							3,4,5,6	1,2	160	Field Net
8/5		0.38	27.40	`4.0923							3,4,5,6	3,4,5,6	160	Field Net
8/5			27.46	14.44							7,8	3,4,5,6	150	C & L
8/7			28.64	14.51							3,4,5,6	7,8	160	Field Net
8/7		0.38	29.08	14.94							3,4,5,6	3,4,5,6	160	Field Net
8/8	0.03		29.52	15.29							south	3,4,5,6	148	Curtis

Table 20: Field 5Data for Stan Spain's "3 GPM" Demonstration Site, 191 bu/ac, SDI (continued)

Date	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well GPM	Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
8/9			30.32	15.35							3,4,5,6	south	155	Field Net
8/10		0.38	30.73	15.76							3,4,5,6	3,4,5,6	155	Field Net
8/11	1.24		32.02	16.09	blister	15.3	27.3	33.3	96.6	96.8	south	3,4,5,6	145	Curtis
8/11			31.92	16.17							3,4,5,6	south	150	Field Net
8/12		0.37	32.91	16.56							3,4,5,6	3,4,5,6	150	Field Net
8/14			33.51	16.96							3,4,5,6	3,4,5,6	150	Field Net
8/15	0.11		33.66	17.45							3,4,5	3,4,5,6	157	Curtis
8/15		0.37	33.90	17.35							3,4,5,6	3,4,5	150	Field Net
8/17			35.03	18.03							1,2	3,4,5,6	154	Curtis
8/17			35.10	17.76							3,4,5,6	1,2	155	Field Net
8/17			35.19	18.19							3,4,5	3,4,5,6	152	Curtis
8/18		0.38	35.51	18.17							3,4,5,6	3,4,5	150	Field Net
8/18	0.12		35.64	18.64	milk	18.3	24.5	38.0	96.2	96.6	7,8	3,4,5,6	148	C & L
8/19			36.29	18.66							15,16	7,8	143	Curtis
8/19			36.51	18.73							1,2	15,16	154	Curtis
8/19			36.71	18.58							3,4,5,6	1,2	155	Field Net
8/20		0.39	37.12	18.99							3,4,5,6	3,4,5,6	155	Field Net
8/22			38.34	19.69							3,4,5,6	3,4,5,6	150	Field Net
8/22			38.33	19.76							3,4,5	3,4,5,6	155	Curtis
8/23		0.37	38.74	20.09							3,4,5,6	3,4,5	150	Field Net
8/23			39.03	20.26							9,10	3,4,5,6	150	Curtis
8/23			39.14	20.26							11,12	9,10	147	Curtis
8/25	0.13		39.17	20.26	dough	26.4	21.7	33.1	96.3	96.8	off	11,12	off	C & L
8/27			39.17	20.28							1,2		start	Field Net
8/27			39.46	20.48							3,4,5,6	off	150	Field Net
8/28		0.37	39.86	20.88							3,4,5,6	1,2	150	Field Net
8/30			41.05	21.27.38							3,4,5,6	3,4,5,6	150	Field Net
8/30	0.55		41.14	21.42							3,4,5	3,4,5,6	159	Curtis
8/30		0.37	41.45	21.67							3,4,5,6	3,4,5,6	150	Field Net
9/2			42.38	21.85	dough	49.7	18.7	28.6	96.5	97.0	off	3,4,5		C & L
9/5											1,2	3,4,5,6		Field Net
9/5			42.63	22.01							3,4,6	pause	150	Field Net
9/6		0.55	42.94	22.36							3,4,6	off	150	Field Net
9/6			42.94	22.38							7,8	1,2	150	Curtis
9/6											stop	3,4,6	Tex-Zac	Field Net
9/8	0.21		43.00	22.43	⅓ mat line	44.6	19.7	28.1	95.4	95.8	off	3,4,6		C & L
9/8			43.00	22.43							7,8	7,8		Field Net
9/9			43.73								15,16	stop		Field Net
9/12			43.91	22.55							off	off		Curtis
9/13			43.93								1,2	7,8		Field Net
9/13			44.06	22.71							1,2	15,16	161	Curtis
9/13			44.12	22.75								off	150	Field Net
9/14		0.38	44.52	23.15							3,4,5,6	1,2	150	Field Net
9/14			44.59	23.23							7,8	1,2	147	Curtis
9/15	0.20		45.24	23.37	⅔ mat line	18.0	18.3	23.8	92.4	94.5	13,14		151	C & L
9/15			45.51	23.37							15,16	3,4,5,6	144	Curtis
9/16			45.71	23.54							3,4,6	7,8		Field Net
9/16		0.55	45.97	23.81							3,4,6	13,14	150	Field Net
9/18			47.17	24.21							3,4,5,6	15,16	155	Field Net
9/19		0.38	47.57								3,4,5,6	3,4,6	155	Field Net
9/19			47.76	24.76							9,10	3,4,6	150	Curtis
9/22	0.26		48.52	24.77	⅔ mat line	18.3	16.5	20.5	90.4	93.8		3,4,5,6	off	C & L
9/26			50.33	24.77							9,10	3,4,5,6	153	Curtis
9/27											15,16	9,10		Field Net
9/27											1,2			Field Net
9/27			51.05	24.93							1,2	9,10	168	Curtis
9/27			51.14	25.02							3,4	15,16	150	Field Net
9/28		0.49	51.34	25.22							5,6	1,2		Field Net
9/28			51.71	25.49							7,8	1,2	151	C & L
9/28			51.93	25.81							3,4	3,4		Field Net
9/29		0.49	52.13	26.01							5,6	5,6	150	Field Net
9/29	0.03		52.40	26.17	¾ mat line	8.9	14.6	16.4	84.6	92.0	7,8	7,8	156	C & L
9/29			52.72	26.41							1,2	3,4		Field Net
9/29			52.77	26.46							1,2	5,6		Field Net
10/3			52.87	26.56								7,8	off	Curtis
10/6			53.48	26.58	brown layer	16.0	13.3	14.3	84.7	91.5	15,16	1,2	151	C & L
10/13	0.14		54.51	26.58	brown layer	11.5	11.8	12.8	83.5	90.4		1,2	off	Curtis
10/19			54.51	26.58	black layer	12.2	12.9	13.9	82.6	89.3			off	Curtis
10/21					harvest							15,16		Stan
10/27			54.51	26.60	harvested	10	10.1	11.4	83.0	89.1			off	Curtis
Total	7.01	13.76				1.64	1.64	1.60	0.23	0.38				
Net soil moisture is 5.49 inches.														
Rainfall (7.01 in), irrigation (13.76 in), and net soil moisture (5.49 in) is total water (26.26 in).														
*Numbers in red are not counted in the total.														

Figure 23: Gypsum Block Readings for Stan Spain's "4 GPM" Demonstration Site, 211 bu/ac, SDI

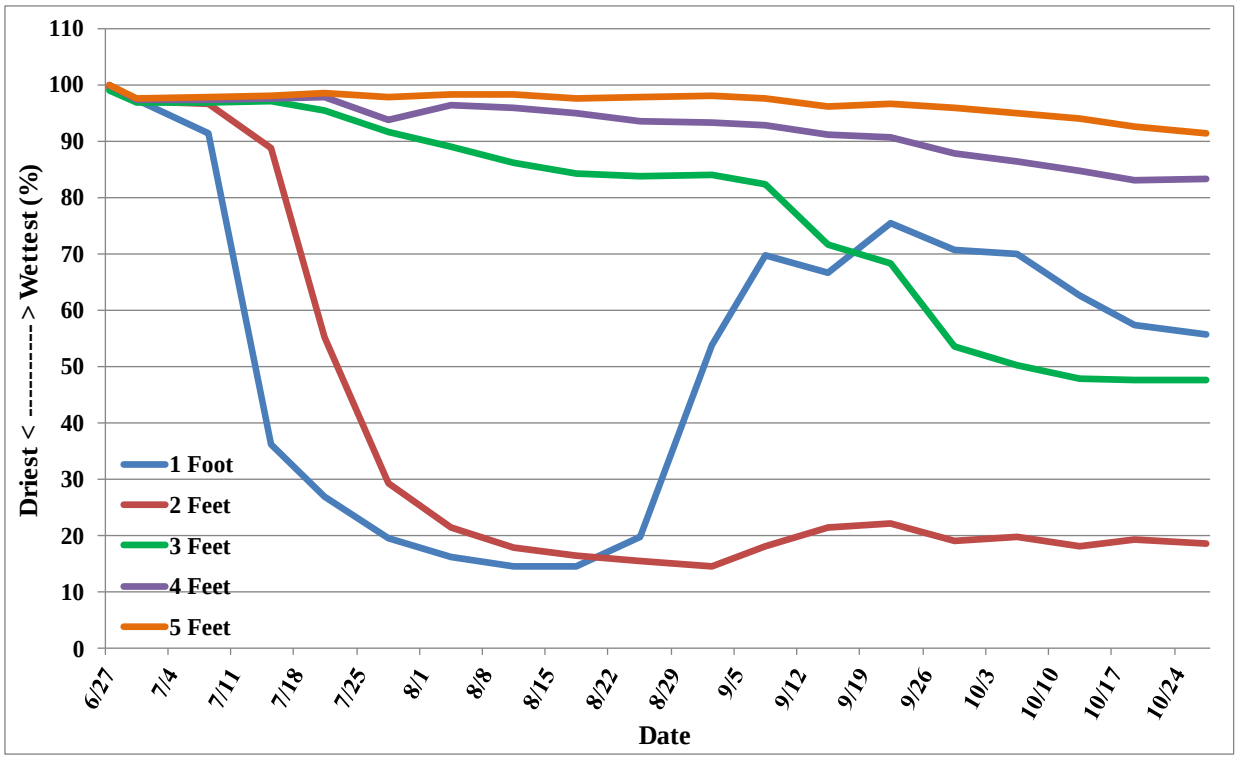


Figure 24: Growing Season Water Tracking for Stan Spain's "4 GPM" Demonstration Site, 211 bu/ac, SDI

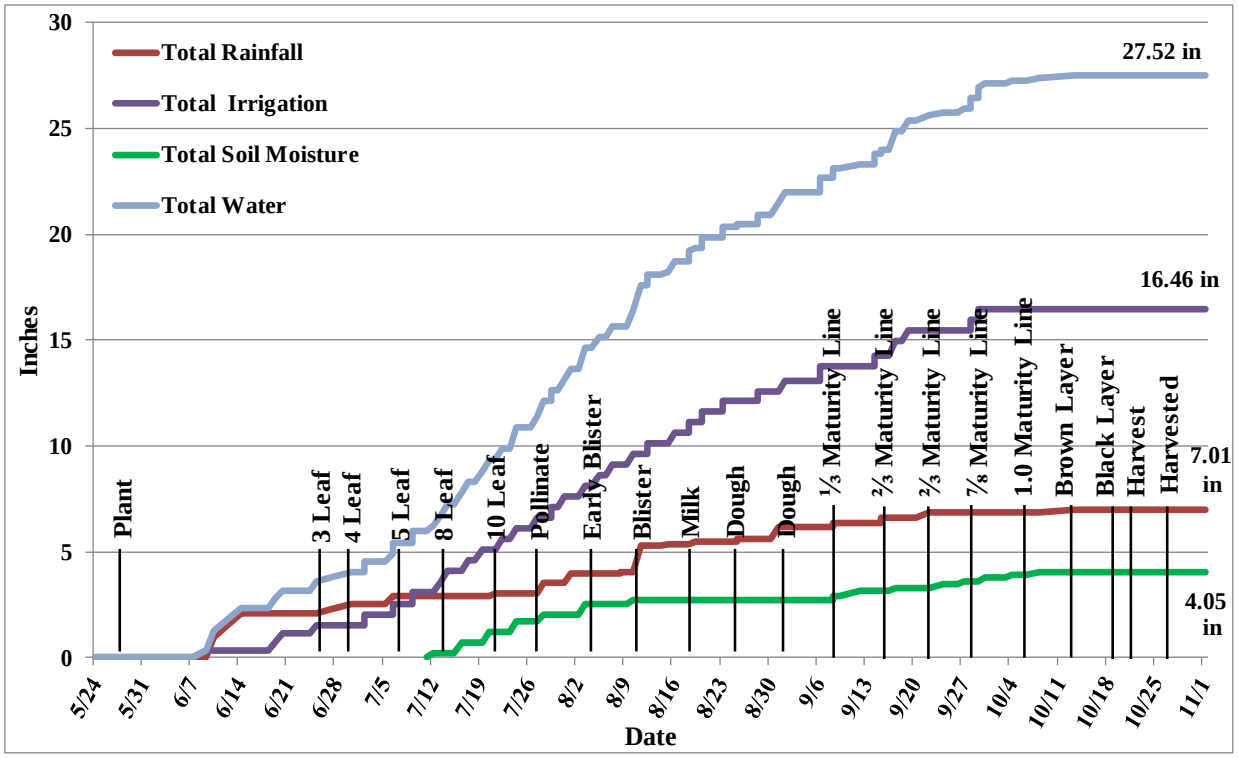


Table 21: Field Data for Stan Spain's "4 GPM" Demonstration Site, 211 bu/ac, SDI

Date	Rainfall (inches)	Irrigation (inches)	Filter Sta Meter AF	Field Meter AF	Growth Stage	Soil Moisture					Zone Irrigating	Crop Irrigating	Filter Sta. Meter GPM	Field Meter GPM	Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet					
2/1	0.19														Curtis
4/16	0.97														Pivotrac
4/17	0.34														Pivotrac
4/19	0.40														Pivotrac
4/28	1.48														Curtis
4/30	0.17														Pivotrac
5/12	0.60														Pivotrac
5/16	0.93														Pivotrac
5/17	0.14														Pivotrac
5/27					plant										Stan
5/30	0.02														Pivotrac
6/6			0.49	0.10											L & J
6/7															Pivotrac
6/9		0.31	1.08	0.61							1-8	3,4,5			Leon
6/10	0.95														Pivotrac
6/14	1.09														Pivotrac
6/18			2.39	0.61							1-4			start N	Stan
6/18		0.41	2.72	0.61							1,2,3,4	3,4	300	300	Stan
6/19			3.05	1.26							1,2,3,4	3,4	290	290	Stan
6/19		0.40	3.37	1.58							1,2,3,4	3,4	290	290	Stan
6/20			3.69	1.90									off		Curtis
6/23													Repair		Jerry
6/24			4.61	2.13							3,4	3,4	175	174	Vieto
6/25		0.40	4.77	2.29							3,4	3,4	175	175	Vieto
6/27	0.20		5.09	2.62	3 leaf	99.7	99.6	99.0	99.9	100.0			off		C & L
6/30	0.24		5.10	2.63	4 leaf	97.4	97.2	97.0	97.3	97.7			off		C & L
7/1			5.10	2.63										off	Leon
7/1			5.10	2.63							1,2,3,4	3,4		start	Stan
7/2		0.49	5.50	3.03							1,2,3,4	3,4	305	305	Stan
7/5											1,2,3,4				Stan
7/5	0.42		6.82	3.54							1,2,3,4		310	315	Curtis
7/5		0.50	7.12	3.83							1,2,3,4	3,4	315	315	Stan
7/6			8.33	4.24											Leon
7/8			8.36	4.24	5 leaf	91.5	96.6	96.9	97.3	97.8	15,16	south	153		C & L
7/8											1,2	1,2		start	Paul
7/8			8.5911	4.4711							into 3,4	3,4	175	175	Field Net
7/9		0.57	8.8222	4.7022							into 5,6	3,4	175	175	Field Net
7/11			10.1825	5.2705							into 3,4	3,4	160	160	Field Net
7/11			10.44	5.46									150	151	Curtis
7/11		0.52	10.3938	5.4818							into 5,6	3,4	160	160	Field Net
7/13			11.8197	6.0832							into 3,4	3,4	160	160	Field Net
7/13		0.52	12.0310	6.2880							into 5,6	3,4	160	160	Field Net
7/15			13.36	7.05	8 leaf	36.1	88.9	97.2	97.7	98.1	13,14	south	146		C & L
7/16			13.4568	6.8089							into3,4,5,6	3,4,5,6	160	160	Field Net
7/16		0.50	13.8796	7.3316							into 7,8	3,4,5,6	160	160	Field Net
7/18			15.0791	7.7520							into3,4,5,6	3,4,5,6	160	160	Field Net
7/19		0.50	15.5019	8.1748							into 7,8	3,4,5,6	160	160	Field Net
7/20			16.7164	8.5974							into3,4,5,6	3,4,5,6	160	160	Field Net
7/21	0.10		17.28	9.72	10 leaf	26.8	55.3	95.5	97.8	98.5	3,4	3,4	160	161	C & L
7/21		0.50	17.1391	9.0201							into 7,8	3,4,5,6	160	160	Field Net
7/23			18.3537	9.4427							into3,4,5,6	3,4,5,6	160	160	Field Net
7/24		0.50	18.7765	9.8655							into 78	3,4,5,6	160	160	Field Net
7/26			19.9911	10.2880							into3,4,5,6	3,4,5,6	160	160	Field Net
7/26		0.50	20.4139	10.7108							into 7,8	3,4,5,6	160	160	Field Net
7/28	0.49		22.00	11.36	pollinate	19.6	29.3	91.6	93.9	97.8	1,2	1,2	156	157	P & L
7/28			21.6285	11.1330							into3,4,5,6	3,4,5,6	160	160	Field Net
7/29		0.50	22.0513	11.5562							into 7,8	3,4,5,6	160	160	Field Net
7/30			23.2526	11.9788							into3,4,5,6	3,4,5,6	160	160	Field Net
7/31		0.50	23.6754	12.4016							into 7,8	3,4,5,6	160	160	Field Net
8/1	0.46		24.80	12.84							13,14	South	150		Curtis
8/2			24.8900	12.8241							into3,4,5,6	3,4,5,6	160	160	Field Net
8/2		0.50	25.3128	13.2469							into 7,8	3,4,5,6	160	160	Field Net
8/4	0.02		26.76	13.74	E. blister	16.1	21.4	89.0	96.3	98.2	1,2	1,2	158	155	C & L
8/4			26.9782	13.6695							into3,4,5,6	3,4,5,6	160	160	Field Net
8/5		0.50	27.4010	`4.0923							into 7,8	3,4,5,6	160	160	Field Net
8/5			27.46								7,8	7,8	155	151	C & L
8/7			28.6420	14.5149							into3,4,5,6	3,4,5,6	160	160	Field Net
8/7		0.50	29.0848	14.9377							into 7,8	3,4,5,6	160	160	Field Net
8/7			29.52	15.29							11,12	south	148		Curtis
8/8	0.03		29.52	15.29							11,12	south	148		Curtis
8/9			30.3191	15.3536							into3,4,5,6	3,4,5,6	155	155	Field Net

Table 21: Field Data for Stan Spain's "4 GPM" Demonstration Site, 211 bu/ac, SDI (continued)

Date	Rainfall (inches)	Irrigation (inches)	Filter Sta Meter AF	Field Meter AF	Growth Stage	Soil Moisture					Zone Irrigating	Crop Irrigating	Filter Sta. Meter GPM	Field Meter GPM	Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet					
8/10		0.50	30.7287	15.7632							into 7,8	3,4,5,6	155	155	Field Net
8/11	1.24		32.02	16.09	blister	14.6	17.9	86.1	95.9	98.2	15,16	south	145		Curtis
8/11			31.9233	16.1658							into3,4,5,6	3,4,5,6	150	150	Field Net
8/12		0.49	32.9137	16.5622							into 7,8	3,4,5,6	150	150	Field Net
8/14			33.5077	16.9582							into3,4,5,6	3,4,5,6	150	150	Field Net
8/15	0.11		33.66	17.45							4,5	3,4,5	157	155	Curtis
8/15		0.49	33.9041	17.3546							into 7,8	3,4,5,6	150	150	Field Net
8/17			35.03	18.03							1,2	1,2	154	152	Curtis
8/17			35.0987	17.7572							into3,5,6	3,4,5,6	155	155	Field Net
8/17			35.19	18.19							3,4	3,4,5	152	149	Curtis
8/18		0.50	35.5083	18.1668							into 7,8	3,4,5,6	150	150	Field Net
8/18	0.12		35.64	18.64	milk	14.6	16.5	84.2	94.9	97.7	7,8	7,8	148	140	C & L
8/19			36.29	18.66							15,16	15,16	143		Curtis
8/19			36.51	18.73							1,2	1,2	154	152	Curtis
8/19			36.7095	18.5761							into3,4,5,6	3,4,5	155	155	Field Net
8/20		0.51	37.1191	18.9857							into 7,8	3,4,5,6	155	155	Field Net
8/22			38.3401	19.689							into3,4,5,6	3,4,5,6	150	150	Field Net
8/22			38.33	19.76							3,4	3,4,5	155	150	Curtis
8/23		0.49	38.7365	20.0854							into 7.8	3,4,5,6	150	150	Field Net
8/23			39.03	20.26							9,10	9,10	150		Curtis
8/23			39.14	20.26							11,12	11,12	147		Curtis
8/23											pause				Field Net
8/25	0.13		39.17	20.26	dough	19.7	15.4	83.8	93.6	97.8	off		off		C & L
8/27			39.17	20.26							1,2	1,2	start		Field Net
8/27			39.4643	20.4814							into3,4,5,6	3,4,5,6	150	150	Field Net
8/28		0.49	39.8607	20.8778							into 7,8	3,4,5,6	150	150	Field Net
8/30			41.049	21.27.38							into3,4,5,6	3,4,5,6	150	150	Field Net
8/30	0.55		41.14	21.42							4,5	3,4,5	159	162	Curtis
8/30		0.49	41.4454	21.6702							into 7,8	3,4,5,6	150	150	Field Net
9/1											into 1,2	pause			Field Net
9/2			42.38	26.85	dough	53.9	14.6	84.1	93.2	98.0	off	off			C & L
9/5											start	1,2			Field Net
9/5			42.6346	22.0134							into3,4,5,6	3,4,6	150	150	Field Net
9/6		0.70	42.9354	22.3569							into 7,8	3,4,6	150	150	Field Net
9/6			42.94	22.38							7,8	7,8	150	148	Curtis
9/6											7,8	stop	Tex-Zac		Field Net
9/8	0.21		43.00	22.43	⅓ mat line	69.7	18.0	82.4	92.9	97.7	off		off		C & L
9/8			43.00	22.43							start	7,8			Field Net
9/9			43.7273								stop	15,16			Field Net
9/12			43.91	22.55							off		off		Curtis
9/13			43.9253								start	1,2			Field Net
9/13			44.06	22.71							1,2	1,2	161	161	Curtis
9/13			44.1226	22.753							into3,4,5,6	3,4,5,6	150	150	Field Net
9/14		0.49	44.5184	23.1488							into 7,8	3,4,5,6	150	150	Field Net
9/14			44.59	23.23							7,8	7,8	147	149	Curtis
9/15	0.20		45.24	23.37	⅔mat line	66.6	21.5	71.7	91.2	96.2	13,14	13,14	151		C & L
9/15			45.51	23.37							15,16	15,16	144		Curtis
9/16			45.7064	23.5435							into3,4,5,6	3,4,6	150		Field Net
9/15		0.70	45.9703	23.8074							into 7,8	3,4,6	150	150	Field Net
9/18			47.1652	24.2100							into3,4,5,6	3,4,5,6	155	155	Field Net
9/19		0.51	47.5748								into 7,8	3,4,5,6	155	155	Field Net
9/19			47.76	24.76							9,10	9,10	150		Curtis
9/22	0.26		48.52	24.77	⅔ mat line	75.4	22.1	68.4	90.7	96.6	off		off		C & L
9/26			50.33	24.77							9,10	9,10	153		Curtis
9/27											stop	15,16			Field Net
9/27											start	1,2			Field Net
9/27			51.05	24.93							1,2	1,2	168	167	Curtis
2/27			51.1409	25.0228							3,4,5	3,4	150	150	Field Net
9/28		0.49	51.3390	25.2203							into 5,6	5,6			Field Net
7/16			51.71	25.49							7,8	7,8	151	151	C & L
9/28			51.93	25.813							into 3,4	3,4			Field Net
9/29		0.49	52.1298	26.011							into 5,6	3,4	150	150	Field Net
9/29	0.03		52.40	26.17	⅞ mat line	70.8	19.0	53.6	87.8	95.9	5,6	3,4,5	156	157	C & L
9/29			52.7226	26.4058							into 1,2	1,2			Field Net
9/29			52.7742	26.4576							stop	1,2			Field Net
10/3			52.87	26.56							off		off		Curtis
10/6			53.48	26.58	1.0 mat line	70.0	19.8	50.3	86.5	95.1	15,16	15,16	151		C & L
10/13	0.14		54.51	26.58	brown layer	62.7	18.1	47.9	84.8	94.0	off		off		Curtis
10/19			54.51	26.58	black layer	57.4	19.2	47.5	83.0	92.6	off		off		Curtis
10/21					harvest										Stan
10/27			54.51	26.60	harvested	55.7	18.5	47.6	83.3	91.4	off		off		Curtis
Total	7.01	16.46				0.87	1.46	0.96	0.48	0.28					
Net soil moisture is 4.05 inches.															
Rainfall (7.01 in), irrigation (16.46 in), and net soil moisture (4.05 in) equals is total water (27.52 in).															
*Numbers in red are not counted in the total.															

Figure 25: Gypsum Block Readings for Stan Spain's "5 GPM" Demonstration Site, 246 bu/ac, SDI

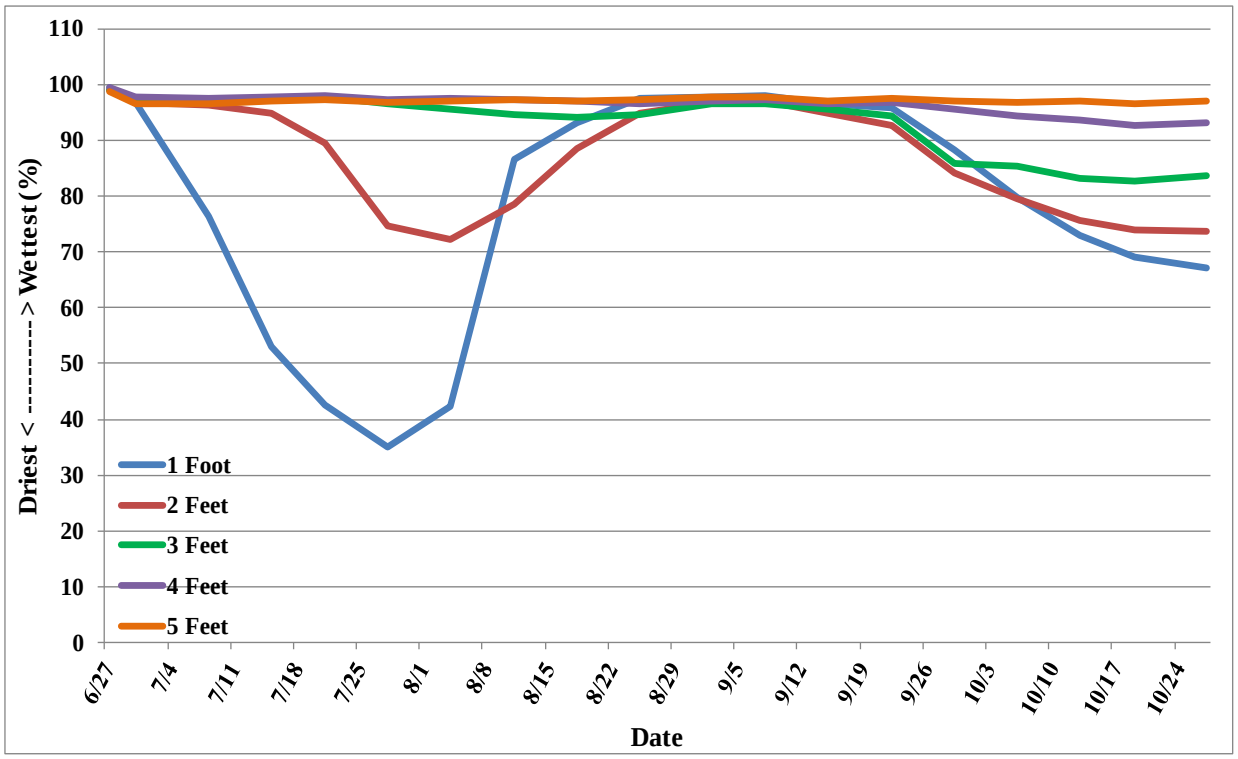


Figure 26: Growing Season Water Tracking for Stan Spain's "5 GPM" Demonstration Site, 246 bu/ac, SDI

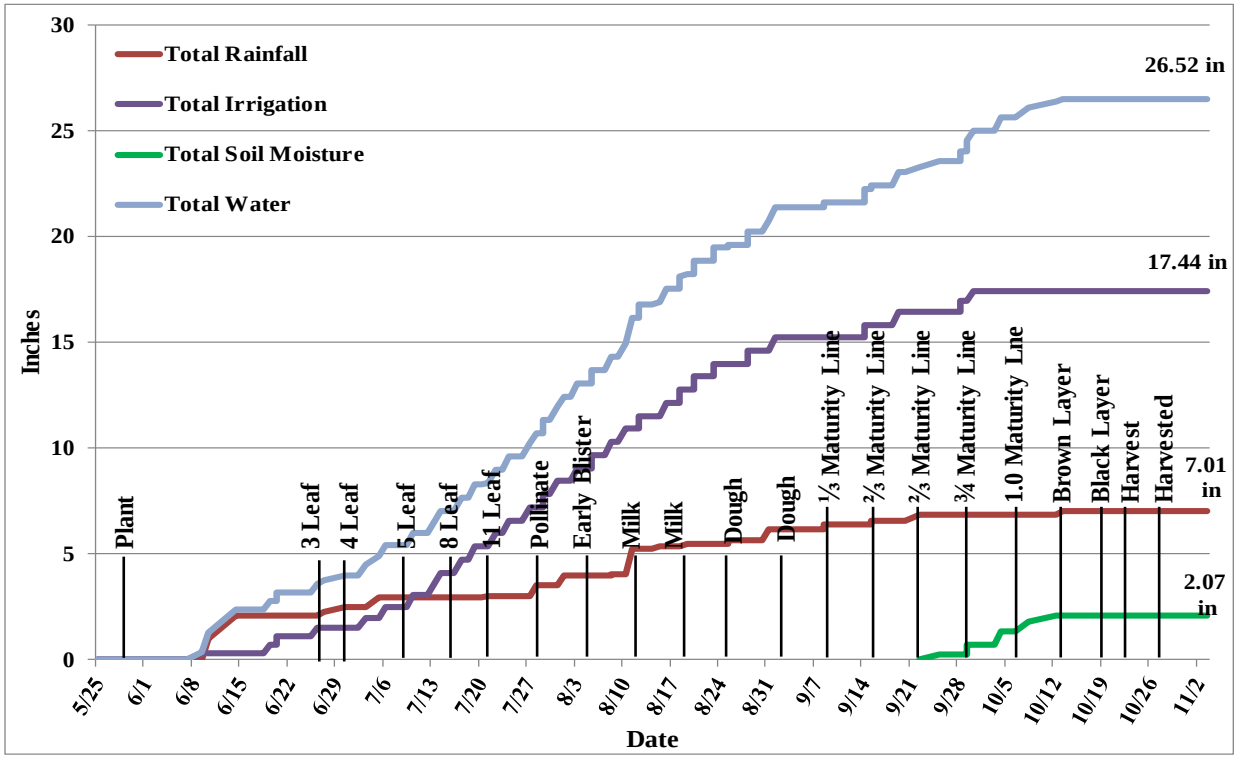


Table 22: Field Data for Stan Spain's "5 GPM" Demonstration Site, 246 bu/ac, SDI

Date	Rainfall (inches)	Irrigation (inches)	Filter Sta Meter AF	Field Meter AF	Growth Stage	Soil Moisture					Zone Irrigating	Crop Irrigating	Filter Sta. Meter GPM	Field Meter GPM	Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet					
2/1	0.19														Curtis
4/16	0.97														Pivotrac
4/17	0.34														Pivotrac
4/19	0.40														Pivotrac
4/28	1.48														Curtis
4/30	0.17														Pivotrac
5/12	0.60														Pivotrac
5/16	0.93														Pivotrac
5/17	0.14														Pivotrac
5/27					plant										Stan
5/30	0.02														Pivotrac
6/6			0.49	0.10											L & J
6/7															Pivotrac
6/9		0.31	1.08	0.61							1-8	3,4,5			Leon
6/10	0.95														Pivotrac
6/14	1.09														Pivotrac
6/18			2.72	0.94							5-8	5		300	Stan
6/19		0.40	3.05	1.26							5,6,7,8	5	300	295	Stan
6/19			3.37	1.58							5,6,7,8	5	290	290	Stan
6/20		0.39	3.69	1.90									290	290	Stan
6/20			3.69	1.90									off	off	Curtis
6/23													Repair		Jerry
6/25			4.77	2.29							5,6	5	175	175	Vieto
6/25		0.40	4.93	2.45							5,6	5	175	175	Vieto
6/27	0.20		5.09	2.62	3 leaf	99.6	99.0	99.0	99.5	98.8			off	off	C & L
6/30	0.24		5.10	2.63	4 leaf	96.8	96.9	97.4	97.7	96.7			off	off	C & L
7/2			5.50	3.03							5,6,7,8	5	305	305	Stan
7/2		0.49	5.90	3.42							5,6,78	5	305	305	Stan
7/5	0.42		6.82	3.54							1,2,3,4	3,4	315	310	Curtis
7/5			7.12	3.54							5,6,7,8	5	315	315	Stan
7/5		0.50	7.53	4.24							5,6,7,8	5	315	315	Stan
7/6			8.33	4.24											Leon
7/8			8.36	4.24	5 leaf	76.5	96.4	97.1	97.6	96.7	south	15,16	153		C & L
7/9			8.82	4.70							into 5,6	5,6	175	175	Field Net
7/9		0.57	9.05	4.93							into 7,8	5,6	175	175	Field Net
7/11			10.44	5.46									150	151	Curtis
7/11			10.39	5.48							into 5,6	5,6	160	160	Field Net
7/11		0.52	10.61	5.69							into 7,8	5,6	160	160	Field Net
7/13			12.03	6.29							into 5,6	5,6	160	160	Field Net
7/13		0.52	12.24	6.49							into 7,8	5,6	160	160	Field Net
7/15			13.36	7.05	8 leaf	53.0	95.0	97.4	97.8	97.1	south	13,14	146		C & L
7/16			13.46	6.81							into3,4,5,6	3,4,5,6	160	160	Field Net
7/166		0.62	13.88	7.33							into 7,8	3,4,5,6	160	160	Field Net
7/18			15.08	7.75							into3,4,5,6	3,4,5,6	160	160	Field Net
7/19		0.62	15.50	8.17							into 7,8	3,4,5,6	160	160	Field Net
7/20			16.72	8.60							into3,4,5,6	3,4,5,6	160	160	Field Net
7/21	0.10		17.28	9.72	11 leaf	42.5	89.5	97.7	98.1	97.4	3,4,5	3,4	160	161	C & L
7/21		0.62	17.14	9.02							into 7,8	3,4,5,6	160	160	Field Net
7/23			18.35	9.44							into3,4,5,6	3,4,5,6	160	160	Field Net
7/24		0.62	18.78	9.87							into 78	3,4,5,6	160	160	Field Net
7/26			19.99	10.29							into3,4,5,6	3,4,5,6	160	160	Field Net
7/26		0.62	20.41	10.71							into 7,8	3,4,5,6	160	160	Field Net
7/28	0.49		22.00	11.36	pollinate	35.1	74.6	96.6	97.3	96.8	1,2	1,2	156	157	P & L
7/28			21.63	11.13							into3,4,5,6	3,4,5,6	160	160	Field Net
7/29		0.62	22.05	11.56							into 7,8	3,4,5,6	160	160	Field Net
7/30			23.25	11.98							into3,4,5,6	3,4,5,6	160	160	Field Net
7/31		0.62	23.68	12.40							into 7,8	3,4,5,6	160	160	Field Net
8/1	0.46		24.80	12.84							south	13,14	150		Curtis
8/2			24.89	12.82							into3,4,5,6	3,4,5,6	160	160	Field Net
8/2		0.62	25.31	13.25							into 7,8	3,4,5,6	160	160	Field Net
8/4	0.02		26.76	13.74	E. blister	42.2	72.2	95.7	97.6	97.2	1,2	1,2	158	155	C & L
8/4			26.98	13.67							into3,4,5,6	3,4,5,6	160	160	Field Net
8/5		0.62	27.40	`4.0923							into 7,8	3,4,5,6	160	160	Field Net
8/5			27.46	14.44							7,8	7,8	155	151	C & L
8/7			28.64	14.51							into3,4,5,6	3,4,5,6	160	160	Field Net
8/7		0.62	29.08	14.94							into 7,8	3,4,5,6	160	160	Field Net
8/8	0.03		29.52	15.29							11,12	11,12	148		Curtis
8/9			30.32	15.35							into3,4,5,6	3,4,5,6	155	155	Field Net
8/10		0.62	30.73	15.76							into 7,8	3,4,5,6	155	155	Field Net

Table 22: Field Data for Stan Spain's "5 GPM" Demonstration Site, 246 bu/ac, SDI (continued)

Date	Rainfall (inches)	Irrigation (inches)	Filter Sta Meter AF	Field Meter AF	Growth Stage	Soil Moisture					Zone Irrigating	Crop Irrigating	Filter Sta. Meter GPM	Field Meter GPM	Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet					
8/11	1.24		32.02	16.09	milk	86.7	78.5	94.6	97.3	97.3	15,16	15,16	145		Curtis
8/11			31.92	16.17							into3,4,5,6	3,4,5,6	150	150	Field Net
8/12		0.61	32.91	16.56							into 7,8	3,4,5,6	150	150	Field Net
8/14			33.51	16.96							into3,4,5,6	3,4,5,6	150	150	Field Net
8/15	0.11		33.66	17.45							4,5	3,4,5	157	155	Curtis
8/15		0.61	33.90	17.35							into 7,8	3,4,5,6	150	150	Field Net
8/17			35.03	18.03							1,2	1,2	154	152	Curtis
8/17			35.10	17.76							into3,4,5,6	3,4,5	155	155	Field Net
8/17			35.19	18.19							3,4	3,4,5	152	149	Curtis
8/18		0.62	35.51	18.17							into 7,8	3,4,5,6	150	150	Field Net
8/18	0.12		35.64	18.64	milk	93.3	88.5	94.2	97.0	97.1	7,8	7,8	148	140	C & L
8/19			36.29	18.66							15,16	15,16	143		Curtis
8/19			36.51	18.73							1,2	1,2	154	152	Curtis
8/19			36.71	18.58							into3,4,5,6	3,4,5,6	155	155	Field Net
8/20		0.63	37.12	18.99							into 7,8	3,4,5,6	155	155	Field Net
8/22			38.34	19.69							into3,4,5,6	3,4,5,6	150	150	Field Net
8/22			38.33	19.76							3,4	3,4,5	155	150	Curtis
8/23		0.61	38.74	20.09							into 7,8	3,4,5,6	150	150	Field Net
8/23			39.03	20.26							9,10	9,10	150		Curtis
8/23			39.14	20.26							11,12	11,12	147		Curtis
8/23											pause				Field Net
8/25	0.13		39.17	20.26	dough	97.5	95.0	94.6	96.7	97.3	off			off	C & L
8/27			39.17	20.26							1,2	1,2	start		Field Net
8/27			39.46	20.48							into3,4,5,6	3,4,5,6	150	150	Field Net
8/28		0.61	39.86	20.88							into 7,8	3,4,5,6	150	150	Field Net
8/30			41.05	21.27.38							into3,4,5,6	3,4,5,6	150	150	Field Net
8/30	0.55		41.14	21.42							4,5	3,4,5	159	162	Curtis
8/30		0.61	41.45	21.67							into 7,8	3,4,5,6	150	150	Field Net
9/1											into 1,2	pause			Field Net
9/2			42.38	21.85	dough	97.9	96.9	96.5	97.2	97.7	off	off			C & L
9/5											start	1,2			Field Net
9/5			42.63	22.01							into3,4,5,6	3,4,6	150	150	Field Net
9/6			42.94	22.36							into 7,8	3,4,6	150	150	Field Net
9/6			42.94	22.38							7,8	7,8	150	148	Curtis
6/6											7,8	stop	Tex-Zac		Field Net
9/8	0.21		43.00	22.43	⅛ mat line	98.0	97.0	96.5	97.4	97.8	off			off	C & L
9/8			43.00	22.43							start	7,8			Field Net
9/9			43.73								stop	15,16			Field Net
9/12			43.91	22.55							off	off			Curtis
9/13			43.93								start	1,2			Field Net
9/13			44.06	22.71							1,2	1,2	161	161	Curtis
9/13			44.12	22.75							into3,4,5,6		150	150	Field Net
9/14		0.62	44.52	23.15							into 7,8	3,4,5,6	150	150	Field Net
9/14			44.59	23.23							7,8	7,8	148	151	Curtis
9/15	0.20		45.24	23.37	⅜ mat line	96.7	94.8	95.6	96.7	97.2	13,14	13,14	151		C & L
9/15			45.51	23.37							15,16	15,16	144		Curtis
9/16			45.71	23.54							into3,4,5,6	3,4,6			Field Net
9/16		0.00	45.97	23.81							into 7,8	3,4,6	150	150	Field Net
9/18			47.17	24.21							into3,4,5,6	3,4,5,6	155	155	Field Net
9/19		0.62	47.57								into 7,8	3,4,5,6	155	155	Field Net
9/19			47.76	24.76							9,10	9,10	150		Curtis
9/22	0.26		48.52	24.77	⅜ mat line	95.9	92.7	94.4	96.8	97.5	off		off		C & L
9/26			50.33	24.77							9,10	9,10	153		Curtis
9/27											stop	15,16			Field Net
9/27											start	1,2			Field Net
9/27			51.05	24.93							1,2	1,2	168	167	Curtis
9/28			51.34	25.22							into 5,6	5,6			Field Net
9/28		0.49	51.54	25.42							into 7,8	5,6	150	150	Field Net
9/28			51.71	25.49							7,8	7,8	151	151	C & L
9/29			52.13	26.01							into 5,6	3,4	150	150	Field Net
9/29	0.03		52.40	26.17	¾ mat line	88.3	84.2	85.9	95.6	97.2	5,6	3,4,5	156	157	C & L
9/29		0.49	52.33	26.21							into 7,8	5,6	150	150	Field Net
9/29			52.72	26.41							into 1,2	1,2			Field Net
9/29			52.77	26.46							stop	1,2			Field Net
10/3			52.87	26.56							off		off		Curtis
10/6			53.48	26.58	1.0 mat line	79.8	79.5	85.4	94.4	96.9	15,16	15,16	151		C & L
10/13	0.14		54.51	26.58	brown layer	73.0	75.7	83.3	93.6	97.0	off		off		Curtis
10/19			54.51	26.58	black layer	69.1	73.9	82.6	92.8	96.7	off		off		Curtis
10/21					harvest										Stan
10/27			54.51	26.60	harvested	67.1	73.8	83.7	93.1	97.0	off		off		Curtis
Total	7.01	17.44				0.74	0.64	0.44	0.20	0.05					
Net soil moisture is 2.07 inches.															
Rainfall (7.01 in), irrigation (17.44 in), and net soil moisture (2.07 in) is total water (26.52 in).															
*Numbers in red are not counted in the total.															

Harvest Results: The 3 GPM field produced a 191 bushel per acre corn yield. Irrigation totaled to 13.76 inches. Production in the 4 GPM field was 212 bushels per acre. Seasonal irrigation totaled to 16.46 inches. Corn yield was 246 bushels per acre for the 5 GPM field. Irrigation totaled to 17.44 inches. There was no pre-season irrigation. The 4 GPM field produced 21 more bushels per acre than the 3 GPM field. Irrigation was 2.70 inches more. The 5 GPM field produced 55 more bushels per acre than the 3 GPM with 3.68 more inches of irrigation. The 5 GPM yield was 34 more bushels per acre than that from 4 GPM field with 0.98 additional inches of irrigation.

Corn production was 13.88 bushels (833 lb) per inch of irrigation in the 3 GPM field compared to 12.88 bushels (773 lb) in the 4 GPM and 14.10 bushels (846 lb) from the 5 GPM field. Production from each inch of irrigation, rainfall, and net soil water that totaled to 26.26 inches was 7.27 bushels (436 lb) per acre in the 3 GPM field. Irrigation, rainfall, and net soil water totaled to 27.52 inches in the 4 GPM field where production was 7.70 bushels (462 lb) per inch. In the 5 GPM field, irrigation, rainfall, and net soil water totaled to 26.52 inches where production was 9.27 bushels (556 lb) per inch of total water.

Crop production costs were $36.17 per acre more for the 4 GPM field than for the 3 GPM from increased irrigation, fertilizer, and harvest expenses. At $3.44 per bushel, the 21 bushels per acre increased corn yield in the 4 GPM field amounts to $72.24 more per acre than from the 3 GPM field. The 4 GPM field's net gain is $36.07 per acre with 2.70 inches more irrigation used compared to production from the 3 GPM field. At $3.44 per bushel, the 55 bushels per acre increased yield from the 5 GPM field compared to the 3 GPM amounts to $189.20 per acre. Crop production costs were $74.39 per acre more for the 5 GPM field. The 5 GPM field's net gain compared to the 3 GPM field is $114.81 per acre with 3.68 additional inches of irrigation. Value of the 34 additional bushels produced in the 5 GPM field compared to the 4 GPM field is $116.96. Production costs were $38.22 more for the 5 GPM field than the 4 GPM.

Net gain for the 5 GPM field is $78.74 per acre with 0.98 inches more irrigation. Net return from the 3 GPM field was $264.83 per acre compared to $300.90 from the 4 GPM field, and $379.64 from the 5 GPM field. Net return from each inch of irrigation is $19.24 for the 3 GPM field compared to $18.28 from the 4 GPM and $21.77 for the 5 GPM field. A summary of the demonstration results is shown in Table 23 and Appendix B.

Table 23: Stan Spain's 2016 SDI Demonstration Results

GPM	Irrigation (in)	Total Water (in)	Production		Gross Crop Value @ $3.44/bu		
			bu/ac	lb/ac-in of Irrigation	per acre ($)	Acre-in of Irrigation ($)	Acre-in of Total Water
3	13.76	[a]26.26	191	833	657.04	47.75	25.02
4	16.46	[b]27.52	212	773	729.28	44.30	26.50
5	17.44	[c]26.52	246	846	846.24	48.52	31.90

[a]Includes 5.49 inches of soil water removed within 5 feet of soil, plus rainfall and irrigation

[b]Includes 4.05 inches of soil water removed within 5 feet of soil, plus rainfall and irrigation.

[c]Includes 2.07 inches of soil water removed within 5 feet of soil, plus rainfall and irrigation.

LEPA Center Pivot and SDI Harvest Demonstration Results: The 3 GPM LEPA field produced a 196 bushel per acre corn yield. Irrigation totaled 14.82 inches. Production in the 3 GPM SDI field was 191 bushels per acre. Seasonal irrigation totaled 13.76 inches. Corn yield was 217 bushels per acre for the 4 GPM LEPA field. Irrigation totaled 18.10 inches. Yield in the 4 GPM SDI field was 212 bushels per acre. Irrigation was 16.46 inches. Production in the 5 GPM LEPA field was 260 bushels per acre. Irrigation was 18.73 inches. Production in the 5 GPM SDI field was 246 bushels per acre. Irrigation totaled 17.44 inches. There was no pre-season irrigation. The 3 GPM LEPA field produced 5 more bushels per acre than the 3 GPM SDI field. Irrigation was 1.06 inches more. The 4 GPM LEPA field produced 5 more bushels per acre than the 4 GPM SDI with 1.64 more inches of irrigation. The 5 GPM LEPA yield was 14 more bushels per acre than that from 5 GPM SDI field with 1.29 additional inches of irrigation.

Corn production was 13.22 bushels (793 lb) per inch of irrigation in the 3 GPM LEPA field compared to 13.88 bushels (833 lb) in the 3 GPM SDI field. Yield was 11.99 bushels (719 lb) from the 4 GPM LEPA compared to 12.88 bushels (773 lb) from the 4 GPM SDI field. The 5 GPM LEPA field produced 13.88 bushels (833 lb) from each inch of irrigation. The 5 GPM SDI produced 14.10 bushels (846 lb) per inch.

Production from each inch of irrigation, rainfall, and net soil water that totaled 27.58 inches was 7.10 bushels (426 lb) per acre in the 3 GPM LEPA field. Irrigation, rainfall, and net soil water totaled 26.26 inches in the 3 GPM SDI field where production was 7.27 bushels (436 lb) per inch. In the 4 GPM LEPA field, irrigation, rainfall, and net soil water totaled 25.82 inches where production was 8.40 bushels (504 lb) per inch of total water. Irrigation, rainfall, and net soil water totaled 27.52 inches in the 4 GPM SDI field where production was 7.70 bushel (462 lb) from each inch. In the 5 GPM LEPA field, irrigation, rainfall, and net soil water totaled 29.52 inches from which production was 8.80 bushels (528 lb) per inch. From 26.52 inches of irrigation, rainfall, and net soil water, production in the 5 GPM SDI field was 9.27 (556 lb) from each inch.

Crop production costs were $11.12 per acre more for the 3 GPM LEPA than the 3 GPM SDI from increased irrigation, fertilizer, and harvest expenses. At $3.44 per bushel, the 5 bushels per acre increased corn yield in the 3 GPM LEPA field amounts to $17.20 more per acre than from the 3 GPM SDI field. The 3 GPM LEPA field's net gain is $6.08 per acre with 1.06 inches more irrigation used compared to the 3 GPM SDI field. At $3.44 per bushel, the 5 bushels per acre increased yield from the 4 GPM LEPA field compared to the 4 GPM SDI amounts to $17.20 per acre. Crop production costs were $14.62 per acre more for the 4 GPM LEPA field. The 4 GPM LEPA fields' net gain compared to the 4 GPM SDI field is $2.58 per acre with 1.64 additional inches of irrigation. Value of the 14 additional bushels produced in the 5 GPM LEPA field compared to the 5 GPM SDI field is $48.16. Production costs were $21.06 more for the 5 GPM LEPA field than the 5 GPM SDI. Net gain for the 5 GPM LEPA field is $27.10 per acre with 1.28 inches more irrigation.

Net return from the 3 GPM LEPA field was $270.91 per acre compared to $264.83 from the 3 GPM SDI field. Net return from the 4 GPM LEPA field was $303.48 and $300.90 from the 4 GPM SDI field. From the 5 GPM fields, net return was $405.66 from LEPA and $379.64 from SDI. Net return from each inch of irrigation is $18.28 for the 3 GPM LEPA field and $19.24 from the 3 GPM SDI.

Net return was $16.76 from each inch of irrigation from the 4 GPM LEPA field compared to $18.28 from the 4 GPM SDI. Net return from each inch of irrigation was $21.45 for the 5 GPM LEPA field and $21.77 for the 5 GPM SDI. A summary of the demonstration results is shown in Tables 23 and 35 and Appendix B.

Zac Yoder's 2016 Dallam County Demonstrations

Planting and Crop Information: Zac Yoder strip tilled and planted 98.70 acres of corn in the SE ¼ circle of Section 64, Y6, for his "3-4-5 Gallon Production Maximization" demonstration. Span 3 of the center pivot was renozzled at 3 GPM per acre to apply 1.10 inches each week, span 4 at 4 GPM per acre was renozzled to apply 1.49 inches each week, and span 5 at 5 GPM per acre was renozzled to apply 1.85 inches each week. Yoder planted each "3-4-5 Gallon Production Maximization" field to the Pioneer P1151AMX hybrid. Seeding rate was 32,000 for the 3 GPM field, 36,000 for the 4 GPM field, and 38,000 for 5 GPM field. Center pivot travel and position was monitored by Pivotrac®. Seasonal water meter readings averaged 308 GPM. Irrigation was with Senninger LDN LESA spray pads with drops spaced 60 inches apart. Planting and crop information for "Yoder 3 GPM", "Yoder 4 GPM", and "Yoder 5 GPM" fields are shown in Table 24 below.

Table 24: Planting and Crop Information for Zac Yoder

3 GPM Demonstration Site: Center Pivot Span 3			
Planted	May 14	**Harvest**	October 21
Hybrid	Pioneer P1151AMX	**Seeding Rate**	32,000
Row Width	30 inches	**Tillage**	Strip Till
No. Acres	75.70	**GPM per acre**	2.78
Total Water	26.98 inches	**Soil Type**	Perico fine sandy loan
Irrigation	14.84 inches	**Fertilizer**	N-224.2
4 GPM Demonstration Site: Center Pivot Span 4			
Planted	May 14	**Harvest**	October 21
Hybrid	Pioneer P1151AMX	**Seeding Rate**	36,000
Row Width	30 inches	**Tillage**	Strip Till
No. Acres	10.00	**GPM per acre**	3.71
Total Water	30.35 inches	**Soil Type**	Perico fine sandy loan
Irrigation	19.90 inches	**Fertilizer**	N-279.2
5 GPM Demonstration Site: Center Pivot Span 5			
Planted	May 14	**Harvest**	October 21
Hybrid	Pioneer P1151AMX	**Seeding Rate**	38,000
Row Width	30 inches	**Tillage**	Strip Till
No. Acres	12.93	**GPM per acre**	4.63
Total Water	34.21 inches	**Soil Type**	Perico fine sandy loan
Irrigation	25.19 inches	**Fertilizer**	N-334.2

Soil Water Profile and Growing Season Rainfall

"3 GPM" Demonstration Site: Gypsum block soil water sensors were installed prior to planting. They show good beginning soil moisture at 1, 2, 3, 4, and 5 feet. Periodic, timely rainfall in June helped maintain good soil moisture levels during early plant growth. Weekly gypsum block readings indicate the crop used most of the soil water at 2 feet in early July and 3 feet by mid-July during the high temperatures with limited to no beneficial rainfall. The soil water sensors show the plants developed

good root structure into 4 and 5 feet in August using all available water. The crop basically thrived on available water in the 1-foot root zone in September, finishing the crop. Gypsum block moisture sensors show the crop had adequate soil water during the growing season. The soil profile had limited available soil water at 3, 4, and 5 feet at the grain maturity black layer. Soil water sensors show 4.30 inches of net soil water was used in producing the crop. Total rainfall from planting until grain black layer totaled to 7.84 inches, and was less than normal, especially in July. The crop was produced in Perico fine sandy loam soil that can store approximately 1.80 inches of available water per foot for potential crop use.

"4 GPM" Demonstration Site: Initial gypsum block moisture sensor readings show soil water was good at 1, 2, 3, 4, and 5 feet prior to planting and at the beginning of the growing season. Weekly gypsum block readings show the soil profile to be full during early plant development in June. The crop began to use more water than irrigation and rainfall provided by early July. Pre-season soil water stored at both 2 and 3 feet in the soil profile root zone was mostly used by late July. Plant roots continued to seek available water at 4 feet and into 5 feet, in addition to the water rainfall and irrigation provided. Sensors show that 2.61 more inches of soil water, mostly at 3, 4, and 5 feet were used producing the crop than rainfall and irrigation provided. Total rainfall from planting through the black layer totaled to 7.84 inches, which was less than normal, especially in July for this location. The crop was produced in Perico fine sandy loam soil that holds approximately 1.80 inches available water per foot for potential crop use.

"5 GPM" Demonstration Site: Beginning soil water sensor readings show soil moisture was 95% to 100% at 1, 2, 3, 4, and 5 feet prior to planting and at crop emergence. Soil water levels remained full throughout early plant growth in June. More water than irrigation and rainfall provided was needed in mid-July when roots developed into 2 and 3 feet using 60% to 70% of the water stored at those depths by early August. Plants continued to search for additional water at 4 and 5 feet which contributed to the 252 bushels per acre harvest. Limited rainfall in September helped finish the crop. Moisture sensors show the crop had sufficient available soil water during the entire growing season. The sensors show plants used 1.18 more inches of soil water from 5 feet than rainfall and irrigation provided producing the crop. Total rainfall was 7.84 inches, and was especially limited in July during 100-degree temperatures. The crop was produced in Perico fine sandy loam that holds approximately 1.80 inches of available water per foot for potential crop use.

Table 25: Monthly Rainfall Data for Zac Yoder

GPM	May (in)	June (in)	July (in)	August (in)	September (in)	Total (in)
3, 4, 5	1.83	2.21	0.55	1.95	1.30	7.84

Growing Season Water Tracking: The District tracked total water and crop growth throughout the growing season using rain gauges, water meters, and both gypsum blocks and Aquaspy® soil moisture sensors. One set of 5 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 4 feet in the root zone at 1 location to monitor soil water levels in the 3 GPM-Early field. Another set of the same type of sensors was installed in each 3, 4, and 5 GPM field. Both the gypsum block sensors and the soil probe were installed in close proximity to each other in each field. Gypsum blocks, water meters, rain gauges, and crop growth were read, recorded, and utilized weekly by district personnel. A 24/7 Aquaspy® probe website shows soil moisture at 4-inch increments to 48 inches and monitors plant root growth. The website lists all

Aquaspy® soil probes in the “3-4-5 Gallon Production Maximization” project and is available to all cooperators and district personnel. Another 24/7 Pivotrac® website tracks each center pivot, monitors system position and travel, and provides information to make irrigation management strategies. Both the cooperating grower and District “3-4-5 Gallon Production Maximization” project leader collectively monitored, controlled, and managed irrigation from the Pivotrac® website.

Following this paragraph, a series of graphs and tables show weekly gypsum block readings for the season; the growing season’s water, including rainfall, irrigation, and soil moisture at various growth stages; and the order of irrigation and rainfall events for each “3-4-5 Gallon Production Maximization” field. Finally, a form describes the protocols for each field. “Total Water,” as shown on the graph for “Growing Season Water Tracking” is the sum of seasonal irrigation, rainfall, and net soil water. Graphs and tables for the 3 GPM acres are shown first, followed by the same illustrations for each 4 GPM and 5 GPM field.

Figure 27: Gypsum Block Readings for Zac Yoder's "3 GPM" Demonstration Site, 203 bu/ac

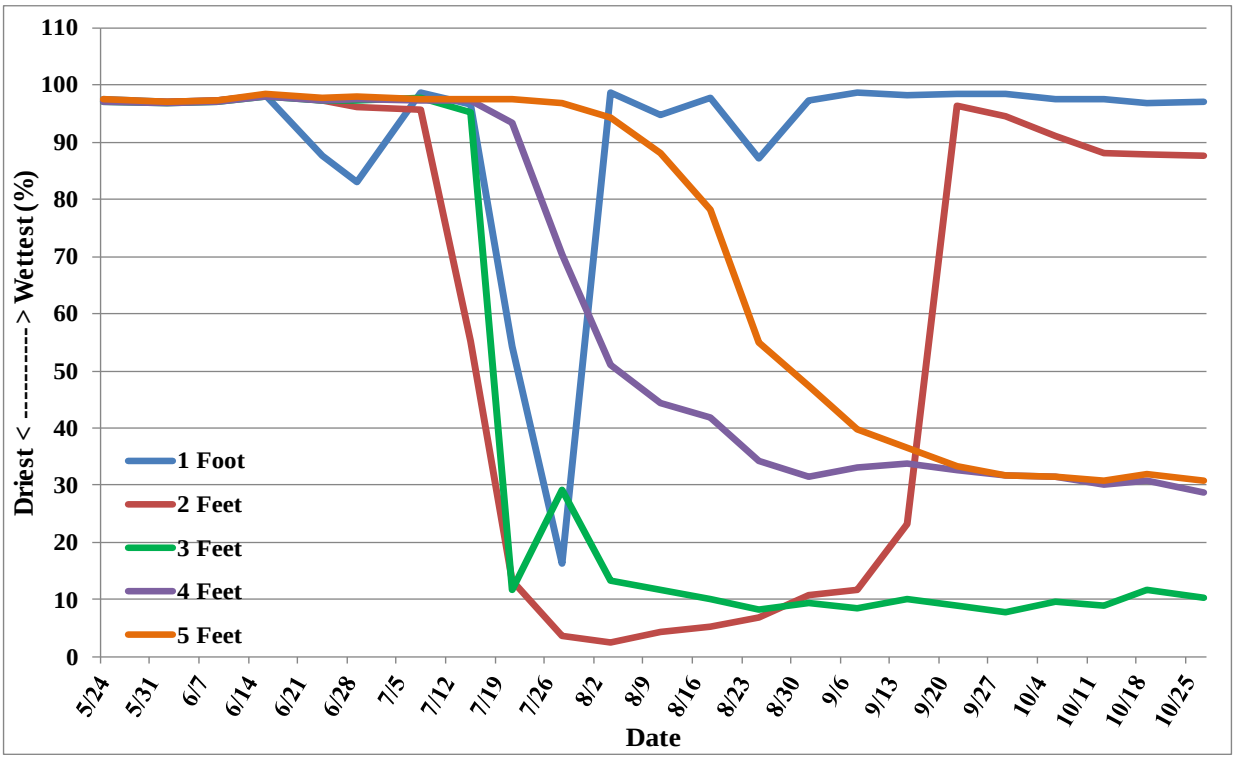


Figure 28: Growing Season Water Tracking for Zac Yoder's "3 GPM" Demonstration Site, 203 bu/ac

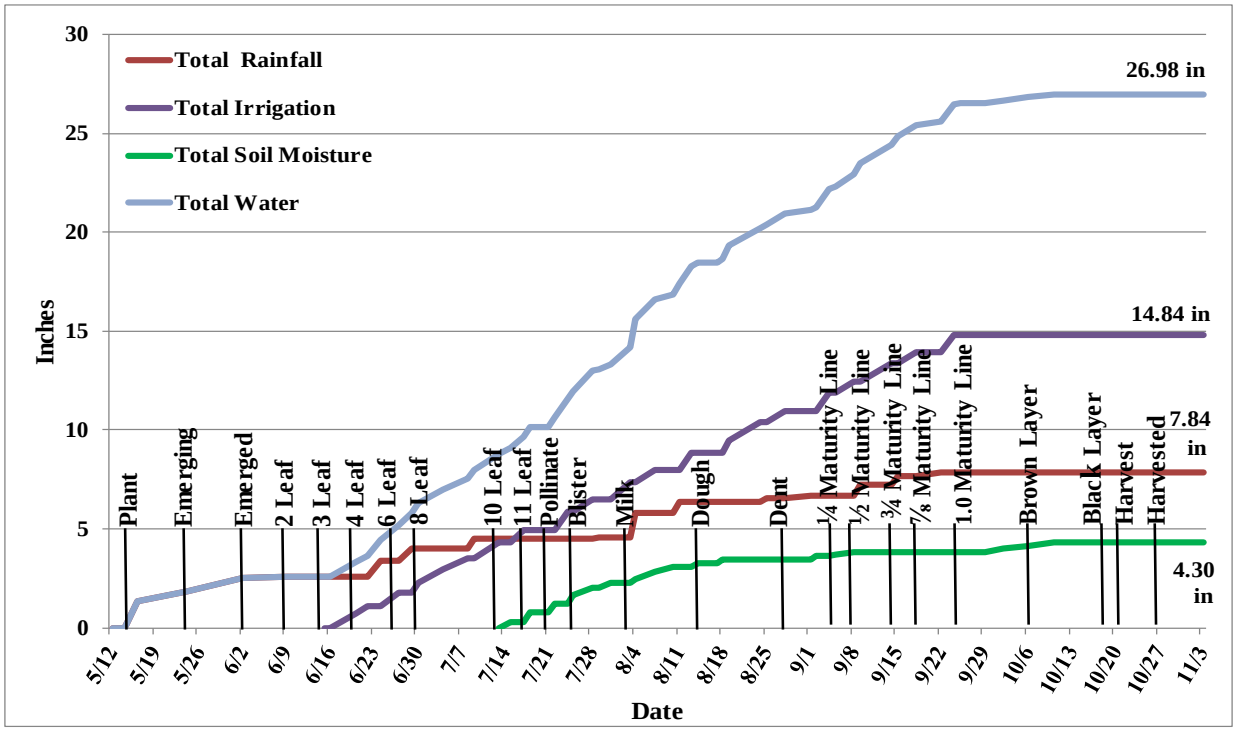


Table 26: Field Data for Zac Yoder's "3 GPM" Demonstration Site, 203 bu/ac

Date	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well GPM	Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
4/16	0.69													Pivotrac
4/19	0.50													Pivotrac
4/29	0.34													Pivotrac
4/30	0.22													Pivotrac
5/12	0.39													Pivotrac
5/14					plant									Zac
5/16	1.35													Pivotrac
5/24	0.48		143.84	13456.10	emerging	97.6	97.4	97.2	97.1	97.5	156	off		L & C
6/2	0.67		143.84	13456.10	emerged	97.1	97.0	96.8	96.8	97.1	156	off		L & C
6/9	0.07		143.84	13456.10	2 leaf	97.4	97.3	97.1	97.0	97.4	156	off		L & C
6/15			143.84	13456.10	3 leaf						156	start cw		Pivotrac
6/16			145.45	13482.00	3 leaf	98.3	98.3	98.1	98.0	98.4	223	3,4,5	336	L & C
6/20			150.85		4 leaf						90	3,4,5	329	Leon
6/22			153.85		4 leaf						156	3,4,5	314	Leon
6/24	0.81		156.80	13673.10	4 leaf	87.6	97.4	97.3	97.4	97.7	287	3,4,5	315	L & C
6/27			160.50		6 leaf						90	3,4,5	314	Leon
6/29	0.66		163.62	13787.50	6 leaf	83.1	96.1	97.4	97.6	98.1	231	3,4,5	309	L & C
6/30		0.75	164.86		8 leaf						156	3,4,5	317	Leon
7/4		0.32	171.30		8 leaf						90	3,4,5	325	Leon
7/8			176.43		8 leaf						156	3,4,5	317	Leon
7/8	0.44	0.72	176.12	14004.40	8 leaf	98.6	95.8	97.7	97.4	97.5	161	3,4,5	297	L & C
7/13			184.08		10 leaf						90	3,4,5	314	Leon
7/15		0.47	185.67	14171.50	10 leaf	96.7	55.1	95.3	97.4	97.6	331	3,4,5	307	L & C
7/17		0.69	189.61		11 leaf						156	3,4,5	314	Leon
7/21		0.55	193.64	14312.20	pollinate	54.3	13.3	11.7	93.5	97.6	329	3,4,5	311	L & C
7/24			198.29		blister							3,4,5	314	Leon
7/28		0.82	203.98		blister						156	3,4,5	300	Leon
7/28	0.11		203.20	14479.30	blister	16.2	3.6	29.1	70.4	96.8	182	3,4,5	299	L & C
8/3		0.60	212.06		milk						90	3,4,5	300	Leon
8/4	1.22		212.91	14647.70	milk	98.6	2.5	13.2	51.1	94.3	340	3,4,5	314	L & C
8/7		0.94	217.89		milk						156	3,4,5	300	Leon
8/11	0.53	0.61	222.24	14812.70	milk	94.8	4.2	11.6	44.4	88.0	12	3,4,5	315	Curtis
8/13			224.95		dough						90	3,4,5	314	Leon
8/16		0.87									256	stop		Pivotrac
8/17											256	start cw		Pivotrac
8/18	0.02	0.63	230.16	14945.50	dough	97.8	5.2	10.1	41.9	78.1	172	3,4,5	321	L & C
8/18			231.08		dough						156	3,4,5	314	Leon
8/24		0.87	339.33		dough						90	3,4,5	300	Leon
8/25	0.18		240.11	15112.40	dough	87.1	6.9	8.3	34.3	55.0	44	3,4,5	308	L & C
8/28			24.82		dent						156	3,4,5	314	Leon
9/1	0.14		249.46	15271.90	dent	97.3	10.8	9.4	31.5	47.3	327	3,4,5	304	L & C
9/4		0.66	253.47		¼ mat line						90	3,4,5	314	Leon
9/8		0.89	258.45		½ mat line						156	3,4,5	314	Leon
9/8	0.54		258.92	15443.60	½ mat line	98.8	11.7	8.5	33.1	39.7	182	3,4,5	298	L & C
9/14		0.59	266.97		¾ mat line						90	3,4,5	314	Leon
9/15	0.46		268.59	15611.80	¾ mat line	98.3	23.1	10.1	33.7	36.6	340	3,4,5	309	L & C
9/18		0.93	272.20		⅞ mat line						156	3,4,5	300	Leon
9/22	0.16	0.55	278.14	15782.20	⅞ mat line	98.4	96.3	8.9	32.6	33.3	23	3,4,5	288	L & C
9/24			280.26		1.0 mat line						90	3,4,5	300	Leon
9/24		0.92	280.61		1.0 mat line						69	stop	300	Pivotrac
9/29			280.40	15824.00	1.0 mat line	98.5	94.5	7.8	31.7	31.7	69	off		L & C
10/6		0.56	280.40	15824.00	brown layer	97.6	91.2	9.6	31.5	31.5	69	off		L & C
10/13			280.40	15824.00	brown layer	97.5	88.0	8.9	30.1	30.9	69	off		L & C
10/19		0.87	280.40	15824.00	black layer	96.9	87.8	11.7	30.8	31.9	69	off		Curtis
10/21		0.03			harvest									Zac
10/27			280.40	15824.90	harvested	97.1	87.6	10.4	28.7	30.9	89	off		Curtis
Total	7.84	14.84				0.00	0.47	1.52	1.17	1.14				Leon
Net soil moisture is 4.30 inches.														
Rainfall (7.84 in), irrigation (14.84 in). and soil moisture (4.30 in) is total water (26.98 in).														
*Numbers in red are not counted in the total rainfall.														

Figure 29: Gypsum Block Readings for Zac Yoder's "4 GPM" Demonstration Site, 239 bu/ac

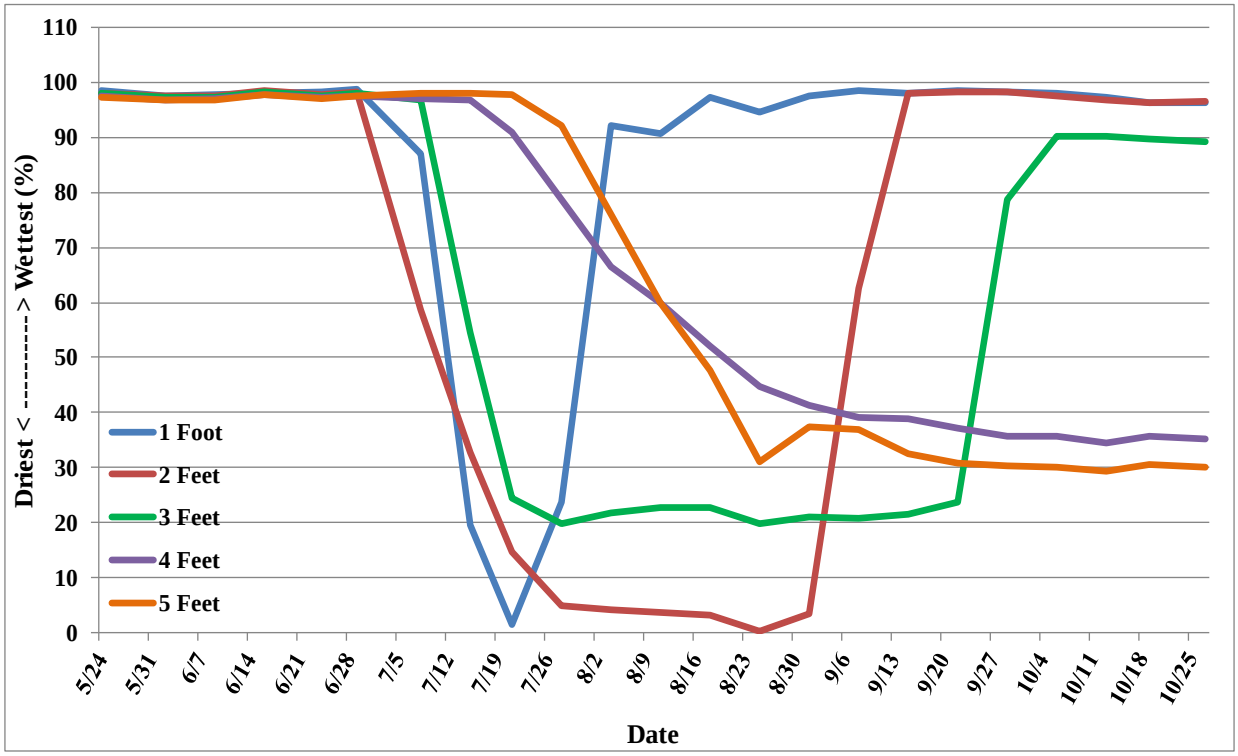


Figure 30: Growing Season Water Tracking for Zac Yoder's "4 GPM" Demonstration Site, 239 bu/ac

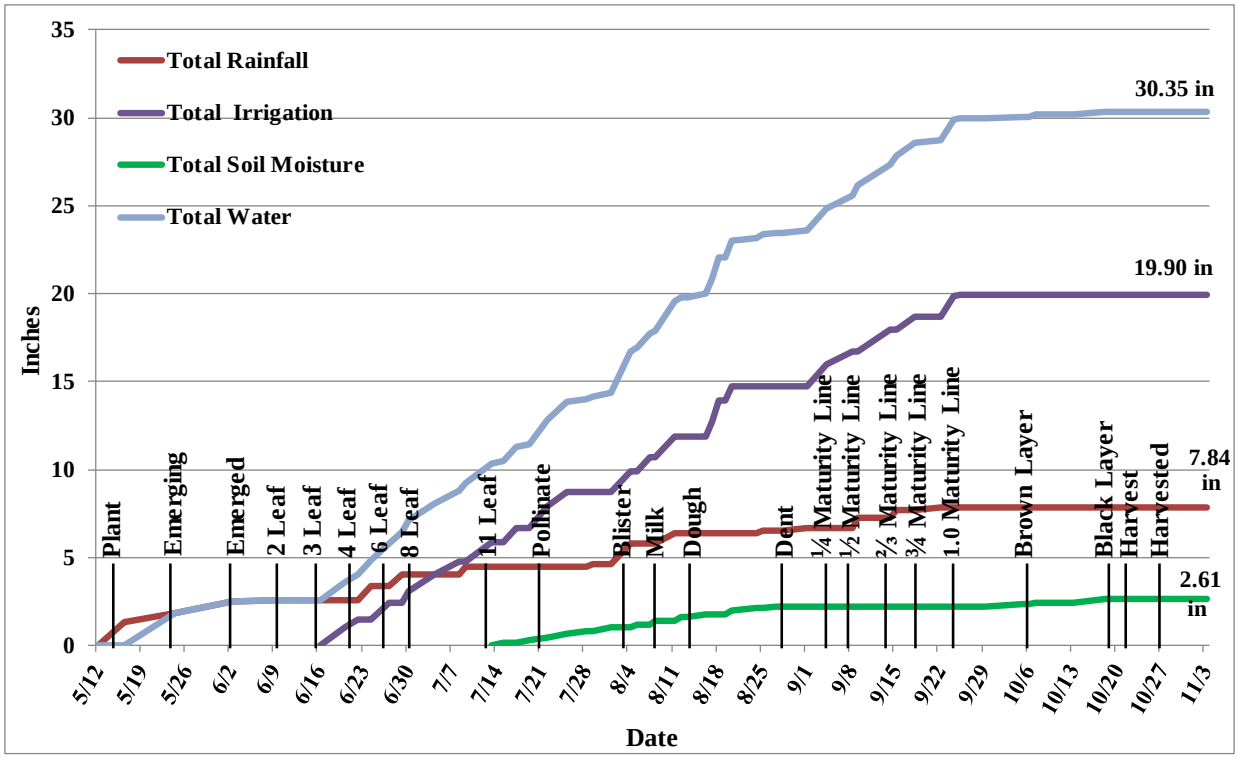


Table 27: Field Data for Zac Yoder's "4 GPM" Demonstration Site, 239 bu/ac

Date	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well GPM	Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
4/16	0.69													Pivotrac
4/19	0.50													Pivotrac
4/29	0.34													Pivotrac
4/30	0.22													Pivotrac
5/12	0.39													Pivotrac
5/14					plant									Zac
5/16	1.35													Pivotrac
5/24	0.48		143.84	13456.10	emerging	98.4	98.1	97.9	97.4	97.2	156	off		L & C
6/2	0.67		143.84	13456.10	emerged	97.5	97.4	97.2	96.8	96.7	156	off		L & C
6/9	0.07		143.84	13456.10	2 leaf	97.7	97.6	97.3	97.0	96.8	156	off		L & C
6/15			143.84	13456.10	2 leaf						156	start cw		Pivotrac
6/16			145.45	13482.00	3 leaf	98.1	98.4	98.2	97.8	97.7	223	3,4,5	336	L & C
6/20		1.02	150.85		3 leaf						90	3,4,5	329	Leon
6/22		0.44	153.85		4 leaf						156	3,4,5	314	Leon
6/24	0.81		156.80	13683.10	4 leaf	98.2	97.8	97.6	97.3	97.1	287	3,4,5	315	L & C
6/27		0.97	160.50		6 leaf						90	3,4,5	314	Leon
6/29	0.66		163.62	13787.50	6 leaf	98.8	98.3	98.0	97.6	97.4	231	3,4,5	309	L & C
6/30		0.64	164.86		8 leaf						156	3,4,5	317	Leon
7/4		0.94	171.30		8 leaf						90	3,4,5	325	Leon
7/8		0.75	176.43		8 leaf						156	3,4,5	317	Leon
7/8	0.44		176.12	14004.40	8 leaf	86.9	58.7	96.7	97.1	97.9	161	3,4,5	297	L & C
7/13		1.10	184.08		11 leaf						90	3,4,5	314	Leon
7/15			185.67	14171.50	11 leaf	19.6	32.8	54.4	96.9	97.9	331	3,4,5	307	L & C
7/17		0.80	189.61		11 leaf						156	3,4,5	314	Leon
7/21			193.64	14312.20	pollinate	1.5	14.7	24.4	91.0	97.7	329	3,4,5	311	L & C
7/24		1.25	198.29		pollinate						90	3,4,5	314	Leon
7/28		0.81	203.98		pollinate						156	3,4,5	300	Leon
7/28	0.11		203.20	14479.30	pollinate	23.8	5.0	19.8	78.7	92.1	182	3,4,5	299	L & C
8/3		1.16	212.06		blister						90	3,4,5	300	Leon
8/4	1.22		212.91	14647.70	blister	92.2	4.1	21.7	66.5	76.0	340	3,4,5	314	L & C
8/7		0.83	217.89		milk						156	3,4,5	300	Leon
8/11	0.53		222.24	14812.70	milk	90.7	3.8	22.7	59.9	59.8	12	3,4,5	315	Curtis
8/13		1.16	224.95		dough						90	3,4,5	314	Leon
8/16											256	stop		Pivotrac
8/17											256	start cw		Pivotrac
8/18	0.02		230.16	14945.50	dough	97.2	3.1	22.7	52.1	47.6	172	3,4,5	321	L & C
8/18		0.88	231.08		dough						156	3,4,5	314	Leon
8/24		1.18	339.33		dough						90	3,4,5	300	Leon
8/25	0.18		240.11	15112.40	dough	94.5	0.2	19.9	44.8	31.0	44	3,4,5	308	L & C
8/28		0.79	244.82		dent						156	3,4,5	314	Leon
9/1	0.14		249.46	15271.90	dent	97.6	3.4	21.0	41.4	37.5	327	3,4,5	304	L & C
9/4		1.25	253.47		¼ mat line						90	3,4,5	314	Leon
9/8		0.74	258.45		½ mat line						156	3,4,5	314	Leon
9/8	0.54		258.92	15443.60	½ mat line	98.6	62.7	20.8	39.1	37.0	182	3,4,5	298	L & C
9/14		1.23	266.97		⅔ mat line						90	3,4,5	314	Leon
9/15	0.46		268.59	15611.80	⅔ mat line	98.1	97.9	21.5	38.8	32.6	340	3,4,5	309	L & C
9/18		0.75	272.20		¾ mat line						156	3,4,5	300	Leon
9/22	0.16		278.14	15782.20	¾ mat line	98.4	98.3	23.8	37.1	30.8	23	3,4,5	288	L & C
9/24		1.16	280.26		1.0 mat line						90	3,4,5	300	Leon
9/24		0.05	280.61		1.0 mat line						69	stop	300	Pivotrac
9/29			280.40	15824.00	1.0 mat line	98.3	98.2	78.6	35.8	30.3	69	off		L & C
10/6			280.40	15824.00	brown layer	97.9	97.4	90.1	35.6	30.1	69	off		L & C
10/13			280.40	15824.00	brown layer	97.3	96.8	90.2	34.5	29.3	69	off		L & C
10/19			280.40	15824.00	black layer	96.3	96.2	89.7	35.8	30.5	69	off		Curtis
10/21					harvest									Zac
10/27			280.40	15824.90	harvested	96.4	96.5	89.2	35.2	30.0	89	off		Curtis
Total	7.84	19.90				0.16	0.25	0.43	0.59	1.18				
Net soil moisture is 2.61 inches.														
Irrigation (7.84 in), rainfall (19.90 in), and soil moisture (2.61 in) is total water (30.35 in).														
*Numbers in red are not counted in the total rainfall.														

Figure 31: Gypsum Block Readings for Zac Yoder's "5 GPM" Demonstration Site, 252 bu/ac

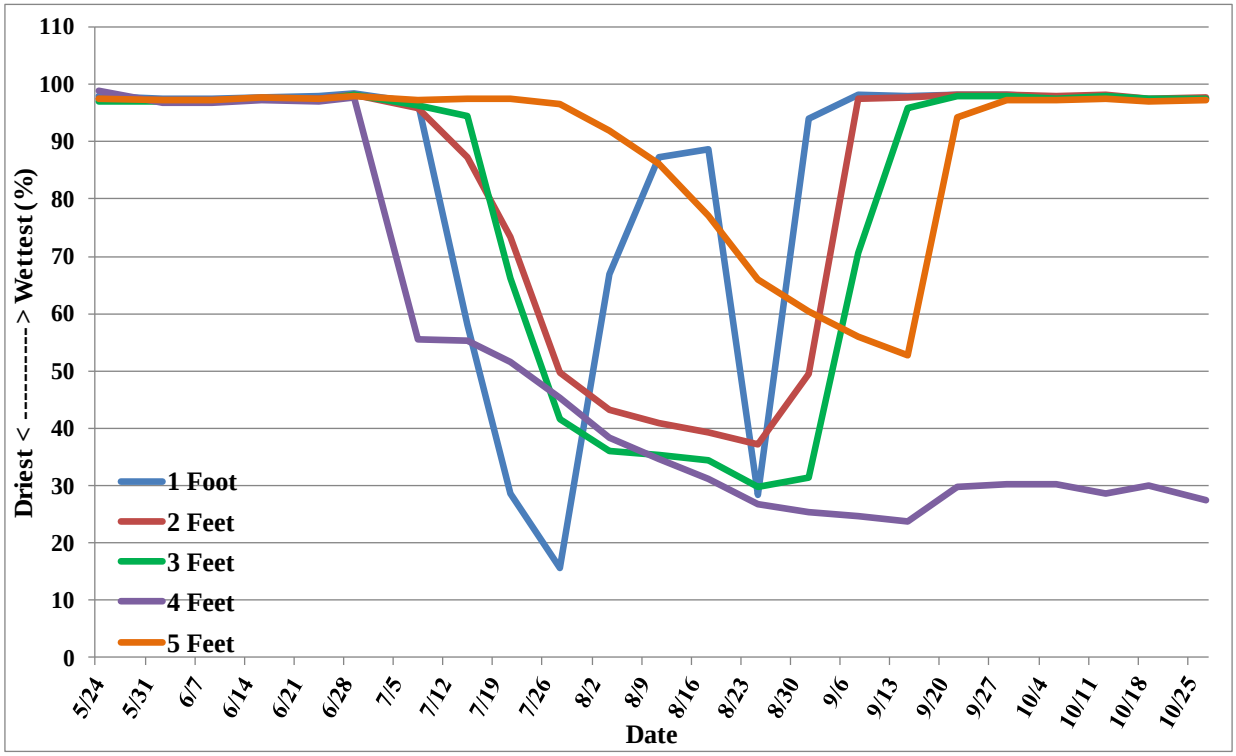


Figure 32: Growing Season Water Tracking for Zac Yoder's "5 GPM" Demonstration Site, 252 bu/ac

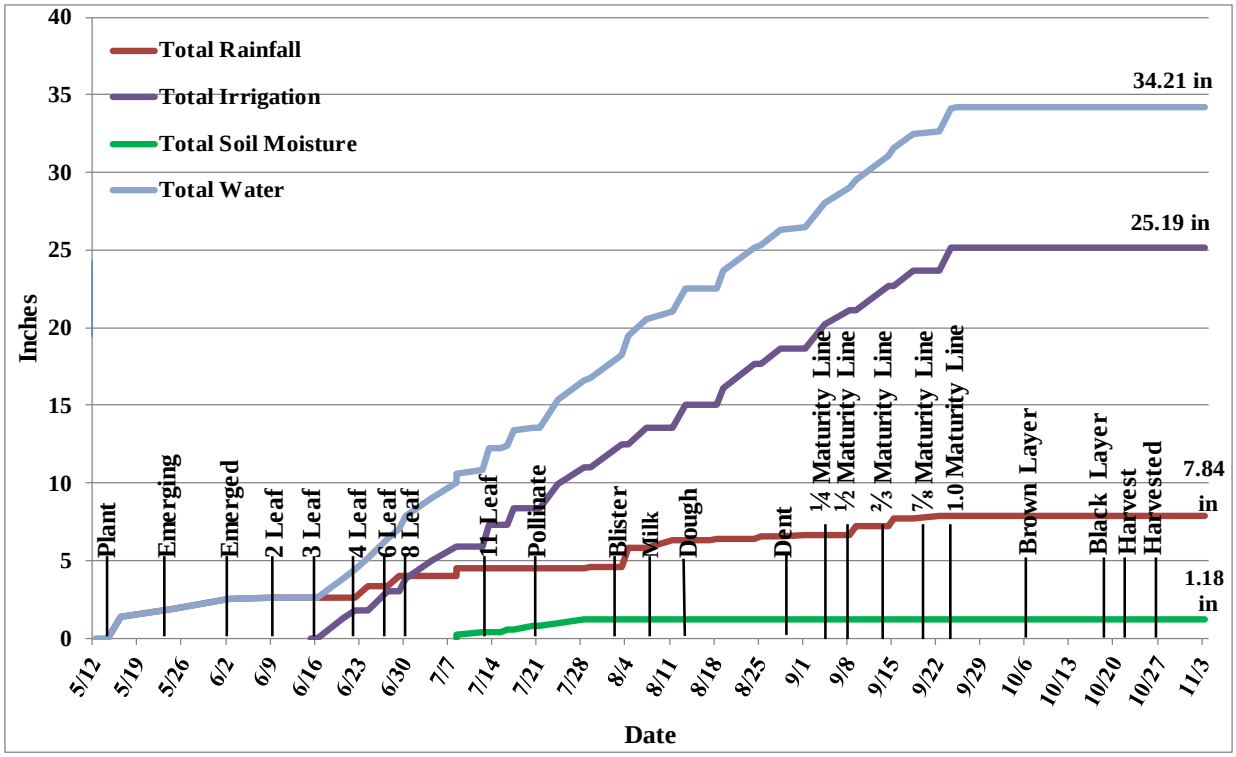


Table 28: Field Data for Zac Yoder's "5 GPM" Demonstration Site, 252 bu/ac

Date	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well GPM	Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
4/16	0.69													Pivotrac
4/19	0.50													Pivotrac
4/29	0.34													Pivotrac
4/30	0.22													Pivotrac
5/12	0.39													Pivotrac
5/14					plant									Zac
5/16	1.35													Pivotrac
5/24	0.48		143.84	13456.10	emerging	98.0	97.6	97.0	98.9	97.6	156	off		L & C
6/2	0.67		143.84	13456.10	emerged	97.5	97.3	97.1	96.8	97.3	156	off		L & C
6/9	0.07		143.84	13456.10	2 leaf	97.5	97.2	97.0	96.8	97.3	156	off		L & C
6/15			143.84	13456.10	2 leaf						156	start cw		Pivotrac
6/16			145.45	13482.00	3 leaf	97.8	97.6	97.4	97.2	97.7	223	3,4,5	336	L & C
6/20		1.27	150.85		3 leaf						90	3,4,5	329	Leon
6/22		0.55	153.85		4 leaf						156	3,4,5	314	Leon
6/24	0.81		156.80	13673.10	4 leaf	98.0	97.6	97.3	97.1	97.6	287	3,4,5	315	L & C
6/27		1.21	160.50		6 leaf						90	3,4,5	314	Leon
6/29	0.66		163.62	13787.50	6 leaf	98.4	98.2	98.2	97.7	97.9	231	3,4,5	309	L & C
6/30		0.79	164.86		8 leaf						156	3,4,5	317	Leon
7/4		1.19	171.30		8 leaf						90	3,4,5	325	Leon
7/8		0.93	176.43		8 leaf						156	3,4,5	317	Leon
7/8	0.44		176.12	14004.40	8 leaf	96.7	95.8	96.4	55.5	97.3	161	3,4,5	297	L & C
7/13		1.40	184.08		11 leaf						90	3,4,5	314	Leon
7/15			185.67	14171.50	11 leaf	58.1	87.4	94.4	55.2	97.4	331	3,4,5	307	L & C
7/17		1.01	189.61		11 leaf						156	3,4,5	314	Leon
7/21			193.64	14312.20	pollinate	28.5	73.4	66.2	51.6	97.4	329	3,4,5	311	L & C
7/24		1.59	198.29		pollinate						90	3,4,5	314	Leon
7/28		1.04	203.98		pollinate						156	3,4,5	300	Leon
7/28	0.11		203.20	14479.30	pollinate	15.7	49.8	41.5	45.4	96.5	182	3,4,5	299	L & C
8/3		1.48	212.06		blister						90	3,4,5	300	Leon
8/4	1.22		212.91	14647.70	blister	66.9	43.2	36.1	38.4	92.0	340	3,4,5	314	L & C
8/7		1.07	217.89		milk						156	3,4,5	300	Leon
8/11	0.53		222.24	14812.70	milk	87.3	40.9	35.4	34.7	86.2	12	3,4,5	315	Curtis
8/13		1.47	224.95		dough						90	3,4,5	314	Leon
8/16											256	stop		Pivotrac
8/17											256	start		Pivotrac
8/18	0.02		230.16	14945.50	dough	88.6	39.2	34.4	31.2	77.2	172	3,4,5	321	L & C
8/18		1.12	231.08		dough						156	3,4,5	314	Leon
8/24		1.51	339.33		dough						90	3,4,5	300	Leon
8/25	0.18		240.11	15112.40	dough	28.3	37.1	29.7	26.8	65.9	44	3,4,5	308	L & C
8/28		1.00	244.82		dent						156	3,4,5	314	Leon
9/1	0.14		249.46	15271.90	dent	94.1	49.4	31.4	25.4	60.5	327	3,4,5	304	L & C
9/4		1.58	253.47		¼ mat line						90	3,4,5	314	Leon
9/8		0.94	258.45		½ mat line						156	3,4,5	314	Leon
9/8	0.54		258.92	15443.60	½ mat line	98.3	97.5	70.6	24.6	56.0	182	3,4,5	298	L & C
9/14		1.56	266.97		⅔ mat line						90	3,4,5	314	Leon
9/15	0.46		268.59	15611.80	⅔ mat line	98.0	97.7	95.9	23.8	52.7	340	3,4,5	309	L & C
9/18		0.95	272.20		⅞ mat line						156	3,4,5	300	Leon
9/22	0.16		278.14	15782.20	⅞ mat line	98.1	98.2	97.9	29.7	94.2	23	3,4,5	288	L & C
9/24		1.47	280.26		1.0 mat line						90	3,4,5	300	Leon
9/24		0.06	280.61		1.0 mat line						69	stop	300	Pivotrac
9/29			280.4	15824.00	1.0 mat line	98.1	98.2	97.9	30.3	97.3	69	off		L & C
10/6			280.40	15824.00	brown layer	97.8	97.9	97.6	30.2	97.2	69	off		L & C
10/13			280.40	15824.00	brown layer	97.8	98.1	97.9	28.6	97.5	69	off		L & C
10/19			280.40	15824.00	black layer	97.3	97.5	97.4	29.9	97.0	69	off		Curtis
10/21					harvest									Zac
10/27			280.40	15824.90	harvested	97.6	97.8	97.6	27.5	97.3	89	off		Curtis
Total	7.84	25.19				0.00	0.00	0.00	1.18	0.00				
Net soil moisture is 1.18 inches.														
Rainfall (7.84 in), irrigation (25.19 in), and net soil moisture (1.18 in) is total water (34.21 in).														
*Numbers in red are not counted in the total rainfall.														

Harvest Results: The 3 GPM field produced a 203 bushel per acre corn yield. Irrigation totaled 14.84 inches. Production in the 4 GPM field was 239 bushels per acre. Irrigation was 19.90 inches. Corn yield was 252 bushels per acre for the 5 GPM field. Irrigation totaled to 25.19 inches. There was no pre-season irrigation. The 4 GPM field produced 36 more bushels per acre than the 3 GPM field, and irrigation was 5.06 inches more. The 5 GPM field produced 49 more bushels per acre than the 3 GPM field with 10.35 more inches of irrigation. The 5 GPM yield was 13 more bushels per acre than the 4 GPM field with 5.29 additional inches of irrigation.

Corn production was 13.68 bushels (820 lb) per inch of irrigation in the 3 GPM field compared to 12.01 bushels (720 lb) in the 4 GPM and 10.00 bushels (600 lb) from the 5 GPM field. Irrigation, rainfall, and net soil water totaled to 26.98 inches and produced 7.52 bushels (451 lb) per acre in the 3 GPM field. Irrigation, rainfall, and net soil water totaled to 30.35 inches in the 4 GPM field where production was 7.87 bushels (472 lb) per inch. In the 5 GPM field, irrigation, rainfall, and net soil water totaled 34.21 inches where production was 7.36 bushels (442 lb) per inch of total water.

Crop production costs were $80.59 per acre more for the 4 GPM field than the 3 GPM field from increased seed, irrigation, fertilizer, and harvest expenses. At $3.44 per bushel, the 36 bushels per acre increased corn yield in the 4 GPM field amounts to $123.84 more per acre than from the 3 GPM field. The 4 GPM field's net gain was $43.25 per acre with 5.06 inches more irrigation used compared to production from the 3 GPM field. At $3.44 per bushel, the 49 bushels per increased yield from the 5 GPM field compared to the 3 GPM amounts to $168.56. Crop production costs were $136.96 more for the 5 GPM field.

The 5 GPM field's net gain compared to the 3 GPM field is $31.60 per acre with 10.35 additional inches of irrigation. The value of the 13 additional bushels produced in the 5 GPM field compared to the 4 GPM field is $44.72. Production costs were $56.37 more for the 5 GPM field than the 4 GPM field. Net gain for the 5 GPM field is -$11.65 per acre with 5.29 inches more irrigation. Net return from the 3 GPM field was $288.20 per acre compared to $331.46 from the 4 GPM field and $319.81 from the 5 GPM field. Net return from each inch of irrigation is $19.42 for the 3 GPM field compared to $16.65 from the 4 GPM and $12.69 for the 5 GPM field. Net return from each inch of irrigation, rainfall, and net soil water is $10.68 for the 3 GPM field, $10.92 from the 4 GPM field, and $9.35 for the 5 GPM field. A summary of the demonstration results is show in Table 29 and Appendix B.

Table 29: Zac Yoder's "3-4-5 Gallon Production Maximization" Demonstration Results

GPM	Irrigation (in)	Total Water (in)	Production		Gross Crop Value @ $3.44/bu		
			bu/ac	lb/ac-in of Irrigation	per acre ($)	Acre-inch of Irrigation ($)	Acre-in of Total Water ($)
3	14.84	[a]26.98	203	820	698.32	47.05	25.88
4	19.90	[b]30.35	239	720	822.16	41.31	27.09
5	25.19	[c]34.21	252	600	866.88	34.41	25.33

[a]Includes 4.30 inches of net soil water added to rainfall and irrigation.
[b]Includes 2.61 inches of net soil water added to rainfall and irrigation.
[c]Includes 1.18 inches of net soil water added to rainfall and irrigation.

Stan Spain's 2016 Moore County LEPA Demonstration

Planting and Crop Information: Stan Spain strip tilled and planted 55 acres of corn in the south half of the east circle of the south half of Section 47, for his "3-4-5 Gallon Production Maximization" demonstration. The 55 acres were equally divided for his 3, 4 and 5 GPM fields. Each field was 18.33 acres. Ninety to 150 degrees was Spain's 5 GPM field, 150 to 210 degrees was the 3 GPM field, and 210 to 270 degrees was the 4 GPM field. Spain planted each "3-4-5 Gallon Production Maximization" field to Dynagro D52SS91RIB hybrid. Seeding rate was 32,000 seeds per acre for the 3 GPM, 4 GPM, and 5 GPM fields. Center pivot travel speed was by Pivotrac®. The speed control prescription moved the center pivot to apply 1.10 inches on the 3 GPM field in 20.50 hours, 1.49 inches on the 4 GPM field in 27.80 hours, and 1.85 inches on the 5 GPM field in 34.60 hours. The north 55 acres were irrigated in 83.30 hours. Seasonal water meter readings averaged 452 GPM. Irrigation was with the Senninger LDN LEPA applicator with drops spaced 30 inches apart. Planting and crop information for "Spain 3 GPM", "Spain 4 GPM", and "Spain 5 GPM" LEPA fields are shown in the Table 30 below.

Table 30: Planting and Crop Information for Stan Spain LEPA

3 GPM Demonstration Site: 150-210 degrees			
Planted	May 27	**Harvested**	October 20
Hybrid	Dynagro D52SS91RIB	**Seeding Rate**	32,000
Row Width	30 inches	**Tillage**	Strip Till
No. Acres	18.33	**GPM per acre**	3.00
Total Water	27.58 inches	**Soil Type**	Sherman clay silty loam
Irrigation	14.82 inches	**Insecticide**	Comite, Warhawk, Cide Trak
4 GPM Demonstration Site: 210-270 degrees			
Planted	May 27	**Harvested**	October 20
Hybrid	Dynagro D52SS91RIB	**Seeding Rate**	32,000
Row Width	30 inches	**Tillage**	Strip Till
No. Acres	18.33	**GPM per acre**	4.00
Total Water	25.82 inches	**Soil Type**	Sherman clay silty loam
Irrigation	18.10 inches	**Insecticide**	Prevathon, Warhaw, Rifle
5 GPM Demonstration Site: 90-150 degrees			
Planted	May 27	**Harvested**	October 20
Hybrid	Dynagro D52SS91RIB	**Seeding Rate**	32,000
Row Width	30 inches	**Tillage**	Strip Till
No. Acres	18.33	**GPM per acre**	5.00
Total Water	29.52 inches	**Soil Type**	Sherman clay silty loam
Irrigation	18.91 inches	**Insecticide**	Prevathon, Warhaw, Rifle

Soil Water Profile and Growing Season Rainfall

"3 GPM" LEPA Demonstration Site: Pre-season soil water was good at 1, 2, 3, 4, and 5 feet. Weekly gypsum block readings indicate the crop used more than irrigation and rainfall provided and removed stored water from 1 and 2 feet by mid-July at the 8-leaf growth stage. Plant roots developed into 3 feet the first week in August and 4 feet the third week in August at the blister growth stage. About 20% of soil water was used from 5 feet in early October finishing the crop. The crop used 6.35 inches of soil

water from 1, 2, 3, 4, and 5 feet in addition to irrigation and rainfall. Soil moisture sensors show the crop had adequate soil water during the growing season. Total rainfall from planting until grain black layer totaled to 6.41 inches. The crop was produced in Sherm clay silty loam that can store approximately 2.00 inches of available water per foot for potential crop use.

"4 GPM" LEPA Demonstration Site: Soil water was good at 1, 2, 3, 4, and 5 feet prior to planting. Soil moisture sensors show plant roots began using water from 1 foot in the root zone at the 6-leaf growth stage in early July and from 2 feet in mid-July at 8 leaves. Water was used from 3 feet the third week in July at pollination. Limited water was used from 4 feet in October, finishing the crop. The sensors indicate no water was used from 5 feet in the soil profile. Weekly gypsum block readings show the crop had adequate soil moisture during the growing season. The crop used approximately 1.31 inches of soil water mostly from 1, 2, and 3 feet in addition to rainfall and irrigation producing the crop. A total of 6.41 inches of rainfall was recorded from planting through black layer. The crop was produced in Sherm silty clay loam that holds approximately 2.00 inches available water per foot for potential crop use.

"5 GPM" LEPA Demonstration Site: Beginning soil water was good at 1, 2, 3, 4, and 5 feet at planting. Soil moisture sensors show plant roots did not begin to remove water from 1 foot until the first week in September during grain maturity after irrigation had been discontinued. Roots then removed significant amounts from 2 and 3 feet and 30% from 4 feet in October to maintain plants and mature grain. Sensors show plants removed 4.20 inches of soil water from grain ⅔ maturity line to black layer in October. That is a perfect example of the importance of having a full profile of soil water when irrigation is stopped at the end of the season. Weekly gypsum block moisture sensors show the crop had sufficient available soil water during the entire growing season. Total rainfall was 6.41 inches. Irrigation totaled to 18.91 inches. The crop was produced in Sherm silty clay loam soil that holds 2.00 inches of available water per foot for potential crop use.

Table 31: Monthly Rainfall Data for Stan Spain LEPA

GPM	June (in)	July (in)	August (in)	September (in)	October (in)	Total (in)
3, 4, 5	2.38	0.62	2.67	0.62	0.12	6.41

Growing Season Water Tracking: The District tracked total water and crop growth throughout the growing season using rain gauges, water meters, and both gypsum blocks and Aquaspy® soil moisture sensors. One set of 5 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 4 feet in the root zone at 1 location to monitor soil water levels in the 3 GPM-Early field. Another set of the same type of sensors was installed in each 3, 4, and 5 GPM field. Both the gypsum block sensors and the soil probe were installed in close proximity to each other in each field. Gypsum blocks, water meters, rain gauges, and crop growth were read, recorded, and utilized weekly by district personnel. A 24/7 Aquaspy® probe website shows soil moisture at 4-inch increments to 48 inches and monitors plant root growth. The website lists all Aquaspy® soil probes in the "3-4-5 Gallon Production Maximization" project and is available to all cooperators and district personnel. Another 24/7 Pivotrac® website tracks each center pivot, monitors system position and travel, and provides information to make irrigation management strategies. Both the

cooperating grower and District “3-4-5 Gallon Production Maximization” project leader collectively monitored, controlled, and managed irrigation from the Pivotrac® website.

Following this paragraph, a series of graphs and tables show weekly gypsum block readings for the season; the growing season’s water, including rainfall, irrigation, and soil moisture at various growth stages; and the order of irrigation and rainfall events for each “3-4-5 Gallon Production Maximization” field. Finally, a form describes the protocols for each field. “Total Water,” as shown on the graph for “Growing Season Water Tracking” is the sum of seasonal irrigation, rainfall, and net soil water. Graphs and tables for the 3 GPM acres are shown first, followed by the same illustrations for each 4 GPM and 5 GPM.

Figure 33: Gypsum Block Readings for Stan Spain's "3 GPM" Demonstration Site, 196 bu/ac, LEPA

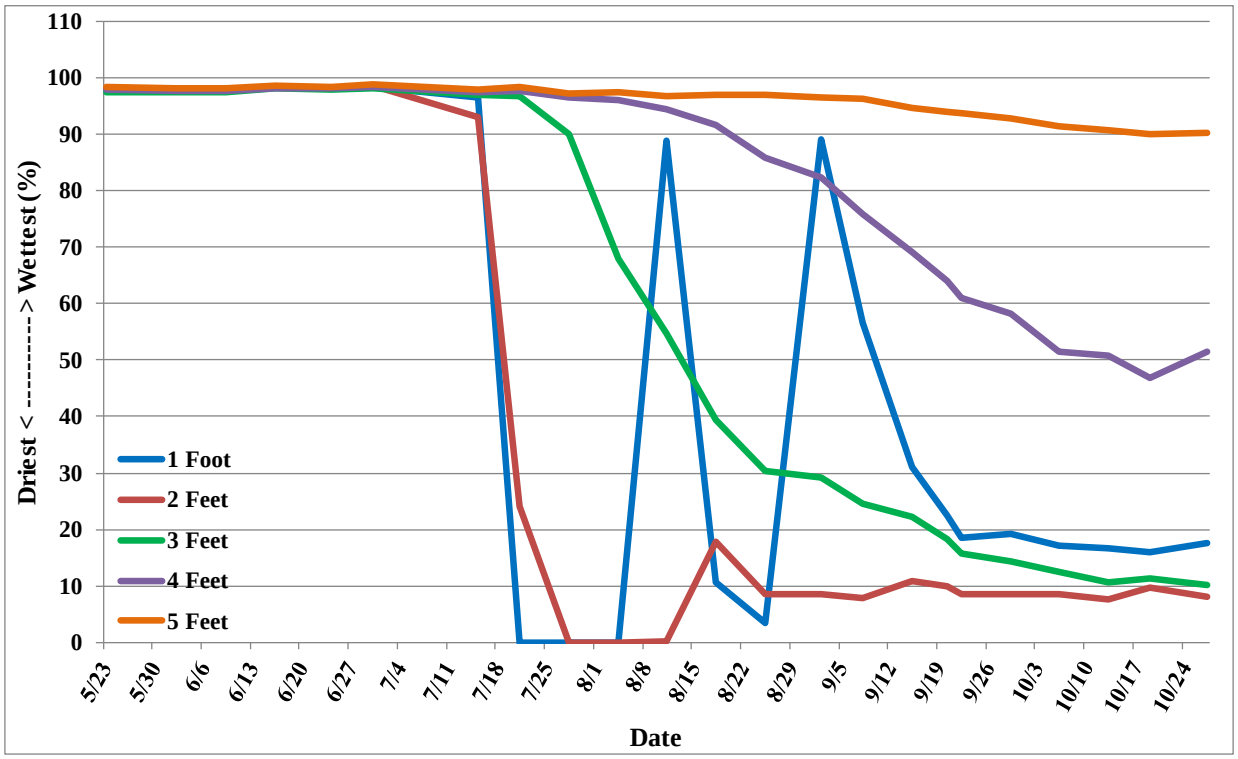


Figure 34: Growing Season Water Tracking for Stan Spain's "3 GPM" Demonstration Site, 196 bu/ac, LEPA

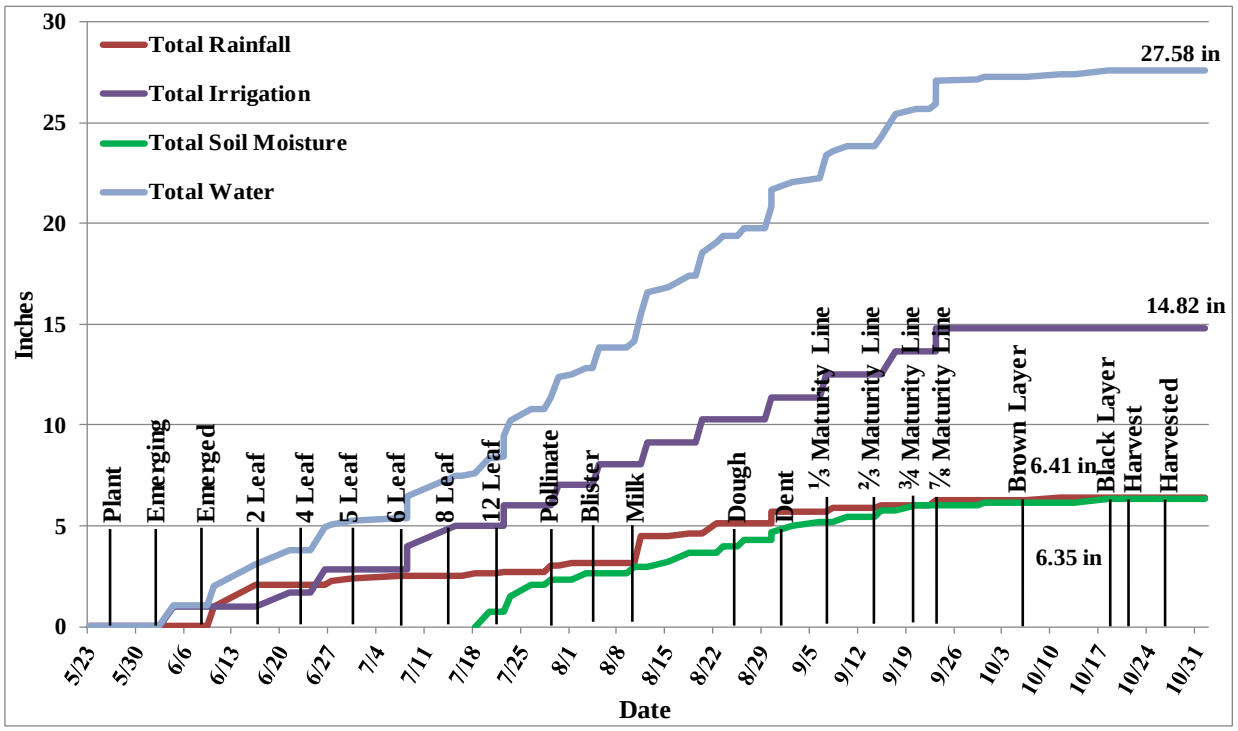


Table 32: Field Data for Stan Spain's "3 GPM" Demonstration Site, 196 bu/ac, LEPA

Date	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well GPM	Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
2/1	0.16													Curtis
4/16	0.97													Pivotrac
4/17	0.34													Pivotrac
4/19	0.40													Pivotrac
4/29	1.46													Pivotrac
4/30	0.17													Pivotrac
5/12	0.60													Pivotrac
5/16	0.93													Pivotrac
5/17	0.14													Pivotrac
5/23	0.02		112.33	1507.20		98.1	98.0	97.6	97.9	98.4	272		off	C & L
5/27					plant									Stan
5/30														Pivotrac
6/2	0.02		116.05	1551.60	emerging	97.8	97.9	97.4	97.7	98.2	54	N	448	C & L
6/3			118..30								150	into 3		Pivotrac
6/4		1.00	119.83								210	3	445	Leon
6/7														Pivotrac
6/9			125.71	1671.00	emerged	97.9	97.9	97.6	97.7	98.1	135		off	C & L
6/10	0.95													Pivotrac
6/14														Pivotrac
6/16	1.09		125.71	1671.00	2 leaf	98.4	98.4	98.1	98.2	98.6	135		off	C & L
6/20			125.96								150	into 3		Pivotrac
6/21		0.71	127.04								210	3	445	Leon
6/24			133.20	1764.90	4 leaf	98.3	98.3	98.0	98.1	98.4	96	5	447	C & L
6/25			134.92								150	into 3		Pivotrac
6/26		1.14	136.66								210	into 4	440	Leon
6/27	0.16		138.13	1826.50									off	Curtis
6/30	0.14		138.13	1826.50	5 leaf	98.5	98.7	98.3	98.5	98.8	271		off	C & L
7/7	0.14		146.26								150	into 3		Pivotrac
7/8			147.34	1938.90	6 leaf	wet					199	3	418	C & L
7/8		1.10	147.94								210	into 4	440	Leon
7/13			159.38								150	into 3		Pivotrac
7/15		1.02	160.93								210	into 4	440	Leon
7/15			161.20	2113.60	8 leaf	96.6	93.1	97.0	97.4	97.9	232	3	447	C & L
7/18	0.12		166.70	2183.60								4	429	Curtis
7/21			171.81								150	into 3		Pivotrac
7/21	0.09		171.88	2250.10	12 leaf	0	24.0	96.9	97.7	98.4	163	3	413	C & L
7/22		1.03	173.38								210	into 4	410	Leon
7/22			173.61	2274.80							237	4	403	C & L
7/28			184.41								150	into 3		Pivotrac
7/28	0.27		184.66	2417.30	pollinate	0	0	90.0	96.5	97.3	172	3	422	P & L
7/28		1.03	186.03								210	into 4	440	Leon
8/1	0.16		192.46	2515.20							35	N	441	Curtis
8/1			192.66	2517.30							39	N	443	Curtis
8/3			196.12	2560.10							126	3	434	Curtis
8/3			197.48								150	into 3		Pivotrac
8/4	0.02		198.10	2585.00	blister	0	0	67.9	96.0	97.4	184	3	433	C & L
8/4		1.01	199.02								210	into 4	430	Leon
8/5			199.90	2609.10							242	5	420	C & L
8/8			205.76	2682.00							39	N	451	Curtis
8/9			208.06	2710.10							98	5	439	Curtis
8/10			209.99	2734.20							141	5	433	Curtis
8/10			210.51								150	into 3		Pivotrac

Table 32: Field Data for Stan Spain's "3 GPM" Demonstration Site, 195 bu/ac, LEPA (continued)

Date	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well GPM	Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
8/11	1.28		211.32	2751.10	milk	88.9	0.07	54.8	94.5	96.9	184	3	422	Curtis
8/12		1.11	212.21								210	into 4	425	Leon
8/12			212.41	2764.70							218	4	445	Curtis
8/15			217.66	2830.30							360	N	425	Curtis
8/17			221.94	2884.70							110	5	425	Curtis
8/18	0.14		223.26	2901.70	milk	10.6	17.9	39.5	91.7	97.0	140	5	422	C & L
8/18			223.81								150	into 3		Pivotrac
8/19			225.04	2924.80							198	3	415	Curtis
8/19		1.12	225.53								210	into 4		Pivotrac
8/19			225.65	2932.80							218	4	423	C & L
8/20			227.71								270	into N	430	Leon
8/22	0.55		230.77	2998.20							356	N	429	Curtis
8/23			232.67	3022.20							47	N	432	Curtis
8/23			233.05	3026.90							57	N	432	Curtis
8/25			233.10		dough	3.4	8.4	30.3	85.9	97.0	59	N	off	C & L
8/29			236.32								150	into 4		Pivotrac
8/29		1.11	238.01								210	into 4	430	Leon
8/30	0.52		238.91	3098.50							231	4	429	Curtis
9/2			244.82	3172.00	dent	89.1	8.4	29.2	82.4	96.6	28	N	446	C & L
9/6			248.47	3215.60							144	5	438	Curtis
9/6			248.34								150	into 3		Pivotrac
9/6			249.29	3225.60							173	3	440	Curtis
9/7		1.14	250.09								210	into 4	440	Leon
9/7			250.57	3241.60							217	4	433	Curtis
9/8	0.20		252.37	3264.30	⅓ mat line	56.6	7.9	24.6	75.9	96.4	266	4	432	C & L
9/12			255.08	3298.00							336	N	off	Curtis
9/13			255.63	3303.90							349	N	456	Curtis
9/14			257.14	3322.00							26	N	456	Curtis
9/15	0.14		259.04	3344.60	⅔ mat line	31.0	10.9	22.3	69.1	94.7	74	N	458	C & L
9/15			259.86	3354.30							97	5	456	Curtis
9/16			261.03								150	into 3		Pivotrac
9/16			261.04								151	3	454	C & L
9/16			261.61								170	3	453	C & L
9/17		1.16	262.81								210	into 4	450	Leon
9/20					¾ mat line	22.4	9.8	18.2	64.0	94.1				Curtis
9/22			272.77								150	into 3		Pivotrac
9/22	0.26		272.91	3513.00	⅞ mat line	18.4	8.4	15.7	61.0	93.7	153	3	444	C & L
9/23		1.14	274.51								210	into 4	440	Leon
9/26			278.72	3584.10							4	N	off	Curtis
9/29	0.02		278.72	3584.10	⅞ mat line	19.2	8.6	14.3	58.3	92.9	4	N	off	C & L
10/3			278.72	3584.10							4	N	off	Curtis
10/6			278.72	3584.10	brown layer	17.1	8.6	12.4	51.6	91.4	4	N	off	C & L
10/11	0.12		278.72	3584.10							4	N	off	Curtis
10/13			278.72	3584.10	brown layer	16.7	7.6	10.6	50.7	90.7	4	N	off	Curtis
10/19			278.72	3584.10	black layer	15.9	9.7	11.2	46.9	90.0	4	N	off	Curtis
10/20					harvest									Stan
10/27			278.72	3586.00	harvested	17.6	8.0	10.2	51.4	90.2	315	N	off	Curtis
Total	6.41	14.82				1.65	1.84	1.60	1.08	0.18				
Net soil moisture is 6.35 inches.														
Rainfall (6.41 in), irrigation (14.82 in), and net soil moisture (6.35 in) is total water (27.58 in).														
*Numbers in red are not counted in the total.														

Figure 35: Gypsum Block Readings for Stan Spain's "4 GPM" Demonstration Site, 217 bu/ac, LEPA

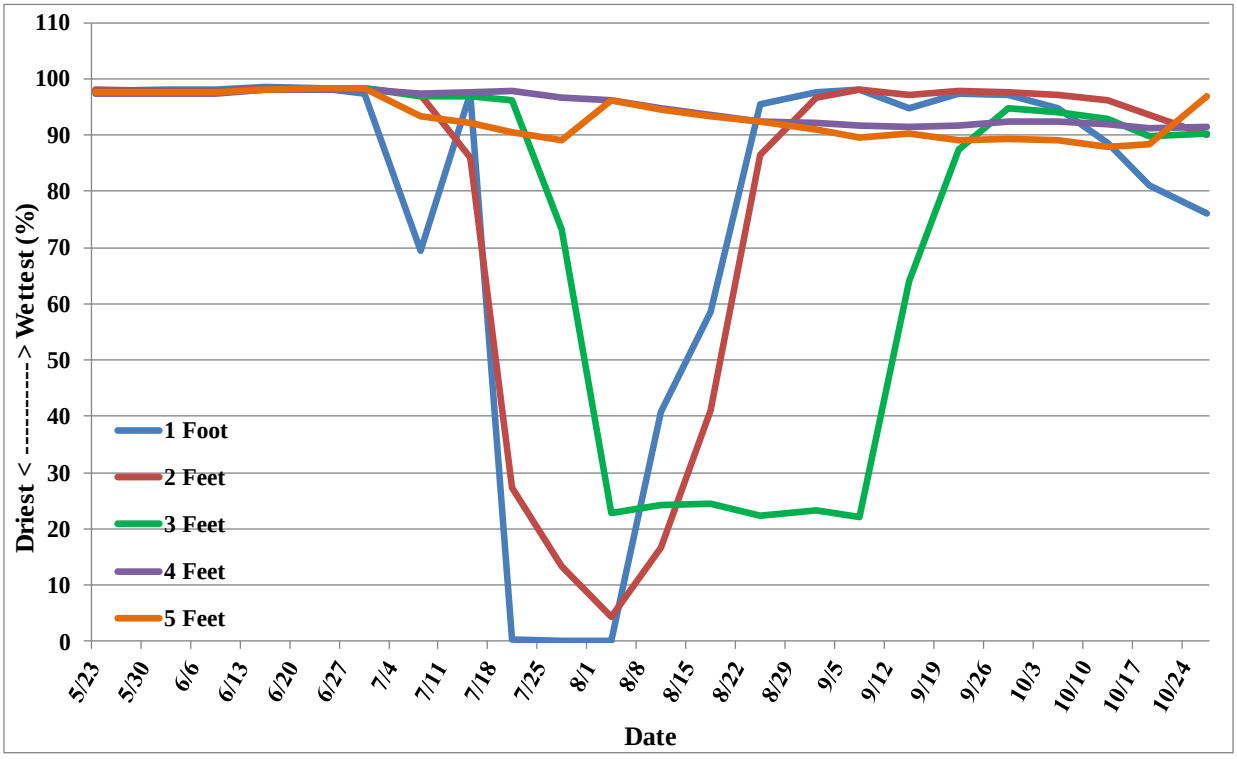


Figure 36: Growing Season Water Tracking for Stan Spain's "4 GPM" Demonstration Site, 217 bu/ac, LEPA

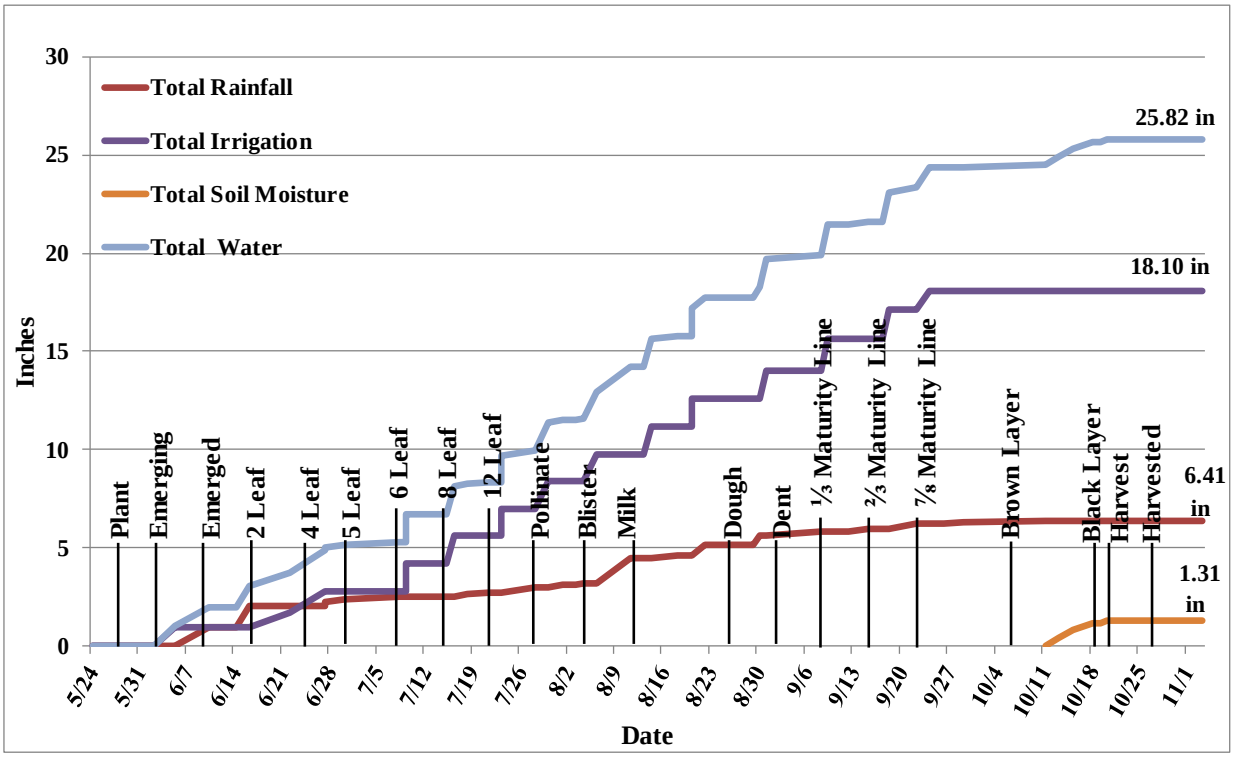


Table 33: Field Data for Stan Spain's "4 GPM" Demonstration Site, 217 bu/ac, LEPA

Date	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well GPM	Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
2/1	0.16													Curtis
4/16	0.97													Pivotrac
4/17	0.34													Pivotrac
4/19	0.40													Pivotrac
4/29	1.46													Pivotrac
4/30	0.17													Pivotrac
5/12	0.60													Pivotrac
5/16	0.93													Pivotrac
5/17	0.14													Pivotrac
5/23	0.02		112.33	1507.20		97.9	98.0	97.6	97.4	97.6	272			C & L
5/27					plant									Stan
5/30														Pivotrac
6/2	0.02		116.05	1551.60	emerging	98.0	97.8	97.6	97.4	97.7	54	N	448	C & L
6/4			119.83								210	into 4		Pivotrac
6/5		0.98	121.33								270	4	445	Leon
6/7														Pivotrac
6/9			125.71	1671.00	emerged	98.1	97.9	97.7	97.5	97.7	135		off	C & L
6/10	0.95													Pivotrac
6/14														Pivotrac
6/16	1.09		125.71	1671.00	2 leaf	98.5	98.3	98.1	98.0	98.1	135		off	C & L
6/21			127.04								210	into 4		Pivotrac
6/21		0.69	128.10								270	into N		Pivotrac
6/24			133.20	1754.90	4 leaf	98.4	98.4	98.2	98.1	98.3	96	5	447	C & L
6/26			136.66								210	into 4		Pivotrac
6/26		1.12	138.37								270	into N	440	Leon
6/27	0.16		138.13	1826.50									off	Curtis
6/30	0.14		138.13	1826.50	5 leaf	97.5	98.4	98.3	98.1	98.3	271		off	C & L
7/8	0.14		147.34	1938.90	6 leaf	69.5	97.1	96.9	97.3	93.4	199	3	418	C & L
7/8			147.94								210	into 4		Pivotrac
7/9		1.41	150.09								270	into N	440	Leon
7/15			160.93								210	into 4		Pivotrac
7/15			161.20	2113.60	8 leaf	97.3	86.0	96.9	97.6	92.3	232	4	447	C & L
7/16		1.41	163.09								270	into N	430	Leon
7/18	0.12		166.70	2183.60							25	N	429	Curtis
7/21	0.09		171.88	2250.10	12 leaf	0.3	27.2	96.2	97.8	90.5	163	3	413	C & L
7/22			173.38								210	into 4		Pivotrac
7/22			173.61	2274.80							237	4	403	C & L
7/23		1.36	175.45								270	into N	410	Leon
7/28	0.27		184.66	2417.30	pollinate	0	13.4	73.2	96.7	89.1	172	3	422	P & L
7/28			186.03								210	into 4		Pivotrac
7/30		1.42	188.20								270	into N	440	Leon
8/1	0.16		192.46	2515.20							35	N	441	Curtis
8/1			192.66	2517.30							39	N	443	Curtis
8/3			196.12	2560.10							126	3	434	Curtis
8/4	0.02		198.10	2585.00	blister	0	4.4	22.7	96.3	96.1	184	4	433	C & L
8/4			199.02								210	into 4		Pivotrac
8/5			199.90	2609.10							242	5	420	C & L
8/5		1.37	201.12								270	into N	420	Leon

Table 33: Field Data for Stan Spain's "4 GPM" Demonstration Site, 217 bu/ac, LEPA (continued)

Date	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well GPM	Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
8/8			205.76	2682.00							39	N	451	Curtis
8/9			208.06	2710.10							98	5	439	Curtis
8/10			209.99	2734.20							141	5	433	Curtis
8/11	1.28		211.32	2751.10	milk	40.7	16.7	24.3	94.8	94.5	184	3	422	Curtis
8/12			212.21								210	into 4		Pivotrac
8/12			212.41	2764.70							218	4	445	Curtis
8/13		1.41	214.36								270	into N	430	Leon
8/15			217.66	2830.30							360	N	425	Curtis
8/17			221.94	2884.70							110	5	425	Curtis
8/18	0.14		223.26	2901.70	milk	58.6	41.0	24.4	93.5	93.4	140	5	422	C & L
8/19			225.04	2924.80							198	3	415	Curtis
8/19			225.53								210	into 4		Pivotrac
8/19			225.65	2932.80							218	4	423	C & L
8/20		1.43	227.71								270	into N	430	Leon
8/22	0.55		230.77	2998.20							356	N	429	Curtis
8/23			232.67	3022.20							47	N	432	Curtis
8/23			233.05	3026.90							57	N	432	Curtis
8/25			233.10		dough	95.5	86.5	22.3	92.4	92.5	59	N	off	C & L
8/29			238.01								210	into 4		Pivotrac
8/30	0.52		238.91	3098.50							231	4	429	Curtis
8/31		1.44	240.21								270	into N	430	Leon
9/2			244.82	3172.00	dent	97.7	96.7	23.4	92.3	91.0	28	N	446	C & L
9/7			250.09								210	into 4		Pivotrac
9/7			250.57	3241.60							217	4	433	Curtis
9/8	0.20		252.37	3264.30	⅓ mat line	98.0	98.2	22.0	91.7	89.7	266	4	432	C & L
9/8		1.58	252.51								270	into N	425	Leon
9/12			255.08	3298.00							336	N	off	Curtis
9/13			255.63	3303.90							349	N	456	Curtis
9/14			257.14	3322.00							26	N	456	Curtis
9/15	0.14		259.04	3344.60	⅔ mat line	94.8	97.1	64.1	91.4	90.3	74	N	458	C & L
9/15			259.86	3354.30							97	5	456	Curtis
9/16			261.04								151	3	454	C & L
9/16			261.61								170	3	453	C & L
9/17			262.81								210	into 4		Pivotrac
9/18		1.48	265.08								270	into N	450	Leon
9/22	0.26		272.91	3513.00	⅞ mat line	97.4	97.8	87.4	91.6	89.1	153	3	444	C & L
9/23			274.51								210	into 4		Pivotrac
9/24		1.00	276.04								270	into N	440	Leon
9/26			278.72	3584.10							4	N	off	Curtis
9/29	0.02		278.72	3584.10	⅞ mat line	97.1	97.7	94.7	92.5	89.3	4	N	off	C & L
10/3			278.72	3584.10							4	N	off	Curtis
10/6			278.72	3584.10	brown layer	94.7	97.2	94.0	92.4	89.0	4	N	off	C & L
10/11	0.12		278.72	3584.10							4	N	off	Curtis
10/13			278.72	3584.10	brown layer	88.6	96.2	92.8	92.0	87.9	4	N	off	Curtis
10/19			278.72	3584.10	black layer	81.1	93.7	89.8	91.3	88.3	4	N	off	Curtis
10/20					harvest									Stan
10/27			278.72	3586.00	harvested	76.1	90.1	90.2	91.4	96.9	315	N	off	Curtis
Total	6.41	18.10	208.987			0.76	0.2	0.2	0.15	0.00				
Net soil moisture is 1.31 inches.														
Rainfall (6.41 in), irrigation (18.10 in), and net soil moisture (1.31 in) is total water (25.82 in).														
*Numbers in red are not counted in the total.														

Figure 37: Gypsum Block Readings for Stan Spain's "5 GPM" Demonstration Site, 260 bu/ac, LEPA

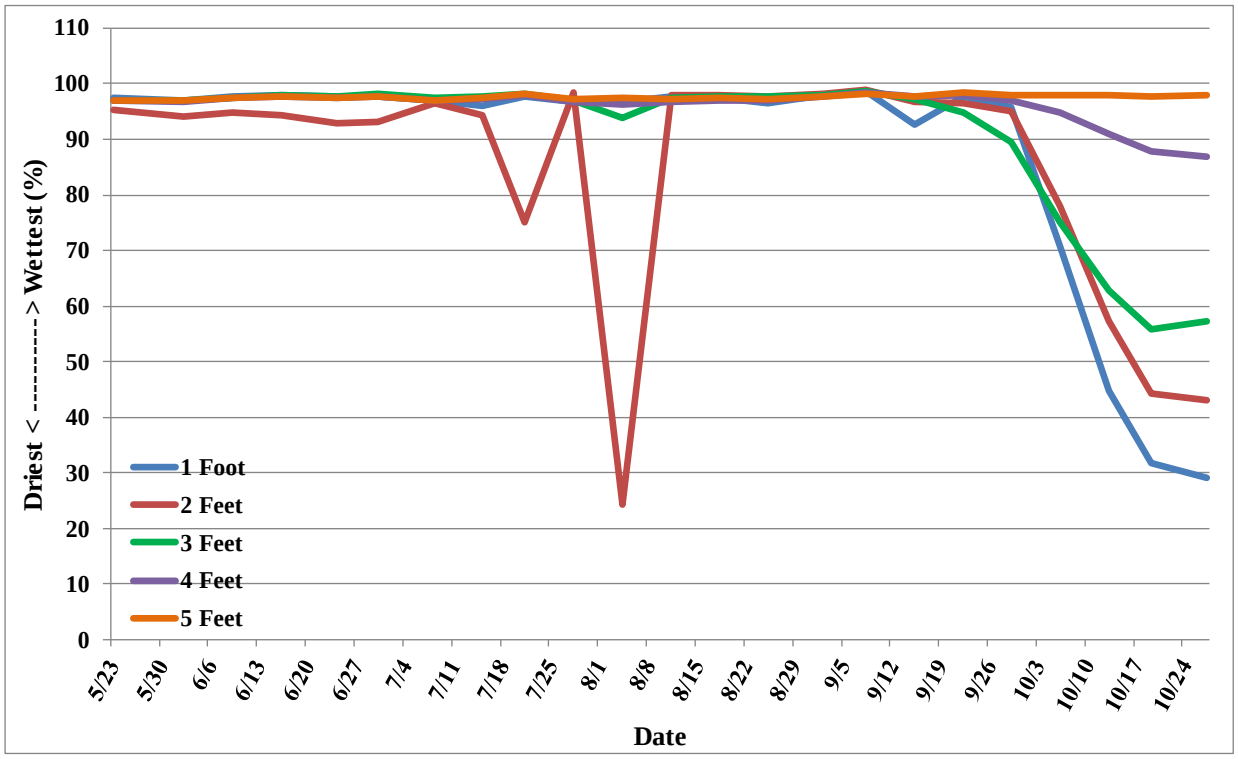


Figure 38: Growing Season Water Tracking for Stan Spain's "5 GPM" Demonstration Site, 260 bu/ac, LEPA

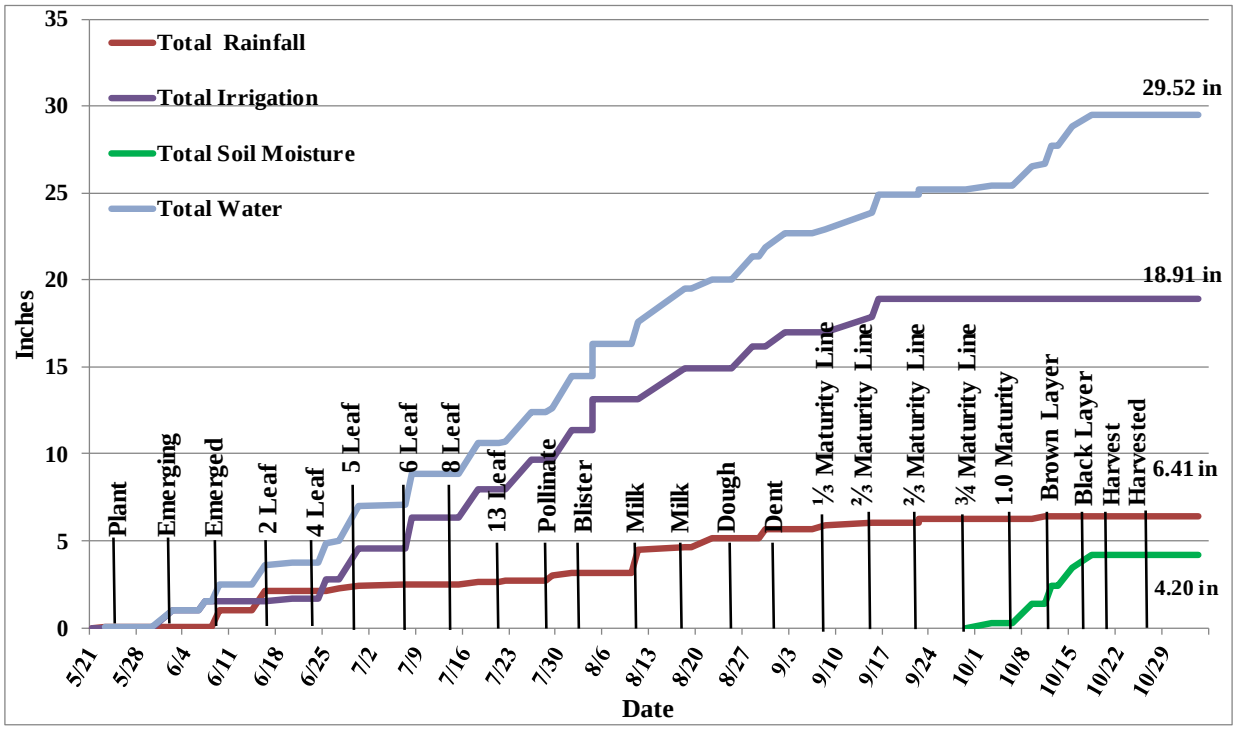


Table 34: Field Data for Stan Spain's "5 GPM" Demonstration Site, 260 bu/ac, LEPA

Date	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well GPM	Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
2/1	0.16													Curtis
4/16	0.97													Pivotrac
4/17	0.34													Pivotrac
4/19	0.40													Pivotrac
4/29	1.46													Pivotrac
4/30	0.17													Pivotrac
5/12	0.60													Pivotrac
5/16	0.93													Pivotrac
5/17	0.14													Pivotrac
5/23	0.02		112.33	1507.20		97.4	95.3	97.0	97.1	97.1	272		off	C & L
5/27					plant									Stan
5/30	0.02													Pivotrac
6/2			116.05	1551.60	emerging	97.1	94.1	96.9	96.8	96.9	54	N	448	C & L
6/2			116.81								90	into 5		Pivotrac
6/3		0.98	118.30								150	5	445	Leon
6/6			124.92								90	into 5		Pivotrac
6/7														Pivotrac
6/7		0.52	125.71								135	5		Leon
6/9	0.95		125.71	1671.00	emerged	97.6	94.8	97.5	97.4	97.4	135	off		C & L
6/10											.			Pivotrac
6/14														Pivotrac
6/16	1.09		125.71	1671.00	2 leaf	98.0	94.4	98.0	97.7	97.7	135	off		C & L
6/20			125.71								135	5		Pivotrac
6/20		0.16	125.96								150	5		Leon
6/24			133.21		4 leaf						90	into 5		Pivotrac
6/24			133.20	1764.90	4 leaf	97.6	92.8	97.8	97.4	97.4	96	5	447	C & L
6/25		1.12	134.92								150	into 3	440	Leon
6/27	0.16		138.13	1826.50									off	Curtis
6/30	0.14		138.13	1826.50	5 leaf	97.8	93.1	98.2	97.7	97.8	271		off	C & L
7/6			143.49								90	into 5		Pivotrac
7/7	0.14	1.81	146.26								150	into 3	440	Leon
7/8			147.34	1938.90	6 leaf	96.9	96.6	97.4	97.1	97.1	199	3	418	C & L
7/13			156.76								90	into 5		Pivotrac
7/14		1.71	159.38								150	into 3	440	Leon
7/15			161.20	2113.60	8 leaf	96.0	94.3	97.7	97.3	97.4	232	4	447	C & L
7/18	0.12		166.70	2183.60							25	N	429	Curtis
7/19			169.24								90	into 5		Pivotrac
7/21		1.68	171.81								150	into 3	420	Leon
7/21	0.09		171.88	2250.10	13 leaf	97.6	75.2	98.1	97.9	98.2	163	3	413	C & L
7/22			173.61	2274.80							237	4	405	C & L
7/26			181.85								90	into 5		Pivotrac
7/28		1.67	184.41								150	into 3	420	Leon
7/28	0.27		184.66	2417.30	pollinate	96.7	98.5	97.0	96.7	97.3	172	3	422	P & L
8/1	0.16		192.46	2515.20							35	N	441	Curtis
8/1			192.66	2517.30							39	N	443	Curtis
8/2			194.89								90	into 5		Pivotrac
8/3			196.12	2560.10							127	5	434	Curtis
8/3		1.70	197.48								150	into 3	430	Leon
8/4	0.02		198.10	2580.00	blister	96.7	24.3	93.9	96.3	97.4	184	4	433	C & L
8/5			199.90	2609.10							242	5	420	C & L

Table 34: Field Data for Stan Spain's "5 GPM" Demonstration Site, 260 bu/ac, LEPA (continued)

Date	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well GPM	Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
8/8			205.76	2682.00							39	N	451	Curtis
8/9			207.81								90	into 5		Pivotrac
8/9			208.06	2710.10							98	5	439	Curtis
8/10			209.99	2734.20							141	5	433	Curtis
8/10		1.76	210.51								150	into 3		Pivotrac
8/11	1.28		211.32	2751.10	milk	97.8	97.9	97.4	96.7	97.3	184	3	422	Curtis
8/12			212.45	2764.70							219	4	445	Curtis
8/15			217.66	2830.30							360	N	425	Curtis
8/17			221.07								90	into 5		Pivotrac
8/17			221.94	2884.70							110	5	425	Curtis
8/18	0.14		223.26	2901.70	milk	97.4	97.9	97.8	97.0	97.4	140	5	422	C & L
8/18		1.79	223.81								150	into 3	430	Leon
8/19			225.04	2924.80							198	3	415	Curtis
8/19			225.65	2932.80							218	4	423	C & L
8/22	0.55		230.77	2998.20							356	N	429	Curtis
8/23			232.67	3022.20							47	N	432	Curtis
8/23			233.05	3026.90							57	N	432	Curtis
8/25			233.10		dough	96.4	97.8	97.7	97.1	97.3	59	N	off	C & L
8/28			234.33								90	into 5		Pivotrac
8/29		1.30	236.32								150	into 3	430	Leon
8/30	0.52		238.91	3098.50							231	4	429	Curtis
9/2			244.82	3172.00	dent	97.9	98.1	98.0	97.6	97.7	28	N	446	C & L
9/5			247.04								90	into 5		Pivotrac
9/6			248.47	3215.60							144	5	438	Curtis
9/6		0.82	248.34								150	into 3	430	Leon
9/7			250.57	3241.60							217	4	433	Curtis
9/8	0.20		252.37	3264.30	⅓ mat line	98.6	98.8	98.6	98.4	98.3	266	4	432	Curtis
9/12			255.08	3298.00							336	N	off	Curtis
9/13			255.63	3303.90							349	N	456	Curtis
9/14			257.14	3322.00							26	N	456	Curtis
9/15	0.14		259.04	3344.60	⅔ mat line	92.6	96.8	97.2	97.6	97.7	74	N	458	C & L
9/15			259.74								90	into 5		Pivotrac
9/15			259.86	3354.30							97	5	456	Curtis
9/16		0.84	261.03								150	into 3	450	Leon
9/16			261.04								151	3	454	C & L
9/16			261.61								170	3	453	C & L
9/21			271.15								90	into 5		Pivotrac
9/22		1.05	272.77								150	into 3	440	Leon
9/22	0.26		272.91	3513.00	⅔ mat line	97.6	96.4	94.7	98.0	98.4	153	3	444	C & L
9/26			278.72	3584.10							4	N	off	Curtis
9/29	0.02		278.72	3584.10	¾ mat line	95.7	95.0	89.6	96.9	98.0	4	N	off	C & L
10/3			278.72	3584.10							4	N	off	Curtis
10/6			278.72	3584.10	1.0 mat line	70.8	78.0	75.2	94.7	98.0	4	N	off	C & L
10/11	0.12		278.72	3584.10							4	N	off	Curtis
10/13			278.72	3584.10	brown layer	44.8	57.3	62.9	90.9	98.0	4	N	off	Curtis
10/19			278.72	3584.10	black layer	31.8	44.4	55.9	87.8	97.6	4	N	off	Curtis
10/20					harvest									Stan
10/27			278.72	3586.00	harvested	29.1	43.1	57.3	86.8	98.0	315	N	off	Curtis
Total	6.41	18.91				1.42	1.20	1.04	0.54	0.00				
Net soil moisture is 4.20 inches.														
Rainfall (6.41 in), irrigation (18.91 in), and net soil moisture (4.20 in) is total water (29.52 in).														
*Numbers in red are not counted in the total.														

Harvest Results: The 3 GPM field produced a 196 bushel per acre corn yield. Irrigation totaled 14.82 inches. Production in the 4 GPM field was 217 bushels per acre. Seasonal irrigation totaled 18.10 inches. Corn yield was 260 bushels per acre for the 5 GPM field. Irrigation totaled 18.91 inches. There was no pre-season irrigation. The 4 GPM field produced 21 more bushels per acre than the 3 GPM field. Irrigation was 3.28 inches more. The 5 GPM field produced 64 more bushels per acre than the 3 GPM with 4.09 more inches of irrigation. The 5 GPM yield was 43 more bushels per acre than that from 4 GPM field with 0.81 additional inches of irrigation.

Corn production was 13.22 bushels (793 lb) per inch of irrigation in the 3 GPM field compared to 11.99 bushels (719 lb) in the 4 GPM and 13.75 bushels (825 lb) from the 5 GPM field. Production from each inch of irrigation, rainfall, and net soil water that totaled 27.58 inches was 7.10 bushels (426 lb) per acre in the 3 GPM field. Irrigation, rainfall, and net soil water totaled 25.82 inches in the 4 GPM field where production was 8.40 bushels (504 lb) per inch. In the 5 GPM field, irrigation, rainfall, and net soil water totaled 29.52 inches where production was 8.80 bushels (528 lb) per inch of total water.

Crop production costs were $39.67 per acre more for the 4 GPM field than for the 3 GPM from increased irrigation, fertilizer, and harvest expenses. At $3.44 per bushel, the 21 bushels per acre increased corn yield in the 4 GPM field amounts to $72.24 more per acre than from the 3 GPM field. The 4 GPM field's net gain is $32.57 per acre with 3.28 inches more irrigation used compared to production from the 3 GPM field. At $3.44 per bushel, the 64 bushels per acre increased yield from the 5 GPM field compared to the 3 GPM amounts to $220.16 per acre. Crop production costs were $85.41 per acre more for the 5 GPM field. The 5 GPM field's net gain compared to the 3 GPM field is $134.75 per acre with 4.09 additional inches of irrigation. Value of the 43 additional bushels produced in the 5 GPM field compared to the 4 GPM field is $147.92. Production costs were $45.74 more for the 5 GPM field than the 4 GPM. Net gain for the 5 GPM field is $102.18 per acre with 0.81 inches more irrigation.

Net return from the 3 GPM field was $270.91 per acre compared to $303.48 from the 4 GPM field and $405.66 from the 5 GPM field. Net return from each inch of irrigation is $18.28 for the 3 GPM field compared to $16.76 from the 4 GPM and $21.45 for the 5 GPM field. A summary of the demonstration results is shown in Table 35 and Appendix B.

Table 35: Stan Spain's 2016 LEPA Demonstration Results

GPM	Irrigation (in)	Total Water (in)	Production		Gross Crop Value @ $3.44/bu		
			bu/ac	lb/ac-in of Irrigation	per acre ($)	Acre-inch of Irrigation	Acre-in of Total Water
3	14.82	[a]27.58	196	793	674.24	45.49	24.44
4	18.10	[b]25.82	217	719	746.48	41.24	28.91
5	18.91	[c]29.52	260	822	894.40	47.75	30.30

[a]Includes 6.35 inches of soil water within 5 feet of soil plus rainfall and irrigation

[b]Includes 1.13 inches of soil water within 5 feet of soil plus rainfall and irrigation.

[c]Includes 4.20 inches of soil water within 5 feet of soil plus rainfall and irrigation.

LEPA Center Pivot and SDI Harvest Demonstration Results: The 3 GPM LEPA field produced a 196 bushel per acre corn yield. Irrigation totaled 14.82 inches. Production in the 3 GPM SDI field was 191 bushels per acre. Seasonal irrigation totaled 13.76 inches. Corn yield was 217 bushels per acre for the 4 GPM LEPA field. Irrigation totaled 18.10 inches. Yield in the 4 GPM SDI field was 212 bushels per acre. Irrigation was 16.46 inches. Production in the 5 GPM LEPA field was 260 bushels per acre. Irrigation was 18.91 inches. Production in the 5 GPM SDI field was 246 bushels per acre. Irrigation totaled 17.44 inches. There was no pre-season irrigation. The 3 GPM LEPA field produced 5 more bushels per acre than the 3 GPM SDI field. Irrigation was 1.06 inches more. The 4 GPM LEPA field produced 5 more bushels per acre than the 4 GPM SDI with 1.64 more inches of irrigation. The 5 GPM LEPA yield was 14 more bushels per acre than that from 5 GPM SDI field with 1.29 additional inches of irrigation.

Corn production was 13.22 bushels (793 lb) per inch of irrigation in the 3 GPM LEPA field compared to 13.88 bushels (833 lb) in the 3 GPM SDI field. Yield was 11.99 bushels (719 lb) from the 4 GPM LEPA compared to 12.88 bushels (773 lb) from the 4 GPM SDI field. The 5 GPM LEPA field produced 13.88 bushels (833 lb) from each inch of irrigation. The 5 GPM SDI produced 14.10 bushels (846 lb) per inch.

Production from each inch of irrigation, rainfall, and net soil water that totaled 27.58 inches was 7.10 bushels (426 lb) per acre in the 3 GPM LEPA field. Irrigation, rainfall, and net soil water totaled 26.26 inches in the 3 GPM SDI field where production was 7.27 bushels (436 lb) per inch. In the 4 GPM LEPA field, irrigation, rainfall, and net soil water totaled 25.82 inches where production was 8.40 bushels (504 lb) per inch of total water. Irrigation, rainfall, and net soil water totaled 27.52 inches in the 4 GPM SDI field where production was 7.70 bushel (462 lb) from each inch. In the 5 GPM LEPA field, irrigation, rainfall, and net soil water totaled 29.52 inches from which production was 8.80 bushels (528 lb) per inch. From 26.52 inches of irrigation, rainfall, and net soil water, production in the 5 GPM SDI field was 9.27 (556 lb) from each inch.

Crop production costs were $11.12 per acre more for the 3 GPM LEPA than the 3 GPM SDI from increased irrigation, fertilizer, and harvest expenses. At $3.44 per bushel, the 5 bushels per acre increased corn yield in the 3 GPM LEPA field amounts to $17.20 more per acre than from the 3 GPM SDI field. The 3 GPM LEPA field's net gain is $6.08 per acre with 1.06 inches more irrigation used compared to the 3 GPM SDI field. At $3.44 per bushel, the 5 bushels per acre increased yield from the 4 GPM LEPA field compared to the 4 GPM SDI amounts to $17.20 per acre. Crop production costs were $14.62 per acre more for the 4 GPM LEPA field. The 4 GPM LEPA fields' net gain compared to the 4 GPM SDI field is $2.58 per acre with 1.64 additional inches of irrigation. Value of the 14 additional bushels produced in the 5 GPM LEPA field compared to the 5 GPM SDI field is $48.16. Production costs were $21.06 more for the 5 GPM LEPA field than the 5 GPM SDI. Net gain for the 5 GPM LEPA field is $27.10 per acre with 1.28 inches more irrigation.

Net return from the 3 GPM LEPA field was $270.91 per acre compared to $264.83 from the 3 GPM SDI field. Net return from the 4 GPM LEPA field was $303.48 and $300.90 from the 4 GPM SDI field. From the 5 GPM fields, net return was $405.66 from LEPA and $379.64 from SDI. Net return from each inch of irrigation is $18.28 for the 3 GPM LEPA field and $19.24 from the 3 GPM SDI.

Net return was $16.76 from each inch of irrigation from the 4 GPM LEPA field compared to $18.28 from the 4 GPM SDI. Net return from each inch of irrigation was $21.45 for the 5 GPM LEPA field and $21.77 for the 5 GPM SDI. A summary of the demonstration results is shown in Tables 23 and 35 and Appendix B.

Conclusion

Summary: Corn production averaged 15.41 bushels (924 lb) per acre inch of irrigation in the 3 GPM fields compared to 13.80 bushels (828 lb) in the 4 GPM and 13.66 bushels (819 lb) per inch in the 5 GPM fields. Net return from each inch of irrigation averaged $23.47 in the 3 GPM fields, $20.21 in the 4 GPM fields, and $20.15 per inch in the 5 GPM fields. Irrigation averaged 13.53 inches in the 3 GPM fields compared to 15.83 inches in the 4 GPM fields and 17.38 inches in the 5 GPM fields. Corn production averaged 206 bushels (12,394 lb) per acre in the 3 GPM fields, 212 bushels (12,700 lb) in the 4 GPM fields, and 227 bushels (13,630 lb) per acre in the 5 GPM fields.

Net return averaged $312.75 per acre from the 3 GPM fields, $306.48 from the 4 GPM fields, and $330.62 per acre from the 5 GPM fields. Average net return from the additional 2.30 inches of irrigation applied to the 4 GPM fields than the 3 GPM is -$2.72 per inch. Average net return from the additional 3.85 inches of irrigation applied to the 5 GPM fields than the 3 GPM is $4.64 per inch. Average net return from the additional 1.55 inches of irrigation applied to the 5 GPM fields than the 4 GPM is $15.57 per inch. Average net return from the 4 GPM fields than the 3 GPM with 2.30 inches more irrigation is -$6.27 per acre. Average net return from the 5 GPM fields where irrigation was 3.85 inches more than the 3 GPM is $17.87 per acre. Average net return from the 5 GPM fields than the 4 GPM where irrigation was 1.55 inches more is $24.14 per acre. Net return per acre averaged $312.75 for the 3 GPM fields, $306.48 for the 4 GPM, and $330.62 for the 5 GPM fields.

Irrigation, rainfall, and net soil water averaged 26.99 inches in the 3 GPM fields, 26.59 inches in the 4 GPM, and 27.53 for the 5 GPM fields. Rainfall averaged 9.28 inches at the 3 GPM fields, 8.43 inches at the 4 GPM and 8.43 inches at the 5 GPM fields. Average net soil water used by the crop is 4.17 inches in the 3 GPM fields, 2.34 inches in the 4 GPM and 1.72 inches in the 5 GPM fields. Average net return from each inch of irrigation, rainfall, and net soil water is $11.59 for the 3 GPM field, $11.56 for the 4 GPM fields, and $12.13 for the 5 GPM fields. Average net return per bushel of corn produced in the 3 GPM fields is $1.5141, $1.4480 in the 4 GPM and $1.4554 in the 5 GPM fields.

Appendix A is a summary of demonstration corn hybrids, seeding rates, irrigation amounts, and harvest results. **Appendix B** shows corn yield per inch of irrigation applied by all cooperating growers in each 3, 4, 5 field. **Appendix C** describes bushels produced from each inch of irrigation for 3, 4, 5 fields and by field. **Appendix D** lists net return from each inch of irrigation by field and grower plus water and harvest data for each 3, 4, and 5 GPM field. **Appendix E** describes net return from each inch of irrigation, rainfall and soil water for all growers and for all 3, 4, 5 GPM fields. **Appendix F** describes net return per acre for each grower and 3, 4, and 5 GPM field.

The "3-4-5 Gallon Production Maximization" Project:

For **Danny Krienke**, irrigation totaled 13.11 inches per acre in the 3 GPM-Early planted field, 11.07 inches for his 3 GPM field, 10.80 inches for the 4 GPM field, and 11.07 inches in his 5 GPM field. There was no pre-season irrigation. Net return from each inch of irrigation is $29.00 for the

3 GPM- Early field compared to $31.14 from the 3 GPM, $32.22 from the 4 GPM and $30.86 for the 5 GPM field. Irrigation, rainfall, and net soil water totaled 31.16 inches for the 3 GPM-Early field, 26.73 inches per acre in the 3 GPM field, 24.82 inches in the 4 GPM field, and 24.03 inches of total water for his 5 GPM field. Net return from each inch is $12.20 for the 3 GPM-Early field, $12.90 for the 3 GPM field, $14.02 for the 4 GPM field, and $14.21 for his 5 GPM field. Net return from the 3 GPM-E field was $380.29 and $344.79 per acre for the 3 GPM compared to $348.04 from the 4 GPM field and $341.68 from the 5 GPM field.

For **Harold Grall PMDI**, irrigation totaled 13.57 inches per acre in his 3 GPM field 14.85 inches in the 4 GPM and 15.82 inches for his 5 GPM field. There was no pre-season irrigation on any field. Net return from each inch of irrigation is $24.79 for the 3 GPM field compared to $19.44 from the 4 GPM field and $17.56 for the 5 GPM field. Irrigation, rainfall, and net soil water totaled 26.37 inches per acre in the 3 GPM field, 25.56 inches in the 4 GPM field, and 24.60 inches in the 5 GPM field. Net return from each inch of irrigation, rainfall, and net soil water is $12.75 per acre for the 3 GPM field, $11.29 for the 4 GPM field, and $11.29 per acre for his 5 GPM field. Net return from the 3 GPM field was $336.41 per acre compared to $288.69 from the 4 GPM field and $277.89 from the 5 GPM field.

For **Harold Grall LEPA**, irrigation totaled 13.57 inches per acre in his 3 GPM field, 14.85 inches in the 4 GPM field, and 15.82 inches for his 5 GPM field. There was no pre-season irrigation. Net return from each inch of irrigation is $22.39 for the 3 GPM field compared to $17.93 from the 4 GPM field, and $16.31 for the 5 GPM field. Irrigation, rainfall, and net soil water totaled 23.87 inches per acre in the 3 GPM field, 25.47 inches in the 4 GPM field, and 26.27 inches in the 5 GPM field. Net return from each inch of irrigation, rainfall, and net soil water is $12.73 per acre for the 3 GPM field, $10.45 for the 4 GPM field, and $9.82 per acre for his 5 GPM field. Net return from the 3 GPM field was $303.83 per acre compared to $266.29 from the 4 GPM field and $257.98 from the 5 GPM field.

In **Harold Grall's LEPA Shroud versus T-L PMDI** drag line irrigation systems demonstration fields, irrigation was 13.57 inches in each 3 GPM field. Net return from each inch of irrigation was $24.79 for the PMDI field compared to $22.39 for his LEPA. Irrigation totaled 14.85 inches in both the 4 GPM LEPA and PMDI fields. Net return from each inch of irrigation was $17.93 for LEPA and $19.44 for PMDI. In both 5 GPM fields, irrigation totaled 15.82 inches. Net return was $16.31 per inch in the 5 GPM LEPA and $17.56 for the PMDI fields. Irrigation, rainfall, and net soil water totaled 23.87 inches per acre in the 3 GPM LEPA field and 26.37 in the 3 GPM PMDI. Net return from each inch of total water was $12.73 for LEPA and $12.75 for 3 GPM PMDI. Irrigation, rainfall plus net soil water totaled 25.47 inches in the 4 GPM LEPA field and 25.56 inches in the PMDI. Net return was $10.45 from each inch for the 4 GPM LEPA field compared to $11.29 for PMDI. In the 5 GPM fields, total water was 26.27 inches for the LEPA field and 24.60 inches for the PMDI field. Net return from each inch was $9.82 for LEPA and $11.29 for PMDI. Net return per acre is $303.83 for the 3 GPM LEPA shroud field and $336.41 for the T-L PMDI drag line field. For the 4 GPM fields, net return was $266.29 per acre for LEPA and $288.69 for PMD. Net return was $257.98 per acre for the 5 GPM LEPA field and $277.89 per acre for 5 GPM PMDI.

In **Stan Spain's SDI** demonstration 3,4,5 GPM fields, irrigation totaled 13.76 inches per acre in the 3 GPM field, 16.46 inches in the 4 GPM and 17.44 inches in the 5 GPM field. There was no pre-season irrigation. Net return from each inch of irrigation is $19.24 for the 3 GPM field compared to $18.28 for the 4 GPM and $21.77 for the 5 GPM field. Irrigation, rainfall and net soil water totaled 26.26 inches per acre in the 3 GPM field, 27.52 inches in the 4 GPM and 26.52 inches in the 5 GPM field. Net return from each inch of total water is $10.08 for his 3 GPM field, $10.93 for the 4 GPM and $14.31 for the 5 GPM field. Net return from the 3 GPM field was $264.83 per acre compared to $300.90 from the 4 GPM field and $379.64 from the 5 GPM field.

In **Zac Yoder's** demonstration fields, irrigation totaled 14.84 inches per acre in his 3 GPM field, 19.90 inches in the 4 GPM and 25.19 inches in the 5 GPM field. There was no pre-season irrigation. Net return from each inch of irrigation is $19.42 for the 3 GPM field compared to $16.65 from the 4 GPM and $12.69 for the 5 GPM field. Irrigation, rainfall and net soil water totaled 26.98 inches per acre in the 3 GPM field, 30.35 inches in the 4 GPM field and 34.21 inches of total water in the 5 GPM field. Net return from each inch of irrigation, rainfall and net soil water is $10.68 for the 3 GPM field, $10.92 from the 4 GPM and $9.35 for the 5 GPM field. Net return from the 3 GPM field was $288.20 per acre compared to $331.46 from the 4 GPM field and $319.81 from the 5 GPM field.

In **Stan Spain's LEPA** demonstration "3-4-5 Gallon Production Maximization" fields, irrigation totaled 14.82 inches per acre in the 3 GPM field, 18.10 inches in the 4 GPM field, and 18.91 inches in the 5 GPM field. There was no pre-season irrigation. Net return from each inch of irrigation is $18.28 for the 3 GPM field compared to $16.76 for the 4 GPM and $21.45for the 5 GPM field. Irrigation, rainfall, and net soil water totaled 27.58 inches per acre in the 3 GPM field, 25.82 inches in the 4 GPM field, and 29.52 inches in the 5 GPM field. Net return from each inch of total water is $9.82 for his 3 GPM field, $11.75 for the 4 GPM field, and $13.74 for the 5 GPM field. Net return from the 3 GPM field was $270.91 per acre compared to $303.48 from the 4 GPM field and $405.66 from the 5 GPM field.

In **Stan Spain's LEPA versus SDI** irrigation systems demonstration fields, irrigation was 14.82 inches in his 3 GPM LEPA field and 13.76 inches for his SDI. Net return from each inch of irrigation was $18.28 for the LEPA field compared to $19.24 for his SDI. Irrigation totaled 18.10 inches in for the 4 GPM LEPA and 16.46 for his SDI fields. Net return from each inch of irrigation was $16.76 for LEPA and $18.28 for SDI. In the 5 GPM fields, irrigation totaled 18.91 inches for LEPA and 17.44 for SDI. Net return was $21.45 per inch in the 5 GPM LEPA and $21.77 for the SDI. Irrigation, rainfall, and net soil water totaled 27.58 inches per acre in the 3 GPM LEPA field and 26.26 in the 3 GPM SDI. Net return from each inch of total water was $9.82 for LEPA and $10.08 for 3 GPM SDI. Irrigation, rainfall plus net soil water totaled 25.82 inches in the 4 GPM LEPA field and 27.52 inches in the SDI. Net return was $11.75 from each inch for the 4 GPM LEPA field compared to $10.93 for SDI. In the 5 GPM fields, total water was 29.52 inches for the LEPA field and 26.52 inches for the SDI field. Net return from each inch was $13.74 for LEPA and $14.31 for SDI. Net return per acre is $270.91 for the 3 GPM LEPA and $264.83 for the SDI field. For the 4 GPM fields, net return was $303.48 per acre for LEPA and $300.90 for SDI. Net return was $405.66 per acre for the 5 GPM LEPA field and $379.64 per acre for 5 GPM SDI.

In **Dennis Buss/Hartley Feeders** 3, 4, 5 demonstration fields, irrigation totaled 10.69 inches per acre in his 3 GPM field, 12.53 inches in the 4 GPM field, and 12.03 inches for his 5 GPM field. There was no pre-season irrigation. Net return from each inch of irrigation is $9.36 for the 3 GPM field compared to $14.26 from the 4 GPM and $22.75 for the 5 GPM field. Irrigation, rainfall, and net soil water totaled 22.01 inches per acre in the 3 GPM field, 22.85 inches in the 4 GPM field, and 23.89 inches in the 5 GPM field. Net return from each inch of irrigation, rainfall, and net soil water is $4.55 per acre for the 3 GPM field, $7.82 for the 4 GPM field, and $11.46 per acre for his 5 GPM field. Net return from the 3 GPM field was $100.13 per acre compared to $178.69 from the 4 GPM field and $273.79 from the 5 GPM field. None of the 3, 4, 5 fields could be irrigated timely to produce representative corn yields for the demonstration project. Rainfall was only 6.66 inches and insufficient to provide additional water needed to produce a representative corn yield, especially during the high daily temperatures in July. Also, plants were damaged by 2 hail storms for which the crop insurance adjuster made a 29% damage allowance that is included in the demonstration corn yields.

For **Harold Grall's** SW 414 T-L PMDI drag line demonstration, irrigation is 16.07 inches per acre. There was no pre-water. Net return from each inch of irrigation is $8.12. Irrigation, rainfall, and net soil water totaled 26.27 inches. Net return from each inch of total water is $4.97. Net return for the PMDI field is $130.61 per acre. Corn yield was limited due to reduced irrigation well production during the growing season. Irrigation capacity became less than 2 GPM per acre which could not maintain yield potential with only 6.53 inches of rainfall.

The NPWD's "3-4-5 Gallon Production Maximization" project demonstrates how water conservation technologies, irrigation management strategies combined with high efficiency irrigation systems and improved plant genetics can reduce groundwater use and allow agricultural irrigation producers to remain financially viable with both restricted and diminishing groundwater resources.

We learned that adjustments can be made to existing center pivots, especially in conjunction with NRCS cost share funding, to improve water application efficiency that gets more of the water pumped to the crop. Also, that soil health is improved from crop residue and strip or no till practices. We learned it is easy to over water corn with 4 and especially 5 GPM per acre when rainfall is more normal and that soil moisture sensors can help manage that. Also, we learned that drought tolerant hybrids were commonly planted, mostly in May and early June, performed well and reduced seasonal irrigation. 2016 was a more normal corn production year with timely beneficial rainfall and cooler temperatures, except in early to mid-July. Beginning soil moisture was superior without any pre-season irrigation.

When the **technologies and methods** utilized by the "3-4-5 Gallon Production Maximization" demonstrations provide can be translated to 3 inches of reduced irrigation over the one million acres of corn and other crops in the District, groundwater 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: 2016 Corn Hybrids Planted, Seeding Rates, and Irrigation Systems, "3-4-5 Gallon Production Maximization"

Grower	County	Field	Planted	Corn Hybrid	Seeding Rate	Yield (bu/ac)	Total Irrigation (in)	bu/ac-in of Irrigation	Acres	Previous Crop	Irrigation by System
Danny Krienke LEPA	Ochiltree	3 GPM-E	4/25	GA4173DG	29,000	231	13.11	17.62	60.00	Corn	LEPA
		3 GPM	5/30	GA4678DG	26,000	207	11.07	18.70	80.00	Wheat	LEPA
		4 GPM	5/30	GA4678DG	29,000	212	10.80	19.63	20.00	Wheat	LEPA
		5 GPM	5/30	GA4678DG	33,000	217	11.07	19.60	20.00	Wheat	LEPA
Harold Grall PMDI	Moore	3 GPM	5/25	P1151AMX	30,000	216	13.57	15.91	16.90	Corn	PMDI
		4 GPM	5/25	P1151AMX	30,000	200	14.85	13.47	1.70	Corn	PMDI
		5 GPM	5/25	P1151AMX	30,000	198	15.82	12.51	1.70	Corn	PMDI
Harold Grall LEPA	Moore	3 GPM	5/25	P1151AMX	30,000	203	13.57	14.96	79.80	Corn	LEPA
		4 GPM	5/25	P1151AMX	30,000	191	14.85	12.86	8.00	Corn	LEPA
		5 GPM	5/25	P1151AMX	30,000	190	15.82	12.01	8.00	Corn	LEPA
Stan Spain SDI	Moore	3 GPM	5/27	D54DC94	32,000	191	13.76	13.88	2.43	Fallow	SDI
		4 GPM	5/27	D54DC94	32,000	211	16.46	12.82	2.43	Fallow	SDI
		5 GPM	5/27	D54DC94	32,000	246	17.44	14.10	2.43	Fallow	SDI
Zac Yoder LESA	Dallam	3 GPM	5/14	P1151AMX	32,000	203	14.84	13.68	75.70	Corn	LESA
		4 GPM	5/14	P1151AMX	36,000	239	19.9	12.01	10.10	Corn	LESA
		5 GPM	5/14	P1151AMX	38,000	252	25.19	10.00	12.90	Corn	LESA
Stan Spain LEPA	Moore	3 GPM	5/27	D52SS91	32,000	195	14.82	13.16	18.30	Corn	LEPA
		4 GPM	5/27	D52SS91	32,000	217	18.10	11.99	18.30	Corn	LEPA
		5 GPM	5/27	D52SS91	32,000	260	18.91	13.75	18.30	Corn	LEPA

Appendix B: 2016 Summary by Grower, Corn Yield Bushels/Acre-Inch of Irrigation, "3-4-5 GPM"

Grower	Field	Planting Date	Pre-Water (in)	Irrigation (in)	Total Irrigation (in)	Rainfall (in)	Total Rainfall & Irrigation (in)	Net Soil Water (in)	Total Water (in)	Corn Yield (bu/ac)	**Yield @ bu/ac-in Irrigation**	Yield @ bu/ac-in Total Water	Net Return/Ac ($3.44/bu)	Net Return/ac-in Irrigation ($)
Danny Krienke	3 GPM-E	4/25	0	13.11	13.11	13.86	26.97	4.19	31.16	231	17.62	7.41	380.29	29.00
	3 GPM	5/30	0	11.07	11.07	12.31	23.36	3.35	26.73	207	18.70	7.74	344.79	31.14
	4 GPM	5/30	0	10.80	10.80	11.74	22.54	2.28	24.82	212	19.63	8.54	348.04	32.22
	5 GPM	5/30	0	11.07	11.07	11.74	22.81	1.22	24.03	217	19.60	9.03	341.68	30.86
Harold Grall PMDI	3 GPM	5/25	0	13.57	13.57	8.78	22.35	4.02	26.37	216	15.91	8.19	336.41	24.79
	4 GPM	5/25	0	14.85	14.85	8.78	23.63	1.93	25.56	200	13.47	7.82	288.69	19.44
	5 GPM	5/25	0	15.82	15.82	8.78	24.60	0	24.60	198	12.51	8.05	277.89	17.56
Harold Grall LEPA	3 GPM	5/25	0	13.57	13.57	8.78	22.35	1.52	23.87	203	14.96	8.50	303.83	22.39
	4 GPM	5/25	0	14.85	14.85	8.78	23.63	1.84	25.47	191	12.86	7.50	266.29	17.93
	5 GPM	5/25	0	15.82	15.82	8.78	24.60	1.67	26.27	190	12.01	7.23	257.98	16.31
Stan Spain SDI	3 GPM	5/27	0	13.76	13.76	7.01	20.77	5.49	26.26	191	13.88	7.27	264.83	19.24
	4 GPM	5/27	0	16.46	16.46	7.01	23.47	4.05	27.52	211	12.82	7.66	300.90	18.28
	5 GPM	5/27	0	17.44	17.44	7.01	24.45	2.07	26.52	246	14.10	9.27	379.64	21.77
Zac Yoder	3 GPM	5/14	0	14.84	14.84	7.84	22.68	4.30	26.98	203	13.68	7.52	288.20	19.42
	4 GPM	5/14	0	19.90	19.90	7.84	27.74	2.61	30.35	239	12.01	7.87	331.46	16.65
	5 GPM	5/14	0	25.19	25.19	7.84	33.03	1.18	34.21	252	10.00	7.36	319.81	12.69
Stan Spain LEPA	3 GPM	5/27	0	14.82	14.82	6.41	21.23	6.35	27.58	195	13.15	7.07	270.91	18.28
	4 GPM	5/27	0	18.10	18.10	6.41	24.51	1.31	25.82	217	11.99	8.40	303.48	16.76
	5 GPM	5/27	0	18.91	18.91	6.41	25.32	4.20	29.52	260	13.75	8.81	405.66	21.45
Average	3 GPM		0	13.53	13.53	9.28	22.82	4.17	26.99	206.57	15.41	7.67	312.75	23.47
Average	4 GPM		0	15.83	15.83	8.43	24.25	2.34	26.59	211.67	13.80	7.97	306.48	20.21
Average	5 GPM		0	17.38	17.38	8.43	25.80	1.72	27.53	227.17	13.66	8.29	330.44	20.11

Appendix C: 2016 Summary by Field, Corn Yield Bushels/Acre-Inch Irrigation, "3-4-5 GPM"

Grower	**Field**	Planting Date	Pre-Water (in)	Irrigation (in)	Total Irrigation (in)	Rainfall (in)	Total Rain & Irrigation (in)	Net Soil Water (in)	Total Water (in)	Corn Yield (bu/ac)	**Yield @ bu/ac-in Irrigation**	Yield @ bu/ac-in Total Water	Net Return/ac @ $3.44/bu	Net Return/ac-in Irrigation ($)
Danny Krienke	4 GPM	30-May	0	10.80	10.80	11.74	22.54	2.28	24.82	212	19.63	8.54	348.04	32.22
Danny Krienke	5 GPM	5/30	0	11.07	11.07	11.74	22.81	1.22	24.03	217	19.60	9.03	341.68	30.86
Danny Krienke	3 GPM	5/30	0	11.07	11.07	12.31	23.36	3.35	26.73	207	18.70	7.74	344.79	31.14
Danny Krienke	3 GPM-E	4/25	0	13.11	13.11	13.86	26.97	4.19	31.16	231	17.62	7.41	380.29	29.00
Harold Grall PMDI	3 GPM	5/25	0	13.57	13.57	8.78	22.35	4.02	26.37	216	15.91	8.19	336.41	24.79
Harold Grall LEPA	3 GPM	5/25	0	13.57	13.57	8.78	22.35	1.52	23.87	203	14.96	8.50	303.83	22.39
Stan Spain SDI	5 GPM	5/27	0	17.44	17.44	7.01	24.45	2.07	26.52	246	14.10	9.27	379.64	21.77
Stan Spain SDI	3 GPM	5/27	0	13.76	13.76	7.01	20.77	5.49	26.26	191	13.88	7.27	264.83	19.24
Zac Yoder	3 GPM	5/14	0	14.84	14.84	7.84	22.68	4.30	26.98	203	13.68	7.52	288.20	19.42
Stan Spain LEPA	5 GPM	5/27	0	18.91	18.91	6.41	25.32	4.20	29.52	260	13.75	8.81	405.66	21.45
Harold Grall PMDI	4 GPM	5/25	0	14.85	14.85	8.78	23.63	1.93	25.56	200	13.47	7.82	288.69	19.44
Stan Spain LEPA	3 GPM	5/27	0	14.82	14.82	6.41	21.23	6.35	27.58	195	13.15	7.07	270.91	18.28
Harold Grall LEPA	4 GPM	5/25	0	14.85	14.85	8.78	23.63	1.84	25.47	191	12.86	7.50	266.29	17.93
Stan Spain SDI	4 GPM	5/27	0	16.46	16.46	7.01	23.47	4.05	27.52	211	12.82	7.66	300.90	18.28
Harold Grall PMDI	5 GPM	5/25	0	15.82	15.82	8.78	24.60	0	24.60	198	12.51	8.05	277.89	17.56
Harold Grall LEPA	5 GPM	5/25	0	15.82	15.82	8.78	24.60	1.67	26.27	190	12.01	7.23	257.98	16.31
Zac Yoder	4 GPM	5/14	0	19.90	19.90	7.84	27.74	2.61	30.35	239	12.01	7.87	331.46	16.65
Stan Spain LEPA	4 GPM	5/27	0	18.10	18.10	6.41	24.51	1.31	25.82	217	11.99	8.40	303.48	16.76
Zac Yoder	5 GPM	5/14	0	25.19	25.19	7.84	33.03	1.18	34.21	252	10.00	7.36	319.81	12.69
Average	3 GPM		0	13.53	13.53	9.28	22.82	4.17	26.99	206.57	15.41	7.67	312.75	23.47
Average	4 GPM		0	15.83	15.83	8.43	24.25	2.34	26.59	211.67	13.80	7.97	306.48	20.21
Average	5 GPM		0	17.38	17.38	8.43	25.80	1.72	27.53	227.17	13.66	8.29	330.44	20.11

Appendix D: 2016 Water Summary by Net Return/Acre-Inch Irrigation by Field, "3-4-5 GPM"

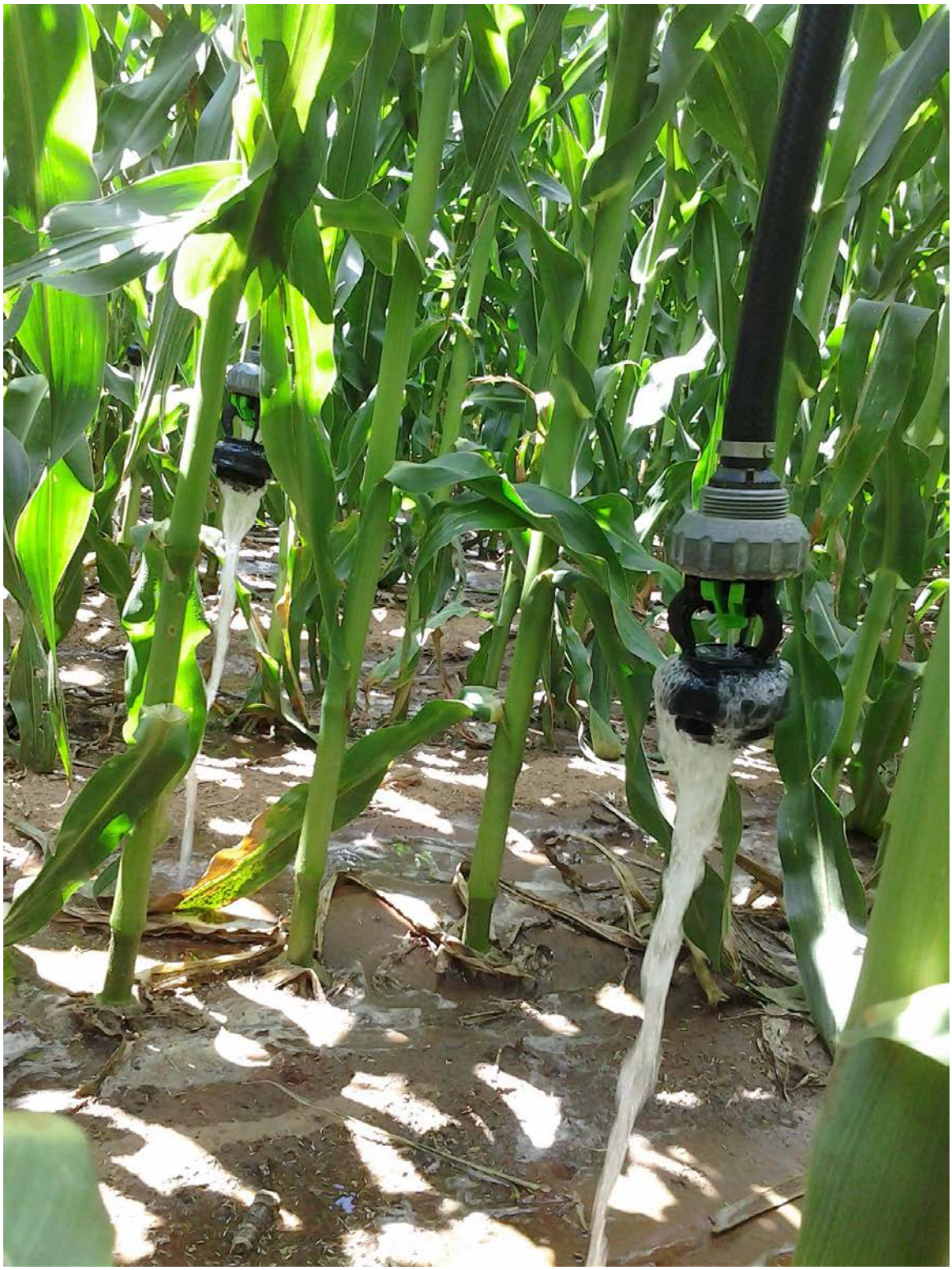
Grower	Field	Planting Date	Pre-Water (in)	Irrigation (in)	**Total Irrigation (in)**	Rainfall (in)	Total Rain & Irrigation (in)	Net Soil Water (in)	Total Water (in)	Corn Yield (bu/ac)	Yield @ bu/ac-in Irrigation	Yield @ bu/ac-in Total Water	Net Return/ac @ $3.44/bu	**Net Return/ac-in Irrigation ($)**
Danny Krienke	4 GPM	5/30	0	10.80	10.80	11.74	22.54	2.28	24.82	212	19.63	8.54	348.04	32.22
Danny Krienke	3 GPM	5/30	0	11.07	11.07	12.31	23.36	3.35	26.73	207	18.70	7.74	344.79	31.14
Danny Krienke	5 GPM	5/30	0	11.07	11.07	11.74	22.81	1.22	24.03	217	19.60	9.03	341.68	30.86
Danny Krienke	3 GPM-E	4/25	0	13.11	13.11	13.86	26.97	4.19	31.16	231	17.62	7.41	380.29	29.00
Harold Grall PMDI	3 GPM	5/25	0	13.57	13.57	8.78	22.35	4.02	26.37	216	15.91	8.19	336.41	24.79
Harold Grall LEPA	3 GPM	5/25	0	13.57	13.57	8.78	22.35	1.52	23.87	203	14.96	8.50	303.83	22.39
Stan Spain SDI	5 GPM	5/27	0	17.44	17.44	7.01	24.45	2.07	26.52	246	14.10	9.27	379.64	21.77
Stan Spain LEPA	5 GPM	5/27	0	18.91	18.91	6.41	25.32	4.20	29.52	260	13.75	8.81	405.66	21.45
Harold Grall PMDI	4 GPM	5/25	0	14.85	14.85	8.78	23.63	1.93	25.56	200	13.47	7.82	288.69	19.44
Zac Yoder	3 GPM	5/14	0	14.84	14.84	7.84	22.68	4.30	26.98	203	13.68	7.52	288.20	19.42
Stan Spain SDI	3 GPM	5/27	0	13.76	13.76	7.01	20.77	5.49	26.26	191	13.88	7.27	264.83	19.24
Stan Spain LEPA	3 GPM	5/27	0	14.82	14.82	6.41	21.23	6.35	27.58	195	13.15	7.07	270.91	18.28
Stan Spain SDI	4 GPM	5/27	0	16.46	16.46	7.01	23.47	4.05	27.52	211	12.82	7.66	300.90	18.28
Harold Grall LEPA	4 GPM	5/25	0	14.85	14.85	8.78	23.63	1.84	25.47	191	12.86	7.50	266.29	17.93
Harold Grall PMDI	5 GPM	5/25	0	15.82	15.82	8.78	24.60	0	24.60	198	12.51	8.05	277.89	17.56
Stan Spain LEPA	4 GPM	5/27	0	18.10	18.10	6.41	24.51	1.31	25.82	217	11.99	8.40	303.48	16.76
Zac Yoder	4 GPM	5/14	0	19.90	19.90	7.84	27.74	2.61	30.35	239	12.01	7.87	331.46	16.65
Harold Grall LEPA	5 GPM	5/25	0	15.82	15.82	8.78	24.60	1.67	26.27	190	12.01	7.23	257.98	16.31
Zac Yoder	5 GPM	5/14	0	25.19	25.19	7.84	33.03	1.18	34.21	252	10.00	7.36	319.81	12.69
Average	3 GPM		0	13.53	13.53	9.28	22.82	4.17	26.99	206.57	15.41	7.67	312.75	23.47
Average	4 GPM		0	15.83	15.83	8.43	24.25	2.34	26.59	211.67	13.80	7.97	306.48	20.21
Average	5 GPM		0	17.38	17.38	8.43	25.80	1.72	27.53	227.17	13.66	8.29	330.44	20.11

Appendix E: 2016 Water Summary by Net Return/Inch of Total Water by Field and by Grower, "3-4-5 GPM"

Grower	Field	Planting Date	Pre-Water (in)	Irrigation (in)	Total Irrigation (in)	Rainfall (in)	Net Soil Water (in)	**Total Water (in)**	Corn Yield (bu/ac)	Yield @ bu/ac-in Irrigation	Yield @ bu/ac-in Total Water	Net Return /ac @ $3.44/bu	Net Return/ac-in Irrigation ($)	**Net Return/Inch Total Water ($)**
Stan Spain SDI	5 GPM	5/27	0	17.44	17.44	7.01	2.07	26.52	246	14.10	9.27	379.64	21.77	14.31
Danny Krienke	5 GPM	5/30	0	11.07	11.07	11.74	1.22	24.03	217	19.60	9.03	341.68	30.86	14.21
Danny Krienke	4 GPM	5/30	0	10.80	10.80	11.74	2.28	24.82	212	19.63	8.54	348.04	32.22	14.02
Stan Spain LEPA	5 GPM	5/27	0	18.91	18.91	6.41	4.20	29.52	260	13.75	8.81	405.66	21.45	13.74
Danny Krienke	3 GPM	5/30	0	11.07	11.07	12.31	3.35	26.73	207	18.70	7.74	344.79	31.14	12.90
Harold Grall PMDI	3 GPM	5/25	0	13.57	13.57	8.78	4.02	26.37	216	15.91	8.19	336.41	24.79	12.75
Harold Grall LEPA	3 GPM	5/25	0	13.57	13.57	8.78	1.52	23.87	203	14.96	8.50	303.83	22.39	12.73
Danny Krienke	3 GPM-E	4/25	0	13.11	13.11	13.86	4.19	31.16	231	17.62	7.41	380.29	29.00	12.20
Stan Spain LEPA	4 GPM	5/27	0	18.10	18.10	6.41	1.31	25.82	217	11.99	8.40	303.48	16.76	11.75
Harold Grall PMDI	4 GPM	5/25	0	14.85	14.85	8.78	1.93	25.56	200	13.47	7.82	288.69	19.44	11.29
Harold Grall PMDI	5 GPM	5/25	0	15.82	15.82	8.78	0	24.60	198	12.51	8.05	277.89	17.56	11.29
Stan Spain SDI	4 GPM	5/27	0	16.46	16.46	7.01	4.05	27.52	211	12.82	7.66	300.90	18.28	10.93
Zac Yoder	4 GPM	5/14	0	19.90	19.90	7.84	2.61	30.35	239	12.01	7.87	331.46	16.65	10.92
Zac Yoder	3 GPM	5/14	0	14.84	14.84	7.84	4.30	26.98	203	13.68	7.52	288.20	19.42	10.68
Harold Grall LEPA	4 GPM	5/25	0	14.85	14.85	8.78	1.84	25.47	191	12.86	7.50	266.29	17.93	10.45
Stan Spain SDI	3 GPM	5/27	0	13.76	13.76	7.01	5.49	26.26	191	13.88	7.27	264.83	19.24	10.08
Stan Spain LEPA	3 GPM	5/27	0	14.82	14.82	6.41	6.35	27.58	195	13.15	7.07	270.91	18.28	9.82
Harold Grall LEPA	5 GPM	5/25	0	15.82	15.82	8.78	1.67	26.27	190	12.01	7.23	257.98	16.31	9.82
Zac Yoder	5 GPM	5/14	0	25.19	25.19	7.84	1.18	34.21	252	10.00	7.36	319.81	12.69	9.35
Average	3 GPM		0	13.53	13.53	9.28	4.17	26.99	206.57	15.41	7.67	312.75	23.47	11.59
Average	4 GPM		0	15.83	15.83	8.43	2.34	26.59	211.67	13.80	7.97	306.48	20.21	11.56
Average	5 GPM		0	17.38	17.38	8.43	1.72	27.53	227.17	13.66	8.29	330.44	20.11	12.12

Appendix F: 2016 Water Summary by Net Return/Acre by Field and Grower, "3-4-5 GPM"

Grower	Field	Planting Date	Pre-Water (in)	Irrigation (in)	Total Irrigation (in)	Rainfall (in)	Net Soil Water (in)	Total Water (in)	Corn Yield (bu/ac)	Yield @ bu/ac-in Irrigation	Yield @ Field Total Water	**Net Return /ac @ $3.44/bu**	Net Return/ac-in of Irrigation ($)	Net Return/Inch Total Water ($)
Stan Spain LEPA	5 GPM	5/27	0	18.91	18.91	6.41	4.20	29.52	260	13.75	8.81	405.66	21.45	13.74
Danny Krienke	3 GPM-E	4/25	0	13.11	13.11	13.86	4.19	31.16	231	17.62	7.41	380.29	29.00	12.20
Stan Spain SDI	5 GPM	5/27	0	17.44	17.44	7.01	2.07	26.52	246	14.10	9.27	379.64	21.77	14.31
Danny Krienke	4 GPM	5/30	0	10.80	10.80	11.74	2.28	24.82	212	19.63	8.54	348.04	32.22	14.02
Danny Krienke	3 GPM	5/30	0	11.07	11.07	12.31	3.35	26.73	207	18.70	7.74	344.79	31.14	12.90
Danny Krienke	5 GPM	5/30	0	11.07	11.07	11.74	1.22	24.03	217	19.60	9.03	341.68	30.86	14.21
Harold Grall PMDI	3 GPM	5/25	0	13.57	13.57	8.78	4.02	26.37	216	15.91	8.19	336.41	24.79	12.75
Zac Yoder	4 GPM	5/14	0	19.90	19.90	7.84	2.61	30.35	239	12.01	7.87	331.46	16.65	10.92
Zac Yoder	5 GPM	5/14	0	25.19	25.19	7.84	1.18	34.21	252	10.00	7.36	319.81	12.69	9.35
Harold Grall LEPA	3 GPM	5/25	0	13.57	13.57	8.78	1.52	23.87	203	14.96	8.50	303.83	22.39	12.73
Stan Spain LEPA	4 GPM	5/27	0	18.10	18.10	6.41	1.31	25.82	217	11.99	8.40	303.48	16.76	11.75
Stan Spain SDI	4 GPM	5/27	0	16.46	16.46	7.01	4.05	27.52	211	12.82	7.66	300.90	18.28	10.93
Harold Grall PMDI	4 GPM	5/25	0	14.85	14.85	8.78	1.93	25.56	200	13.47	7.82	288.69	19.44	11.29
Zac Yoder	3 GPM	5/14	0	14.84	14.84	7.84	4.30	26.98	203	13.68	7.52	288.20	19.42	10.68
Harold Grall PMDI	5 GPM	5/25	0	15.82	15.82	8.78	0	24.60	198	12.51	8.05	277.89	17.56	11.29
Stan Spain LEPA	3 GPM	5/27	0	14.82	14.82	6.41	6.35	27.58	195	13.15	7.07	270.91	18.28	9.82
Harold Grall LEPA	4 GPM	5/25	0	14.85	14.85	8.78	1.84	25.47	191	12.86	7.50	266.29	17.93	10.45
Stan Spain SDI	3 GPM	5/27	0	13.76	13.76	7.01	5.49	26.26	191	13.88	7.27	264.83	19.24	10.08
Harold Grall LEPA	5 GPM	5/25	0	15.82	15.82	8.78	1.67	26.27	190	12.01	7.23	257.98	16.31	9.82
Average	3 GPM			13.53	13.53	9.28	4.17	26.99	206.57	15.41	7.67	312.75	23.47	11.59
Average	4 GPM			15.83	15.83	8.43	2.34	26.59	211.67	13.80	7.97	306.48	20.21	11.56
Average	5 GPM			17.38	17.38	8.43	1.72	27.53	227.17	13.66	8.29	330.44	20.11	12.12



Center pivots apply irrigation water directly to the soil where plant roots get it to produce the crop. There is no plant foliage or wind losses with minimum evaporation losses. Flip to the spray pad at choice for seed germination, manage herbicides and other, and then back to bubble mode to achieve 95% or more irrigation water application efficiency.

Retrofit center pivot to high efficiency Low Elevation Precision Application (LEPA) to get more irrigation water to the crop with the current NRCS or NPGCD Master Irrigator class cost share. Retrofit is a significant opportunity to improve crop production from available irrigation water, which becomes less each growing season. Develop a plan and do it yourself for reduced cost.

NORTH PLAINS GROUNDWATER Conservation District