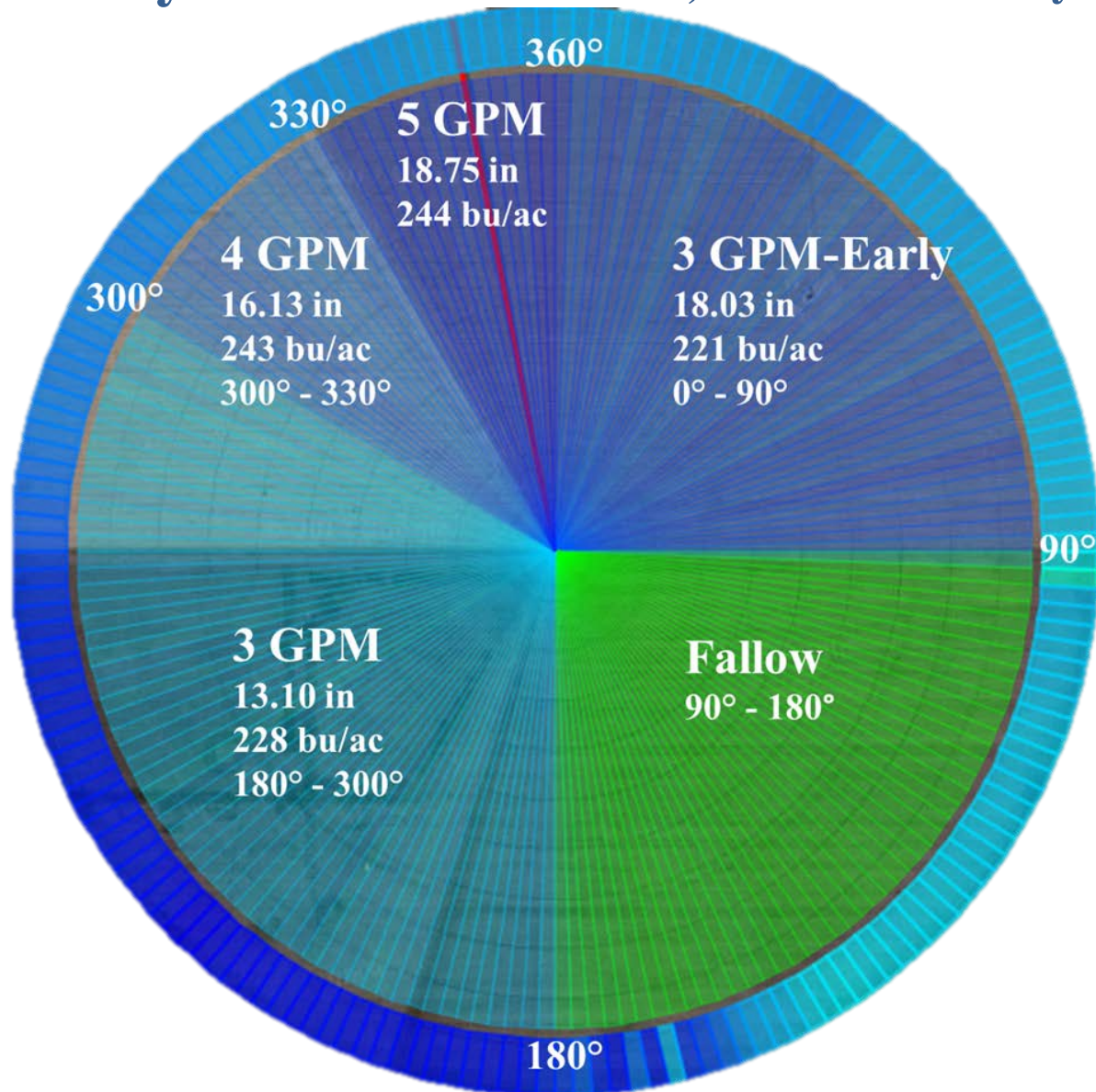


“3-4-5 Gallon Production Maximization Corn Demonstration Project”, 2017



The District’s “3-4-5 GPM” Project Demonstrates Advanced Technologies, Strategic Methods and Practices Producing Corn Using 3, 4 and 5 Gallons per Minute per Acre Irrigation Capacity to Achieve Optimum Grower Bottom Dollar Gain Managing Soil Water Levels that Supports Plant Development Requirements and Ready Additional Evaluation and Adoption.

Danny Krienke-Section 47, Ochiltree County



The “3-4-5 GPM” field scale demonstration project is achieved by writing a prescription that controls the center pivot travel speed by remote telemetry to apply 1.10 inches each week for the 3 GPM fields, 1.49 inches for the 4 GPM fields, and 1.85 inches per week for the 5 GPM fields. The water intensity map above illustrates where the 3 GPM, 4 GPM, 5 GPM, and 3 GPM-Early planted fields are located, the different amounts of irrigation applied, and the resulting corn yields for Danny Krienke’s 2017 Demonstration. Each 3, 4, 5 GPM travel speed prescription is based on what the GPM individual center pivots are nozzled to apply.

Principal Participants

Harold Grall - Moore County Cooperator (NPGCD Director)

Danny Krienke - Ochiltree County Cooperator (NPGCD Director)

Stan Spain - Moore County Cooperator

Principal Staff

Leon New - Agricultural Engineer (District Conservationist)

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Texas Water Development Board - Agricultural Water Conservation Grant

**A special thanks goes to all those not mentioned above who helped make the
“3-4-5 GPM” demonstrations possible.**

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Executive Summary

The “3-4-5 Gallon Production Maximization (GPM)” project is a three-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 North Plains Groundwater Conservation District planned and initiated the “3-4-5 GPM” 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 using 5 GPM irrigation capacity. These weekly amounts of irrigation represented one 120 acre center pivot correctly nozzled, pressured, and managed to apply 360 gallons per minute (3 GPM), 480 (4 GPM), and 600 gallons (5 GPM) as typically used by any grower. Similarly, a 500 acre half mile center pivot was nozzled to apply 1500 gallons (3 GPM), 2000 gallons (4 GPM), and 2500 (5GPM).

Following results and data from the previous five-year “200-12” project, the “3-4-5 GPM” project was established to provide information on where to apply groundwater to provide its most profitable use. Field data collected and tabulated from growers’ fields in the five-year “200-12” project showed promising, optimum corn yields and profitability where center pivot irrigation systems were nozzled for 3.0 and 4.0 GPM per acre. That data showed some “200-12” project fields were overwatered managing 4.0 GPM per acre, especially when excessive pre-water was pumped. Likewise, some corn production fields were significantly overwatered, where center pivots were nozzled for 5.0 GPM per acre. Advanced technology and management tools can be conveniently utilized to improve efficiency and increase conservation for both 4 GPM and 5 GPM per acre corn production.

In **2015**, the “3-4-5 GPM” project’s first year, five cooperating growers committed 700 acres to achieve initial field demonstration results. In **2016**, the project’s second year, five cooperating growers dedicated 654 acres to obtain additional demonstration results. In **2017**, the final year of the project, **Danny Krienke** planted 180 acres in Ochiltree County, **Harold Grall** planted 241 acres in Moore County, and **Stan Spain** planted 94 acres, of which 39 acres were Sub-surface Drip Irrigation (SDI) in Moore County. **Krienke, Grall**, and **Spain** also demonstrated the benefit of high efficiency water application LEPA and PMDI center pivot irrigation systems within the “3-4-5 GPM” 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, 5” field. **Appendix C** describes bushels produced from each inch of irrigation for 3, 4, 5 GPM fields and by field. **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, 5 GPM field. **Appendix F** describes net return per acre for each grower and 3, 4, 5 GPM field. Next are the results from the 2017 cooperating producer fields.

Stan Spain SDI Fields

In Moore County, Spain produced 10 more bushels per acre in his 3 GPM SDI field than the 4 GPM field with 2.16 less inches of irrigation. The 3 GPM field produced 12 more bushels per acre than the 5 GPM

with 4.32 less inches of irrigation. The 4 GPM yield was 2 more bushels per acre than that from the 5 GPM field with 2.16 less inches of irrigation. Corn production was 26.82 bushels (1,501 lb.) per inch of irrigation in the 3 GPM field compared to 21.38 bushels (1,197 lb.) in the 4 GPM field, and 18.09 bushels (1,013 lb.) from the 5 GPM field.

The 3 GPM field's net gain was \$40.05 per acre with 2.16 inches less irrigation used compared to production from the 4 GPM field. The 3 GPM field's net gain compared to the 5 GPM field was \$58.77 per acre with 4.32 less inches of irrigation. Net gain for the 4 GPM field was \$18.72 per acre more than the 5 GPM with 2.16 inches less irrigation. Net return from each inch of irrigation was \$54.96 for the 3 GPM field compared to \$42.24 from the 4 GPM and \$34.73 for the 5 GPM field. Net return from each inch of total water was \$23.79 for the 3 GPM field, \$20.27 for the 4 GPM field, and \$18.06 for the 5 GPM field.

Stan Spain LEPA Fields

In Moore County, Spain produced 10 more bushels per acre in the 4 GPM center pivot LEPA field than the 3 GPM field, and irrigation was 2.29 inches more. The 5 GPM field produced 10 more bushels per acre than the 3 GPM with 4.56 more inches of irrigation. The 4 GPM yield and 5 GPM yield were both 270 bushels per acre, but the 4 GPM field used 2.27 less inches of irrigation. Corn production was 22.85 bushels (1,279 lb.) per inch of irrigation in the 3 GPM field compared to 19.75 bushels (1,106 lb.) in the 4 GPM, and 16.94 bushels (948 lb.) from the 5 GPM field.

The 4 GPM field's net gain was \$12.46 per acre with 2.29 inches more irrigation used compared to production from the 3 GPM field. The 3 GPM field's net gain compared to the 5 GPM field was \$1.62 more per acre with 4.56 less inches of irrigation. Net gain for the 4 GPM field was \$14.08 per acre more than the 5 GPM with 2.29 inches less irrigation. Net return from each inch of irrigation was \$45.32 for the 3 GPM field compared to \$38.64 from the 4 GPM and \$32.25 for the 5 GPM field. Net return from each inch of total water was \$21.49 for the 3 GPM field, \$20.09 for the 4 GPM field, and \$18.00 for the 5 GPM field.

Harold Grall LEPA Fields

In Moore County, Grall produced 4 more bushels per acre in the 4 GPM LEPA field than the 3 GPM field with 4.76 more inches of irrigation. The 5 GPM field produced 1 bushel per acre more than the 3 GPM with 6.36 more inches of irrigation. The 4 GPM yield was 3 bushels per acre more than that from the 5 GPM field with 1.60 less inches of irrigation. Corn production was 18.04 bushels (1,010 lb.) per inch of irrigation in the 3 GPM field compared to 13.45 bushels (753 lb.) in the 4 GPM and 12.19 bushels (682 lb.) from the 5 GPM field.

The 3 GPM field's net gain was \$18.86 per acre with 4.76 inches less irrigation used compared to production from the 4 GPM field. The 3 GPM field's net gain compared to the 5 GPM field was \$36.78 per acre with 6.36 less inches of irrigation. Net loss for the 5 GPM field compared to the 4 GPM was \$17.92 per acre with 1.60 inches more irrigation. Net return from each inch of irrigation was \$34.76 for the 3 GPM field compared to \$24.43 from the 4 GPM field, and \$21.50 for the 5 GPM field. Net return

from each inch of total water was \$18.82 per acre for Grall's 3 GPM LEPA field, \$15.07 for the 4 GPM field, and \$13.69 for the 5 GPM LEPA field.

Danny Krienke LEPA Fields

In Ochiltree County, the 4 GPM field produced 15 more bushels per acre than the 3 GPM field with an additional 3.03 inches of irrigation. The 5 GPM field produced 16 more bushels per acre than the 3 GPM field with 5.65 more inches of irrigation. The 5 GPM yield was 1 more bushel per acre than that from 4 GPM field with 2.62 additional inches of irrigation. Production in the 3 GPM-Early field was 7 less bushels per acre than the 3 GPM field, 22 bushels less than in the 4 GPM field, and 23 less bushels than in the 5 GPM field. Corn production was 17.40 bushels (974 lb.) per inch of irrigation in the 3 GPM field compared to 15.06 bushels (844 lb.) in the 4 GPM field and 13.01 bushels (729 lb.) from the 5 GPM field. Production in the 3-Early planted field was 12.26 bushels (686 lb.) per inch of irrigation.

The 4 GPM field's net gain was \$21.21 per acre with 3.03 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 was \$7.62 per acre with 5.65 additional inches of irrigation. Net loss for the 5 GPM field compared to the 4 GPM was \$13.59 per acre with 2.62 inches more irrigation. Net return from each inch of irrigation was \$33.07 for the 3 GPM field compared to \$28.17 from the 4 GPM field, \$23.51 for the 5 GPM field, and \$20.56 from the 3 GPM-Early planted field. Net return from each inch of total water was \$18.37 per acre for the 3 GPM field, \$16.39 for the 4 GPM field, \$15.08 for the 5 GPM field, and \$13.47 per inch from his 3 GPM-Early planted field. Net return per acre was \$433.25 for the 3 GPM field, \$454.45 for 4 GPM field, \$440.87 for GPM field, and \$370.72 for 3 GPM-Early planted field.

Harold Grall PMDI Fields

In Moore County, Grall produced 7 more bushels per acre in the 4 GPM field than the 3 GPM field, and irrigation was 4.76 inches more. The 5 GPM field produced 6 more bushels per acre than the 3 GPM field with 6.36 more inches of irrigation. The 5 GPM yield was 1 fewer bushel per acre than that from 4 GPM field with 1.60 additional inches of irrigation. Corn production was 16.89 bushels (946 lb.) per inch of irrigation in the 3 GPM field compared to 12.78 bushels (715 lb.) in the 4 GPM acres and 11.67 bushels (654 lb.) from the 5 GPM field.

The 3 GPM field's net gain was \$10.87 per acre with 4.76 inches less irrigation used compared to production from the 4 GPM field. The 3 GPM field's net gain compared to the 5 GPM field was \$23.45 per acre with 6.36 less inches of irrigation. Net gain for the 4 GPM field compared to the 5 GPM was \$12.58 per acre with 1.60 inches less irrigation. Net return from each inch of irrigation was \$31.71 per acre for the 3 GPM field compared to \$22.64 from the 4 GPM field and \$20.13 for the 5 GPM field. Net return from each inch of total water was \$17.16 for Grall's 3 GPM PMDI field, \$13.96 for the 4 GPM PMDI field, and \$12.82 for the 5 GPM PMDI field.

2017 Irrigation Systems within the “3-4-5 GPM” Project

2017 Harold Grall LEPA and PMDI Fields

In Moore County, the 3 GPM LEPA field produced 15 more bushels per acre than the 3 GPM PMDI field. Irrigation in each field was 13.08 inches. The 4 GPM LEPA field produced 12 more bushels per acre than the 4 GPM PMDI field, and irrigation was 17.84 inches for each field. The 5 GPM LEPA field produced 10 more bushels per acre than the 5 GPM PMDI; irrigation was 19.44 inches for both fields.

Corn production was 18.04 bushels (1,010 lb.) per inch of irrigation in the 3 GPM LEPA field compared to 16.89 bushels (946 lb.) in the 3 GPM PMDI. In the 4 GPM fields, production was 13.45 bushels (753 lb.) per inch of irrigation for LEPA and 12.78 bushels (715 lb.) for PMDI. Production in the 5 GPM LEPA field was 12.19 bushels (682 lb.) from each inch of irrigation as compared to 11.67 bushels (654 lb.) per inch in the 5 GPM SDI field.

Irrigation, rainfall, and net soil water totaled 24.16 inches in the 3 GPM LEPA field and also in the 3 GPM PMDI field. Production from each inch of total water was 9.77 bushels (547 lb.) for the 3 GPM LEPA and 9.15 bushels (5,121 lb.) for 3 GPM PMDI. Production from 28.92 inches of total water in the 4 GPM LEPA field was 8.30 bushels (464 lb.) compared to 7.88 bushels (441 lb.) from each of 28.92 inches for the 4 GPM PMDI field. Total water was 30.52 inches for the 5 GPM LEPA field from which production was 7.76 bushels (435 lb.) per inch. Total water in the 5 GPM PMDI field was 30.52 inches from which production was 7.43 bushels (416 lb.) per inch.

Net return from each inch of irrigation is \$34.76 for the 3 GPM LEPA field and \$31.71 per inch for the 3 GPM PMDI field. In the 4 GPM LEPA field, net return per inch of irrigation was \$24.43 per inch and \$22.64 for 4 GPM PMDI field. Net return for the 5 GPM LEPA field was \$21.50 from each inch of irrigation and \$20.13 per inch from the 5 GPM PMDI field.

Net return per acre was \$454.70 for the 3 GPM LEPA field and \$414.73 for the 3 GPM PMDI field. Net return for the 4 GPM LEPA field was \$435.85 per acre and \$403.86 for the 4 GPM PMDI field. In the 5 GPM LEPA field, net return was \$417.93 per acre compared to \$391.28 per acre for the 5 GPM PMDI field.

Stan Spain LEPA and SDI Fields

In Moore County, the 3 GPM SDI field produced 17 more bushels per acre than the 3 GPM center pivot LEPA field. Irrigation in the SDI field was 10.33 inches and 11.38 in the LEPA field. The 4 GPM LEPA field produced 3 more bushels per acre than the 4 GPM SDI field. Irrigation was 13.67 inches per acre for the LEPA field and 12.49 inches for the SDI field. The 5 GPM LEPA field produced 5 more bushels per acre than the 5 GPM SDI field. Irrigation was 15.94 inches for the 5 GPM LEPA field compared to 14.65 inches in the SDI field.

Corn production was 26.82 bushels (1,501 lb.) per inch of irrigation in the 3 GPM SDI field and 22.85 bushels (1,279 lb.) in the 3 GPM LEPA field. In the 4 GPM field, production was 19.75 bushels (1,106

lb.) per inch of irrigation for LEPA and 21.38 bushels (1,197 lb.) for SDI. Production in the 5 GPM LEPA field was 16.94 bushels (948 lb.) from each inch of irrigation and 18.09 bushels (1,013 lb.) per acre for the 5 GPM SDI field.

Irrigation, rainfall, and net soil water totaled 23.86 inches per acre in the 3 GPM SDI field and 24.00 inches in the 3 GPM LEPA field. Production from each inch of total water was 11.61 bushels (650 lb.) for the 3 GPM SDI and 10.83 bushels (606 lb.) for 3 GPM LEPA. Production from 26.29 inches of total water in the 4 GPM LEPA field was 10.27 bushels (575 lb.) compared to 10.26 bushels (574 lb.) from the 4 GPM SDI field. Total water was 28.56 inches per acre for the 5 GPM LEPA field from which production was 9.45 bushels (529 lb.) per inch. Total water in the 5 GPM SDI was 28.18 inches per acre from which production was 9.40 bushels (526 lb.) per inch.

Net return from each inch of irrigation was \$45.32 for the 3 GPM LEPA field and \$54.96 per inch for the 3 GPM SDI field. For the 4 GPM LEPA field, net return per inch of irrigation was \$38.64 per inch compared to \$42.24 for 4 GPM SDI field. Net return per acre for the 5 GPM LEPA field was \$32.25 from each inch of irrigation compared to \$34.73 per inch for the 5 GPM SDI field.

Net return per acre was \$515.76 for the 3 GPM LEPA field and \$567.59 for the 3 GPM SDI field. Net return for the 4 GPM LEPA field was \$528.22 per acre and \$527.54 per acre for the 4 GPM SDI field. For the 5 GPM LEPA field, net return was \$514.14 per acre compared to \$508.82 per acre for the 5 GPM SDI field.

Harold Grall T-L PMDI Field

In Moore County, Grall produced 12.17 bushels (681 lb.) per acre from each inch of irrigation with his T-L PMDI center pivot. Net return from each inch of irrigation was \$20.15 per acre. Net return per acre was \$322.87. Irrigation capacity was 2.82 GPM per acre from two wells from which seasonal water meter readings averaged 338 GPM. The T-L oil hydraulic drive center pivot was not readily remote guided for the “3, 4, 5 GPM” Variable Rate Irrigation (VRI) by travel speed control, but provided valuable on-site irrigation system corn production data for area growers to evaluate for potential adoption.

Stan Spain “3-4-5 GPM” SDI Cotton Fields

In Moore County, Spain produced 185 pounds per inch of irrigation in the 3 GPM field compared to 158 pounds in the 4 GPM and 89 pounds from the 5 GPM field. Production from each inch of irrigation, rainfall, and net soil water that totaled 23.13 inches was 51 pounds per acre in the 3 GPM field. Irrigation, rainfall, and net soil water totaled 22.87 inches in the 4 GPM field where production was 52 pounds per inch. In the 5 GPM field, irrigation, rainfall, and net soil water totaled 23.65 inches where production was 32 pounds per inch of total water.

At \$0.5668 per pound of lint cotton produced, gross value from each inch of irrigation applied was \$104.97 per acre for the 3 GPM field compared to \$89.63 for the 4 GPM and \$50.67 for the 5 GPM. Gross value of each inch of irrigation, rainfall, and net soil water measured that totaled 23.13 inches in

the 3GPM field was \$29.13. Value of the 22.87 inches of irrigation, rainfall, and net soil water measured in the 4 GPM field was \$29.39. Irrigation, rainfall, and net soil water totaled 23.65 inches in the 5 GPM field for which the gross value was \$18.38 from each inch. Gross value of cotton produced in the 3 GPM field was \$673.92 per acre compared to \$672.22 for the 4 GPM and \$434.74 for the 5 GPM field. **Appendix K** highlights the “3-4-5 GPM” SDI cotton production details.

“3-4-5 GPM” Project 3-Year Summary

Five progressive, innovative, cooperating growers developed valuable corn production guideline information conducting 60 field-scale water management demonstrations on 1,869 acres following strategic protocol for the three-year “3- 4-5 GPM” project. Corn yield averaged 223 bushels (12,488 lb.) per acre from the 3 GPM fields, 232 bushels (12,992 lb.) from the 4 GPM fields, 242 bushels (13,552 lb.) from the 5 GPM field, and 226 bushels (12,656 lb.) per acre from the 3 GPM Early planted fields.

Corn yield averaged 18.17 bushels (1,017 lb.) per inch of irrigation in the 3 GPM fields, 15.66 bushels (877 lb.) from the 4 GPM fields, 14.40 bushels (806 lb.) from the 5 GPM fields, and 14.94 bushels (836 lb.) per inch from the 3 GPM-Early planted fields. Yields averaged 8.74 bushels (489 lb.) from each inch of irrigation, rainfall, and net soil water in the 3 GPM fields, 8.47 bushels (474 lb.) from the 4 GPM fields, 8.38 bushels (469 lb.) from the 5 GPM fields, and 7.72 bushels (432 lb.) per inch in the 3 GPM-Early planted fields.

Irrigation averaged 12.61 inches per acre in the 3 GPM fields, 15.28 inches in the 4 GPM fields, 17.36 inches in the 5 GPM fields, and 15.57 inches per acre in the 3 GPM-Early planted fields. Irrigation, rainfall, and net soil water averaged 25.66 inches per acre in the 3 GPM fields, 27.39 inches per acre in the 4 GPM fields, 28.94 inches in the 5 GPM fields, and 29.34 inches per acre in the 3 GPM-Early planted fields.

Net return averaged \$417.08 per acre in the 3 GPM fields compared to \$422.59 in the 4 GPM fields, \$434.94 per acre in the 5 GPM fields, and \$404.16 per acre in the 3 GPM-Early planted fields. Net return from each inch of irrigation averaged \$33.08 from the 3 GPM fields, \$27.66 from the 4 GPM fields, \$25.03 from the 5 GPM fields, and \$25.96 per inch from the 3 GPM-Early planted fields. Net return from each inch of total water averaged \$16.25 for the 3 GPM fields compared to \$15.43 for the 4 GPM fields, \$15.03 from the 5 GPM fields, and \$13.78 per inch from the 3 GPM-Early planted fields.

The above crop production costs and net returns were based on 2017 costs as follows: \$6.20 per inch of irrigation, \$3.33 per thousand seeds planted per acre, \$0.36 per bushel harvest expense, nutrient costs provided by Better Harvest, and corn priced at \$3.63 per bushel. 2017 completed the 3-year “3-4-5 GPM” demonstration project

Appendix G describes the 3-year average planting dates, seeding rates, irrigation, and harvest results. **Appendix H** describes the 3-year bushels per inch of irrigation by grower. **Appendix I** describes the 3-year per inch of irrigation by 3, 4, 5 GPM field and grower. **Appendix J** summarizes the 3-year bushels per inch of total water by 3, 4, 5 GPM field and grower.

Introduction

In 2015, the North Plains Groundwater Conservation District planned and initiated a field demonstration identified as the “3-4-5 Gallon Production Maximization (GPM)” project that would use the latest water conservation technologies and practices to grow corn irrigated at three different amounts weekly as needed. The project was 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 represented one 120 acre center pivot correctly nozzled and managed to apply 360 gallons per minute (3 GPM), 480 (4 GPM), and 600 gallons (5 GPM). Similarly, a 500 acre half-mile center pivot was nozzled to apply 1500 (3 GPM) gallons per minute (GPM), 2,000 gallons (4 GPM), and 2,500 (5 GPM). The “3-4-5 GPM” project was planned for a three-year period with 2017 being the final year.

Following results and data from the previous five-year 200-12 project, the “3-4-5 GPM” 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 showed promising, optimum corn yields and profitability where center pivot irrigation systems were correctly designed and nozzled for 3.00 and 4.00 GPM per acre. The data showed some project fields were overwatered managing 4 GPM per acre, especially when excessive pre-water was pumped and seasonal beneficial rainfall was more than 9 inches. Where center pivots were nozzled for 5 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 crop productivity and efficiency.

The “200-12” project was a five-year initiative that provided 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 through 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 stepped up to the next level, based on what was learned from the “200-12” and Agri-Partner projects. That was 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 GPM” project demonstrated 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 Low Energy Precision Application (LEPA) or Low Elevation Spray Application (LESA) in canopy center pivot irrigation systems combined with strip or no till and crop residue management farming practices. The “3-4-5 GPM” project was designed as a three-year initiative that provided 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 guided by 24/7 soil water sensor monitoring.

In **2015**, the “3-4-5 GPM” project’s first year, 5 cooperating growers committed 700 acres to achieve initial field demonstration results. In 2016, 5 cooperating growers committed 654 acres, of which 19 acres were Sub-surface drip (SDI). In 2017, **Harold Grall** dedicated 241 acres in Moore County, **Danny Krienke** used 180 acres in Ochiltree County, and **Stan Spain** planted 94 acres, of which 39 acres were Sub-surface Drip Irrigation (SDI), at the Districts’ WCC in Moore County. Additional information was compiled in 2015 and 2016 for the “3-4-5 GPM” project and 2010, 2011, 2012, 2013, and 2014 for the previous “200-12 project and can be obtained from the website: northplainsgcd.org/education. The District office is located at 603 East 1st street, Dumas, Texas. (806) 935-6401.

Methods

Each of the 3 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 the 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 North Plains Groundwater Conservation District’s (District) “3-4-5 GPM” project protocols and guidelines. Each cooperator established and wrote a variable center pivot travel speed prescription to apply the different irrigation amounts no more often than weekly. 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 each 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 gallons per minute. The district’s project leader received pre-programmed text notification when each center pivot entered and departed individual acres/sectors or fields that was recorded and used to calculate individual 3, 4, 5 GPM sector/field irrigation amounts based on weekly on-site water meter GPM flow.

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 remote continuous tracking and control to manage and monitor irrigation application. Each cooperator was provided soil and plant leaf sampling for each 3, 4, 5 GPM sector/field four times during the growing season by Better Harvest, Inc. to monitor and guide fertility levels. During the growing season, District personnel collected water, soil moisture, crop growth, and other data and maintained recording equipment weekly in each demonstration field. The District’s tabulated demonstration field data is included with each cooperator individual report that follows in this report. 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 GPM, 4 GPM and 5 GPM

fields/sectors. Individual irrigation amounts were calculated using each text message from Pivotrak to the District conservationist who recorded when irrigation stopped in one sector and began in the other sector. The time the irrigation system was in the 3 GPM, 4 GPM, and 5 GPM sectors/fields in combination with weekly gallons per minute (GPM) water meter readings, established a method to track irrigation. All demonstrations began at planting and ended at harvest, which each cooperator managed.

The District compared harvest and irrigation results from each 3 GPM, 4 GPM, 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 \$3.63 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 was \$3.33 per thousand, irrigation was \$6.20 per inch applied, and harvest was \$0.36 per bushel. Fertilizer costs were calculated for each field based on basic nutrients removed to produce the corn yield harvested. Method of calculation and nutrient prices was provided by Better Harvest. 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 GPM, 4 GPM and 5 GPM acres/sectors/fields measured and recorded in 2017, the third and final year for the "3-4-5 GPM" project.

Stan Spain's 2017 Moore County SDI Corn Demonstration

2017 Planting and Crop Information, SDI Corn, Spain

Stan Spain strip tilled and planted 19.44 acres of corn in the south half of section 47 for his “3, 4, 5 GPM” SDI demonstration. The SDI acres were positioned between two LEPA 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 5 GPM field, zone 4 was the 4 GPM field, and zone 5 was the 3 GPM field. Three irrigation plans were developed and run by Field Net to apply the project's weekly irrigation amounts. Each plan irrigated two zones simultaneously and three 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 .062 inches to apply 1.86 inches for the 5 GPM field. The south SDI acres were planted to cotton and irrigated in sequence with the north acres. Spain planted each “3, 4, 5 GPM” corn field to Dynagro D58VC53 hybrid. Seeding rate was 32,000 seeds per acre for the 3 GPM, 4 GPM, and 5 GPM acres. Seasonal water meter readings averaged 153 GPM (for 2.00 - 2.43 acre zones). Irrigation was with Netafim 13 mil Typhoon series SDI tape laterals spaced 30 inches apart with 0.18 GPH TurbONet emitters spaced 24 inches. Planting and crop information for “Spain 3 GPM”, “Spain 4 GPM”, and “Spain 5 GPM” LEPA are shown in the Table 1 below.

Table 1: 2017 Planting and Crop Information, SDI Corn, Stan Spain

3 GPM Demonstration Site: Zone 5				
Planted	May 24	Harvested	October 28	
Hybrid	Dynagro D58VC53	Seeding Rate	32,000	
Row Width	30 inches	Tillage	Strip Till	
No. Acres	2.43	GPM per acre	3.00	
Total Water	23.86 inches	Soil Type	Sherman Clay Silty Loam	
Irrigation	10.33 inches	Insecticide	Prevathon, Warhawk, Rifle	
4 GPM Demonstration Site: Zone 4				
Planted	May 24	Harvested	October 27	
Hybrid	Dynagro D58VC53	Seeding Rate	32,000	
Row Width	30 inches	Tillage	Strip Till	
No. Acres	2.43	GPM per acre	4.00	
Total Water	26.02 inches	Soil Type	Sherman Clay Silty Loam	
Irrigation	12.49 inches	Insecticide	Prevathon, Warhawk, Rifle	
5 GPM Demonstration Site: Zone 3				
Planted	May 24	Harvested	October 27	
Hybrid	Dynagro D58VC53	Seeding Rate	32,000	
Row Width	30 inches	Tillage	Strip Till	
No. Acres	2.43	GPM per acre	5.00	
Total Water	28.18 inches	Soil Type	Sherman Clay Silty Loam	
Irrigation	14.65 inches	Insecticide	Prevathon, Warhawk, Rifle	

2017 Soil Water Profile and Growing Season Rainfall, SDI Corn, Spain

“3 GPM” SDI Demonstration Site

Rainfall in March and April finished refilling the soil profile to needed levels prior to planting. Preseason soil water was good at 1, 2, 3, 4, and 5 feet. Weekly gypsum block readings indicated the crop used more than irrigation and rainfall provided and removed stored water from 1 and 2 feet by mid – July at the 10 leaf growth stage using 90% of that stored at 1 foot and 75% from 2 feet. The 7.05 inches of rainfall in August refilled the profile. Plant roots developed into 3 feet in September during grain maturity using about 55% of that stored, 100% from 2 feet and 50% from 1 foot plus irrigation and rainfall. The sensors showed no soil water was used from 4 and 5 feet in the root zone. Rainfall in September and October refilled soil water at 1, 2, 3, 4, and 5 feet by harvest leaving good levels for the 2018 crop. Soil moisture sensors showed 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. Rainfall from planting until grain black layer totaled 13.53 inches.

“4 GPM” SDI Demonstration Site

Soil water was good at 1, 2, 3, 4, and 5 feet at planting from preseason rainfall. Soil moisture sensors showed plant roots began using water from 1 foot in the root zone at the 10 leaf growth stage in mid-July and from 2 feet in late July at pollination in addition to irrigation and rainfall. Plants used 90% of the water stored at 1 foot and 60% of that at 2 feet. Abundant rainfall in August refilled the soil profile to beginning levels which were maintained by irrigation and rainfall that followed leaving a full soil profile at the end of the season. Sensors showed no soil water was used from 3, 4, and 5 feet producing the crop. Weekly gypsum block readings showed the crop had adequate soil moisture during the growing season. No net soil water was used. A total of 13.53 inches of rainfall was recorded from planting through black layer. Soil was 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 from preseason rainfall. Soil moisture sensors show plant roots removed water from 1 foot the first week in July at the 10 leaf growth stage in addition to irrigation and rainfall. Plants used about 85% of the water stored at 1 foot and 50% of that stored at 2 feet in the root zone in mid to late July at tassel and pollination. No additional soil water was used until mid- September during grain maturity when about 20% of soil water stored at both 3 and limited amounts from 1 and 2 feet was used. Rainfall in October refilled the soil profile to the levels at planting. Weekly gypsum block moisture sensors showed the crop had sufficient available soil water during the entire growing season. Rainfall was 13.53 inches. Irrigation totaled 14.65 inches. No net soil water was used. 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 2: 2017 Monthly Rainfall Data, SDI Corn, Spain

GPM	June (in)	July (in)	August (in)	September (in)	October (in)	Total (in)
3, 4, 5	1.86	0.45	7.05	2.98	1.19	13.53

2017 Growing Season Water Tracking, SDI Corn, Spain

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 five gypsum block soil moisture sensors was installed at 1, 2, 3, 4, and 5 feet, and an AquaSpy™ soil moisture probe was installed down to four feet in the root zone at one location to monitor soil water levels in the “3 GPM” field. Another set of the same type of sensors were installed in each “4 GPM” and “5 GPM” fields. 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 are read, recorded and utilized weekly by district personnel. Each AquaSpy® probe was installed following crop emergence. A 24/7 Aquaspy probe website shows soil moisture at four inch increments to 48 inches and monitors plant root growth. The website lists all Aquaspy soil probes in the “3, 4, 5, GPM” project and was available to all cooperators and district personnel. Another 24/7 Pivotrak website tracks each center pivot system and monitored and controlled irrigation. The SDI irrigation plans written to apply 1.14 inches (“3 GPM”), 1.50 inches (“4 GPM”), and 1.86 inches (“5 GPM”) was managed from the Field Net website. Both the cooperating grower and district “3, 4, 5 GPM Project Leader collectively monitored, controlled, and managed irrigation from the Field Net website.

Following this paragraph, a series of graphs and tables shows weekly gypsum block readings for the season; growing season water, including rainfall, irrigation, and soil moisture at various growth stages; and the order of irrigation and rainfall events for each “3, 4, 5, GPM” field. “Water Summary,” as shown on the graph for growing season water, is the sum of seasonal irrigation, rainfall, and net soil water. Graphs and tables for the 3 GPM acres are shown first, followed by the same illustrations for each 4 GPM and 5 GPM.

Figure 1: 2017 Gypsum Block Readings, “3 GPM” SDI Corn, 277 bu/ac, Spain

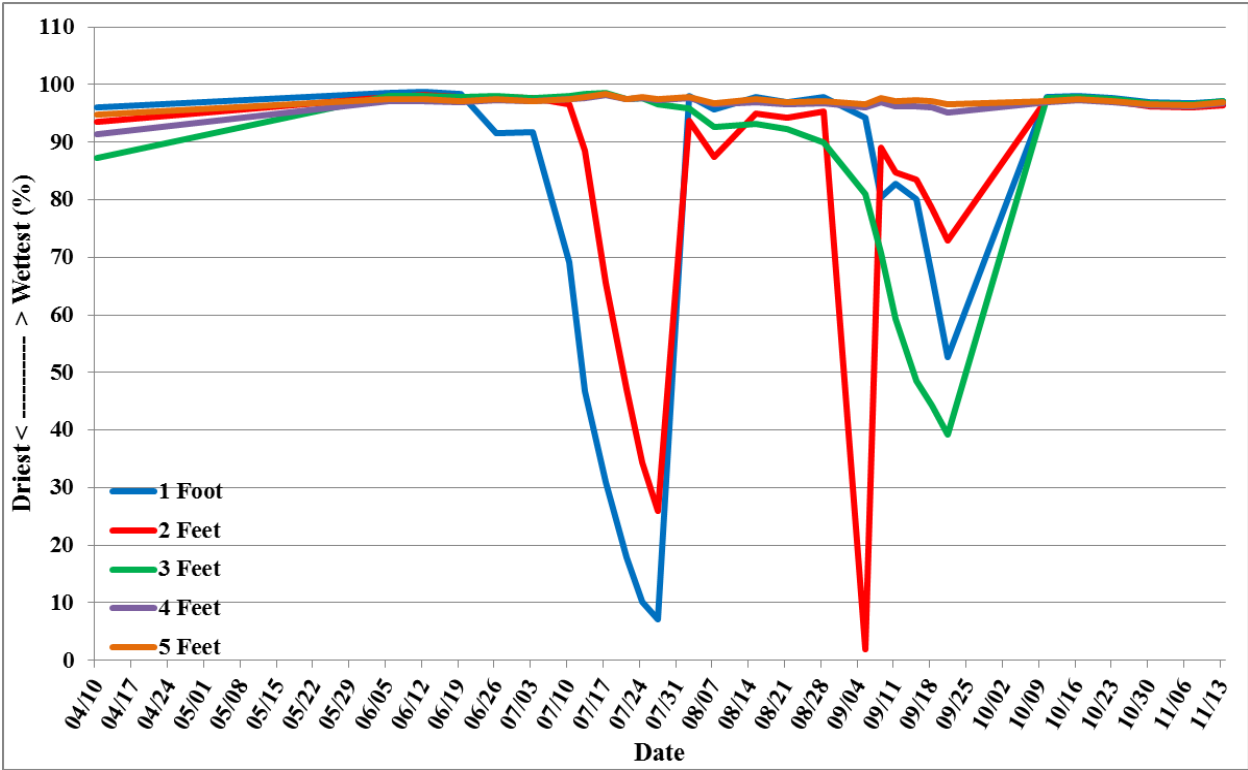


Figure 2: 2017 Growing Season Water Tracking, “3 GPM” SDI Corn, 277 bu/ac, Spain

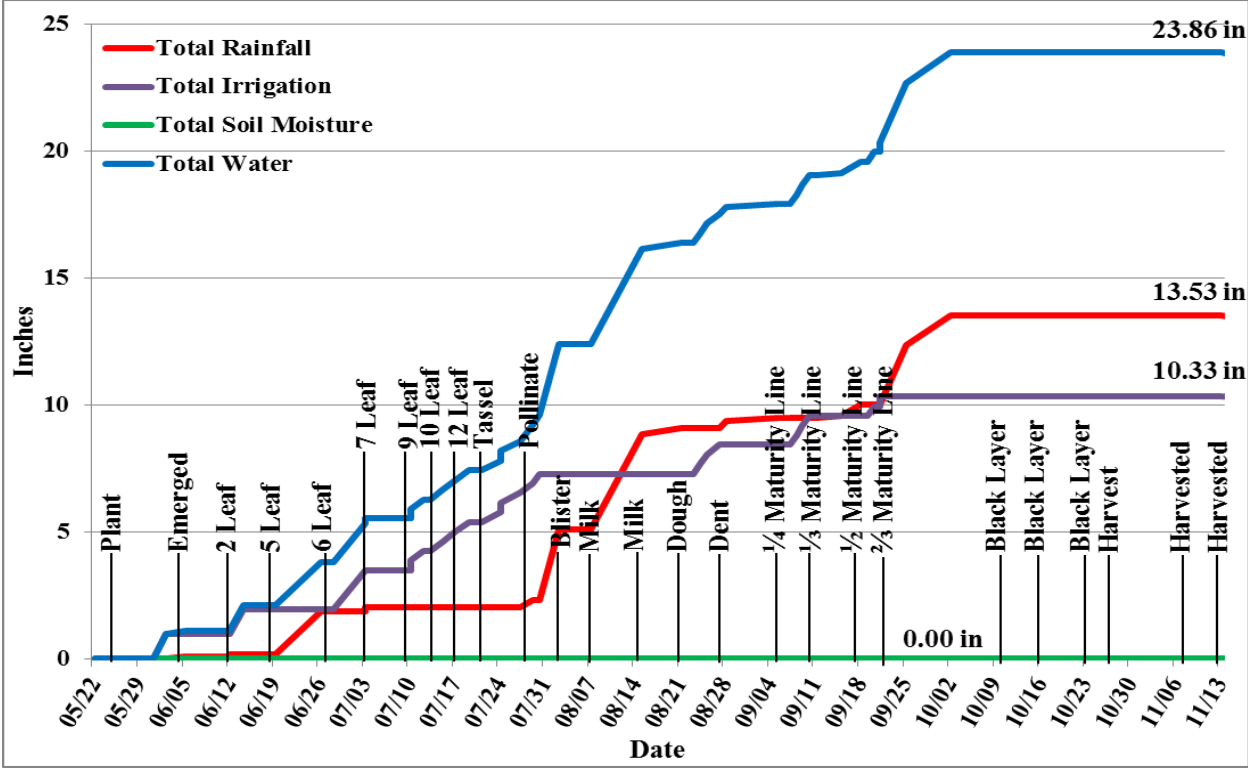


Table 3: 2017 Field Data, “3 GPM” SDI Corn, 277 bu/ac, Spain

Date	Time	Rainfall (inches)	Irrigation (inches)	Growth Stage	Soil Moisture					Zone Irrigating	Filter Sta. Meter GPM	Filter Sta. PSI	Field Meter GPM	Zone Man. PSI	Zone Man. PSI	Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet							
03/27		0.33														Curtis
04/03		2.06														Curtis
04/10	10:05 AM	0.58			96.1	93.6	87.3	91.3	94.7	off						C & L
04/24		0.77														Curtis
05/01		1.51														Curtis
05/15		0.48														Curtis
05/23		0.38														Curtis
05/24				plant												Stan
05/28	03:10 PM									11,12						Stan
05/30	10:05 AM									13,14	149	14.5	0	14.5	11.0	Curtis
05/30	10:05 PM									15,16						S & FN
05/31	07:20 AM									1,2						S & FN
06/02	03:40 PM		1.00							7,8						S & FN
06/05	01:55 PM	0.09		emerged	98.5	97.9	98.1	97.1	97.5	off						Curtis
06/12	02:30 PM									1,2						S & FN
06/12	02:50 PM	0.07		2 leaf	98.7	98.2	98.1	97.2	97.5	1 & 2	150	14.0	148	12.5	10.5	Curtis
06/14	04:25 PM		0.96							7,8						S & FN
06/15	08:50 AM									11,12						S & FN
06/17	05:55 PM									9,10						S & FN
06/19	10:40 AM			5 leaf	98.4	97.9	97.8	97.0	97.2	off						Curtis
06/26	01:45 PM	1.70		6 leaf	91.5	97.9	98.0	97.3	97.4	off						Curtis
06/28										1,2						Stan
07/03	02:20 AM		1.53							7,8						S & FN
07/03	08:00 PM	0.17		7 leaf	91.8	97.6	97.7	97.1	97.2	off						Curtis
07/05	04:20 PM									9,10						S & FN
07/08	01:20 AM									15,16						S & FN
07/08	02:30 AM									Plan 1						S & FN
07/08	02:30 AM									1,2						S & FN
07/10	09:45 AM			9 leaf	69.1	96.6	98.0	97.5	97.5	15 & 16	141	15.0	0	14.5	10.5	Curtis
07/10	11:30 AM		0.38							15,16						FN
07/12	08:35 PM		0.38							15,16						FN
07/13	08:40 AM			10 leaf	46.8	88.5	98.3	97.7	97.8	3 & 6	150	15.0	148	13.0	11.0	Curtis
07/15	05:40 AM		0.38							15,16						S & FN
07/15	05:45 AM									Plan 2						S & FN
07/15	05:45 AM									1,2						FN
07/17	02:50 PM		0.38							1,2						S & FN
07/17	03:15 PM			12 leaf	30.9	65.6	98.5	98.2	98.3	1 & 2	160	16.0	159	15.0	12.5	Curtis
07/19	11:50 PM		0.38							15,16						S & FN
07/21	09:55 AM			tassle	17.9	47.1	97.5	97.5	97.5	9 & 10	153	17.0	0	16.0	12.0	Curtis
07/22	08:50 AM		0.38							15,16						FN
07/24	01:45 PM			pollinate	10.2	34.4	97.6	97.7	97.9	15,16	150			16.0	14.0	Paul
07/24	06:35 PM		0.38							15,16						FN
07/27	03:55 AM		0.38							15,16						FN
07/27	02:00 PM	0.28		pollinate	7.1	25.9	96.5	97.3	97.5	3 & 6	163	16.0	160	16.0	14.0	Paul
07/29	01:00 PM		0.38							15,16						FN
07/29	01:05 PM									Plan 3						S & FN
07/29	01:05 PM									1,2						S & FN
07/30	05:40 PM		0.38							7,8						S & FN
08/02	02:30 PM	2.78		blister	98.1	93.7	95.9	97.6	97.8	off						Curtis
08/07	09:40 AM			milk	95.6	87.5	92.7	96.6	96.8	off						Curtis
08/15	02:25 PM	3.74		milk	97.8	94.9	93.2	97.0	97.4	off						Curtis
08/21	10:25 AM	0.26		dough	97.0	94.3	92.2	96.6	96.9	off						Curtis
08/23	11:10 AM									Corn						S & FN
08/23	11:10 AM									1,2						S & FN
08/24	03:40 PM		0.38							7,8						FN
08/25	08:10 PM		0.38							7,8						FN
08/27	12:40 AM		0.38							7,8						S & FN
08/28	11:40 AM	0.27		dent	97.9	95.3	90.0	96.8	97.2	off						Curtis
09/05	09:50 AM	0.12		¼ mat line	94.2	1.9	81.0	96.1	96.6	off						Curtis
09/07	09:20 AM									1,2						S & FN
09/08	01:50 PM		0.38	¼ mat line						7,8						S & FN
09/08	02:45 PM			¼ mat line	80.4	89.0	70.8	96.9	97.6	1 & 2	156	15.0	152	14.0	12.0	Curtis
09/09	06:20 PM		0.38							7,8						S & FN
09/10	10:45 PM		0.38							7,8						S & FN
09/11	11:05 AM			¼ mat line	82.8	84.7	59.3	96.3	97.1	off						Curtis
09/15	01:50 PM	0.08		¼ mat line	80.1	83.5	48.6	96.3	97.3	off						Curtis
09/18	01:20 PM	0.45		¼ mat line	66.7	78.4	44.2	96.0	97.2	off						Curtis
09/19	10:40 AM									1,2						S & FN
09/20	03:10 PM		0.38							7,8						S & FN
09/21	09:00 AM			¼ mat line	52.6	73.0	39.3	95.2	96.6	4 & 5	158	16.5	154	15.5	12.5	Curtis
09/21	03:10 PM									148			148			Curtis
09/21	07:40 PM		0.38							7,8						S & FN
09/25	11:20 AM	2.33							off							Curtis
10/02	10:25 AM	1.19							off							Curtis
10/10	02:30 PM	3.40		black layer	97.8	97.4	97.6	96.9	97.1	off						Curtis
10/16	01:30 PM			black layer	98.1	97.6	97.8	97.3	97.4	off						Curtis
10/23	01:35 PM			black layer	97.6	97.1	97.5	97.0	97.1	off						Curtis
10/27				harvest												Stan
10/30	10:05 AM			harvested	97.0	96.3	96.8	96.4	96.5	off						Curtis
11/07	10:20 AM			harvested	96.7	96.1	96.6	96.3	96.4	off						Curtis
11/13	01:25 PM			harvested	97.1	96.4	97.1	96.8	96.9	off						Curtis
Total		13.53	10.33		0.0	0.0	0.0	0.0	0.0	= 0.0"	Soil Moisture					Leon

Net soil moisture is 0.00 inches.

Rainfall (13.53 in), irrigation (10.33 in), and net soil moisture (0.00 in) is total water (23.86 in).

*Numbers in red are not counted in the total rainfall.

Figure 3: 2017 Gypsum Block Readings, “4 GPM” SDI Corn, 267 bu/ac, Spain

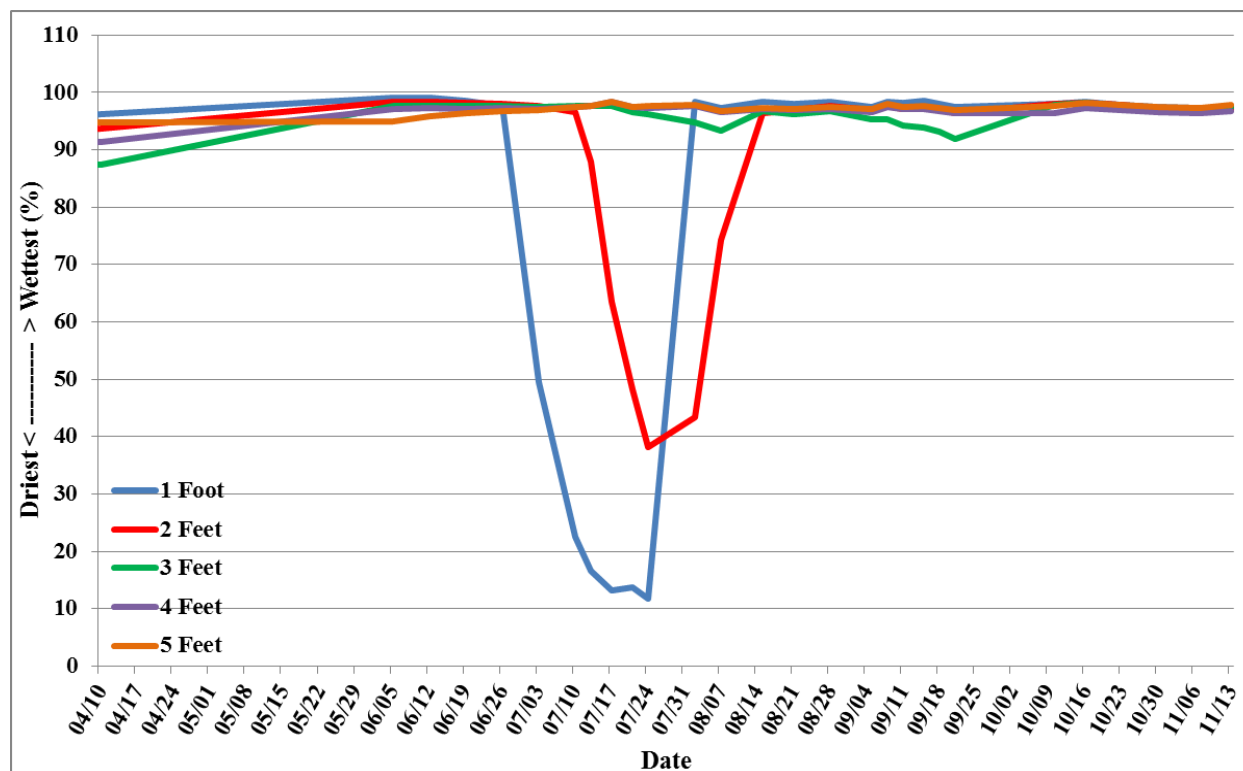


Figure 4: 2017 Growing Season Water Tracking, “4 GPM” SDI Corn, 267 bu/ac, Spain

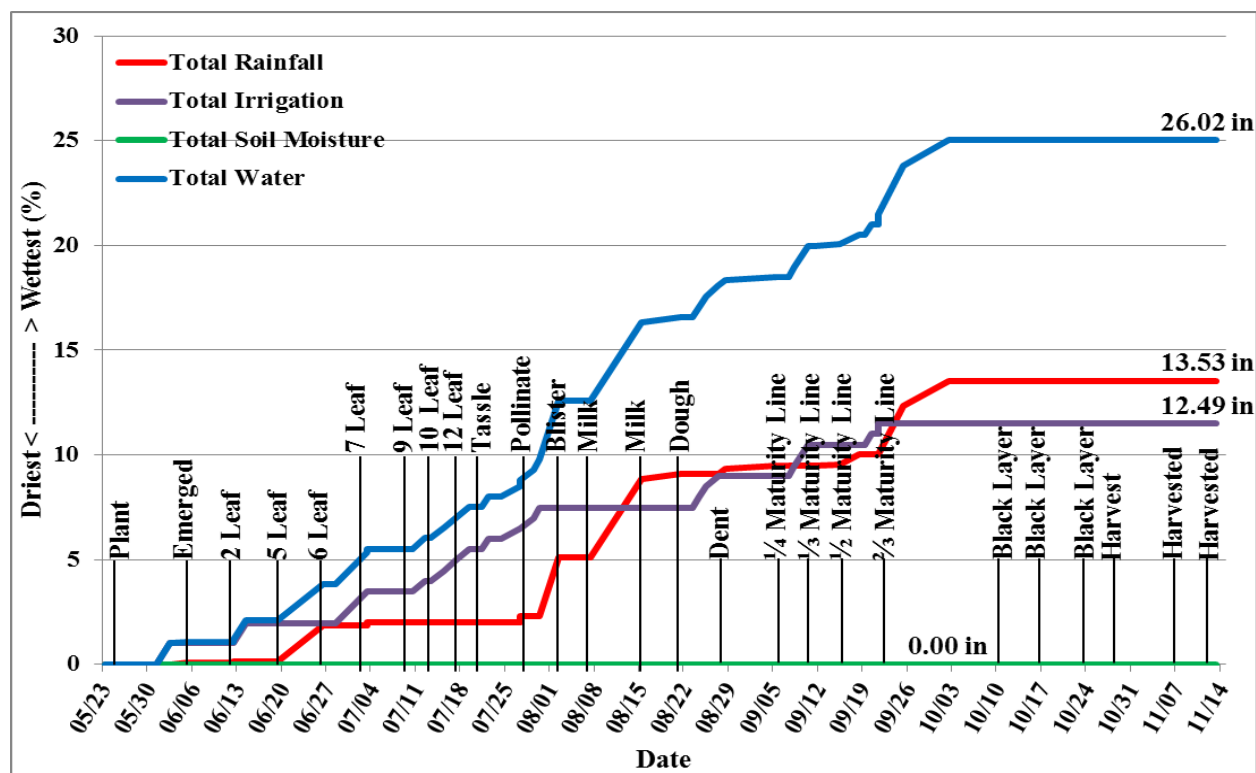


Table 4: 2017 Field Data, “4 GPM” SDI Corn, 267 bu/ac, Spain

Date	Time	Rainfall (inches)	Irrigation (inches)	Crop Irrigate	Filter Sta. Meter AF	Field Meter AF	Growth Stage	Soil Moisture					Zone Irrigating	Filter Sta. Meter GPM	Filter Sta. PSI	Field Meter GPM	Zone Man. PSI	Zone Man. PSI	Source
								1 Foot	2 Feet	3 Feet	4 Feet	5 Feet							
03/27		0.33																	Curtis
04/03		2.06																	Curtis
04/10	10:05 AM	0.58		off	55.59	27.14		96.1	93.6	87.3	91.3	94.7	off						C & L
04/24		0.77																	Curtis
05/01		1.51																	Curtis
05/15		0.48																	Curtis
05/23		0.38																	Curtis
05/24							plant												Stan
05/28	03:10 PM			start	55.59								11,12						Stan
05/30	10:05 AM			cotton	56.81	27.14							13,14	149	14.5	0	14.5	11.0	Curtis
05/30	10:05 PM			stop	57.14	27.14							9,10						S & FN
05/31	07:20 AM			start	57.14	27.14							1,2						S & FN
06/02	03:40 PM		1.00	stop									7,8						S & FN
06/05	01:55 PM	0.09			58.77	28.77	emerged	99.0	98.3	97.7	97.1	95.0	off						Curtis
06/12	02:30 PM			start	58.77	28.77							1,2						S & FN
06/12	02:50 PM	0.07			58.79	28.78	2 leaf	99.1	98.3	97.6	97.2	95.8	1 & 2	150	14.0	148	12.5	10.5	Curtis
06/14	04:25 PM		0.96	stop	60.33	30.32							7,8						S & FN
06/15	08:50 AM				60.33	30.32							11,12						S & FN
06/17	05:55 PM			stop	61.88	30.32							9,10						S & FN
06/19	10:40 AM				61.88	30.32	5 leaf	98.6	98.1	97.7	97.1	96.3	off						Curtis
06/26	01:45 PM	1.70			62.09	3032.00	6 leaf	97.7	98.0	97.7	97.3	96.8	off						Curtis
06/28				start	62.11	30.32							1,2						Stan
07/03	02:20 AM		1.53	stop	64.60	32.81							7,8						S & FN
07/03	08:00 PM	0.17			64.60	32.81	7 leaf	49.5	97.6	97.5	97.1	96.9	off						Curtis
07/05	04:20 PM			start	64.60	32.81							9,10						S & FN
07/08	01:20 AM			stop	66.20	32.81							15,16						S & FN
07/08	02:30 AM			Plan 1	66.20	32.81													S & FN
07/08	02:30 AM			start	66.20	32.81							1,2						S & FN
07/10	09:45 AM			cotton	67.71	33.60	9 leaf	22.5	96.6	97.7	97.5	97.4	15 & 16	141	15.0	0	14.5	10.5	Curtis
07/10	11:30 AM		0.50	into corn									15,16						FN
07/12	08:35 PM		0.50	into corn									15,19						FN
07/13	08:40 AM			corn	69.57	34.70	10 leaf	16.5	87.9	97.6	97.6	97.6	3 & 6	150	15.0	148	13.0	11.0	Curtis
07/15	05:40 AM		0.50		70.80	35.15							15,16						S & FN
07/15	05:45 AM			Plan 2	70.80	35.15							Plan 2						S & FN
07/15	05:45 AM			start	70.80	35.15							1,2						FN
07/17	02:50 PM		0.50	into corn									1,2						S & FN
07/17	03:15 PM			corn	72.47	36.05	12 leaf	13.2	63.4	97.7	98.3	98.3	1 & 2	160	16.0	159	15.0	12.5	Curtis
07/19	11:50 PM		0.50	into corn									15,16						S & FN
07/21	09:55 AM			cotton	75.13	37.82	tassle	13.7	48.3	96.5	97.5	97.5	9 & 10	153	17.0	0	16.0	12.0	Curtis
07/22	08:50 AM		0.50	into corn									15,16						FN
07/24	01:45 PM			cotton	77.32	38.72	pollinate	11.8	38.2	96.2	97.2	97.7	15 & 16	150			16.0	14.0	Paul
07/24	06:35 PM		0.50	into corn									15,16						FN
07/27	03:55 AM		0.50	into corn									15,16						FN
07/27	02:00 PM	0.28		corn	79.50	39.92	pollinate	12.2	33.9	94.8	97.3	97.5	3 & 6	163	16.0	160	16.0	14.0	Paul
07/29	01:00 PM		0.50	cotton	80.79	40.51							15,16						FN
07/29	01:05 PM			Plan 3									Plan 3						S & FN
07/29	01:05 PM			start	80.79	40.51							1,2						S & FN
07/30	05:40 PM		0.50	stop	81.66	41.35							7,8						S & FN
08/02	02:30 PM	2.78			81.724	81.66	41.35	blister	98.4	43.4	94.8	97.7	97.8	off					Curtis
08/07	09:40 AM				81.658	81.66	41.35	milk	97.3	74.3	93.4	96.6	96.8	off					Curtis
08/15	02:25 PM	3.74			81.658	81.66	41.35	milk	98.4	96.3	96.7	97.1	97.3	off					Curtis
08/21	10:25 AM	0.26			81.658	81.66	41.35	dough	98.0	96.9	96.2	96.9	97.0	off					Curtis
08/23	11:10 AM			Corn	81.66	41.35							Corn						S & FN
08/23	11:10 AM			start	81.66	41.35							1,2						S & FN
08/24	03:40 PM		0.50	into 1,2									7,8						FN
08/25	08:10 PM		0.50	into 1,2									7,8						FN
08/27	12:40 AM		0.50	stop	84.19	43.85							7,8						S & FN
08/28	11:40 AM	0.27			84.19	43.85	dent	98.3	97.6	96.8	97.1	97.4	off						Curtis
09/05	09:50 AM	0.12			84.19	43.85	½ mat line	97.5	96.9	95.3	96.6	97.0	off						Curtis
09/07	09:20 AM			start	84.19	43.85							1,2						S & FN
09/08	01:50 PM		0.50	into 1,2			½ mat line						1 & 2						S & FN
09/08	02:45 PM			corn	85.05	44.71	½ mat line	98.3	97.6	95.3	97.5	98.0	1 & 2	156	15.0	152	14.0	12.0	Curtis
09/09	06:20 PM		0.50	into 1,2									7,8						S & FN
09/10	10:45 PM		0.50	stop	86.67	46.31							7,8						S & FN
09/11	11:05 AM				86.67	46.31	½ mat line	98.2	97.1	94.2	97.0	97.5	off						Curtis
09/15	01:50 PM	0.08			86.67	46.31	½ mat line	98.5	97.5	93.9	97.1	97.7	off						Curtis
09/18	01:20 PM	0.45			86.67	46.31	½ mat line	97.9	97.0	93.2	96.8	97.3	off						Curtis
09/19	10:40 AM			start	86.67	46.31							1,2						S & FN
09/20	03:10 PM		0.50	into 1,2									7,8						S & FN
09/21	09:00 AM			corn	88.05	47.68	½ mat line	97.5	96.4	91.9	96.3	96.9	4 & 5	158	16.5	154	15.5	12.5	Curtis
09/21	03:10 PM			corn	88.22	47.85								148		148			Curtis
09/21	07:40 PM		0.50	stop	88.35	47.97							7,8						S & FN
09/25	11:20 AM	2.33			88.346	47.97							off						Curtis
10/02	10:25 AM	1.19			88.346	47.97							off						Curtis
10/10	02:30 PM	3.40			88.346	47.97	black layer	98.0	97.9	97.8	96.3	97.7	off						Curtis
10/16	01:30 PM				88.346	47.97	black layer	98.3	98.2	98.1	97.2	98.1	off						Curtis
10/23	01:35 PM				88.346	47.97	black layer	97.8	97.8	97.6	96.9	97.8	off						Curtis
10/27							harvest												Stan
10/30	10:05 AM				88.346	47.97	harvested	97.5	97.2	97.3	96.6	97.5	off						Curtis
11/07	10:20 AM				88.346	47.97	harvested	97.2	96.7	97.0	96.3	97.3	off						Curtis
11/13	01:25 PM				88.346	47.97	harvested	97.2	96.9	97.5	96.7	97.8	off						Curtis
Total		13.53	12.49					0.0	0.0	0.0	0.0	0.0	= 0.0"	Soil Moisture					Leon
Net soil moisture is 0.00 inches.																			
Rainfall (13.53 in), irrigation (12.49 in), and net soil moisture (0.00 in) is total water (26.02 in).																			
*Numbers in red are not counted in the total rainfall.																			

Figure 5: 2017 Gypsum Block Readings, “5 GPM” SDI Corn, 265 bu/ac, Spain

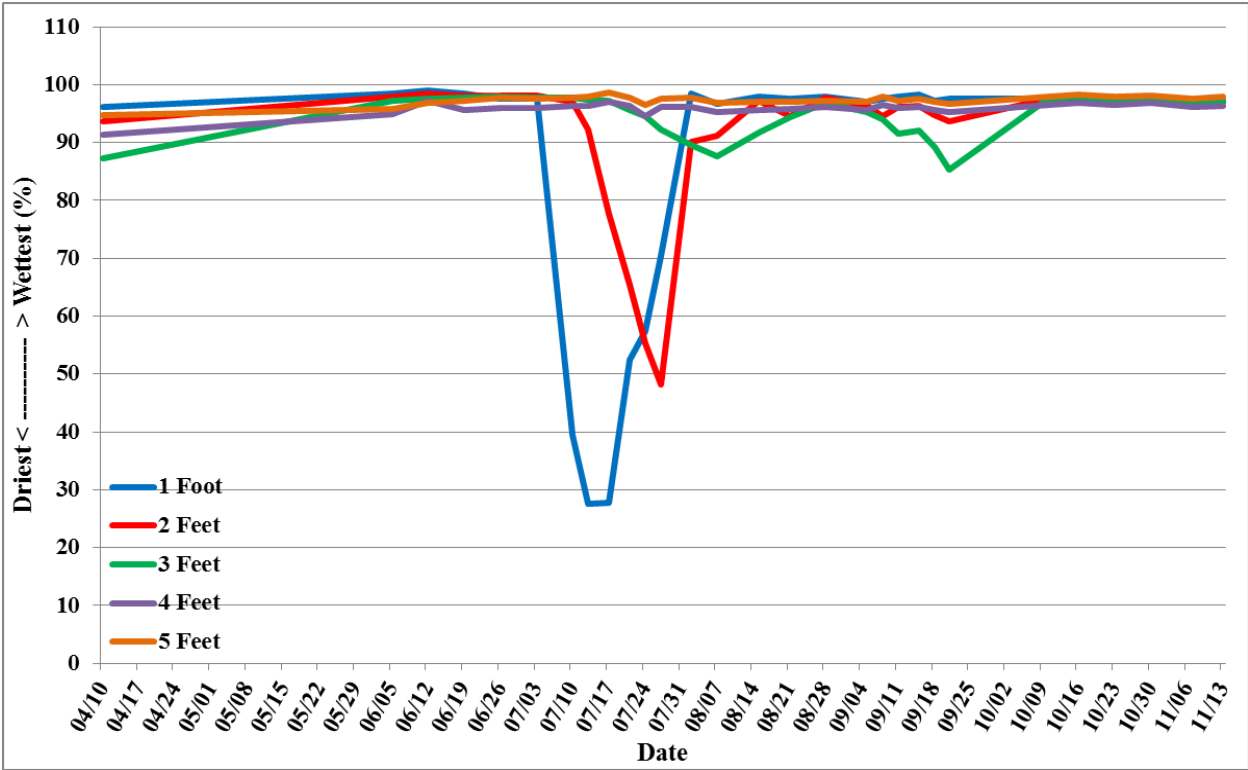


Figure 6: 2017 Growing Season Water Tracking, “5 GPM” SDI Corn, 265 bu/ac, Spain

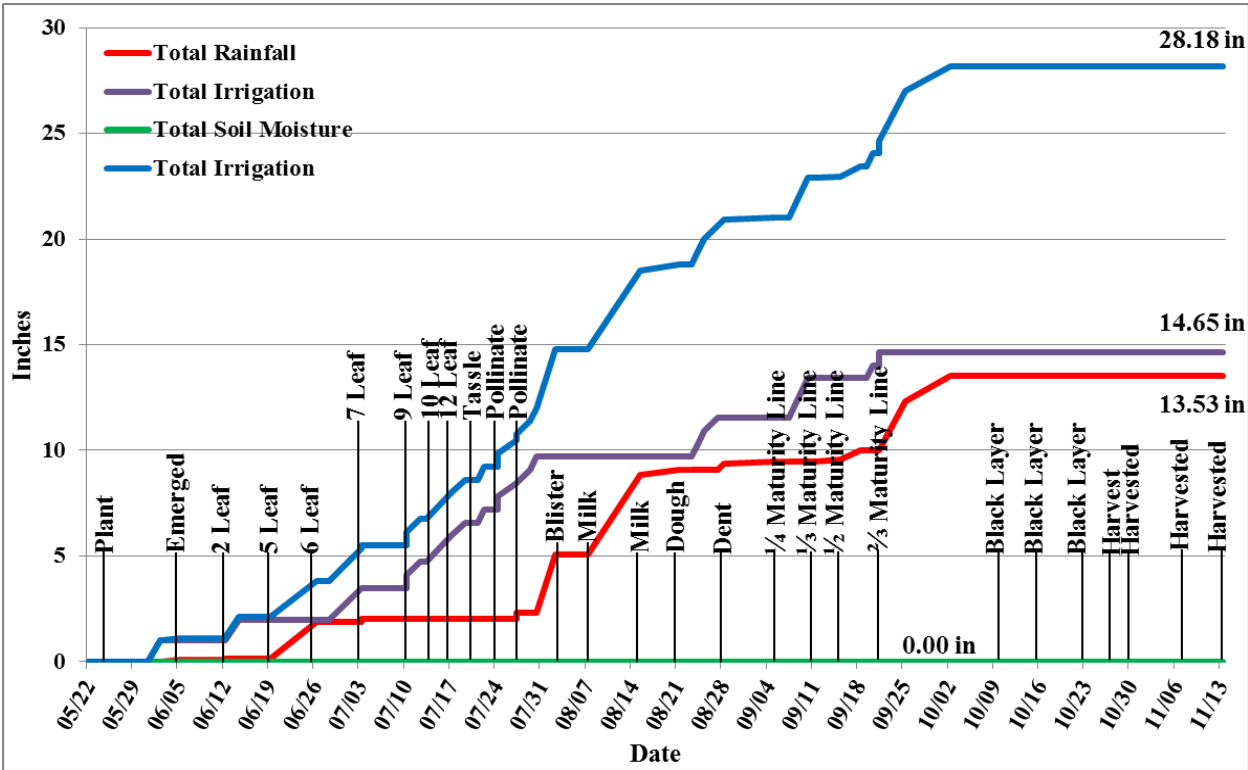


Table 5: 2017 Field Data, “5 GPM” SDI Corn, 265 bu/ac, Spain

Date	Time	Rainfall (inches)	Irrigation (inches)	Crop Irrigate	Filter Sta. Meter AF	Field Meter AF	Growth Stage	Soil Moisture					Zone Irrigating	Filter Sta. Meter GPM	Filter Sta. PSI	Field Meter GPM	Zone Man. PSI	Zone Man. PSI	Source
								1 Foot	2 Feet	3 Feet	4 Feet	5 Feet							
03/27		0.33																	Curtis
04/03		2.06																	Curtis
04/10	10:05 AM	0.55		off	55.59	27.14		96.1	93.6	87.3	91.3	94.7	off						C & L
04/24		0.77																	Curtis
05/01		1.51																	Curtis
05/15		0.48																	Curtis
05/23		0.38																	Curtis
05/24							plant												Stan
05/28	03:10 PM			start	55.59								11,12						S & FN
05/30	10:05 AM			cotton	56.81	27.14							13,14	149	14.5	0	14.5	11.0	Curtis
05/30	10:05 PM			stop	57.14	27.14							9,10						S & FN
05/31	07:20 AM			start	57.14	27.14							1,2						S & FN
06/02	03:40 PM		1.00	stop									7,8						S & FN
06/05	01:55 PM	0.09			58.77	28.77	emerged	98.4	98.0	97.2	95.0	95.8	off						Curtis
06/12	02:30 PM			start	58.77	28.77							1,2						S & FN
06/12	02:50 PM	0.07		corn	58.79	28.78	2 leaf	99.0	98.5	97.6	97.2	96.8	1 & 2	150	14.0	148	12.5	10.5	Curtis
06/14	04:25 PM		0.96	stop	60.33	30.32							7,8						S & FN
06/15	08:50 AM			start	60.33	30.32							11,12						S & FN
06/17	05:55 PM			stop	61.88	30.32							9,10						S & FN
06/19	10:40 AM				61.88	30.32	5 leaf	98.4	98.1	97.8	95.7	97.3	off						Curtis
06/26	01:45 PM	1.70			62.09	30.32	6 leaf	97.5	98.2	97.9	96.0	97.7	off						Curtis
06/28				start	62.11	30.32							1,2						Stan
07/03	02:20 AM		1.53	stop	64.60	32.81							7,8						S & FN
07/03	08:00 PM	0.17			64.60	32.81	7 leaf	97.6	98.1	97.7	95.9	97.5	off						Curtis
07/05	04:20 PM			start	64.60	32.81							9,10						S & FN
07/08	01:20 AM			stop	66.20	32.81							15,16						S & FN
07/08	02:30 AM			Plan 1	66.20	32.81							1,2						S & FN
07/08	02:30 AM			start	66.20	32.81							1,2						S & FN
07/10	09:45 AM			cotton	67.71	33.60	9 leaf	39.5	97.0	97.8	96.3	97.8	15 & 16	141	15.0	0	14.5	10.5	Curtis
07/10	11:30 AM		0.62	nto corn									15,16						FN
07/12	08:35 PM		0.62	nto corn									15,19						FN
07/13	08:40 AM			corn	69.57	34.70	10 leaf	27.5	92.3	97.4	96.4	97.9	3 & 6	150	15.0	148	13.0	11.0	Curtis
07/15	05:40 AM		0.62		70.80	35.15							15,16						S & FN
07/15	05:45 AM			Plan 2	70.80	35.15							Plan 2						S & FN
07/15	05:45 AM			start	70.80	35.15							1,2						FN
07/17	02:50 PM		0.62	nto corn									1,2						S & FN
07/17	03:15 PM			corn	72.47	36.05	12 leaf	27.7	77.7	97.3	97.1	98.7	1 & 2	160	16.0	159	15.0	12.5	Curtis
07/19	11:50 PM		0.62	nto corn									15,16						S & FN
07/21	09:55 AM			cotton	75.13	37.82	tassle	52.5	65.4	95.6	96.3	97.8	9 & 10	153	17.0	0	16.0	12.0	Curtis
07/22	08:50 AM		0.62	nto corn									15,16						FN
07/24	01:45 PM			cotton	77.32	38.72	pollinate	57.5	55.2	94.5	94.5	96.5	15 & 16	150			16.0	14.0	Paul
07/24	06:35 PM		0.62	nto corn									15,16						FN
07/27	03:55 AM		0.62	nto corn									15,16						FN
07/27	02:00 PM	0.28		corn	79.50	39.92	pollinate	70.4	48.2	92.2	96.1	97.6	3 & 6	163	16.0	160	16.0	14.0	Paul
07/29	01:00 PM		0.62	cotton	80.79	40.51							15,16						FN
07/29	01:05 PM			Plan 3									Plan 3						S & FN
07/29	01:05 PM			start	80.79	40.51							1,2						S & FN
07/30	05:40 PM		0.62	stop	81.66	41.35							7,8						S & FN
08/02	02:30 PM	2.78			81.66	41.35	blister	98.5	90.2	89.6	96.2	97.8	off						Curtis
08/07	09:40 AM				81.66	41.35	milk	96.7	91.2	87.7	95.3	96.8	off						Curtis
08/15	02:25 PM	3.74			81.66	41.35	milk	98.0	97.2	91.8	95.6	97.1	off						Curtis
08/21	10:25 AM	0.26			81.66	41.35	dough	97.5	94.6	94.4	95.8	97.1	off						Curtis
08/23	11:10 AM			Corn	81.66	41.35							Corn						S & FN
08/23	11:10 AM			start	81.66	41.35							1,2						S & FN
08/24	03:40 PM		0.62	into 1,2									7,8						FN
08/25	08:10 PM		0.62	into 1,2									7,8						FN
08/27	12:40 AM		0.62	stop	84.19	43.85							7,8						S & FN
08/28	11:40 AM	0.27			84.19	43.85	dent	98.0	97.8	96.9	96.2	97.3	off						Curtis
09/05	09:50 AM	0.12			84.19	43.85	1/4mat ln	97.0	96.4	95.3	95.7	97.0	off						Curtis
09/07	09:20 AM			start	84.19	43.85							1,2						S & FN
09/08	01:50 PM		0.62	into 1,2			½ mat line						1 & 2						S & FN
09/08	02:45 PM			corn	85.05	44.71	½ mat line	97.6	94.5	94.1	96.5	98.0	1 & 2	156	15.0	152	14.0	12.0	Curtis
09/09	06:20 PM		0.62	into 1,2									7,8						S & FN
09/10	10:45 PM		0.62	stop	86.67	46.31							7,8						S & FN
09/11	11:05 AM				86.67	46.31	½ mat line	98.0	96.1	91.5	96.0	97.3	off						Curtis
09/15	01:50 PM	0.08			86.67	46.31	½ mat line	98.3	96.4	92.1	96.1	97.6	off						Curtis
09/18	01:20 PM	0.45			86.67	46.31	½ mat line	97.3	94.8	89.3	95.6	97.0	off						Curtis
09/19	10:40 AM			start	86.67	46.31							1,2						S & FN
09/20	03:10 PM		0.62	into 1,2									7,8						S & FN
09/21	09:00 AM			corn	88.05	47.68	½ mat line	97.5	93.6	85.3	95.2	96.7	4 & 5	158	16.5	154	15.5	12.5	Curtis
09/21	03:10 PM			corn	88.22	47.85							148			148			Curtis
09/21	07:40 PM		0.62	stop	88.35	47.97							7,8						S & FN
09/25	11:20 AM	2.33			88.346	47.97							off						Curtis
10/02	10:25 AM	1.19			88.346	47.97							off						Curtis
10/10	02:30 PM	3.40			88.346	47.97	black layer	97.5	97.5	97.6	96.5	97.9	off						Curtis
10/16	01:30 PM				88.346	47.97	black layer	97.8	97.9	98.0	96.9	98.3	off						Curtis
10/23	01:35 PM				88.346	47.97	black layer	97.4	97.5	97.4	96.6	98.0	off						Curtis
10/27							harvest												Stan
10/30	10:05 AM				88.346	47.97	harvested	97.6	97.6	97.6	96.8	98.1	off						Curtis
11/07	10:20 AM				88.346	47.97	harvested	97.0	96.9	96.8	96.1	97.5	off						Curtis
11/13	01:25 PM				88.346	47.97	harvested	97.2	97.1	97.1	96.4	97.9	off						Curtis
Total		13.53	14.65					0.0	0.0	0.0	0.0	0.0	= 0.0"	Soil Moisture					Leon

Net soil moisture is 0.00 inches.

Rainfall (13.53 in), irrigation (14.65 in), and net soil moisture (0.00 in) is total water (28.18 in).

*Numbers in red are not counted in the total rainfall.

2017 Harvest Results, SDI Corn, Spain

The 3 GPM field produced a 277 bushel per acre corn yield. Irrigation totaled 10.33 inches. Production in the 4 GPM field was 267 bushels per acre. Seasonal irrigation totaled 12.49 inches. Corn yield was 265 bushels per acre for the 5 GPM field. Irrigation totaled 14.65 inches. There was no pre-season irrigation. The 3 GPM field produced 10 more bushels per acre than the 4 GPM field. Irrigation was 2.16 inches more for the 4 GPM field. The 3 GPM field produced 12 more bushels per acre than the 5 GPM with 4.32 less inches of irrigation. The 4 GPM yield was 2 more bushels per acre than that from 5 GPM field with 2.16 less inches of irrigation.

Corn production was 26.82 bushels (1501lb.) per inch of irrigation in the 3 GPM field compared to 21.38 bushels (1197lb.) in the 4 GPM and 18.09 bushels (1013lb.) from the 5 GPM field. Production from each inch of irrigation, rainfall and net soil water that totaled 23.86 inches was 11.61 bushels (650lb.) per acre in the 3 GPM field. Irrigation, rainfall and net soil water totaled 26.02 inches in the 4 GPM field where production was 10.26 bushels (574lb.) per inch. In the 5 GPM field, irrigation, rainfall and net soil water totaled 28.18 inches where production was 9.40 bushels (526lb.) per inch of total water.

Crop production costs were \$3.75 per acre more for the 4 GPM field than for the 3 GPM from increased irrigation expenses. At \$3.63 per bushel, the 10 bushels per acre increased corn yield in the 3 GPM field amounts to \$36.30 more per acre than from the 3 GPM field. The 3 GPM field's net gain is \$40.05 per acre with 2.16 inches less irrigation used compared to production from the 4 GPM field. At \$3.63 per bushel, the 12 bushel per acre increased yield from the 3 GPM field compared to the 5 GPM amounts to \$43.56 per acre. Crop production costs were \$15.21 per acre more for the 5 GPM field. The 3 GPM fields' net gain compared to the 5 GPM field is \$58.77 per acre with 4.32 less inches of irrigation. Value of the 2 additional bushels produced in the 4 GPM field compared to the 5 GPM field is \$7.26. Production Costs were \$11.46 more for the 5 GPM field than the 4 GPM from increased irrigation. Net gain for the 4 GPM field is \$18.72 per acre with 2.16 inches less irrigation. Net return from the 3 GPM field was \$567.59 per acre compared to \$527.64 from the 4 GPM field and \$508.82 from the 5 GPM field. Net return from each inch of irrigation is \$54.96 for the 3 GPM field compared to \$42.24 from the 4 GPM and \$34.73 for the 5 GPM field. A summary of the demonstration results are shown in table 6 and Appendix B.

Table 6: 2017 SDI Corn Demonstration Results, Spain

GPM	Irrigation (in)	Total Water (in)	Production		Gross Crop Value @ \$3.63/bu		
			bu/ac	lb/ac-in of Irrigation	per acre (\$)	Acre-inch of Irrigation (\$)	Acre-inch of Total Water
3 GPM	10.33	23.86	277	1501	\$1,005.51	\$97.34	\$42.14
4 GPM	12.49	26.02	267	1197	\$969.21	\$77.60	\$37.25
5 GPM	14.45	28.18	265	1013	\$961.95	\$65.66	\$34.14
All fields include 0.00 inches of soil water within 5 feet of soil, only rainfall and irrigation.							

2017 LEPA Center Pivot and SDI Harvest Results, Spain

The 3 GPM LEPA field produced a 260 bushel per acre corn yield; irrigation totaled 11.38 inches. Production in the 3 GPM SDI field was 277 bushels per acre; seasonal irrigation totaled 10.33 inches. Corn yield was 270 bushels per acre for the 4 GPM LEPA field; irrigation totaled 13.67 inches. Yield in the 4 GPM SDI field was 267 bushels per acre; irrigation was 12.49 inches. Production in the 5 GPM LEPA field was 270 bushels per acre; irrigation was 15.94 inches. Production in the 5GPM SDI field was 265 bushels per acre; irrigation totaled 14.65 inches. There was no pre-season irrigation.

The 3 GPM SDI field produced 17 more bushels per acre than the 3 GPM LEPA field; irrigation was 1.05 inches less. The 4 GPM LEPA field produced 3 more bushels per acre than the 4 GPM SDI with 1.18 more inches of irrigation. The 5 GPM LEPA yield was 5 more bushels per acre than that from 5 GPM SDI field with 1.29 additional inches of irrigation.

Corn production was 22.84 bushels (1279lb.) per inch of irrigation in the 3 GPM LEPA field compared to 26.81 bushels (1501 lb.) in the 3 GPM SDI field. Yield was 21.61 bushels (1210 lb.) from the 4 GPM LEPA compared to 21.38 bushels (1197 lb.) from the 4 GPM SDI field. The 5 GPM LEPA field produced 16.94 bushels (948 lb.) from each inch of irrigation. The 5 GPM SDI produced 18.09 bushels (1013 lb.) per inch.

Production from each inch of irrigation, rainfall, and net soil water that totaled 24.00 inches was 10.83 bushels (606 lb.) per acre in the 3 GPM LEPA field. Irrigation, rainfall, and net soil water totaled 23.86 inches in the 3 GPM SDI field where production was 11.61 bushels (650 lb.) per inch. In the 4 GPM LEPA field, irrigation, rainfall, and net soil water totaled 26.29 inches where production was 10.27 bushels (575 lb.) per inch of total water. Irrigation, rainfall, and net soil water totaled 26.02 inches in the 4 GPM SDI field where production was 10.26 bushel (574 lb.) from each inch. In the 5 GPM LEPA field. Irrigation, rainfall, and soil water totaled 28.56 inches from which production was 9.45 bushels (529 lb.) per inch. From 28.18 inches of irrigation, rainfall, and soil water, production in the 5 GPM SDI field was 9.40 (526 lb.) from each inch.

Crop production costs were \$9.72 per acre more for the 3 GPM SDI field than the 3 than for the 3 GPM LEPA from fertilizer and harvest expenses. At \$3.44 per bushel, the 17 bushels per acre increased corn yield in the 3 GPM SDI field amounts to \$61.71 more per acre than from the 3 GPM LEPA field. The 3 GPM SDI field's net gain is \$51.92 per acre with 1.05 inches less irrigation used compared to the 3 GPM LEPA field.

At \$3.63 per bushel, the 3 bushel per acre increased yield from the 4 GPM LEPA field compared to the 4 GPM SDI amounts to \$10.89 per acre. Crop production costs were \$9.24 per acre more for the 4 GPM LEPA field. The 4 GPM LEPA field's net gain compared to the 4 GPM SDI field is \$1.65 per acre with 1.18 additional inches of irrigation. Value of the 5 additional bushels produced in the 5 GPM LEPA field compared to the 5 GPM SDI field is \$18.15. Production costs were \$12.86 more for the 5 GPM LEPA field than the 5 GPM SDI. Net gain for the 5 GPM LEPA field is \$5.29 per acre with 1.29 inches more irrigation.

Net return from the 3 GPM LEPA field was \$515.67 per acre compared to \$567.59 from the 3 GPM SDI field. Net return from the 4 GPM LEPA field was \$528.22 and \$530.20 from the 4 GPM SDI field. From the 5 GPM fields, net return was \$514.14 from LEPA and \$510.06 from SDI.

Stan Spain's 2017 Moore County LEPA Corn Demonstration

2017 Planting and Crop Information, LEPA Corn, Spain

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 GPM” 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 3 GPM field, 150 to 210 degrees was the 5 GPM field, and 210 to 270 degrees was the 4 GPM field. Spain planted each “3, 4, 5 GPM” field to the Pioneer P1197AMX 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 Pivotrak. 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 445 GPM. Irrigation was with Senningers' LDN LEPA bubbler applicator with drops spaced 30 inches apart. Planting and crop information for “Spain 3 GPM”, “Spain 4 GPM”, and “Spain 5 GPM” LEPA are shown in the Table 7 below.

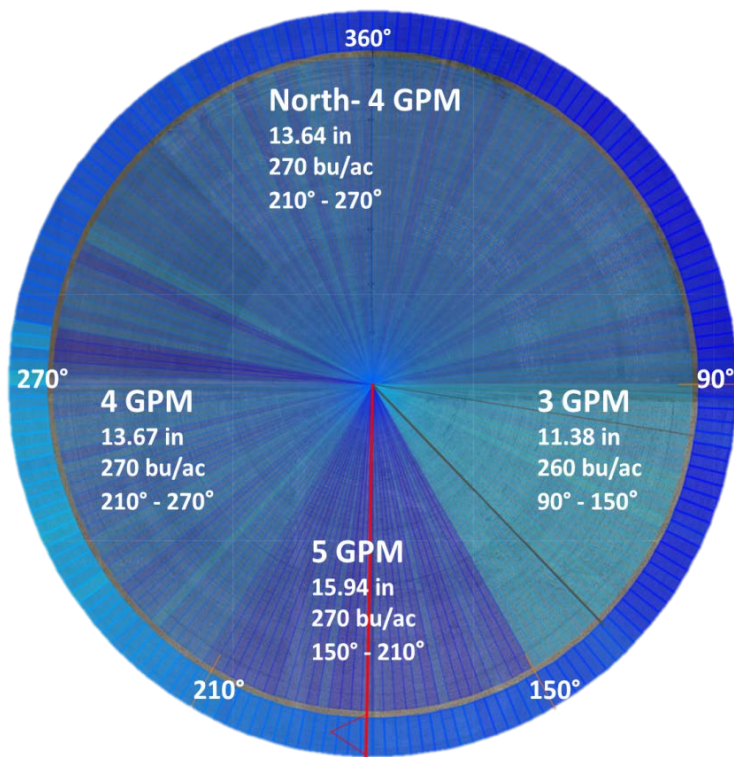
Table 7: 2017 Planting and Crop Information, LEPA Corn, Stan Spain

3 GPM Demonstration Site: 90-150 degrees				
Planted		May 25	Harvested	October 28
Hybrid		Pioneer P1197AMT	Seeding Rate	32,000
Row Width		30 inches	Tillage	Strip Till
No. Acres		18.33	GPM per acre	3.00
Total Water		24.00 inches	Soil Type	Sherman Clay Silty Loam
Irrigation		11.38 inches	Insecticide	Comite, Warhawk, Cide Trak
4 GPM Demonstration Site: 210-270 degrees				
Planted		May 25	Harvested	October 28
Hybrid		Pioneer P1197AMT	Seeding Rate	32,000
Row Width		30 inches	Tillage	Strip Till
No. Acres		18.33	GPM per acre	4.00
Total Water		26.29 inches	Soil Type	Sherman Clay Silty Loam
Irrigation		13.67 inches	Insecticide	Prevathon, Warhaw, Rifle
5 GPM Demonstration Site: 150-210 degrees				
Planted		May 25	Harvested	October 28
Hybrid		Pioneer P1197AMT	Seeding Rate	32,000
Row Width		30 inches	Tillage	Strip Till
No. Acres		18.33	GPM per acre	5.00
Total Water		28.56 inches	Soil Type	Sherman Clay Silty Loam
Irrigation		15.94 inches	Insecticide	Prevathon, Warhaw, Rifle

2017 Irrigation Intensity Map, LEPA Corn, Spain

A center pivot travel speed prescription was written and loaded on Pivotracs control monitor for 6.90% to apply 1.10 inches of irrigation in a seven day revolution in the 3 GPM field from 90 to 150 degrees in the circle. At 150 degrees in the rotation, travel speed was reduced to 4.10% to apply 1.85 inches in the 5 GPM field from 150 to 210 degrees. Travel speed was increased to 5.10% beginning at 210 to 270 degrees to apply 1.49 inches in the 4 GPM field. The north half of the circle from 270 to 90 degrees continued to be irrigated at the 4 GPM per acre capacity in a 168 hour weekly revolution.

Figure 7: 2017 Irrigation Intensity Map, LEPA Corn, Spain



2017 Soil Water Profile and Growing Season Rainfall, LEPA Corn, Spain

“3 GPM” LEPA Demonstration Site

Preseason soil water was good at 1, 2, 3, 4, and 5 feet at planting. 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 tassel growth stage. Plant roots developed more into 2 feet during July mostly depleting the plant root zone at the 2 feet depth. Significant soil water was used from 1 and 2 feet plus irrigation and rainfall during July. Weekly soil water sensor readings showed limited to no soil water use from 3, 4, and 5 feet in the root zone. Soil water used from 1 and 2 feet in July was replaced by late season rainfall resulting in a full soil profile at 1, 2, 3, 4, and 5 feet at harvest in October indicating no net soil water was used in producing the crop. Soil moisture sensors showed 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. Rainfall from planting until grain black layer totaled 12.62 inches.

“4 GPM” LEPA Demonstration Site

Soil water was good at 1, 2, 3, 4, and 5 feet prior to and at planting. Soil moisture sensors show plant roots began using water from 1 foot in the root zone at the 9 leaf growth stage in mid-July, in addition to rainfall and irrigation. Plant roots grew rapidly into 2 and 3 feet in July at tassel and pollination, basically depleting stored soil water at 1, 2, and 3 feet in addition to rainfall and irrigation. Weekly sensor readings showed no soil water was used from 4 feet in producing the crop. The seasonal soil water readings at 5 feet were typical for caliche soil that has no real contribution in storing water to produce any crop. The sensor at 5 feet indicated no water was available or used from 5 feet in the soil profile. Weekly gypsum block readings show the crop had adequate soil moisture during the growing season. Late season rainfall in September and October that totaled 3.85 inches contributed to producing a good corn yield plus refilled the soil profile, resulting in no net soil water being used producing the crop. A total of 12.62 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

Soil water sensor readings in April and May prior to planting showed approximately 25% of full profile available water at 3 feet, 45% at 4 feet, and 75% at 5 feet. Following sensor readings indicated the 3.56 inches of rainfall filled the profile to capacity by planting. Therefore, beginning soil water was good at 1, 2, 3, 4, and 5 feet at planting. Soil moisture sensors showed plant roots began to remove water from 1 foot and 2 feet in July during pollination. Roots continued to use stored soil water from 1 and 2 feet in addition to irrigation and rainfall during July until both feet were basically depleted. The sensors showed no soil water was used from 3, 4, and 5 feet producing the crop. Sensors showed rainfall in September and October that totaled 3.85 inches refilled that used earlier in the season from 1 and 2 feet. Sensor readings at harvest were similar to the ones at planting, indicating no net soil water was used producing the crop. The preseason sensor readings showed how to utilize rainfall rather than pre-water to provide essential soil water during the primary water use growth stages when rainfall and irrigation was not enough. Weekly gypsum block moisture sensors showed the crop had sufficient available soil water during the entire growing season. Total rainfall was 12.62 inches. Irrigation totaled 15.94 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 8: 2017 Monthly Rainfall Data, LEPA Corn, Spain

GPM	June (in)	July (in)	August (in)	September (in)	October (in)	Total (in)
3, 4, 5	1.70	0.53	6.54	2.77	1.08	12.62

2017 Growing Season Water Tracking, LEPA Corn, Spain

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 five gypsum block soil

moisture sensors was installed at 1, 2, 3, 4, and 5 feet. An AquaSpy™ soil moisture probe was installed down to four feet in the root zone at one location to monitor soil water levels in the “3 GPM” field. Another set of the same type of sensors was installed in each “4 GPM” 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. Each AquaSpy® probe was installed following crop emergence. A 24/7 Aquaspy probe website showed soil moisture at 4 inch increments to 48 inches and monitored plant root growth. The website listed all Aquaspy soil probes in the “3, 4, 5, GPM” project and was available to all cooperators and district personnel. Another 24/7 Pivotrak website tracked each center pivot system and monitored and controlled irrigation. Each center pivot travel speed prescription was written to apply 1.10 inches (“3 GPM”), 1.49 inches (“4 GPM”), and 1.85 inches (“5 GPM”) and was managed from the Pivotrak website. The cooperating grower and the district “3, 4, 5 GPM” Project Leader collectively monitored, controlled, and managed irrigation from the Pivotrak website.

Following this paragraph, a series of graphs and tables shows weekly gypsum block readings for the season; growing season water, including rainfall, irrigation, and soil moisture at various growth stages; and the order of irrigation and rainfall events for each “3, 4, 5, GPM” field. “Water Summary,” as shown on the graph for growing season water, was 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 8: 2017 Gypsum Block Readings, “3 GPM” LEPA Corn, 260 bu/ac, Spain

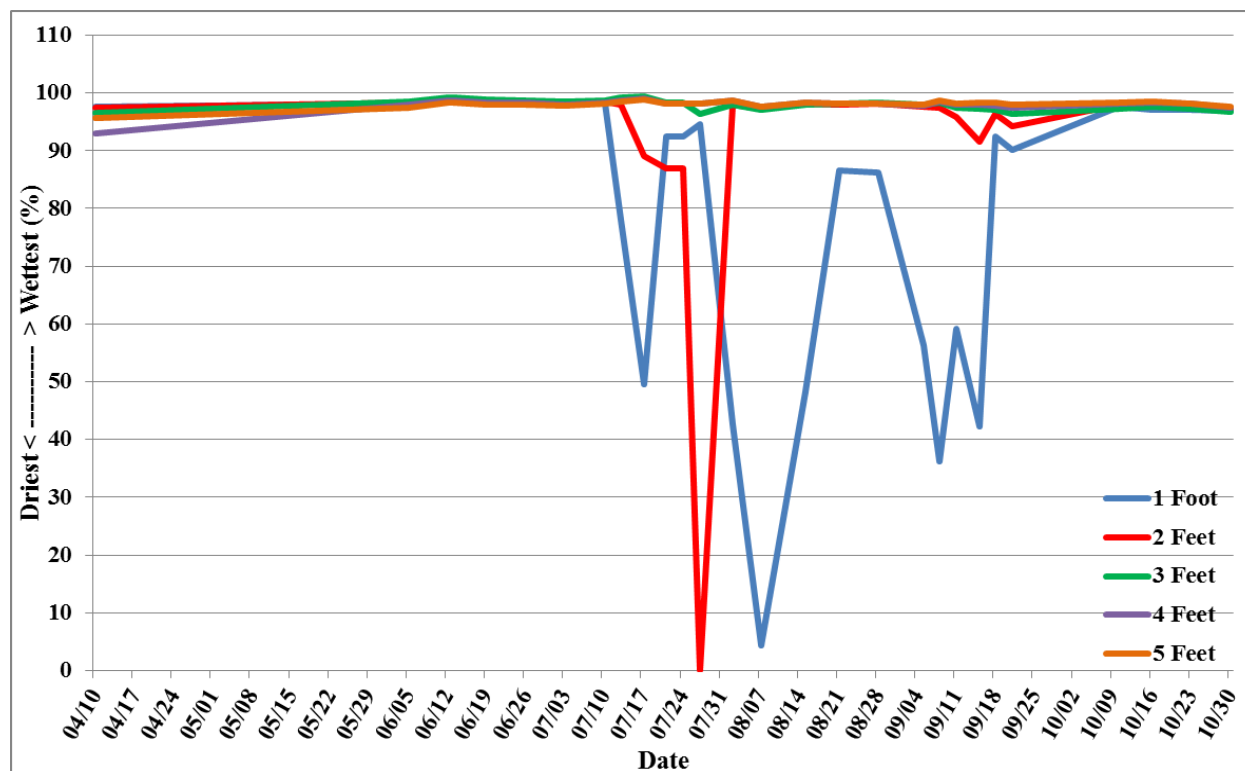


Figure 9: 2017 Growing Season Water Tracking, “3 GPM” LEPA Corn, 260 bu/ac, Spain

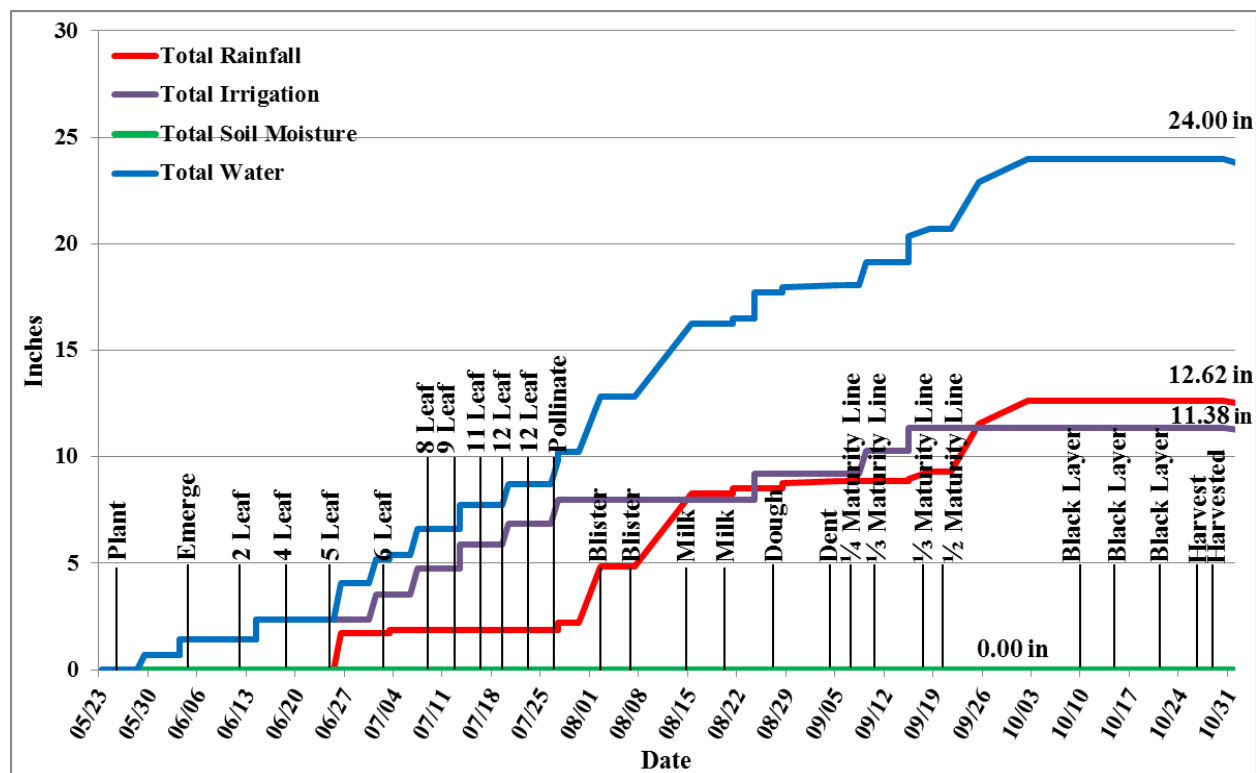


Table 9: 2017 Field Data, “3 GPM” LEPA Corn, 260 bu/ac, Spain

Date	Time	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				
03/27	10:40AM	0.33		278.72								290			Curtis
04/03	10:25AM	2.02										290			Curtis
04/10	4:40PM			278.72	3592.8		97.6	97.4	96.6	92.9	95.6	290			C & L
04/24	11:30AM	0.75		278.72								290			Curtis
05/01	11:40AM	1.38		278.72								290			Curtis
05/15	9:40AM	0.48		278.72								274			Curtis
05/23	11:50AM	0.36		278.72								259			Curtis
05/25						plant						move dry			Stan
05/27	03:45 PM			278.72								278	start		Pivotrac
05/27	04:00 PM			278.74								270	into 4	445	Pivotrac
05/28	06:30 AM			279.93								210	into 5	445	Pivotrac
05/28	07:30 PM			281.00								150	into 3	445	Pivotrac
05/29	08:45 AM		0.71	282.10								90	into N	445	Pivotrac
05/30	11:05 AM			284.44	3668.3							329	N	448	Curtis
05/30	10:15 PM			285.19								278	stop	445	Pivotrac
05/31	08:35 AM			285.35	3679.6							278	off		Curtis
06/02	06:40 AM			285.35								278	start	445	Pivotrac
06/02	08:30 AM			285.34								270	into 4	445	Pivotrac
06/02	09:20 PM			286.40								210	into 5	445	Pivotrac
06/03	10:30 AM			287.48								150	into 3	445	Pivotrac
06/03	11:25 PM		0.70	288.54								90	into N	445	Pivotrac
06/05	12:45 PM			291.94	3757.8	emerge	98.1	98.3	98.5	97.9	97.5	278	N	442	Curtis
06/05	01:15 PM			291.66								277	N	445	Pivotrac
06/12	09:20 AM			291.97	3758.0	2 leaf	98.8	99.0	99.2	98.7	98.3	271	off		Curtis
06/12	11:30 AM			291.97								277	start		Pivotrac
06/13	01:25 PM			292.14	3759.7	2 leaf	98.8	99.0	99.2	98.7	98.3	271	N	452	Curtis
06/13	01:50 PM			291.86								270	into 4	445	Pivotrac
06/13	07:25 AM			293.30								210	into 5	445	Pivotrac
06/14	12:45 AM			294.73								150	into 3	445	Pivotrac
06/14	06:30 PM		0.95	296.19								90	into N	445	Pivotrac
06/16	09:00 PM			300.36								277	stop		Pivotrac
06/19	11:00 AM			300.67	3863.3	4 leaf	98.5	98.6	98.8	98.3	98.0	277	off		Curtis
06/25	02:30 PM			300.69								277	start		Pivotrac
06/25	04:50 PM			300.55								270	into 4		Pivotrac
06/25	11:30 PM											250	stop		Pivotrac
06/26	02:15 PM	1.70		301.41	3872.9	5 leaf	98.3	98.5	98.7	98.3	98.0	250	off		Curtis
06/28	05:00 PM											250	start		Pivotrac
06/29	08:35 AM			302.40								210	into 5	445	Pivotrac
06/30	05:20 AM			304.11								150	into 3	445	Pivotrac
07/01	02:40 AM		1.15	305.86								90	into N	445	Pivotrac
07/03	05:25 PM			311.03								270	into 4	445	Pivotrac
07/03	08:15 PM	0.16		311.70	3996.1	6 leaf	98.1	98.3	98.5	98.0	97.8	264	4	438	Curtis
07/04	08:10 PM			313.24								210	into 5	445	Pivotrac
07/06	04:25 AM			315.90								150	into 3	445	Pivotrac
07/07	03:00 AM		1.22	317.76								90	into N	445	Pivotrac
07/10	10:00 AM			324.40	4153.7	8 leaf	98.2	98.5	98.7	98.3	98.1	271	N	444	Curtis
07/10	10:30 AM			324.31								270	N	445	Pivotrac

Table 9: 2017 Field Data, “3 GPM” LEPA Corn, 260 bu/ac, Spain (continued)

Date	Time	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				
07/11	01:15 PM			326.51								210	into 5	445	Pivotrac
07/12	09:40 PM			329.17								150	into 3	445	Pivotrac
07/13	09:00 PM			330.17	4224.7	9 leaf	78.0	97.9	99.2	98.7	98.5	118	3	449	Curtis
07/13	06:40 PM		1.13	330.90								90	into N	445	Pivotrac
07/17	04:10 AM			337.62								270	into 4	445	Pivotrac
07/17	11:40 AM			338.17	4322.7	11 leaf	49.5	89.0	99.4	99.0	98.8	253	4	434	Curtis
07/18	06:55 AM			339.82								210	into 5	445	Pivotrac
07/19	03:30 PM			342.51								150	into 3	445	Pivotrac
07/20	11:55 AM		1.01	344.19								90	into N	445	Pivotrac
07/21	11:15 AM			346.02	4417.7	12 leaf	92.4	86.9	98.3	98.2	98.2	32	N	450	Curtis
07/23	06:45 PM			350.85								270	into 4	445	Pivotrac
07/24	11:45 AM			351.97	4490.1	12 leaf	92.4	86.9	98.3	98.2	98.2	231	4	455	Paul
07/24	09:05 PM			353.04								210	into 5	450	Pivotrac
07/26	05:25 AM			355.74								150	into 3	450	Pivotrac
07/27	01:50 AM		1.11	357.44								90	into N	450	Pivotrac
07/27	10:30 AM	0.37		357.86	4561.0	pollinate	94.6	0	96.4	98.1	98.2	71	N	443	Paul
07/30	09:30 AM			364.08								273	stop	450	Pivotrac
08/02	02:50 PM	2.61		363.60	4631.9	blister	42.6	97.9	98.0	98.6	98.7	273	off		Curtis
08/07	9:50AM			363.60	4631.9	blister	4.3	97.3	97.0	97.6	97.7	273	off		Curtis
08/15	03:00 PM	3.45		363.76	4633.0	milk	48.3	98.2	98.0	98.3	98.3	271	Flush		Curtis
08/16	11:20 AM											278	move dry		Pivotrac
08/21	09:20 AM											278	start		Pivotrac
08/21	12:55 PM			364.36								270	into 4		Pivotrac
08/21	01:55 PM	0.24		364.14	4637.7	milk	86.5	98.0	98.2	98.2	98.1	268	4	443	Curtis
08/22	04:00 PM			366.59								210	into 5	445	Pivotrac
08/24	01:40 AM			369.36								150	into 3	445	Pivotrac
08/24	10:55 PM		1.20	371.20								90	into N	445	Pivotrac
08/28	06:15 AM			377.74								278	stop		Pivotrac
08/28	11:00 AM	0.24		377.13	4797.5	dough	86.3	98.1	98.3	98.1	98.2	278	off		Curtis
09/05	10:35 AM	0.11		377.13	4797.5	dent	56.4	97.6	97.9	97.8	97.9	278	off		Curtis
09/05	02:55 PM			377.13								278	start		Pivotrac
09/05	06:40 PM			378.01								270	into 4	440	Pivotrac
09/06	09:10 PM			380.17								210	into 5	440	Pivotrac
09/07	07:35 AM			382.98								150	into 3	440	Pivotrac
09/08	01:55 PM			382.94	4868.5	¼ mat line	36.3	97.4	98.3	98.5	98.7	131	3	445	Curtis
09/09	04:10 AM		1.10	384.65								90	into N	440	Pivotrac
09/11	10:15 AM			388.50	4936.6	¼ mat line	59.2	95.8	97.4	97.9	98.2	330	N	450	Curtis
09/12	01:30 PM			391.28								270	N	440	Pivotrac
09/13	03:55 PM			393.43								210	4	440	Pivotrac
09/15	02:00 AM			396.21								150	into 3	440	Pivotrac
09/15	12:55 PM	0.08		396.59	5035.3	¼ mat line	42.3	91.5	97.2	98.0	98.4	119	3	451	Curtis
09/15	10:35 PM		1.10	397.89								90	into N	440	Pivotrac
09/18	2:00PM	0.34		402.24	5108.3	¼ mat line	92.4	96.3	97.0	97.8	98.4	310	N	443	Curtis
09/19	07:10 AM			404.60								272	stop	450	Pivotrac
09/21	10:05 AM			403.94	5129.1	¼ mat line	90.1	94.2	96.4	97.4	98.0	272	off		Curtis
09/25	11:20 AM	2.24		403.95	5129.1							272	off		Curtis
10/02	10:25 AM	1.08		403.95	5129.1							272	off		Curtis
10/10	03:15 PM	3.24		403.95	5129.1	black layer	97.7	97.9	97.3	98.2	98.3	272	off		Curtis
10/16	02:25 PM			403.95	5129.1	black layer	97.1	98.2	97.6	98.4	98.5	272	off		Curtis
10/23	02:10 PM			403.95	5129.1	black layer	97.0	97.8	97.3	98.1	98.2	272	off		Curtis
10/28						harvest									Stan
10/30	10:40 AM			403.95	5133.8	harvested	96.9	97.3	96.7	97.4	97.6	313	off		Curtis
Total		12.62	11.38				0.0	0.0	0.0	0.0	0.0	= 0.0"	Soil Moisture		Leon

Net soil moisture is 0.00 inches.

Rainfall (12.62 in), irrigation (11.38 in), and net soil moisture (0.00 in) is total water (24.00 in).

*Numbers in red are not counted in the total rainfall.

Figure 10: 2017 Gypsum Block Readings, “4 GPM” LEPA Corn, 270 bu/ac, Spain

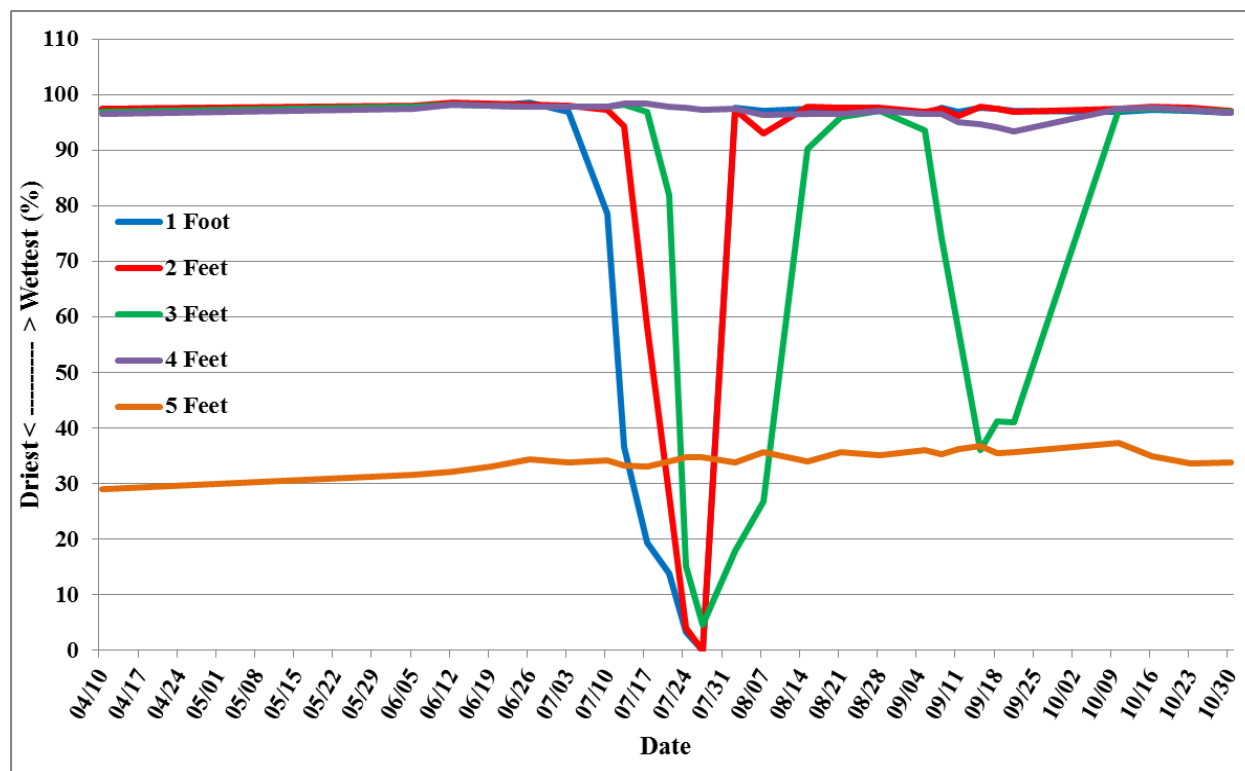


Figure 11: 2017 Growing Season Water Tracking, “4 GPM” LEPA Corn, 270 bu/ac, Spain

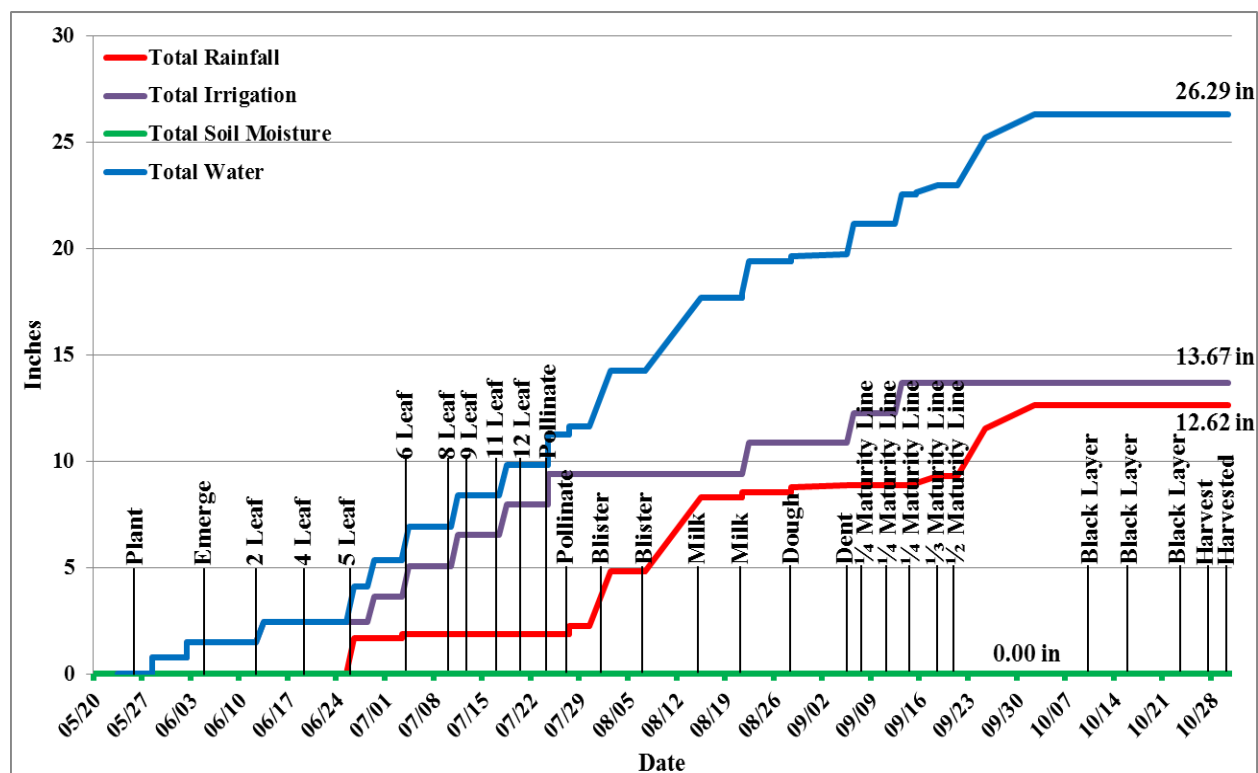


Table 10: 2017 Field Data, “4 GPM” LEPA Corn, 270 bu/ac, Spain

Date	Time	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				
03/27	10:40AM	0.33		278.72								290			Curtis
04/03	10:25AM	2.02		278.72								290			Curtis
04/10	4:40PM			278.72	3592.8		97.6	97.5	97.0	96.5	29.1	290			C & L
04/24	11:30AM	0.75		278.72								290			Curtis
05/01	11:40AM	1.38		278.72								290			Curtis
05/15	9:40AM	0.48		278.72								270			Curtis
05/23	11:50AM	0.36		278.72								259			Curtis
05/25						plant									Stan
05/27	03:45 PM			278.72								278	start		Pivotrac
05/27	04:00 PM			278.74								270	into 4	445	Pivotrac
05/28	06:30 AM			279.93								210	into 5	445	Pivotrac
05/28	07:30 PM		0.78	281.00								150	into 3	445	Pivotrac
05/29	08:45 AM			282.10								90	into N	445	Pivotrac
05/30	11:05 AM			284.44	3668.3							329	N	448	Curtis
05/30	10:15 PM			285.19								278	stop	445	Pivotrac
05/31	08:35 AM			285.35	3679.6							278	off		Curtis
06/02	06:40 AM			285.35								278	start	445	Pivotrac
06/02	08:30 AM			285.34								270	into 4	445	Pivotrac
06/02	09:20 PM		0.69	286.40								210	into 5	445	Pivotrac
06/03	10:30 AM			287.48								150	into 3	445	Pivotrac
06/03	11:25 PM			288.54								90	into N	445	Pivotrac
06/05	12:45 PM			291.94	3757.8	emerge	97.8	98.0	97.8	97.6	31.7	278	N	442	Curtis
06/05	01:15 PM			291.66								277	N	445	Pivotrac
06/12	09:20 AM			291.97	3758.0							277			Curtis
06/12	11:30 AM			291.97								277	start		Pivotrac
06/12	01:25 PM			292.14	3759.7	2 leaf	98.5	98.7	98.3	98.2	32.2	271	N	452	Curtis
06/12	01:50 PM			291.86								270	into 4	445	Pivotrac
06/13	07:25 AM		0.95	293.30								210	into 5	445	Pivotrac
06/14	12:45 AM			294.73								150	into 3	445	Pivotrac
06/14	06:30 PM			296.19								90	into N	445	Pivotrac
06/16	09:00 PM			300.36								277	N	445	Pivotrac
06/19	11:00 AM			300.67	3863.3	4 leaf	98.1	98.4	98.0	98.0	33.1	277			Curtis
06/25	02:30 PM			300.69								277	start	445	Pivotrac
06/25	04:50 PM			300.55								270	into 4		Pivotrac
06/25	11:30 PM											250	4		Pivotrac
06/26	02:15 PM	1.70		301.41	3872.9	5 leaf	98.7	98.2	97.9	97.9	34.4	250	off		Curtis
06/28	05:00 PM											250	start		Pivotrac
06/29	08:35 AM		1.21	302.40								210	into 5	445	Pivotrac
06/30	05:20 AM			304.11								150	into 3	445	Pivotrac
07/01	02:40 AM			305.86								90	into N	445	Pivotrac
07/03	05:25 PM			311.03								270	into 4	445	Pivotrac
07/03	08:15 PM	0.16		311.70	3996.1	6 leaf	97.0	98.1	97.8	97.8	33.8	264	4	438	Curtis
07/04	08:10 PM		1.44	313.24								210	into 5	445	Pivotrac
07/06	04:25 AM			315.90								150	into 3	445	Pivotrac
07/07	03:00 AM			317.76								90	into N	445	Pivotrac
07/10	10:00 AM			324.40	4153.7	8 leaf	78.7	97.4	97.8	97.9	34.2	271	N	444	Curtis
07/10	10:30 AM			324.31								270	N	445	Pivotrac

Table 10: 2017 Field Data, “4 GPM” LEPA Corn, 270 bu/ac, Spain (continued)

Date	Time	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				
07/11	01:15 PM		1.44	326.51								210	into 5	445	Pivotrac
07/12	09:40 PM			329.17								150	into 3	445	Pivotrac
07/13	09:00 PM			330.17	4224.7	9 leaf	36.6	94.4	98.2	98.4	33.3	118	3	449	Curtis
07/13	06:40 PM			330.90								90	into N	445	Pivotrac
07/17	04:10 AM			337.62								270	into 4	445	Pivotrac
07/17	11:40 AM			338.17	4322.7	11 leaf	19.5	58.3	96.9	98.5	33.2	253	4	434	Curtis
07/18	06:55 AM		1.44	339.82								210	into 5	445	Pivotrac
07/19	03:30 PM			342.51								150	into 3	445	Pivotrac
07/20	11:55 AM			344.19								90	into N	445	Pivotrac
07/21	11:15 AM			346.02	4417.7	12 leaf	13.8	27.9	81.9	97.9	34.1	32	N	441	Curtis
07/23	06:45 PM			350.85								270	into 4	445	Pivotrac
07/24	11:45 AM			351.97	4490.1	pollinate	3.3	4.1	15.2	97.7	34.7	231	4	455	Paul
07/24	09:05 PM		1.44	353.04								210	into 5	450	Pivotrac
07/26	05:25 AM			355.74								150	into 3	450	Pivotrac
07/27	01:50 AM			357.44								90	into N	450	Pivotrac
07/27	10:30 AM	0.37		357.86	4561.0	pollinate	0	0	4.6	97.4	34.7	71	N	442	Paul
07/30	09:30 AM			364.08								273	stop	450	Pivotrac
08/02	02:50 PM	2.61		363.60	4631.9	blister	97.7	97.3	17.9	97.6	33.9	273	off		Curtis
08/07	9:50AM			363.60	4631.9	blister	97.1	93.1	26.8	96.4	35.8	273	off		Curtis
08/15	03:00 PM	3.45		363.76	4633.0	milk	97.5	97.9	90.3	96.5	34.1	271	Flush		Curtis
08/16	11:20 AM											278	move dry		Pivotrac
08/21	09:20 AM											278	start	440	Pivotrac
08/21	12:55 PM			364.36								270	into 4	440	Pivotrac
08/21	01:55 PM	0.24		364.14	4637.7	milk	97.5	97.7	96.1	96.6	35.7	268	4	443	Curtis
08/22	04:00 PM		1.46	366.59								210	into 5	445	Pivotrac
08/24	01:40 AM			369.36								150	into 3	445	Pivotrac
08/24	10:55 PM			371.20								90	into N	445	Pivotrac
08/28	06:15 AM			377.74								278	stop		Pivotrac
08/28	11:00 AM	0.24		377.13	4797.5	dough	97.4	97.7	97.2	97.1	35.1	278	off		Curtis
09/05	10:35 AM	0.11		377.13	4797.5	dent	96.6	97.0	93.6	96.5	36.0	278	Off		Curtis
09/05	02:55 PM			377.13								278	start		Pivotrac
09/05	06:40 PM			378.01								270	into 4	440	Pivotrac
09/06	09:10 PM		1.41	380.17								210	into 5	440	Pivotrac
09/07	07:35 AM			382.98								150	into 3	440	Pivotrac
09/08	01:55 PM			382.94	4868.5	¼ mat line	97.7	97.6	74.2	96.6	35.3	131	3	445	Curtis
09/09	04:10 AM			384.65								90	into N	440	Pivotrac
09/11	10:15 AM			388.50	4936.6	½ mat line	96.9	96.3	57.7	95.2	36.2	330	N	450	Curtis
09/12	01:30 PM			391.28								270	N	440	Pivotrac
09/13	03:55 PM		1.41	393.43								210	4	440	Pivotrac
09/15	02:00 AM			396.21								150	into 3	451	Pivotrac
09/15	12:55 PM	0.08		396.59	5035.3	¾ mat line	97.7	97.9	36.0	94.7	36.9	119	3	440	Curtis
09/15	10:35 PM			397.89								90	into N	445	Pivotrac
09/18	10:10 AM	0.34		402.24	5104.5	¾ mat line	97.5	97.6	41.2	94.2	35.5	319	N	450	Curtis
09/19	07:10 AM			404.60								272	stop		Pivotrac
09/21	10:05 AM			403.95	5129.1	½ mat line	97.1	96.9	41.1	93.4	35.7	272	off		Curtis
09/25	11:20 AM	2.24		403.95	5129.1							272	off		Curtis
10/02	10:25AM	1.08		403.95	5129.1							272	off		Curtis
10/10	03:15 PM			403.95	5129.1	black layer	97.0	97.6	97.4	97.6	37.3	272	off		Curtis
10/16	02:25 PM	3.24		403.95	5129.1	black layer	97.3	97.8	97.6	97.7	35.0	272	off		Curtis
10/23	02:10 PM			403.95	5129.1	black layer	97.2	97.7	97.4	97.4	33.7	272	off		Curtis
10/28						harvest									Stan
10/30	10:40 AM			403.95	5133.8	harvested	96.7	97.1	96.9	96.8	33.8	313	move dry		Curtis
Total		12.62	13.67				0.0	0.0	0.0	0.0	0.0	= 0.0"	Soil Moisture		Leon
Net soil moisture is 0.00 inches.															
Rainfall (12.62 in), irrigation (13.67 in), and net soil moisture (0.00 in) is total water (26.29 in).															
*Numbers in red are not counted in the total rainfall.															

Figure 12: 2017 Gypsum Block Readings, “5 GPM” LEPA Corn, 270 bu/ac, Spain

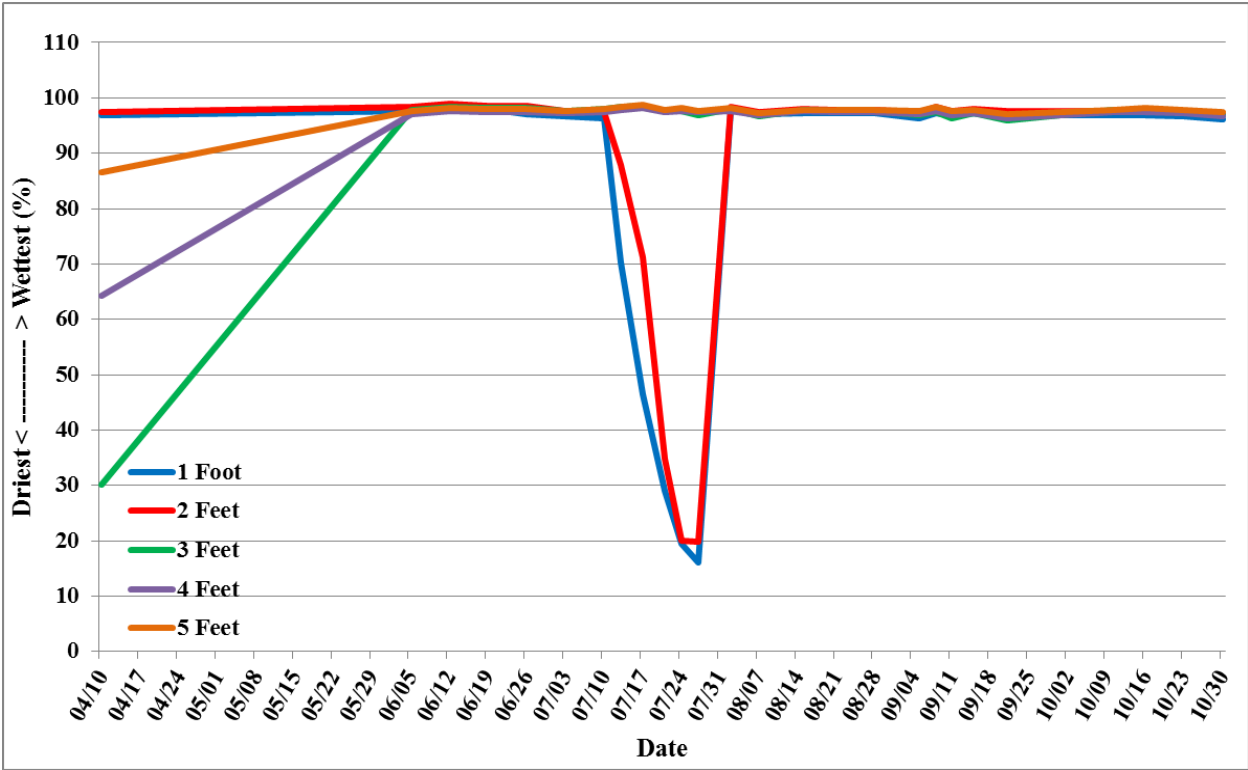


Figure 13: 2017 Growing Season Water Tracking, “5 GPM” LEPA Corn, 270 bu/ac, Spain

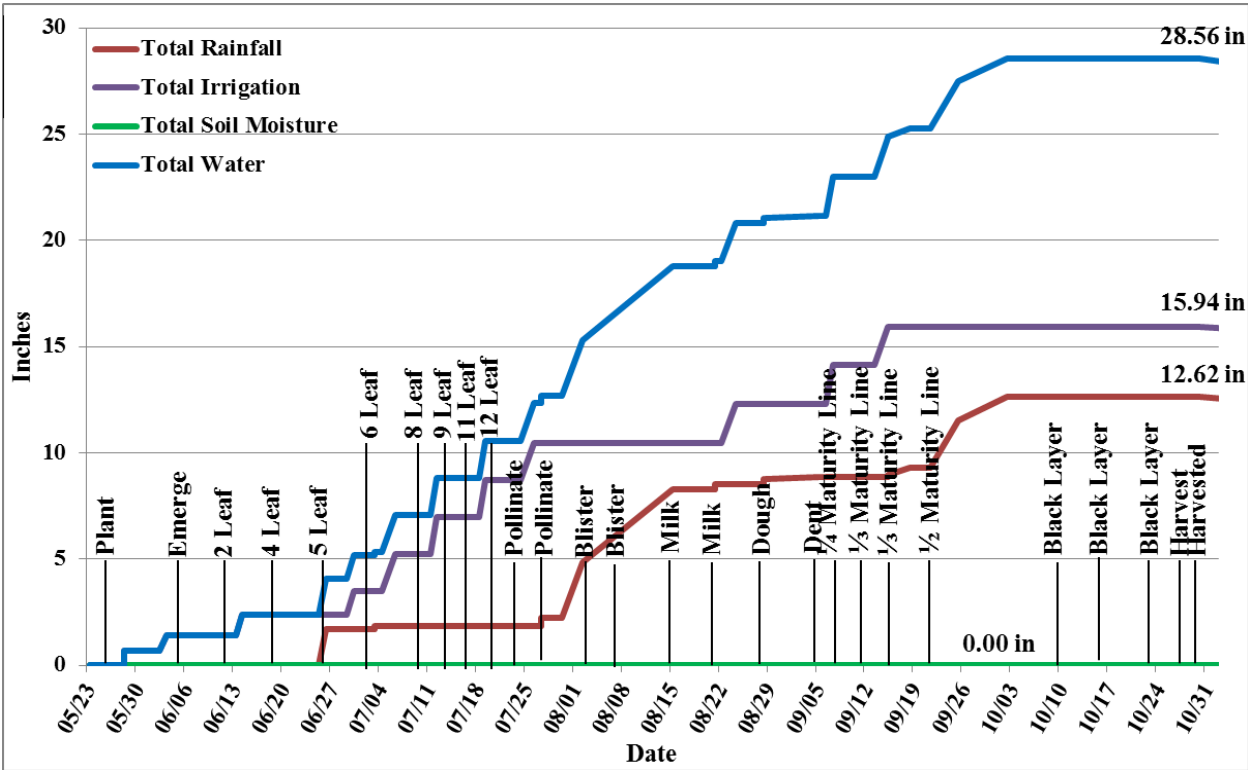


Table 11: 2017 Field Data, “5 GPM” LEPA Corn, 270 bu/ac, Spain

Date	Time	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				
03/27	10:40 AM	0.33		278.72								290			Curtis
04/03	10:25 AM	2.02		278.72								290			Curtis
04/10	04:40 PM			278.72	3592.8		96.8	97.5	30.1	64.3	86.6	290			C & L
04/24	11:30 AM	0.75		278.72								290			Curtis
05/01	11:40 AM	1.38		278.72								290			Curtis
05/15	09:40 AM	0.48		278.72								270			Curtis
05/23	11:50AM	0.36		278.72								259			Curtis
05/25						plant									Stan
05/27	03:45 PM			278.72								278	start		Pivotrac
05/27	04:00 PM			278.74								270	into 4	445	Pivotrac
05/28	06:30 AM			279.93								210	into 5	445	Pivotrac
05/28	07:30 PM		0.70	281.00								150	into 3	445	Pivotrac
05/29	08:45 AM			282.10								90	into N	445	Pivotrac
05/30	11:05 AM			284.44	3668.3							329	N	448	Curtis
05/30	10:15 PM			285.19								278	stop	445	Pivotrac
05/31	08:35 AM			285.35	3679.6							278	off		Curtis
06/02	06:40 AM			285.35								278	start	445	Pivotrac
06/02	08:30 AM			285.34								270	into 4	445	Pivotrac
06/02	09:20 PM			286.40								210	into 5	445	Pivotrac
06/03	10:30 AM		0.71	287.48								150	into 3	445	Pivotrac
06/03	11:25 PM			288.54								90	into N	442	Pivotrac
06/05	12:45 PM			291.94	3757.8	emerge	97.7	98.3	97.9	97.1	97.6	278	N	445	Curtis
06/05	01:15 PM			291.66								277	N		Pivotrac
06/12	09:20 AM			291.97	3758.0							277			Curtis
06/12	11:30 AM			291.97								277	start	452	Pivotrac
06/12	01:25 PM			292.14		2 leaf	98.3	98.9	98.4	97.7	98.2	271	N	445	Curtis
06/12	01:50 PM			291.86								270	into 4	445	Pivotrac
06/13	07:25 AM			293.30								210	into 5	445	Pivotrac
06/14	12:45 AM		0.94	294.73								150	into 3	445	Pivotrac
06/14	06:30 PM			296.19								90	into N	445	Pivotrac
06/16	09:00 PM			300.36								277	N		Pivotrac
06/19	11:00 AM			300.67	3863.3	4 leaf	98.0	98.6	98.1	97.5	98.0	277			Curtis
06/25	02:30 PM			300.69								277	start	445	Pivotrac
06/25	04:50 PM			300.55								270	into 4		Pivotrac
06/25	11:30 PM											250	4		Pivotrac
06/26	02:15 PM	1.70		301.41	3872.9	5 leaf	97.0	998.5	98.1	97.5	98.0	250			Curtis
06/28	05:00 PM											250	start	445	Pivotrac
06/29	08:35 AM			302.40								210	into 5	445	Pivotrac
06/30	05:20 AM		1.12	304.11								150	into 3	445	Pivotrac
07/01	02:40 AM			305.86								90	into N	445	Pivotrac
07/03	05:25 PM			311.03								270	into 4	438	Pivotrac
07/03	08:15 PM	0.16		311.70	3996.1	6 leaf	96.6	97.6	97.7	97.2	97.7	264	4	445	Curtis
07/04	08:10 PM			313.24								210	into 5	445	Pivotrac
07/06	04:25 AM		1.74	315.90								150	into 3	445	Pivotrac
07/07	03:00 AM			317.76								90	into N	444	Pivotrac
07/10	10:00 AM			324.40	4153.7	8 leaf	96.4	97.5	98.0	97.5	98.0	271	N	445	Curtis
07/10	10:30 AM			324.31								270	N	445	Pivotrac

Table 11: 2017 Field Data, “5 GPM” LEPA Corn, 270 bu/ac, Spain (continued)

Date	Time	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				
07/11	01:15 PM			326.51								210	into 5	445	Pivotrac
07/12	09:40 PM		1.74	329.17								150	into 3	449	Pivotrac
07/13	09:00 PM			330.17	4224.7	9 leaf	70.3	87.8	98.4	97.9	98.4	118	3	445	Curtis
07/13	06:40 PM			330.90								90	into N	445	Pivotrac
07/17	04:10 AM			337.62								270	into 4	434	Pivotrac
07/17	11:40 AM			338.17	4322.7	11 leaf	46.4	71.2	98.6	98.2	98.7	253	4	445	Curtis
07/18	06:55 AM			339.82								210	into 5	445	Pivotrac
07/19	03:30 PM		1.76	342.51								150	into 3	445	Pivotrac
07/20	11:55 AM			344.19								90	into N	441	Pivotrac
07/21	11:15 AM			346.02	4417.7	12 leaf	29.0	34.8	97.7	97.5	97.9	32	N	445	Curtis
07/23	06:45 PM			350.85								270	into 4	455	Pivotrac
07/24	11:45 AM			351.97	4490.1	pollinate	19.5	20.1	97.6	97.6	98.2	231	4	450	Paul
07/24	09:05 PM			353.04								210	into 5	450	Pivotrac
07/26	05:25 AM		1.76	355.74								150	into 3	450	Pivotrac
07/27	01:50 AM			357.44								90	into N	442	Pivotrac
07/27	10:30 AM	0.37		357.86	4561.0	pollinate	16.1	19.8	96.8	97.4	97.7	71	N	450	Paul
07/30	09:30 AM			364.08								273	stop		Pivotrac
08/02	02:50 PM	2.61		363.60	4631.9	blister	97.9	98.3	98.0	97.7	98.2	273	off		Curtis
08/07	9:50AM			363.60	4631.9	blister	97.0	97.5	96.7	96.8	97.2	273	off		Curtis
08/15	03:00 PM	3.45		363.76	4633.0	milk	97.3	98.0	97.8	97.6	97.9	271	Flush		Curtis
08/16	11:20 AM											278	move dry		Pivotrac
08/21	09:20 AM											278	start		Pivotrac
08/21	12:55 PM			364.36								270	into 4	445	Pivotrac
08/21	01:55 PM	0.24		364.14	4637.7	milk	97.2	97.9	97.6	97.4	97.8	268	4	443	Curtis
08/22	04:00 PM			366.59								210	into 5	445	Pivotrac
08/24	01:40 AM		1.81	369.36								150	into 3	445	Pivotrac
08/24	10:55 PM			371.20								90	into N	445	Pivotrac
08/28	06:15 AM			377.74								278	stop		Pivotrac
08/28	11:00 AM	0.24		377.13	4797.5	dough	97.2	97.9	97.6	97.4	97.9	278	off		Curtis
09/05	10:35 AM	0.11		377.13	4797.5	dent	96.4	97.4	96.8	97.0	97.6	278	Off		Curtis
09/05	02:55 PM			377.13								278	start		Pivotrac
09/05	06:40 PM			378.01								270	into 4	440	Pivotrac
09/06	09:10 PM			380.17								210	into 5	440	Pivotrac
09/07	07:35 AM		1.84	382.98								150	into 3	445	Pivotrac
09/08	01:55 PM			382.94	4868.5	½ mat line	97.2	98.3	97.5	97.6	98.3	131	3	445	Curtis
09/09	04:10 AM			384.65								90	into N	445	Pivotrac
09/11	10:15 AM			388.50	4936.6	½ mat line	96.8	97.7	96.4	96.8	97.6	330	off	450	Curtis
09/12	01:30 PM			391.28								270	N	440	Pivotrac
09/13	03:55 PM			393.43								210	4	440	Pivotrac
09/15	02:00 AM		1.82	396.21								150	into 3	440	Pivotrac
09/15	12:55 PM	0.08		396.59	5035.3	½ mat line	97.3	98.0	97.3	97.3	97.8	119	3	451	Curtis
09/15	10:35 PM			397.89								90	into N	440	Pivotrac
09/18	10:10 AM	0.34		402.24	5104.5							319	N	445	Curtis
09/19	07:10 AM			404.60								272	stop	450	Pivotrac
09/21	10:05 AM			403.95	5129.1	½ mat line	96.9	97.6	95.9	96.4	97.1	272	off		Curtis
09/25	11:20 AM	2.24		403.95	5129.1							272	off		Curtis
10/02	10:25 AM	1.08		403.95	5129.1							272	off		Curtis
10/10	03:15 PM	3.24		403.95	5129.1	black layer	96.8	97.7	97.8	97.4	97.9	272		off	Curtis
10/16	02:25 PM			403.95	5129.1	black layer	96.8	97.8	97.7	97.4	98.1	272		off	Curtis
10/23	02:10 PM			403.95	5129.1	black layer	96.7	97.5	97.4	97.2	97.8	272		off	Curtis
10/28						harvest						313	move dry		Stan
10/30	10:45 AM			403.95	5133.8	harvested	96.2	97.1	96.8	96.7	97.4	313		off	Curtis
Total		12.62	15.94		Soil		0.0	0.0	0.0	0.0	0.0	= 0.0"	Soil Moisture		Leon
Net soil moisture is 0.00 inches.															
Rainfall (12.62 in), irrigation (15.94 in), and net soil moisture (0.00 in) is total water (28.56 in).															
*Numbers in red are not counted in the total rainfall.															

2017 Harvest Results, LEPA Corn, Spain

The 3 GPM field produced a 260 bushel per acre corn yield. Irrigation totaled 11.38 inches. Production in the 4 GPM field was 270 bushels per acre; seasonal irrigation totaled 13.67 inches. Corn yield was 270 bushels per acre for the 5 GPM field; irrigation totaled 15.94 inches. There was no pre-season irrigation.

The 4 GPM field produced 10 more bushels per acre than the 3 GPM field. Irrigation was 2.29 inches more. The 5 GPM field produced 10 more bushels per acre than the 3 GPM with 4.56 more inches of irrigation. The 5 GPM yield was the same 270 bushels per acre as that from 4 GPM field with 2.27 additional inches of irrigation.

Corn production was 22.85 bushels (1279 lb.) per inch of irrigation in the 3 GPM field compared to 19.75 bushels (1106 lb.) in the 4 GPM and 16.94 bushels (948 lb.) from the 5 GPM field. Production from each inch of irrigation, rainfall, and net soil water that totaled 24.00 inches was 10.83 bushels (606 lb.) per acre in the 3 GPM field. Irrigation, rainfall, and net soil water totaled 26.29 inches in the 4 GPM field where production was 10.27 bushels (575 lb.) per inch. In the 5 GPM field, irrigation, rainfall, and net soil water totaled 28.56 inches where production was 9.45 bushels (529 lb.) per inch of total water.

Crop production costs were \$23.85 per acre more for the 4 GPM field than for the 3 GPM from increased irrigation, fertilizer, and harvest expenses. At \$3.63 per bushel, the 10 bushels per acre increased corn yield in the 4 GPM field amounted to \$36.30 more per acre than from the 3 GPM field. The 4 GPM field's net gain is \$12.45 per acre with 2.29 inches more irrigation used compared to production from the 3 GPM field. At \$3.63 per bushel, the 10 bushel per acre increased yield from the 5 GPM field compared to the 3 GPM amounts to \$36.30 per acre. Crop production costs were \$37.93 per acre more for the 5 GPM field. The 5 GPM field's net loss compared to the 3 GPM field is \$1.63 per acre with 4.56 additional inches of irrigation. Corn yields were 270 bushels per acre in both the 4 GPM and 5 GPM fields. Production costs were \$14.08 more for the 5 GPM field than the 4 GPM field. Net gain for the 4 GPM field was \$14.08 per acre with 2.27 inches less irrigation.

Net return from the 3 GPM field was \$515.76 per acre compared to \$528.22 from the 4 GPM field and \$514.14 from the 5 GPM field. Net return from each inch of irrigation is \$45.32 for the 3 GPM field compared to \$38.64 from the 4 GPM and \$32.25 for the 5 GPM field. A summary of the demonstration results are shown in Table 12 and Appendix B.

Table 12: 2017 LEPA Demonstration Results, Spain

GPM	Irrigation (in)	Total Water (in)	Production		Gross Crop Value @ \$3.63/bu		
			bu/ac	lb/ac-in of Irrigation	per acre (\$)	Acre-inch of Irrigation (\$)	Acre-in of Total Water
3 GPM	11.38	24.00	260	1279	\$943.80	\$82.93	\$39.32
4 GPM	13.67	26.29	270	1106	\$980.10	\$71.70	\$37.28
5 GPM	15.94	28.56	270	948	\$980.10	\$61.48	\$34.32

All fields include 0.00 inches of soil water within 5 feet of soil, only rainfall and irrigation.

Harold Grall's 2017 LEPA Shroud and T-L PMDI Corn Demonstration

2017 Planting and Crop Information LEPA and PMDI Corn, Grall

Harold Grall strip tilled and planted 120 acres of corn in the NW ¼ of Section 328 circle for his “3, 4, 5 GPM” 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 and continues to use his improved center pivot irrigation water application system to support the low available groundwater and well irrigation capacity for the 120 acres of corn. 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 “3, 4, 5 GPM” “LEPA Shroud and PMDI fields was 28,000 seeds per acre. Center pivot travel was tracked by Pivotrak. Seasonal water meter readings averaged 283 gallons per minute. Irrigation capacity averaged 0.88 inches in a 7 day circle revolution. Both the LEPA Shroud and T-L PMDI fields received hail damage on June 25 at the 6 to 7 leaf growth stage. Harvest yields in this report were adjusted to 30% damage according to the crop insurance adjustment for the fields. Planting and crop information for “Grall LEPA Shroud” and “Grall T-L PMDI” are shown in Table 13 below.

Table 13: 2017 Planting and Crop Information, LEPA Shroud & T-L PMDI, 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		November 7
Hybrid		Pioneer P1151AMX		Seeding Rate		28,000
Row Width		30 inches		Tillage		Strip Till
No. Acres		79.80		GPM/Acre		2.36
Total Water		24.16 inches		Soil Type		Sherm Silty Clay Loam
Irrigation		13.08 inches		Insecticide		Comite, Stratego Fungicide
3 GPM T-L PMDI Demonstration Site: Span 6, 270-210 degrees						
Planted		May 25		Harvested		November 7
Hybrid		Pioneer P1151AMX		Seeding Rate		28,000
Row Width		30 inches		Tillage		Strip Till
No. Acres		16.90		GPM/Acre		2.36
Total Water		24.16 inches		Soil Type		Sherm Silty Clay Loam
Irrigation		13.08 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		November 7
Hybrid		Pioneer P1151AMX		Seeding Rate		28,000
Row Width		30 inches		Tillage		Strip Till
No. Acres		8.00		GPM/Acre		3.14
Total Water		28.92 inches		Soil Type		Sherm Silty Clay Loam
Irrigation		17.84 inches		Insecticide		Comite, Stratego Fungicide
4 GPM T-L PMDI Demonstration Site: Span 6, 210-240 degrees						
Planted		May 25		Harvested		November 7
Hybrid		Pioneer P1151AMX		Seeding Rate		28,000
Row Width		30 inches		Tillage		Strip Till
No. Acres		1.70		GPM/Acre		3.14
Total Water		28.92 inches		Soil Type		Sherm Silty Clay Loam
Irrigation		17.84 inches		Insecticide		Comite, Stratego Fungicide

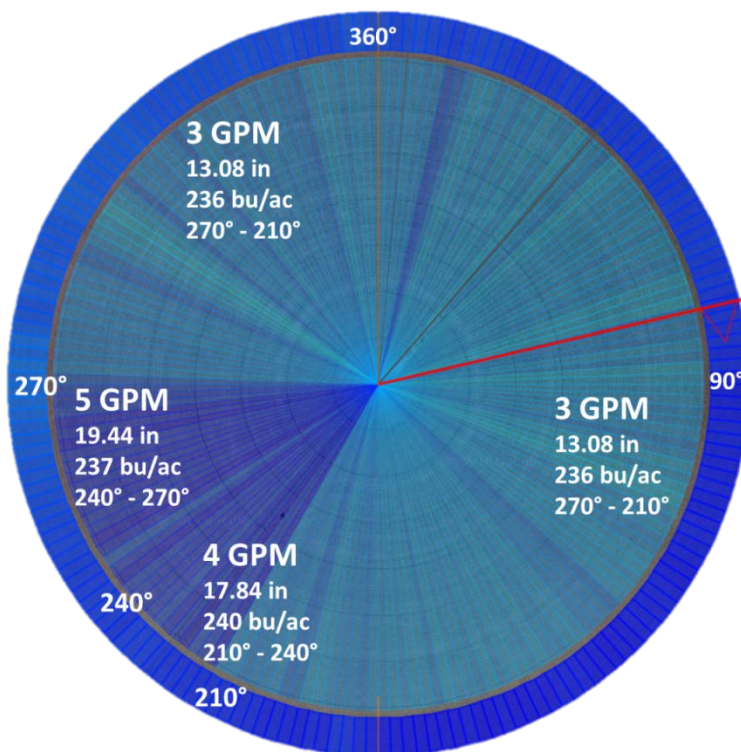
**Table 13: 2017 Planting and Crop Information, LEPA Shroud & T-L PMDI, Grall
(continued)**

5 GPM LEPA Shroud Demonstration Site: Spans 2, 3, 4, 5, 7, 8 and End Section, 240-270 degrees					
Planted	May 25		Harvested		November 7
Hybrid	Pioneer P1151AMX		Seeding Rate	28,000	
Row Width	30 inches		Tillage	Strip Till	
No. Acres	8.00		GPM/Acre	3.93	
Total Water	30.52 inches		Soil Type	Sherm Silty Clay Loam	
Irrigation	19.44 inches		Insecticide	Comite, Stratego Fungicide	
5 GPM T-L PMDI Demonstration Site: Span 6, 240-270 degrees					
Planted	May 25		Harvested		November 7
Hybrid	Pioneer P1151AMX		Seeding Rate	28,000	
Row Width	30 inches		Tillage	Strip Till	
No. Acres	1.70		GPM/Acre	3.93	
Total Water	30.52 inches		Soil Type	Sherm Silty Clay Loam	
Irrigation	19.44 inches		Insecticide	Comite, Stratego Fungicide	

2017 Water Intensity Map, “3-4-5 GPM” LEPA Shroud Corn, Grall

Seasonal irrigation was 17.84 inches per acre for the 4 GPM LEPA field from 210 to 240 degrees compared to 13.08 inches for the 3 GPM field from 270 to 210 degrees. Center pivot travel speed was reduced each revolution to apply 19.44 inches of irrigation from 240 to 270 degrees in the circle for the 5 GPM LEPA field. A Water Intensity Map (courtesy of Pivotrac) was developed for the “3-4- 5 GPM” project.

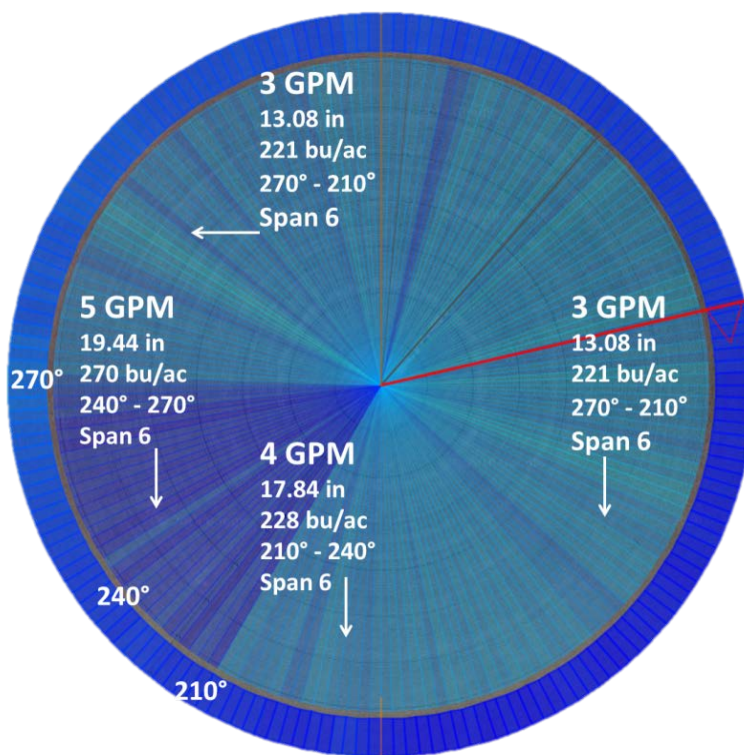
Figure 14: 2017 Water Intensity Map, “3-4-5 GPM” LEPA Shroud Corn, Grall



2017 Water Intensity Map, “3-4-5-GPM” T-L PMDI Corn, Grall

Seasonal irrigation totaled 13.08 inches for the 3 GPM T-L PMDI field compared to 17.84 inches for the 4 GPM. The 3 GPM field was from 270 to 210 degrees and the 4 GPM 210 to 240 degrees in the circle. 19.44 inches of irrigation was applied for the 5 GPM field from 240 to 270 degrees in the circle. T-L PMDI was in span 6 of the 8 span center pivot. A Water Intensity Map (courtesy of Pivotrak) was developed for the “3-4-5 GPM” project.

Figure 15: 2017 Water Intensity Map, “3-4-5 GPM” T-L PMDI Corn, Grall



2017 Soil Water Profile and Growing Season Rainfall Corn, Grall

“LEPA Shroud” Demonstration Site

Preseason soil water was good at 1, 2, 3, 4, and 5 feet in the 3 GPM, 4 GPM, and 5 GPM LEPA fields. Periodic timely, beneficial rainfall helped produce the crop. Soil type 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 showed the crop in each “GPM” field had adequate soil water during the growing season. Rainfall totaled 11.08 inches from planting until grain maturity in late October.

“3 GPM”: Plants used more water than rainfall and irrigation provided beginning in early-July at 8 leaves when rainfall totaled 0.80 inches for the month. Soil moisture sensors show no soil water was used from beyond 1 foot in the plant root zone during the growing season. Net soil water used to produce the crop was 0.00 inches. Late season rainfall refilled the plant root zone to the level at planting.

“4 GPM”: Plant roots used soil water from 1 and 2 feet at the tassel growth stage in July in addition to rainfall and irrigation. Only limited water was used from 3, 4, and 5 feet during the growing season. No net soil water was used to produce the crop. Late season rainfall refilled the 1 and 2 feet plant root zone similar to the level at planting.

“5 GPM”: Plants used water primarily from 1 and 2 feet in July at the tassel growth stage when rainfall and irrigation was not enough. Soil moisture sensors showed water use from 1 foot beginning in early-July and from 2 feet in mid-July. There was no significant use from 3, 4, and 5 feet during the growing season. Abundant rainfall in August followed by more in October refilled the plant root zone at 1 and 2 feet similar to the level at planting, resulting in no net soil water use.

“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 show the crop had sufficient soil water during the growing season. Total rainfall from planting through black layer totaled 11.08 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”: Weekly gypsum block readings showed plants used about 30% of the water from 1 foot in the soil profile and 20% stored at 2 feet in addition to irrigation and rainfall at tassel during mid to late July. The sensors show only limited to no water use from 3, 4, and 5 feet producing the crop. Net soil water totaled 0.00 inches, following abundant rainfall in August followed by irrigation and rainfall in September.

“4 GPM”: Plants used about 30% of the soil water from 1 foot and 20% from 2 feet in the soil profile by mid to late-July in addition to irrigation and rainfall. Soil water sensors showed no water use from 3, 4, and 5 feet producing the crop, indicating sufficient water was available. Net soil water use was 0.00 inches.

“5 GPM”: Soil water sensors showed the 1 foot soil profile was only 20% of capacity prior to planting, but preseason rainfall refilled it by planting time. Roots began to use water from 1 foot in the soil profile in mid to late-July at tassel growth stage, in addition to rainfall and irrigation. Plant roots used additional water from the 1 foot zone in September. Soil moisture sensors showed no water was used from 2, 3, 4, and 5 feet of the soil profile. Late season irrigation and rainfall refilled the 1, 2, 3, 4, and 5 feet root zones, resulting in no net soil water use producing the crop.

Table 14: 2017 Monthly Rainfall Data, LEPA Shroud and T-L PMDI Corn, Grall

System	June (in)	July (in)	August (in)	September (in)	Total (in)
LEPA, PMDI	1.41	0.80	7.94	0.93	11.08

2017 Growing Season Water Tracking, LEPA Shroud and T-L PMDI Corn, Grall

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 five gypsum block soil moisture sensors was installed at 1, 2, 3, 4, and 5 feet. An AquaSpy™ soil moisture probe was installed down to 4 feet in the root zone at one location to monitor soil water levels in the “3 GPM” LEPA and “3 GPM” PMDI fields. Another set of the same type of sensors

were installed in the “4 GPM” and “5 GPM” fields. Both the gypsum block sensors and the soil probe were installed in close proximity to each other in each field. Gypsum blocks, water meter, rain gauges, and crop growth were read, recorded, and utilized weekly by district personnel. A 24/7 Aquaspy probe website showed soil moisture at 4 inch increments to 48 inches and monitored plant root growth. The website listed all Aquaspy soil probes in the “3-4-5 GPM” project and was available to all cooperators and district personnel. Another 24/7 Pivotrak website tracked each center pivot, monitored system position and travel, and provided information to make irrigation strategic management decisions. Both the cooperating grower and district “3-4-5 GPM” Project Leader collectively monitored, controlled, and managed irrigation from the Pivotrak website.

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

Figure 16: 2017 Gypsum Block Readings, “3 GPM” LEPA Shroud Corn, 236 bu/ac, Grall

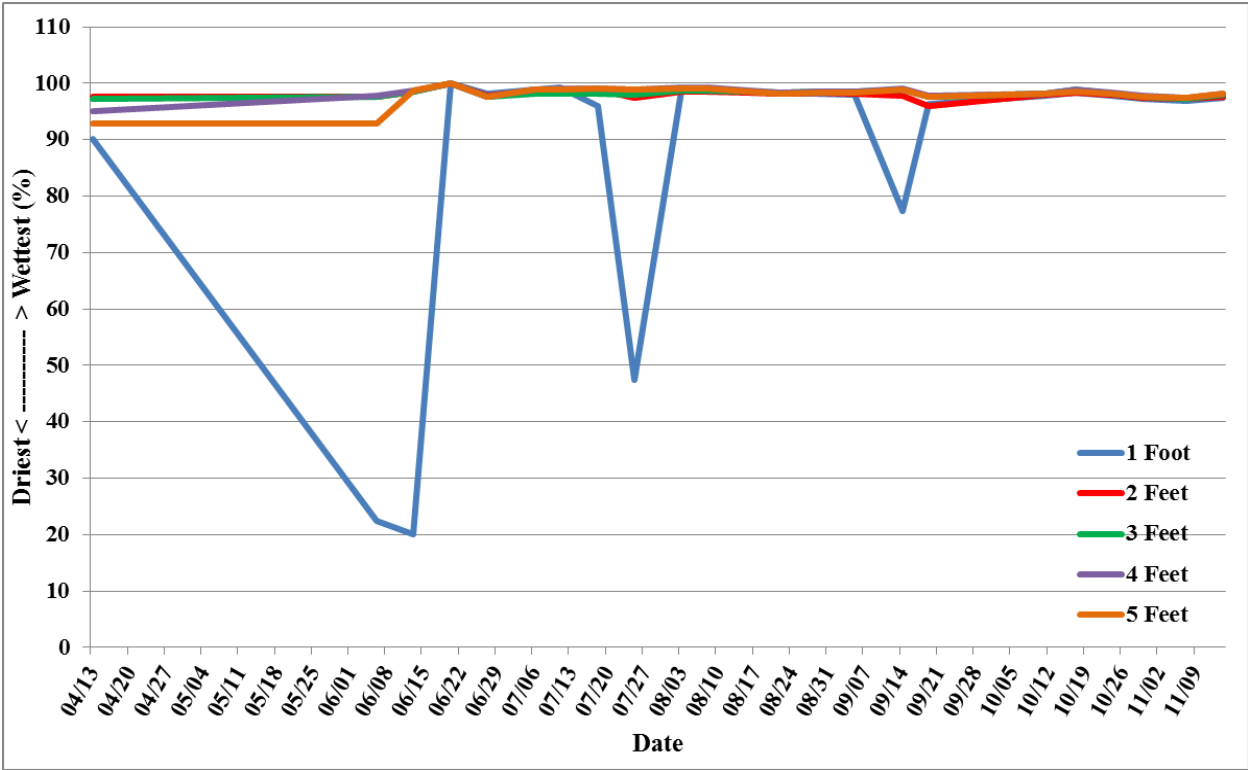


Figure 17: 2017 Growing Season Water Tracking, “3 GPM” LEPA Shroud Corn, 236 bu/ac, Grall

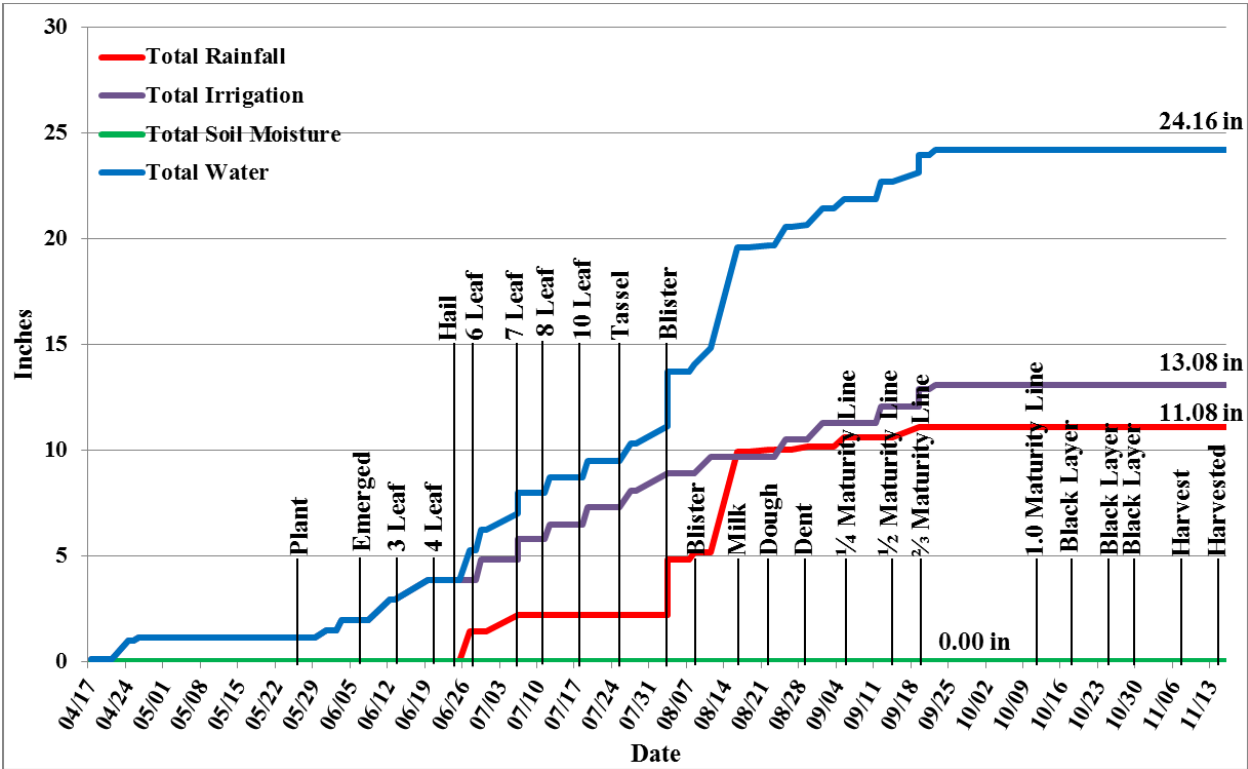


Table 15: 2017 Field Data, “3 GPM” LEPA Shroud Corn, 236 bu/ac, Grall

Date	Time	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well GPM	Tracking Source
							1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
03/30		1.44													Pivotrac
04/01		2.23													Pivotrac
04/05		0.48													Pivotrac
04/13	03:30 PM			256.844	30477.2		90.1	97.7	97.3	95.0	92.8	184		off	C & L
04/17	11:15 AM			256.844								184	start		Pivotrac
04/17	08:05 PM		0.08	257.542								210	into 4	320	Pivotrac
04/18	01:40 PM			258.587								240	into 5	320	Pivotrac
04/19	07:15 AM			259.629								270	into 3	320	Pivotrac
04/21		0.90													Pivotrac
04/24	03:30 PM		0.90	267.230								210	into 4	320	Pivotrac
04/25	06:05 AM			268.095								240	into 5	320	Pivotrac
04/25	07:35 PM			268.895								270	into 3	320	Pivotrac
04/26	07:50 AM		0.15	270.137								296	stop	320	Pivotrac
04/26		0.44										296	move dry		Pivotrac
04/30		1.39													Pivotrac
05/03		0.34													Pivotrac
05/10		0.47													Pivotrac
05/16		0.19													Pivotrac
05/18	03:05 PM											350	move dry		Pivotrac
05/22		0.73													Pivotrac
05/27						plant						356	move dry		Harold
05/29	12:30 pm											355	start cw		Pivotrac
05/31	09:05 am		0.31	272.780								210	into 4	320	Pivotrac
05/31	03:30 pm			273.160								240	into 5	320	Pivotrac
05/31	09:45 pm			273.531								270	into 3	320	Pivotrac
06/02	10:00 am											80	stop		Pivotrac
06/02	03:45 pm											80	start cw		Pivotrac
06/03	06:35 pm		0.52	277.981								210	into 4	320	Pivotrac
06/04	08:30 am			278.806								240	into 5	320	Pivotrac
06/04	10:25 pm			279.631								270	into 3	320	Pivotrac
06/06	11:10 am			279.375	30942.2	emerged	22.5	97.7	97.6	97.8	352	3	3	320	Curtis
06/06	09:50 pm											14	stop		Pivotrac
06/08	10:40 am											14	start cw		Pivotrac
06/12	07:45 am		0.95	287.697								210	into 4	310	Pivotrac
06/12	09:45 pm			288.501								240	into 5	310	Pivotrac
06/13	11:30 am			287.234	31074.7	2 leaf	20.1	98.6	98.5	98.7	269	269	5	312	Curtis
06/13	11:50 am			288.506								270	into 3	310	Pivotrac
06/19	07:35 am		0.95	296.529								210	into 4	310	Pivotrac
06/19	09:40 pm			297.337								240	into 5	310	Pivotrac
06/20	11:40 am			298.141								270	into 3	310	Pivotrac
06/20	04:40 pm			297.059	31247.8	4 leaf	101	101	100	100	100	280	3	310	Curtis
06/25	08:35 pm					hail						186	stop		Pivotrac
06/27	11:00 am	1.41		303.907	31372.4	6 leaf	98.2	97.8	97.7	97.7		186	stop		Curtis
06/28	07:15 pm											186	srart cw		Pivotrac
06/29	05:10 am		0.95	306.121								210	into 4	310	Pivotrac
06/29	09:15 pm			307.044								240	into 5	310	Pivotrac
06/30	12:35 pm			307.925								270	into 3	310	Pivotrac
07/06	11:45 am	0.80		314.331	31559.0	7 leaf	98.9	98.7	98.1	98.8	98.8	196	3	302	Curtis
07/06	01:15 pm		0.95	315.962								210	into 4	300	Pivotrac
07/07	07:55 am			317.00								240	into 5	300	Pivotrac
07/08	05:15 am			318.129								270	into 3	300	Pivotrac
07/11	11:40 am			320.746	31678.8	8 leaf	99.3	98.8	98.1	99.0	98.8	152	3	292	Curtis
07/12	02:05 pm		0.72	324.231								210	into 4	300	Pivotrac
07/13	08:20 am			325.245								240	into 5	300	Pivotrac
07/14	06:15 am			326.463								270	into 3	300	Pivotrac
07/18	11:30 am			329.579	31846.4	10 leaf	96.0	98.9	98.2	99.1	99.0	137	3	276	Curtis
07/19	08:00 pm		0.80	333.276								210	into 4	275	Pivotrac

Table 15: 2017 Field Data, “3 GPM” LEPA Shroud Corn, 236 bu/ac, Grall (continued)

Date	Time	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well GPM	Tracking Source
							1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
07/20	02:20 pm			334.209								240	into 5	275	Pivotrac
07/21	01:40 pm			335.398								270	into 3	275	Pivotrac
07/25	10:20 am			338.206	32012.6	tassle	47.4	97.4	98.0	98.8	98.8	124	3	281	Paul
07/27	01:30 am		0.79	342.112								210	into 4	275	Pivotrac
07/27	07:35 pm			343.033								240	into 5	275	Pivotrac
07/28	04:35 pm			344.103								270	into 3	275	Pivotrac
08/03	08:40 am		0.82	351.035								210	into 4	275	Pivotrac
08/03	12:35 pm	2.58		349.356	32230.9	blister	98.7	98.6	98.7	99.2	99.1	216	4 cw	276	Curtis
08/04	04:15 am			352.032								240	into 5	275	Pivotrac
08/05	01:40 am											270	into 3	275	Pivotrac
08/07	04:25 am											15	stop		Pivotrac
08/07	10:55 am											15	start cw		Pivotrac
08/08	03:55 pm	0.36		355.294	32347.9	blister	98.7	98.6	98.7	99.2	99.1	80	3 cw	264	Curtis
08/11	04:10 am		0.77	359.597								210	into 4	250	Pivotrac
08/11	01:25 pm											224	stop		Pivotrac
08/16	04:45 pm	4.77		358.764	32417.2	milk	98.5	98.4	98.5	98.7	98.5	224	off		Curtis
08/17	12:20 pm											224	start		Pivotrac
08/17	11:05 pm			360.523								240	into 5	250	Pivotrac
08/18	08:50 pm			361.530								270	into 3	250	Pivotrac
08/22	04:35 pm	0.11		365.215	32541.4	dough	98.2	98.2	98.3	98.4	98.2	110	3	265	Curtis
08/23	05:00 am											134	stop		Pivotrac
08/23	10:55 am											134	start		Pivotrac
08/25	12:10 am		0.84	368.633								210	into 4	250	Pivotrac
08/25	06:00 pm			369.552								240	into 5	250	Pivotrac
08/26	04:55 pm			370.613								270	into 3	250	Pivotrac
08/29	12:40 pm	0.12		373.201	32699.4	dent	98.1	98.3	98.5	98.6	98.4	58	3	268	Curtis
09/01	10:25 am		0.75	376.980								210	into 4	250	Pivotrac
09/02	05:25 am			377.860								240	into 5	250	Pivotrac
09/03	03:05 am			378.863								270	into 3	250	Pivotrac
09/05	03:40 pm	0.46		381.657		½ mat line	97.9	98.2	98.5	98.6	98.4	42	3	266	Curtis
09/08	10:00 am				32870.5							185	3		Pivotrac
09/11	04:10 pm											185	start		Pivotrac
09/12	05:05 am		0.80	385.597								210	into 4	260	Pivotrac
09/12	10:25 pm			386.431								240	into 5	260	Pivotrac
09/13	08:50 pm			387.511								270	into 3	260	Pivotrac
09/14	03:20 pm			388.524	33007.8	½ mat line	77.3	97.8	98.9	99.0	98.8	311	3	272	Curtis
09/19	09:55 am	0.47		394.122	33007.8	¾ mat line	96.4	96.0	97.7	97.8	97.7	197	3	256	Curtis
09/19	04:00 pm		0.82	394.470	33122.4							210	into 4	270	Pivotrac
09/20	11:30 am			395.445								240	into 5	270	Pivotrac
09/21	08:30 am			396.496								270	into 3	270	Pivotrac
09/22	08:30 pm		0.21	398.296								347	stop	270	Pivotrac
10/11	3:25pm	5.72		398.178	33204.8	1.0 mat line	97.8	97.9	98.1	98.2	98.1	347	off		Curtis
10/17	3:45pm			398.178	33204.8	black layer	98.4	98.4	98.8	98.8	98.6	347	off		Curtis
10/24	03:50 PM			398.178	33204.8	black layer	97.8	97.9	98.2	98.3	98.2	347	off		Curtis
10/30	03:50 PM			398.178	33204.8	black layer	97.2	97.4	97.7	97.8	97.7	347	off		Curtis
11/07	01:05 PM			398.178	33206.6	black layer	96.9	97.2	97.3	97.5	97.4	347	off		Curtis
11/07						harvest						move dry			Harold
11/14	01:00 PM			398.178	33206.6	harvested	97.4	97.7	97.9	98.2	98.1	10	off		Curtis
Total		11.08	13.08				0.0	0.0	0.0	0.0	0.0	= 0.0	Soil Moisture	283 GPM	Leon

Net soil moisture is 0.00 inches.

Rainfall (11.08 in), irrigation (13.08 in), and net soil moisture (0.00 in) is total water (24.16 in).

*Numbers in red are not counted in the total rainfall.

Figure 18: 2017 Gypsum Block Readings, “4 GPM” LEPA Shroud Corn, 240 bu/ac, Grall

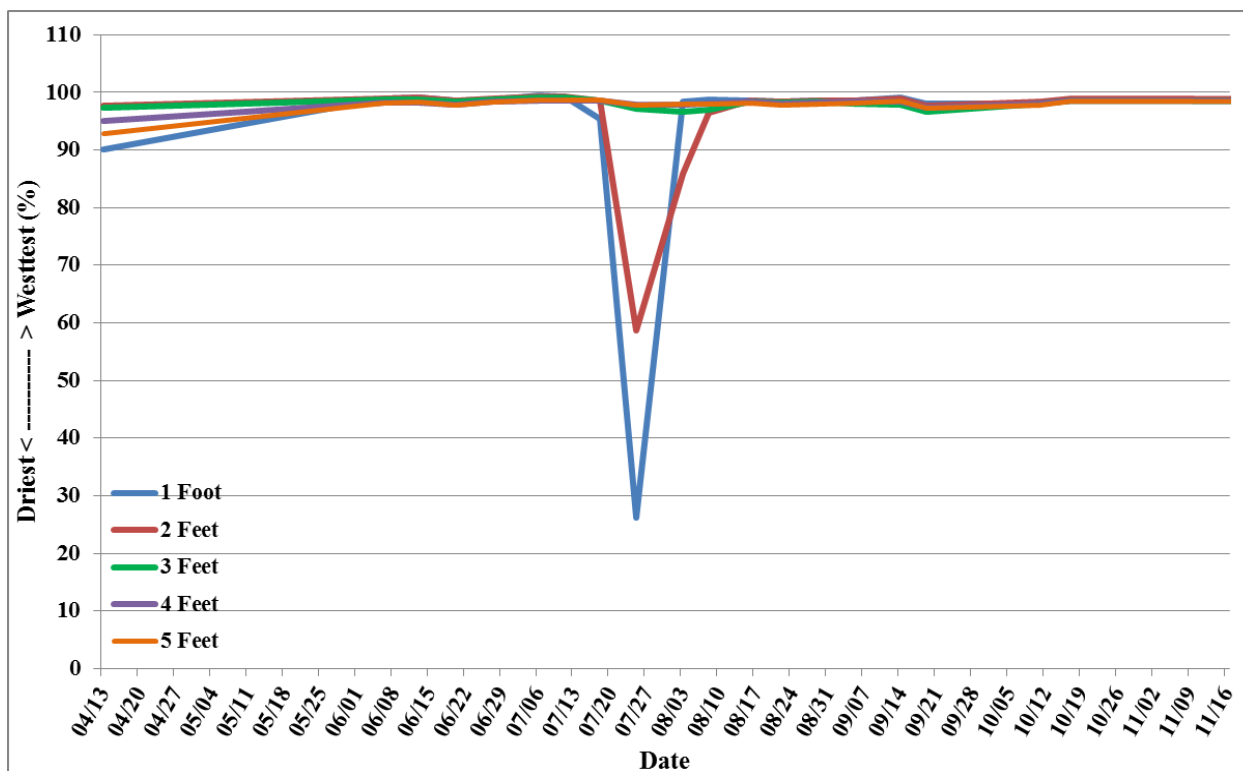


Figure 19: 2017 Growing Season Water Tracking, “4 GPM” LEPA Shroud Corn, 240 bu/ac, Grall

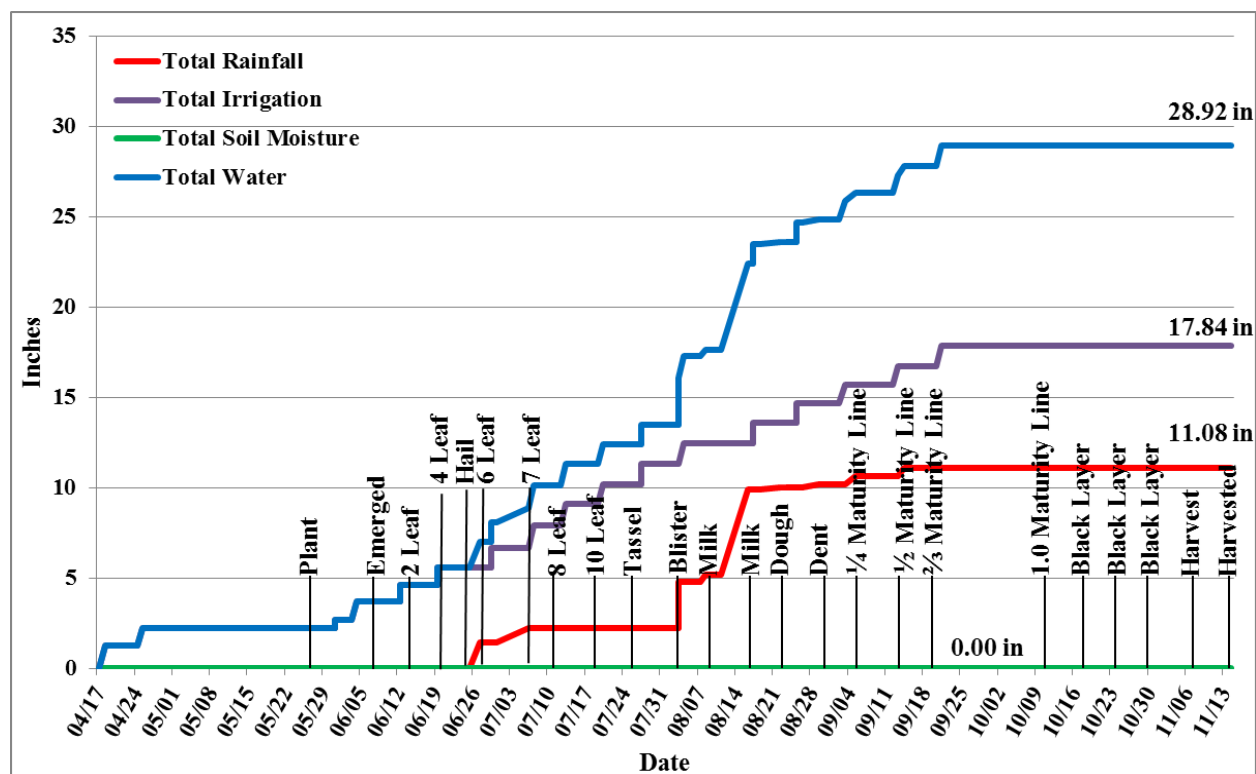


Table 16: 2017 Field Data, “4 GPM” LEPA Shroud Corn, 240 bu/ac, Grall

Date	Time	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well (GPM)	Tracking Source
							1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
03/30		1.44													Pivotrac
04/01		2.23													Pivotrac
04/05		0.48													Pivotrac
04/13	03:30 PM			256.844	30477.2		90.1	97.7	97.3	95.0	92.8	184		off	C & L
04/17	11:15 AM			256.844								184	start		Pivotrac
04/17	08:05 PM			257.542								210	into 4	320	Pivotrac
04/18	01:40 PM		1.23	258.587								240	into 5	320	Pivotrac
04/19	07:15 AM			259.629								270	into 3	320	Pivotrac
04/21		0.90													Pivotrac
04/24	03:30 PM			267.230								210	into 4	320	Pivotrac
04/25	06:05 AM		1.02	268.095								240	into 5	320	Pivotrac
04/25	07:35 PM			268.895								270	into 3	320	Pivotrac
04/26	07:50 AM			270.137								296	stop	320	Pivotrac
04/26		0.44										296	move dry		Pivotrac
04/30		1.39													Pivotrac
05/03		0.34													Pivotrac
05/10		0.47													Pivotrac
05/16		0.19													Pivotrac
05/18	03:05 PM											350	move dry		Pivotrac
05/22		0.73													Pivotrac
05/27						plant						356	move dry		Harold
05/29	12:30 PM											355	start		Pivotrac
05/31	09:05 AM			272.780								210	into 4	320	Pivotrac
05/31	03:30 PM		0.45	273.160								240	into 5	320	Pivotrac
05/31	09:45 PM			273.531								270	into 3	320	Pivotrac
06/02	10:00 AM											80	stop		Pivotrac
06/02	03:45 PM											80	start		Pivotrac
06/03	06:35 PM			277.981								210	into 4	320	Pivotrac
06/04	08:30 AM		0.98	278.806								240	into 5	320	Pivotrac
06/04	10:25 PM			279.631								270	into 3	320	Pivotrac
06/06	11:10 AM			279.375	30942.2	emerged	98.9	98.9	98.7	98.2	98.1	352	3	320	Curtis
06/06	09:50 PM											14	stop		Pivotrac
06/08	10:40 AM											14	start		Pivotrac
06/12	07:45 AM			287.697								210	into 4	310	Pivotrac
06/12	09:45 PM		0.95	288.501								240	into 5	310	Pivotrac
06/13	11:30 AM			287.234	31074.7	2 leaf	99.0	99.0	98.8	98.2	98.2	269	5	312	Curtis
06/13	11:50 AM			288.506								270	into 3	310	Pivotrac
06/19	07:35 AM			296.529								210	into 4	310	Pivotrac
06/19	09:40 PM		0.95	297.337								240	into 5	310	Pivotrac
06/20	11:40 AM			298.141								270	into 3	310	Pivotrac
06/20	04:40 PM			297.059	31247.8	4 leaf	98.5	98.6	98.3	97.9	97.8	280	3	310	Curtis
06/25	08:35 PM					hail						186	stop		Pivotrac
06/27	11:00 AM	1.41		303.907	31372.4	6 leaf	98.8	98.9	98.7	98.3	98.2	186			Curtis
06/28	07:15 PM											186	start		Pivotrac
06/29	05:10 AM			306.121								210	into 4	310	Pivotrac
06/29	09:15 PM		1.09	307.044								240	into 5	310	Pivotrac
06/30	12:35 PM			307.925								270	into 3	310	Pivotrac
07/06	11:45 AM	0.80		314.331	31559.0	7 leaf	99.4	99.3	99.1	98.6	98.6	196	3	302	Curtis
07/06	01:15 PM			315.962								210	into 4	300	Pivotrac
07/07	07:55 AM		1.23	317.00								240	into 5	300	Pivotrac
07/08	05:15 AM			318.129								270	into 3	300	Pivotrac
07/11	11:40 AM			320.746	31678.8	8 leaf	99.3	99.3	99.0	98.6	98.6	152	3	292	Curtis
07/12	02:05 PM			324.231								210	into 4	300	Pivotrac
07/13	08:20 AM		1.20	325.245								240	into 5	300	Pivotrac
07/14	06:15 AM			326.463								270	into 3	300	Pivotrac
07/18	11:30 AM			329.579	31846.4	10 leaf	95.3	98.6	98.5	98.6	98.6	137	3	276	Curtis
07/19	08:00 PM			333.276								210	into 4	275	Pivotrac

Table 16: 2017 Field Data, “4 GPM” LEPA Shroud Corn, 240 bu/ac, Grall (continued)

Date	Time	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well (GPM)	Tracking Source
							1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
07/20	02:20 PM		1.10	334.209								240	into 5	275	Pivotrac
07/21	01:40 PM			335.398								270	into 3	275	Pivotrac
07/25	10:20 AM			338.206	32012.6	tassle	26.1	58.6	97.1	97.8	97.8	124	3	281	Paul
07/27	01:30 AM			342.112								210	into 4	275	Pivotrac
07/27	07:35 PM		1.09	343.033								240	into 5	275	Pivotrac
07/28	04:35 PM			344.103								270	into 3	275	Pivotrac
08/03	08:40 AM			351.035								210	into 4	275	Pivotrac
08/03	12:35 PM	2.58		349.356	32230.9	blister	98.3	85.8	96.6	97.9	97.9	216	4	276	Curtis
08/04	04:15 AM		1.18	352.032								240	into 5	275	Pivotrac
08/05	01:40 AM			353.114								270	into 3	275	Pivotrac
08/07	04:25 AM											15	stop		Pivotrac
08/07	10:55 AM											15	start		Pivotrac
08/08	03:55 PM	0.36		355.294	32347.9	milk	98.7	96.4	97.0	98.0	97.9	80	3	264	Curtis
08/11	04:10 AM			359.597								210	into 4	250	Pivotrac
08/11	01:25 PM											224	stop		Pivotrac
08/16	04:45 PM	4.77		358.764	32417.2	milk	98.6	98.5	98.4	98.3	98.1	224	off		Curtis
08/17	12:20 PM											224	start		Pivotrac
08/17	11:05 PM		1.10	360.523								240	into 5	250	Pivotrac
08/18	08:50 PM			361.530								270	into 3	250	Pivotrac
08/22	04:35 PM	0.11		365.215	32541.4	dough	98.3	98.3	98.2	98.1	97.8	110	3	265	Curtis
08/23	05:00 AM											134	stop		Pivotrac
08/23	10:55 AM											134	start		Pivotrac
08/25	12:10 AM			368.633								210	into 4	250	Pivotrac
08/25	06:00 PM		1.09	369.552								240	into 5	250	Pivotrac
08/26	04:55 PM			370.613								270	into 3	250	Pivotrac
08/29	12:40 PM	0.12		373.201	32699.4	dent	98.5	98.5	98.3	98.2	98.0	58	3	268	Curtis
09/01	10:25 AM			376.980								210	into 4	250	Pivotrac
09/02	05:25 AM			377.860								240	into 5	250	Pivotrac
09/03	03:05 AM		1.04	378.863								270	into 3	250	Pivotrac
09/05	03:40 PM	0.46		381.657	32870.5	¼ mat line	98.6	98.6	98.1	98.3	98.1	42	3	266	Curtis
09/08	10:00 AM											185	3		Pivotrac
09/11	04:10 PM											185	start		Pivotrac
09/12	05:05 AM			385.597								210	into 4	260	Pivotrac
09/12	10:25 PM			386.431								240	into 5	260	Pivotrac
09/13	08:50 PM		0.99	387.511								270	into 3	260	Pivotrac
09/14	03:20 PM	0.47		388.524	33007.8	½ mat line	99.0	98.9	97.8	98.4	98.4	311	3	272	Curtis
09/19	09:55 AM			394.122	33122.4	¾ mat line	98.0	97.7	96.6	97.4	97.3	197	3	256	Curtis
09/19	04:00 PM			394.470								210	into 4	270	Pivotrac
09/20	11:30 AM			395.445								240	into 5	270	Pivotrac
09/21	08:30 AM		1.15	396.496								270	into 3	270	Pivotrac
09/22	08:30 PM			398.296								347	stop	270	Pivotrac
10/11	03:25 AM	5.72		398.178	33204.8	1.0 mat line	98.1	98.3	98.1	98.0	97.8	347	off		Curtis
10/17	03:45 AM			398.178	33204.8	black layer	98.7	98.9	98.6	98.5	98.4	347	off		Curtis
10/24	03:50 PM			398.178	33204.8	black layer	98.3	98.4	97.9	98.0	98.0	347	off		Curtis
10/30	03:50 PM			398.178	33204.8	black layer	97.5	97.6	97.3	97.4	97.3	347	off		Curtis
11/07	01:05 PM			398.178	33206.6	black layer	97.6	97.8	97.4	97.3	97.4	347	off		Curtis
11/07						harvest						move dry			Harold
11/14	01:00 PM			398.178	33206.6	harvested	97.9	98.0	97.9	97.6	97.7	10	off		Curtis
Total		11.08	17.84				0.0	0.0	0.0	0.0	0.0	= 0.0	Soil Moisture	283 GPM	Leon
Net soil moisture is 0.00 inches.															
Rainfall (11.08 in), irrigation (17.84 in), and net soil moisture (0.00 in) is total water (28.92 in).															
*Numbers in red are not counted in the total rainfall.															

Figure 20: 2017 Gypsum Block Readings, “5 GPM” LEPA Shroud Corn, 237 bu/ac, Grall

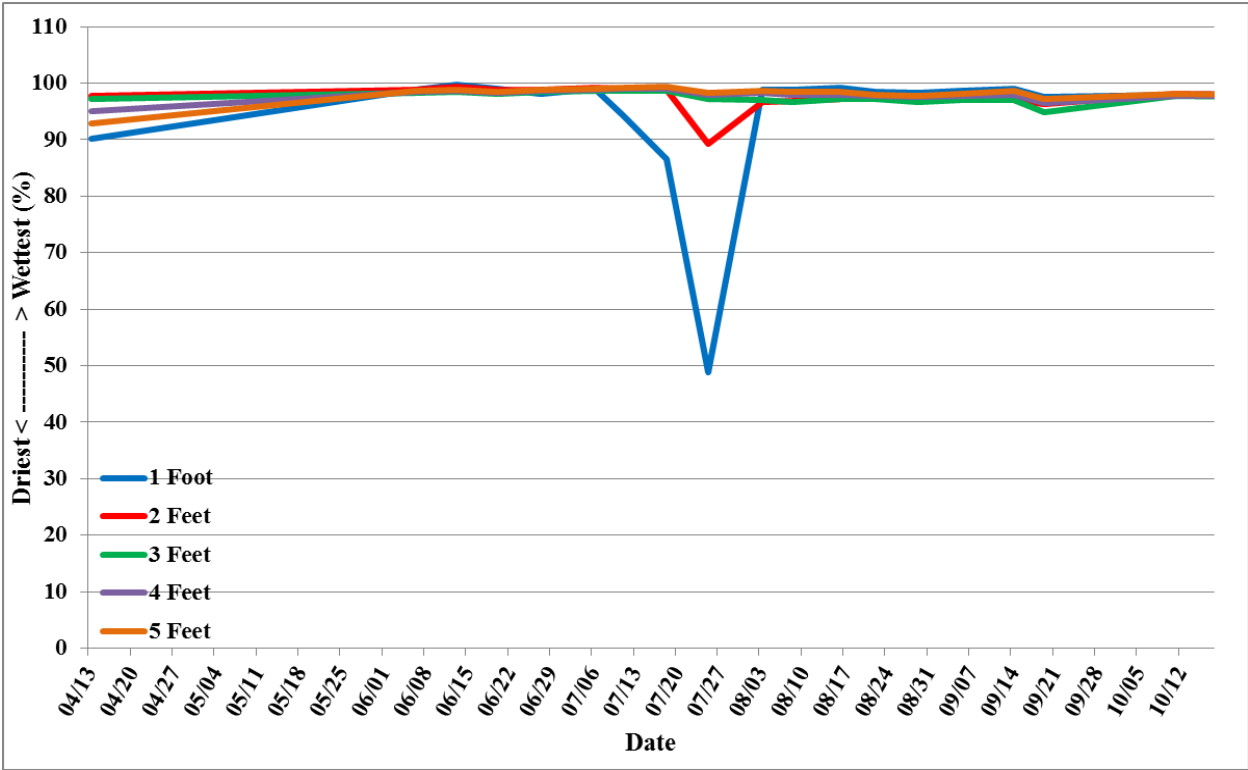


Figure 21: 2017 Growing Season Water Tracking, “5 GPM” LEPA Shroud Corn, 237 bu/ac, Grall

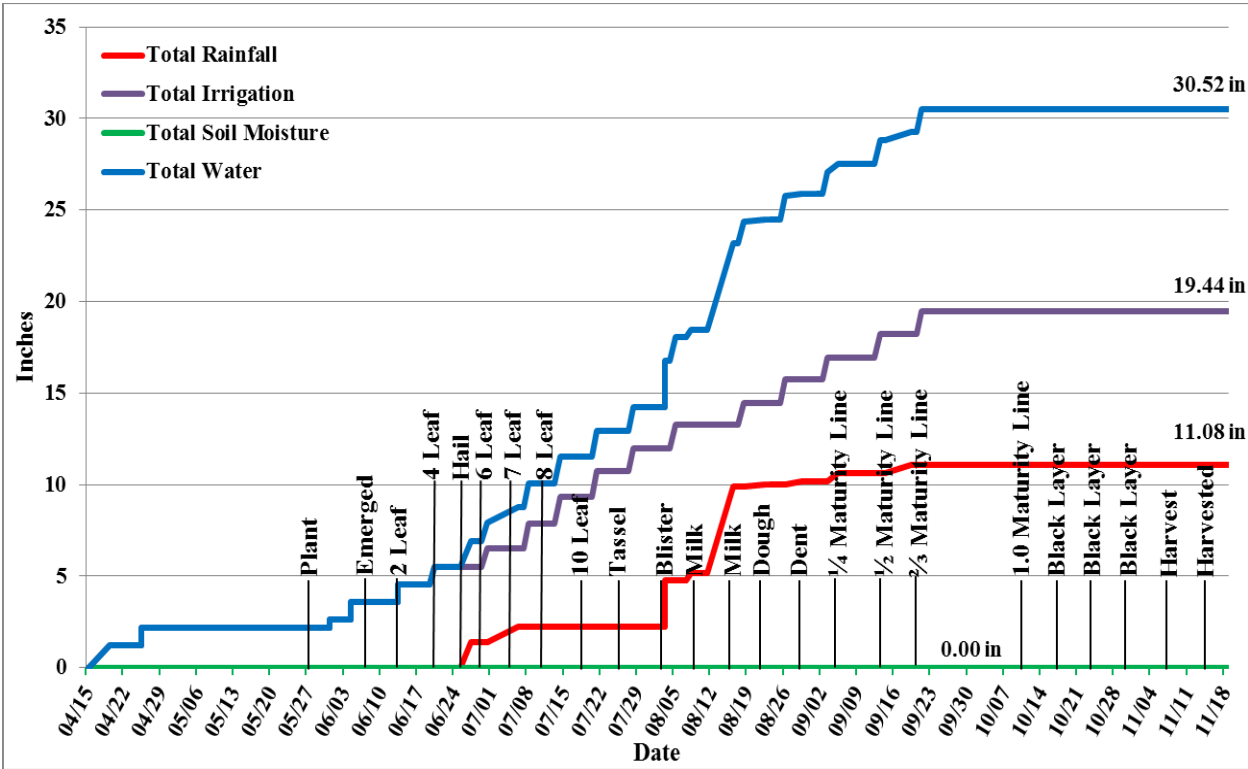


Table 17: 2017 Field Data, “5 GPM” LEPA Shroud Corn, 237 bu/ac, Grall

Date	Time	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well (GPM)	Tracking Source
							1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
03/30		1.44													Pivotrac
04/01		2.23													Pivotrac
04/05		0.48													Pivotrac
04/13	03:30 PM			256.844	30477.2		90.1	97.7	97.3	95.0	92.8	184		off	C & L
04/17	11:15 AM			256.844								184	start		Pivotrac
04/17	08:05 PM			257.542								210	into 4	320	Pivotrac
04/18	01:40 PM			258.587								240	into 5	320	Pivotrac
04/19	07:15 AM		1.23	259.629								270	into 3	320	Pivotrac
04/21		0.90													Pivotrac
04/24	03:30 PM			267.230								210	into 4	320	Pivotrac
04/25	06:05 AM			268.095								240	into 5	320	Pivotrac
04/25	07:35 PM		0.95	268.895								270	into 3	320	Pivotrac
04/26	07:50 AM			270.137								296	stop	320	Pivotrac
04/26		0.44										296	move dry		Pivotrac
04/30		1.39													Pivotrac
05/03		0.34													Pivotrac
05/10		0.47													Pivotrac
05/16		0.19													Pivotrac
05/18	03:05 PM											350	move dry		Pivotrac
05/22		0.73													Pivotrac
05/27						plant						356	move dry		Harold
05/29	12:30 PM											355	start		Pivotrac
05/31	09:05 AM			272.780								210	into 4	320	Pivotrac
05/31	03:30 PM			273.160								240	into 5	320	Pivotrac
05/31	09:45 PM		0.44	273.531								270	into 3	320	Pivotrac
06/02	10:00 AM											80	stop		Pivotrac
06/02	03:45 PM											80	start		Pivotrac
06/03	06:35 PM			277.981								210	into 4	320	Pivotrac
06/04	08:30 AM			278.806								240	into 5	320	Pivotrac
06/04	10:25 PM		0.98	279.631								270	into 3	320	Pivotrac
06/06	11:10 AM			279.375	30942.2	emerged	98.9	98.8	98.3	98.4	98.7	352	3	320	Curtis
06/06	09:50 PM											14	stop		Pivotrac
06/08	10:40 AM											14	start		Pivotrac
06/12	07:45 AM			287.697								210	into 4	310	Pivotrac
06/12	09:45 PM			288.501								240	into 5	310	Pivotrac
06/13	11:30 AM			287.234	31074.7	2 leaf	99.7	99.3	98.5	98.7	98.9	269	5	312	Curtis
06/13	11:50 AM		0.95	288.506								270	into 3	310	Pivotrac
06/19	07:35 AM			296.529								210	into 4	310	Pivotrac
06/19	09:40 PM			297.337								240	into 5	310	Pivotrac
06/20	11:40 AM		0.95	298.141								270	into 3	310	Pivotrac
06/20	04:40 PM			297.059	31247.8	4 leaf	99.0	98.8	98.2	98.3	98.5	280	3	310	Curtis
06/25	08:35 PM					hail						186	stop		Pivotrac
06/27	11:00 AM	1.41		303.907	31372.4	6 leaf	98.1	98.9	98.4	98.6	98.8	186	start		Curtis
06/28	07:15 PM											186	start		Pivotrac
06/29	05:10 AM			306.121								210	into 4	310	Pivotrac
06/29	09:15 PM			307.044								240	into 5	310	Pivotrac
06/30	12:35 PM		1.04	307.925								270	into 3	310	Pivotrac
07/06	11:45 AM	0.80		314.331	31559.0	7 leaf	99.0	99.2	98.7	98.9	99.1	196	3	302	Curtis
07/06	01:15 PM			315.962								210	into 4	300	Pivotrac
07/07	07:55 AM			317.00								240	into 5	300	Pivotrac
07/08	05:15 AM		1.34	318.129								270	into 3	300	Pivotrac
07/11	11:40 AM			320.746	31678.8	8 leaf	94.2	99.1	98.7	99.0	99.2	152	3	292	Curtis

Table 17: 2017 Field Data, “5 GPM” LEPA Shroud Corn, 237 bu/ac (continued), Grall

Date	Time	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well (GPM)	Tracking Source
							1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
07/12	02:05 PM			324.231								210	into 4	300	Pivotrac
07/13	08:20 AM			325.245								240	into 5	300	Pivotrac
07/14	06:15 AM		1.44	326.463								270	into 3	300	Pivotrac
07/18	11:30 AM			329.579	31846.4	10 leaf	86.6	98.8	98.7	99.0	99.3	137	3	276	Curtis
07/19	08:00 PM			333.276								210	into 4	275	Pivotrac
07/20	02:20 PM			334.209								240	into 5	275	Pivotrac
07/21	01:40 PM		1.41	335.398								270	into 3	275	Pivotrac
07/25	10:20 AM			338.206	32012.6	tassle	48.8	89.3	97.3	98.0	98.3	124	3	281	Paul
07/27	01:30 AM			342.112								210	into 4	275	Pivotrac
07/27	07:35 PM			343.033								240	into 5	275	Pivotrac
07/28	04:35 PM		1.27	344.103								270	into 3	275	Pivotrac
08/03	08:40 AM			351.035								210	into 4	275	Pivotrac
08/03	12:35 PM	2.58		349.356	32230.9	blister	98.9	96.7	97.1	98.3	98.7	216	4	276	Curtis
08/04	04:15 AM			352.032								240	into 5	275	Pivotrac
08/05	01:40 AM		1.28	353.114								270	into 3	275	Pivotrac
08/07	04:25 AM											15	stop		Pivotrac
08/07	10:55 AM											15	start		Pivotrac
08/08	03:55 PM	0.36		355.294	32347.9	milk	98.9	96.9	96.6	97.9	98.5	80	3	264	Curtis
08/11	04:10 AM			359.597								210	into 4	250	Pivotrac
08/11	01:25 PM											224	stop		Pivotrac
08/16	04:45 PM	4.77		358.764	32417.2	milk	99.2	97.2	97.3	98.0	98.4	224	off		Curtis
08/17	12:20 PM											224	start		Pivotrac
08/17	11:05 PM			360.523								240	into 5	250	Pivotrac
08/18	08:50 PM		1.19	361.530								270	into 3	250	Pivotrac
08/22	04:35 PM	0.11		365.215	32541.4	dough	98.5	97.4	97.2	97.7	98.0	110	3	265	Curtis
08/23	05:00 AM											134	stop		Pivotrac
08/23	10:55 AM											134	start		Pivotrac
08/25	12:10 AM			368.633								210	into 4	250	Pivotrac
08/25	06:00 PM			369.552								240	into 5	250	Pivotrac
08/26	04:55 PM		1.26	370.613								270	into 3	250	Pivotrac
08/29	12:40 PM	0.12		373.201	32699.4	dent	98.3	97.3	96.7	97.5	97.8	58	3	268	Curtis
09/01	10:25 AM			376.980								210	into 4	250	Pivotrac
09/02	05:25 AM			377.860								240	into 5	250	Pivotrac
09/03	03:05 AM		1.19	378.863								270	into 3	250	Pivotrac
09/05	03:40 PM	0.46		381.657	32870.5	¼ mat line	98.7	97.0	97.0	97.8	98.2	42	3	266	Curtis
09/08	10:00 AM											185	3		Pivotrac
09/11	04:10 PM											185	start		Pivotrac
09/12	05:05 AM			385.597								210	into 4	260	Pivotrac
09/12	10:25 PM			386.431								240	into 5	260	Pivotrac
09/13	08:50 PM		1.28	387.511								270	into 3	260	Pivotrac
09/14	03:20 PM			388.524	33007.8	½ mat line	99.0	97.0	97.0	98.0	98.6	311	3	272	Curtis
09/19	09:55 AM	0.47		394.122	33122.4	¾ mat line	97.6	96.3	94.9	96.5	97.2	197	3	256	Curtis
09/19	04:00 PM			394.470								210	into 4	270	Pivotrac
09/20	11:30 AM			395.445								240	into 5	270	Pivotrac
09/21	08:30 AM		1.24	396.496								270	into 3	270	Pivotrac
09/22	08:30 PM			398.296								347	stop	270	Pivotrac
10/11	03:25 PM	5.72		398.178	33204.8	1.0 mat line	98.0	98.1	97.7	97.8	98.1	347	off		Curtis
10/17	03:45 PM			398.178	33204.8	black layer	98.7	98.1	98.2	98.3	98.4	347	off		Curtis
10/24	03:50 PM			398.178	33204.8	black layer	98.1	98.0	97.5	97.7	98.0	347	off		Curtis
10/30	03:50 PM			398.178	33204.8	black layer	97.5	97.6	96.9	97.1	97.5	347	off		Curtis
11/07	01:05 PM			398.178	33206.6	black layer	97.3	97.3	96.6	96.9	97.3	347	off		Curtis
11/07						harvest						move dry			Harold
11/14	01:00 PM			398.178	33206.6	harvested	97.7	97.0	97.1	97.4	97.8	10	off		Curtis
Total		11.08	19.44				0.0	0.0	0.0	0.0	0.0	= 0.0	Soil Moisture		Leon

Net soil moisture is 0.00 inches.

Rainfall (11.08 in), irrigation (19.44 in), and net soil moisture (0.00 in) is total water (30.52 in).

*Numbers in red are not counted in the total rainfall.

Figure 22: 2017 Gypsum Block Readings, “3 GPM” PMDI Corn, 221 bu/ac, Grall

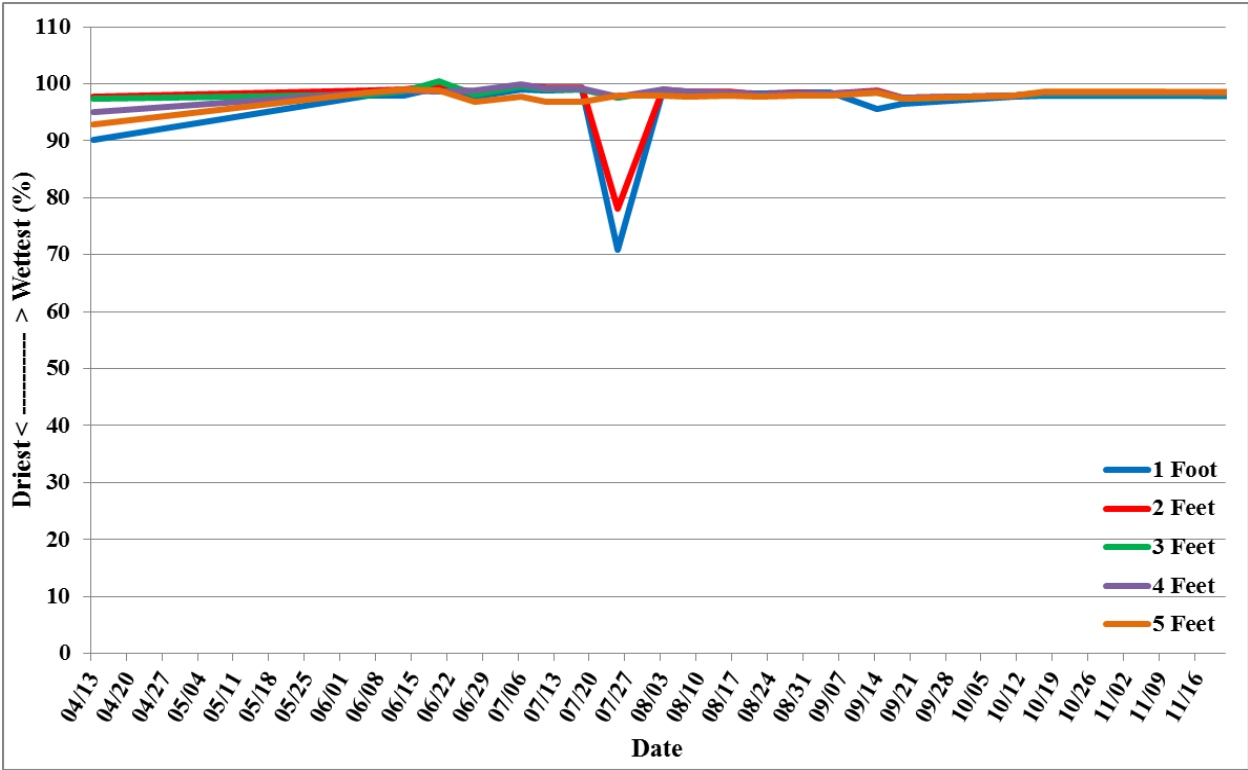


Figure 23: 2017 Growing Season Water Tracking, “3 GPM” PMDI Corn, 221 bu/ac, Grall

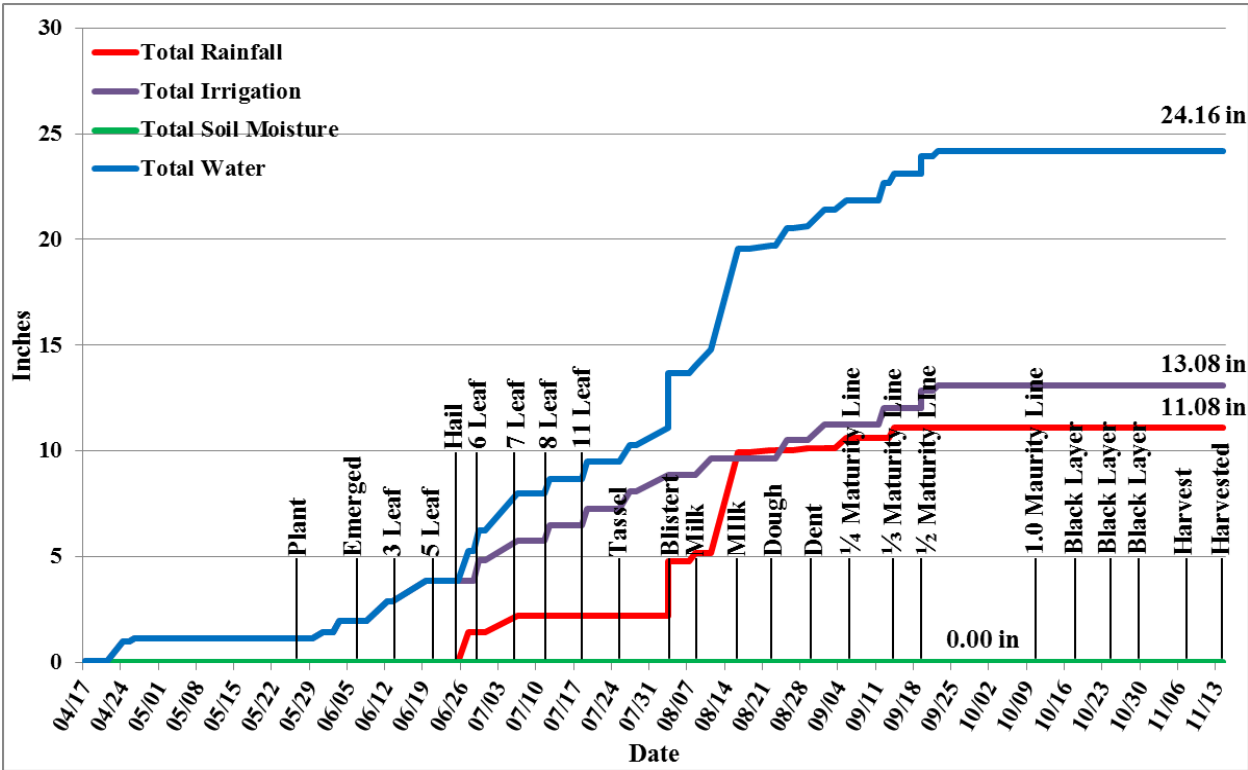


Table 18: 2017 Field Data, “3 GPM” PMDI Corn, 221 bu/ac, Grall

Date	Time	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well (GPM)	Tracking Source
							1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
03/30		1.44													Pivotrac
04/01		2.23													Pivotrac
04/05		0.48													Pivotrac
04/13	03:30 PM			256.844	30477.2		90.1	97.7	97.3	95.0	92.8	184		off	C & L
04/17	11:15 AM			256.844								184	start		Pivotrac
04/17	08:05 PM		0.08	257.542								210	into 4	320	Pivotrac
04/18	01:40 PM			258.587								240	into 5	320	Pivotrac
04/19	07:15 AM			259.629								270	into 3	320	Pivotrac
04/21		0.90													Pivotrac
04/24	03:30 PM		0.90	267.230								210	into 4	320	Pivotrac
04/25	06:05 AM			268.095								240	into 5	320	Pivotrac
04/25	07:35 PM			268.895								270	into 3	320	Pivotrac
04/26	07:50 AM		0.15	270.137								296	stop	320	Pivotrac
04/26		0.44										296	move dry		Pivotrac
04/30		1.39													Pivotrac
05/03		0.34													Pivotrac
05/10		0.47													Pivotrac
05/16		0.19													Pivotrac
05/18	03:05 PM											350	move dry		Pivotrac
05/22		0.73													Pivotrac
05/27						plant						356	move dry		Harold
05/29	12:30 PM											355	start		Pivotrac
05/31	09:05 AM		0.31	272.780								210	into 4	320	Pivotrac
05/31	03:30 PM			273.160								240	into 5	320	Pivotrac
05/31	09:45 PM			273.531								270	into 3	320	Pivotrac
06/02	10:00 AM											80	stop		Pivotrac
06/02	03:45 PM											80	start		Pivotrac
06/03	06:35 PM		0.52	277.981								210	into 4	320	Pivotrac
06/04	08:30 AM			278.806								240	into 5	320	Pivotrac
06/04	10:25 PM			279.631								270	into 3	320	Pivotrac
06/06	11:10 AM			279.375	30942.2	emerged	98.0	98.9	98.2	98.5	98.4	352	3	320	Curtis
06/06	09:50 PM											14	stop		Pivotrac
06/08	10:40 AM											14	start		Pivotrac
06/12	07:45 AM		0.95	287.697								210	into 4	310	Pivotrac
06/12	09:45 PM			288.501								240	into 5	310	Pivotrac
06/13	11:30 AM			287.234	31074.7	3 leaf	97.9	99.0	98.7	98.9	99.1	269	5	312	Curtis
06/13	11:50 AM			288.506								270	into 3	310	Pivotrac
06/19	07:35 AM		0.95	296.529								210	into 4	310	Pivotrac
06/19	09:40 PM			297.337								240	into 5	310	Pivotrac
06/20	11:40 AM			298.141								270	into 3	310	Pivotrac
06/20	04:40 PM			297.059	31247.8	5 leaf	99.4	99.8	100.5	98.6	98.8	280	3	310	Curtis
06/25	08:35 PM					hail						186	stop		Pivotrac
06/27	11:00 AM	1.41		303.907	31372.4	6 leaf	97.8	98.5	98.2	98.8	96.8	186	start		Curtis
06/28	07:15 PM											186	start		Pivotrac
06/29	05:10 AM		0.95	306.121								210	into 4	310	Pivotrac
06/29	09:15 PM			307.044								240	into 5	310	Pivotrac
06/30	12:35 PM			307.925								270	into 3	310	Pivotrac
07/06	11:45 AM	0.80	0.95	314.331	31559.0	7 leaf	99.0	99.8	99.5	100.0	97.7	196	3	302	Curtis
07/06	01:15 PM			315.962								210	into 4	300	Pivotrac
07/07	07:55 AM			317.00								240	into 5	300	Pivotrac
07/08	05:15 AM			318.129								270	into 3	300	Pivotrac
07/11	11:40 AM			320.746	31678.8	8 leaf	98.9	99.3	99.0	99.2	96.9	152	3	292	Curtis

Table 18: 2017 Field Data, “3 GPM” PMDI Corn, 221 bu/ac, Grall (continued)

Date	Time	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well (GPM)	Tracking Source
							1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
07/12	02:05 PM		0.72	324.231								210	into 4	300	Pivotrac
07/13	08:20 AM			325.245								240	into 5	300	Pivotrac
07/14	06:15 AM			326.463								270	into 3	300	Pivotrac
07/18	11:30 AM			329.579	31846.4	11 leaf	99.1	99.3	99.0	99.2	96.8	137	3	276	Curtis
07/19	08:00 PM		0.80	333.276								210	into 4	275	Pivotrac
07/20	02:20 PM			334.209								240	into 5	275	Pivotrac
07/21	01:40 PM			335.398								270	into 3	275	Pivotrac
07/25	10:20 AM			338.206	32012.6	tassel	70.9	78.1	97.6	97.8	98.0	124	3	281	Paul
07/27	01:30 AM		0.79	342.112								210	into 4	275	Pivotrac
07/27	07:35 PM			343.033								240	into 5	275	Pivotrac
07/28	04:35 PM			344.103								270	into 3	275	Pivotrac
08/03	08:40 AM		0.82	351.035								210	into 4	275	Pivotrac
08/03	12:35 PM	2.58		349.356	32230.9	blister	98.8	99.1	98.8	99.1	97.9	216	4	276	Curtis
08/04	04:15 AM			352.032								240	into 5	275	Pivotrac
08/05	01:40 AM			353.114								270	into 3	275	Pivotrac
08/07	04:25 AM											15	stop		Pivotrac
08/07	10:55 AM											15	start		Pivotrac
08/08	03:55 PM	0.36		355.294	32347.9	milk	98.5	98.7	98.3	98.6	97.8	80	3	264	Curtis
08/11	04:10 AM		0.77	359.597								210	into 4	250	Pivotrac
08/11	01:25 PM											224	stop		Pivotrac
08/16	04:45 PM	4.77		358.764	32417.2	milk	98.5	98.6	98.3	98.5	98.0	224	off		Curtis
08/17	12:20 PM											224	start		Pivotrac
08/17	11:05 PM			360.523								240	into 5	250	Pivotrac
08/18	08:50 PM			361.530								270	into 3	250	Pivotrac
08/22	04:35 PM	0.11		365.215	32541.4	dough	98.3	98.2	98.0	98.2	97.7	110	3	265	Curtis
08/23	05:00 AM											134	stop		Pivotrac
08/23	10:55 AM											134	start		Pivotrac
08/25	12:10 AM		0.84	368.633								210	into 4	250	Pivotrac
08/25	06:00 PM			369.552								240	into 5	250	Pivotrac
08/26	04:55 PM			370.613								270	into 3	250	Pivotrac
08/29	12:40 PM	0.12		373.201	32699.4	dent	98.5	98.4	98.1	98.3	98.0	58	3	268	Curtis
09/01	10:25 AM		0.75	376.980								210		250	Pivotrac
09/02	05:25 AM			377.860								240		250	Pivotrac
09/03	03:05 AM			378.863								270		250	Pivotrac
09/05	03:40 PM	0.46		381.657	32870.5	¼ mat line	98.4	98.3	98.1	98.3	98.0			250	Pivotrac
09/08	10:00 AM				32870.5							42		266	Curtis
09/11	04:10 PM											185			Pivotrac
09/12	05:05 AM		0.80	385.597								210		260	Pivotrac
09/12	10:25 PM			386.431								240		260	Pivotrac
09/13	08:50 PM			387.511								270		260	Pivotrac
09/14	03:20 PM	0.47		388.524	33007.8	½ mat line	95.6	98.8	98.4	98.7	98.5	311		272	Curtis
09/19	09:55 AM			394.122	33122.4	½ mat line	96.4	97.6	97.3	97.5	97.4	197		256	Curtis
09/19	04:00 PM		0.82	394.470								210		270	Pivotrac
09/20	11:30 AM			395.445								240		270	Pivotrac
09/21	08:30 AM			396.496								270		270	Pivotrac
09/22	08:30 PM		0.21	398.296								347	stop	270	Pivotrac
10/11	03:25PM			398.178	33204.8	1.0 mat line	97.7	98.0	97.9	98.0	98.0	347	stop		Curtis
10/17	03:45 PM			398.178	33204.8	black layer	98.0	98.5	98.3	98.5	98.7	347	off		Curtis
10/24	3:50PM			398.178	33204.8	black layer	97.4	97.9	97.8	98.0	98.2	347		off	Curtis
10/30	3:50PM			398.178	33204.8	black layer	96.9	97.4	97.1	97.4	97.7	347		off	Curtis
11/07	1:05PM			398.178	33204.8	black layer	96.6	97.1	96.8	97.1	97.4	347		off	Curtis
11/07						harvest						move dry			Harold
11/14	1:00PM			398.178	33204.8	harvested	97.2	97.8	97.4	97.7	98.2	10		off	Curtis
Total		11.08	13.08				0.0	0.0	0.0	0.0	0.0	= 0.0	Soil Moisture		Leon

Net soil moisture is 0.00 inches.

Rainfall (11.08 in), irrigation (13.08 in), and net soil moisture (0.00 in) is total water (24.16 in).

*Numbers in red are not counted in the total rainfall.

Figure 24: 2017 Gypsum Block Readings, “4 GPM” PMDI Corn, 228 bu/ac, Grall

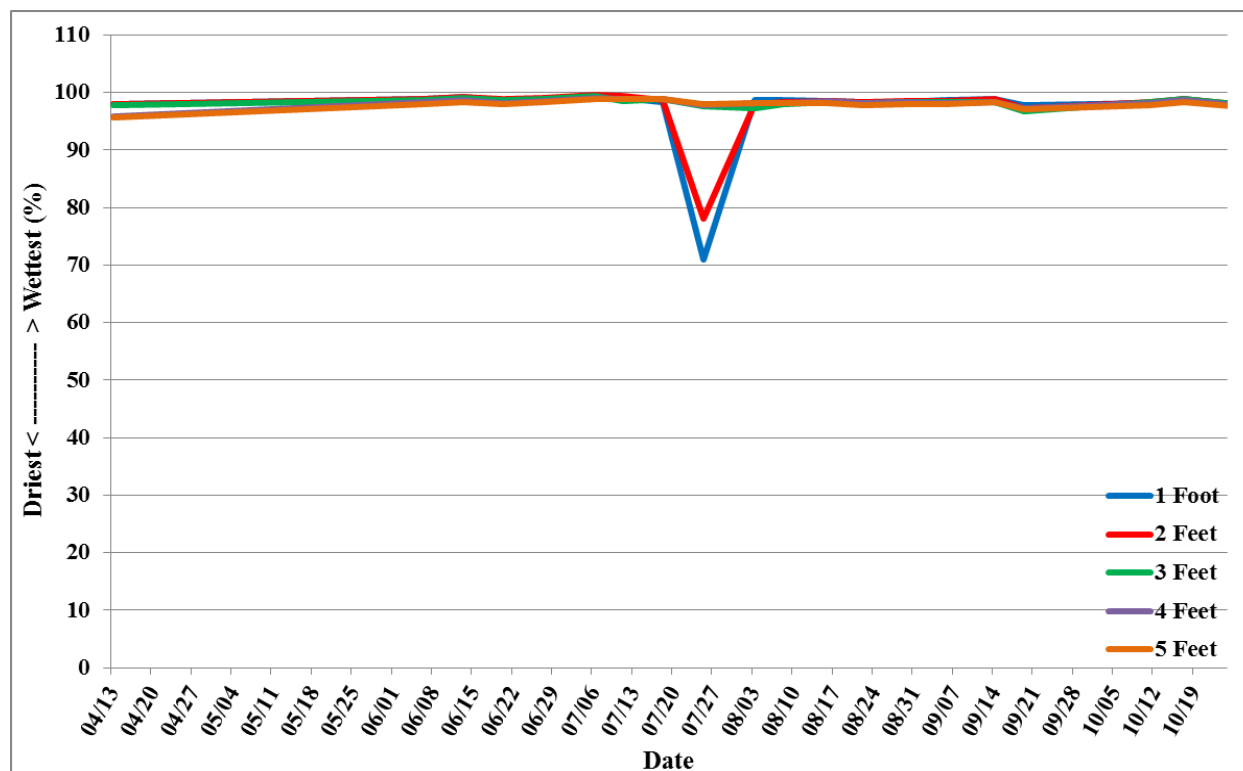


Figure 25: 2017 Growing Season Water Tracking, “4 GPM” PMDI Corn, 228 bu/ac, Grall

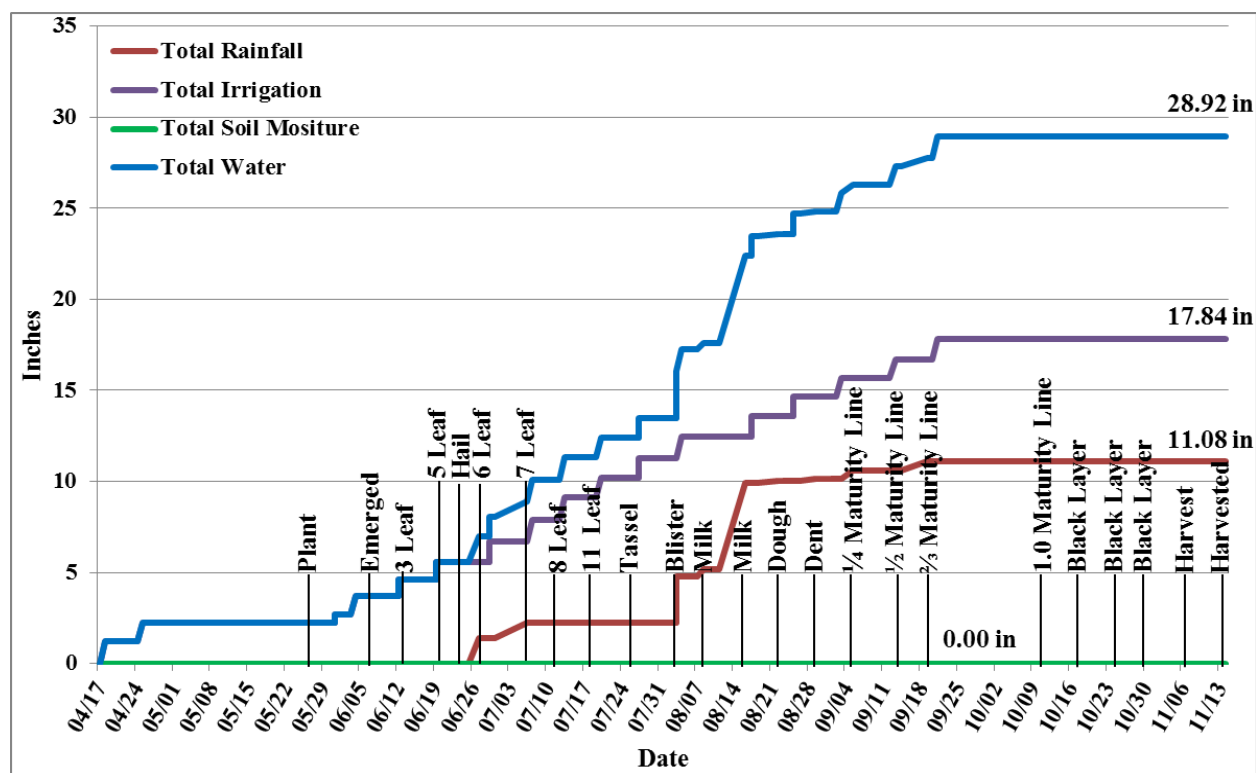


Table 19: 2017 Field Data, “4 GPM” PMDI Corn, 228 bu./ac, Grall

Date	Time	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate
							1 Foot	2 Feet	3 Feet	4 Feet	5 Feet		
03/30		1.44											
04/01		2.23											
04/05		0.48											
04/13	03:30 PM			256.844	30477.2		97.9	97.9	97.7	95.8	95.7	184	
04/17	11:15 AM			256.844								184	start
04/17	08:05 PM			257.542								210	into 4
04/18	01:40 PM		1.23	258.587								240	into 5
04/19	07:15 AM			259.629								270	into 3
04/21		0.90											
04/24	03:30 PM			267.230								210	into 4
04/25	06:05 AM		1.02	268.095								240	into 5
04/25	07:35 PM			268.895								270	into 3
04/26	07:50 AM			270.137								296	stop
04/26		0.44										296	move dry
04/30		1.39											
05/03		0.34											
05/10		0.47											
05/16		0.19											
05/18	03:05 PM											350	move dry
05/22		0.73											
05/27						plant						356	move dry
05/29	12:30 PM											355	start
05/31	09:05 AM			272.780								210	into 4
05/31	03:30 PM		0.45	273.160								240	into 5
05/31	09:45 PM			273.531								270	into 3
06/02	10:00 AM											80	stop
06/02	03:45 PM											80	start
06/03	06:35 PM			277.981								210	into 4
06/04	08:30 AM		0.98	278.806								240	into 5
06/04	10:25 PM			279.631								270	into 3
06/06	11:10 AM			279.375	30942.2	emerged	98.8	98.8	98.7	98.3	97.9	352	3
06/06	09:50 PM											14	stop
06/08	10:40 AM											14	start
06/12	07:45 AM			287.697								210	into 4
06/12	09:45 PM		0.95	288.501								240	into 5
06/13	11:30 AM			287.234	31074.7	3 leaf	99.2	99.2	99.1	98.7	98.3	269	5
06/13	11:50 AM			288.506								270	into 3
06/19	07:35 AM			296.529								210	into 4
06/19	09:40 PM		0.95	297.337								240	into 5
06/20	11:40 AM			298.141								270	into 3
06/20	04:40 PM			297.059	31247.8	5 leaf	98.7	98.8	98.7	98.2	97.9	280	3
06/25	08:35 PM					hail						186	stop
06/27	11:00 AM	1.41		303.907	31372.4	6 leaf	98.9	99.0	98.9	98.5	98.3	186	start
06/28	07:15 PM											186	start
06/29	05:10 AM			306.121								210	into 4
06/29	09:15 PM		1.09	307.044								240	into 5
06/30	12:35 PM			307.925								270	into 3
07/06	11:45 AM	0.80		314.331	31559.0	7 leaf	99.4	99.6	99.4	99.0	98.8	196	3
07/06	01:15 PM			315.962								210	into 4
07/07	07:55 AM		1.23	317.00								240	into 5
07/08	05:15 AM			318.129								270	into 3
07/11	11:40 AM			320.746	31678.8	8 leaf	99.0	99.4	98.5	98.9	98.8	152	3

Table 19: 2017 Field Data, “4 GPM” PMDI Corn, 228 bu./ac. Grall (continued)

Date	Time	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well (GPM)	Tracking Source
							1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
07/12	02:05 PM			324.231								210	into 4	300	Pivotrac
07/13	08:20 AM		1.20	325.245								240	into 5	300	Pivotrac
07/14	06:15 AM			326.463								270	into 3	300	Pivotrac
07/18	11:30 AM			329.579	31846.4	11 leaf	98.3	98.7	98.8	98.9	98.9	137	3	276	Curtis
07/19	08:00 PM			333.276								210	into 4	275	Pivotrac
07/20	02:20 PM		1.10	334.209								240	into 5	275	Pivotrac
07/21	01:40 PM			335.398								270	into 3	275	Pivotrac
07/25	10:20 AM			338.206	32012.6	tassel	70.9	78.1	97.6	97.8	98.0	124	3	281	Paul
07/27	01:30 AM			342.112								210	into 4	275	Pivotrac
07/27	07:35 PM		1.09	343.033								240	into 5	275	Pivotrac
07/28	04:35 PM			344.103								270	into 3	275	Pivotrac
08/03	08:40 AM			351.035								210	into 4	275	Pivotrac
08/03	12:35 PM	2.58		349.356	32230.9	blister	98.6	97.9	97.2	98.1	98.2	216	4	276	Curtis
08/04	04:15 AM		1.18	352.032								240	into 5	275	Pivotrac
08/05	01:40 AM			353.114								270	into 3	275	Pivotrac
08/07	04:25 AM											15	stop		Pivotrac
08/07	10:55 AM											15	start		Pivotrac
08/08	03:55 PM	0.36		355.294	32347.9	milk	98.6	98.4	97.9	98.1	98.1	80	3	264	Curtis
08/11	04:10 AM			359.597								210	into 4	250	Pivotrac
08/11	01:25 PM											224	stop		Pivotrac
08/16	04:45 PM	4.77		358.764	32417.2	milk	98.5	98.5	98.4	98.5	98.1	224	off		Curtis
08/17	12:20 PM											224	start		Pivotrac
08/17	11:05 PM		1.10	360.523								240	into 5	250	Pivotrac
08/18	08:50 PM			361.530								270	into 3	250	Pivotrac
08/22	04:35 PM	0.11		365.215	32541.4	dough	98.3	98.3	98.2	98.2	97.8	110	3	265	Curtis
08/23	05:00 AM											134	stop		Pivotrac
08/23	10:55 AM											134	start		Pivotrac
08/25	12:10 AM			368.633								210	into 4	250	Pivotrac
08/25	06:00 PM		1.09	369.552								240	into 5	250	Pivotrac
08/26	04:55 PM			370.613								270	into 3	250	Pivotrac
08/29	12:40 PM	0.12		373.201	32699.4	dent	98.4	98.5	98.4	98.3	98.0	58	3	268	Curtis
09/01	10:25 AM			376.980								210	into 4	250	Pivotrac
09/02	05:25 AM			377.860								240	into 5	250	Pivotrac
09/03	03:05 AM		1.04	378.863								270	into 3	250	Pivotrac
09/05	03:40 PM	0.46		381.657	32870.5	¼ mat line	98.6	98.5	98.4	98.2	98.0	42	3	266	Curtis
09/08	10:00 AM											185	stop		Pivotrac
09/11	04:10 PM											185	start		Pivotrac
09/12	05:05 AM			385.597								210	into 4	260	Pivotrac
09/12	10:25 PM			386.431								240	into 5	260	Pivotrac
09/13	08:50 PM		0.99	387.511								270	into 3	260	Pivotrac
09/14	03:20 PM			388.524	33007.8	½ mat line	98.9	98.8	98.3	98.4	98.3	311	3	272	Curtis
09/19	09:55 AM	0.47		394.122	33122.4	¾ mat line	97.8	97.2	96.7	97.2	97.1	197	3	256	Curtis
09/19	04:00 PM			394.470								210	into 4	270	Pivotrac
09/20	11:30 AM			395.445								240	into 5	270	Pivotrac
09/21	08:30 AM		1.15	396.496								270	into 3	270	Pivotrac
09/22	08:30 PM			398.296								347	stop	270	Pivotrac
10/11	3:25PM	5.72		398.178	33204.8	1.0 mat line	98.1	98.3	98.4	98.1	97.7	347	off		Curtis
10/17	3:45PM			398.178	33204.8	black layer	98.8	98.9	98.9	98.6	98.3	347	off		Curtis
10/24	03:50 PM			398.178	33204.8	black layer	98.2	98.2	98.2	97.9	97.8	347	off		Curtis
10/30	03:50 PM			398.178	33204.8	black layer	97.5	97.6	97.6	97.4	97.2	347	off		Curtis
11/07	01:05 PM			398.178	33206.6	black layer	97.6	97.5	97.5	97.2	97.0	347	off		Curtis
11/07						harvest						move dry			Harold
11/14	01:00 PM			398.178	33206.6	harvested	98.0	97.9	98.0	97.7	97.5	10	off		Curtis
Total		11.08	17.84				0.0	0.0	0.0	0.0	0.0	= 0.0	Soil Moisture	283 GPM	Leon

Net soil moisture is 0.00 inches.

Rainfall (11.08 in), irrigation (17.84 in), and net soil moisture (0.00 in) is total water (28.92 in).

*Numbers in red are not counted in the total rainfall.

Figure 26: 2017 Gypsum Block Readings, “5 GPM” PMDI Corn, 227 bu/ac, Grall

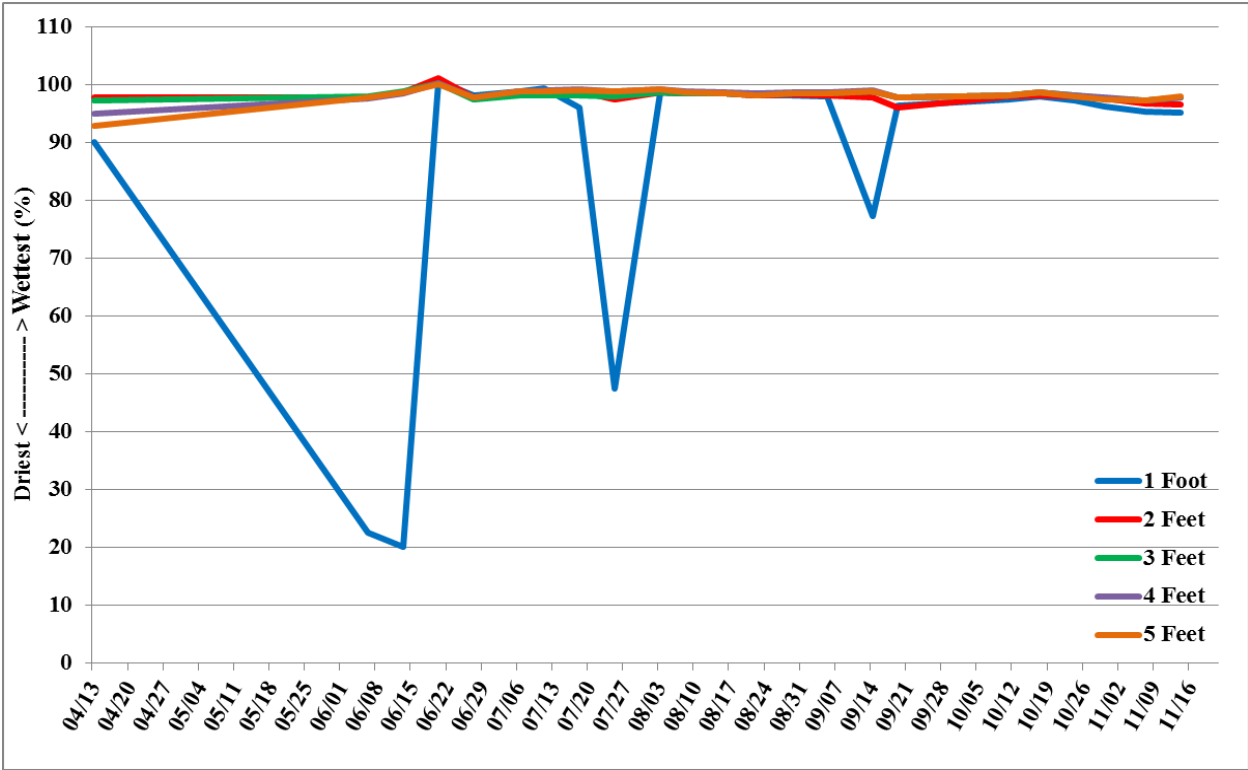


Figure 27: 2017 Growing Season Water Tracking, “5 GPM” PMDI Corn, 227 bu/ac, Grall

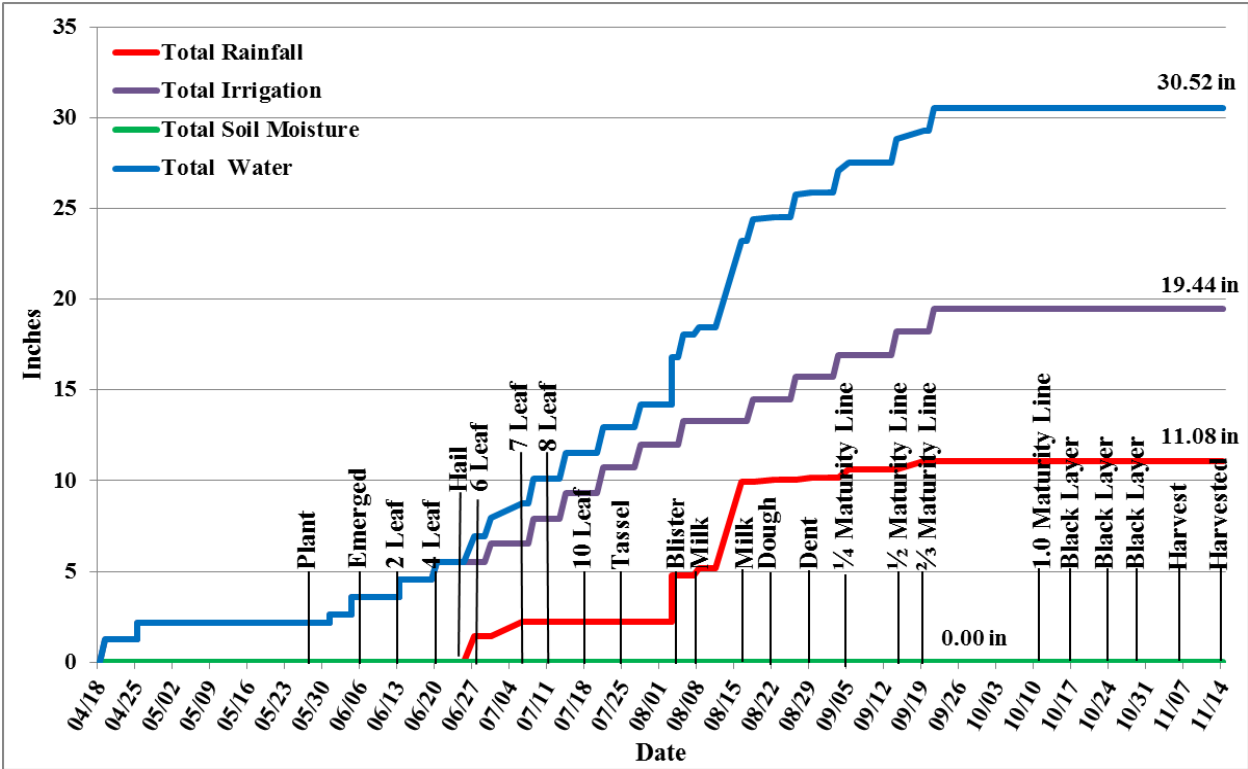


Table 20: 2017 Field Data, “5 GPM” PMDI Corn, 227 bu/ac, Grall

Date	Time	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well (GPM)	Tracking Source
							1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
03/30		1.44													Pivotrac
04/01		2.23													Pivotrac
04/05		0.48													Pivotrac
04/13	03:30 PM			256.844	30477.2		90.1	97.7	97.3	95.0	92.8	184		off	C & L
04/17	11:15 AM			256.844								184	start		Pivotrac
04/17	08:05 PM			257.542								210	into 4	320	Pivotrac
04/18	01:40 PM			258.587								240	into 5	320	Pivotrac
04/19	07:15 AM		1.23	259.629								270	into 3	320	Pivotrac
04/21		0.90													Pivotrac
04/24	03:30 PM			267.230								210	into 4	320	Pivotrac
04/25	06:05 AM			268.095								240	into 5	320	Pivotrac
04/25	07:35 PM		0.95	268.895								270	into 3	320	Pivotrac
04/26	07:50 AM			270.137								296	stop	320	Pivotrac
04/26		0.44										296	move dry		Pivotrac
04/30		1.39													Pivotrac
05/03		0.34													Pivotrac
05/10		0.47													Pivotrac
05/16		0.19													Pivotrac
05/18	03:05 PM											350	move dry		Pivotrac
05/22		0.73													Pivotrac
05/27						plant						356	move dry		Harold
05/29	12:30 PM											355	start		Pivotrac
05/31	09:05 AM			272.780								210	into 4	320	Pivotrac
05/31	03:30 PM			273.160								240	into 5	320	Pivotrac
05/31	09:45 PM		0.44	273.531								270	into 3	320	Pivotrac
06/02	10:00 AM											80	stop		Pivotrac
06/02	03:45 PM											80	start		Pivotrac
06/03	06:35 PM			277.981								210	into 4	320	Pivotrac
06/04	08:30 AM			278.806								240	into 5	320	Pivotrac
06/04	10:25 PM		0.98	279.631								270	into 3	320	Pivotrac
06/06	11:10 AM			279.375	30942.2	emerged	22.5	97.7	98.0	97.6	97.8	352	3	320	Curtis
06/06	09:50 PM											14	stop		Pivotrac
06/08	10:40 AM											14	start		Pivotrac
06/12	07:45 AM			287.697								210	into 4	310	Pivotrac
06/12	09:45 PM			288.501								240	into 5	310	Pivotrac
06/13	11:30 AM			287.234	31074.7	2 leaf	20.1	98.6	98.8	98.5	98.7	269	5	312	Curtis
06/13	11:50 AM		0.95	288.506								270	into 3	310	Pivotrac
06/19	07:35 AM			296.529								210	into 4	310	Pivotrac
06/19	09:40 PM			297.337								240	into 5	310	Pivotrac
06/20	11:40 AM		0.95	298.141								270	into 3	310	Pivotrac
06/20	04:40 PM			297.059	31247.8	4 leaf	100.6	101.1	100.3	100.3	100.1	280	3	310	Curtis
06/25	08:35 PM					hail						186	stop		Pivotrac
06/27	11:00 AM	1.41		303.907	31372.4	6 leaf	98.2	97.8	97.4	97.7	97.7	186	off		Curtis
06/28	07:15 PM											186	start		Pivotrac
06/29	05:10 AM			306.121								210	into 4	310	Pivotrac
06/29	09:15 PM			307.044								240	into 5	310	Pivotrac
06/30	12:35 PM		1.04	307.925								270	into 3	310	Pivotrac
07/06	11:45 AM	0.80		314.331	31559.0	7 leaf	98.9	98.7	98.1	98.8	98.8	196	3	302	Curtis
07/06	01:15 PM			315.962								210	into 4	300	Pivotrac
07/07	07:55 AM			317.00								240	into 5	300	Pivotrac
07/08	05:15 AM		1.34	318.129								270	into 3	300	Pivotrac
07/11	11:40 AM			320.746	31678.8	8 leaf	99.3	98.8	98.1	99.0	98.8	152	3	292	Curtis

Table 20: 2017 Field Data, “5 GPM” PMDI Corn, 227 bu/ac, Grall (continued)

Date	Time	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well (GPM)	Tracking Source
							1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
07/12	02:05 PM			324.231								210	into 4	300	Pivotrac
07/13	08:20 AM			325.245								240	into 5	300	Pivotrac
07/14	06:15 AM		1.44	326.463								270	into 3	300	Pivotrac
07/18	11:30 AM			329.579	31846.4	10 leaf	96.0	98.9	98.2	99.1	99.0	137	3	276	Curtis
07/19	08:00 PM			333.276								210	into 4	275	Pivotrac
07/20	02:20 PM			334.209								240	into 5	275	Pivotrac
07/21	01:40 PM		1.41	335.398								270	into 3	275	Pivotrac
07/25	10:20 AM			338.206	32012.6	tassle	47.4	97.4	98.0	98.8	98.8	124	3	281	Paul
07/27	01:30 AM			342.112								210	into 4	275	Pivotrac
07/27	07:35 PM			343.033								240	into 5	275	Pivotrac
07/28	04:35 PM		1.27	344.103								270	into 3	275	Pivotrac
08/03	08:40 AM			351.035								210	into 4	275	Pivotrac
08/03	12:35 PM	2.58		349.356	32230.9	blister	98.7	98.6	98.7	99.2	99.1	216	4	276	Curtis
08/04	04:15 AM			352.032								240	into 5	275	Pivotrac
08/05	01:40 AM		1.28	353.114								270	into 3	275	Pivotrac
08/07	04:25 AM											15	stop		Pivotrac
08/07	10:55 AM											15	start		Pivotrac
08/08	03:55 PM	0.36		355.294	32347.9	milk	98.5	98.4	98.4	98.8	98.7	80	3	264	Curtis
08/11	04:10 AM			359.597								210	into 4	250	Pivotrac
08/11	01:25 PM											224	stop		Pivotrac
08/16	04:45 PM	4.77		358.764	32417.2	milk	98.5	98.4	98.5	98.7	98.5	224	off		Curtis
08/17	12:20 PM											224	start		Pivotrac
08/17	11:05 PM			360.523								240	into 5	250	Pivotrac
08/18	08:50 PM		1.19	361.530								270	into 3	250	Pivotrac
08/22	04:35 PM	0.11		365.215	32541.4	dough	98.2	98.2	98.3	98.4	98.2	110	3	265	Curtis
08/23	05:00 AM											134	stop		Pivotrac
08/23	10:55 AM											134	start		Pivotrac
08/25	12:10 AM			368.633								210	into 4	250	Pivotrac
08/25	06:00 PM			369.552								240	into 5	250	Pivotrac
08/26	04:55 PM		1.26	370.613								270	into 3	250	Pivotrac
08/29	12:40 PM	0.12		373.201	32699.4	dent	98.1	98.3	98.5	98.6	98.4	58	3	268	Curtis
08/29				148											
09/01	10:25 AM			376.980								210	into 4	250	Pivotrac
09/02	05:25 AM			377.860								240	into 5	250	Pivotrac
09/03	03:05 AM		1.19	378.863								270	into 3	250	Pivotrac
09/05	03:40 PM	0.46		381.657	32870.5	¼ mat line	97.9	98.2	98.5	98.6	98.4	42	3	266	Curtis
09/08	10:00 AM				32870.5							185	3		Pivotrac
09/11	04:10 PM											185	start		Pivotrac
09/12	05:05 AM			385.597								210	into 4	260	Pivotrac
09/12	10:25 PM			386.431								240	into 5	260	Pivotrac
09/13	08:50 PM			387.511								270	into 3	260	Pivotrac
09/14	03:20 PM		1.28	388.524	33007.8	½ mat line	77.3	97.8	98.9	99.0	98.8	311	3	272	Curtis
09/19	09:55 AM	0.47		394.122	33122.4	¾ mat line	96.4	96.0	97.7	97.8	97.7	197	3	256	Curtis
09/19	04:00 PM			394.470								210	into 4	270	Pivotrac
09/20	11:30 AM			395.445								240	into 5	270	Pivotrac
09/21	08:30 AM		1.24	396.496								270	into 3	270	Pivotrac
09/22	08:30 PM			398.296								347	stop	270	Pivotrac
10/11	03:25 PM	5.72		398.178	33204.8	1.0 mat line	97.4	98.0	98.2	98.2	98.1	347	off		Curtis
10/17	03:45 PM			398.178	33204.8	black layer	98.0	98.1	98.7	98.7	98.6	347	off		Curtis
10/24	03:50 PM			398.178	33204.8	black layer	97.2	97.9	98.1	98.2	98.0	347		off	Curtis
10/30	03:50 PM			398.178	33204.8	black layer	96.2	97.6	97.6	97.7	97.5	347		off	Curtis
11/07	01:05 PM			398.178	33204.8	black layer	95.4	96.7	97.2	97.3	97.2	347		off	Curtis
11/07						harvest						move dry			Harold
11/14	01:00 PM			398.178	33204.8	harvested	95.2	96.5	97.8	97.8	97.9	10		off	Curtis
Total		11.08	19.44				0.0	0.0	0.0	0.0	0.0	= 0.0	Soil Moisture		Leon

Net soil moisture is 0.00 inches.

Rainfall (11.08 in), irrigation (19.44 in), and net soil moisture (0.00 in) is total water (30.52 in).

*Numbers in red are not counted in the total rainfall.

2017 Harvest Results “3-4-5 GPM” LEPA Shroud Corn, Grall

The 3 GPM LEPA field produced a 236 bushel per acre corn yield. Irrigation totaled 13.08 inches that included 1.13 inches of pre-water. Production in the 4 GPM field was 240 bushels per acre. Irrigation totaled 17.84 inches with 2.25 inches of pre-water. Corn yield was 237 bushels per acre for the 5 GPM field. Irrigation totaled 19.44 inches that included 2.18 inches of pre-water.

The 4 GPM field produced 4 more bushels per acre than the 3 GPM field and irrigation was 4.76 inches more. The 5 GPM field produced 1 more bushel per acre than the 3 GPM with 6.36 more inches of irrigation. The 4 GPM yield was 3 more bushels per acre than that from the 5 GPM field with 1.60 less inches of irrigation.

Corn production was 18.04 bushels (1,010 lb.) per inch of irrigation in the 3 GPM field compared to 13.45 bushels (753 lb.) in the 4 GPM field and 12.19 bushels (682 lb.) from the 5 GPM field. Production from each inch of irrigation, rainfall, and net soil water that totaled 24.16 inches was 9.77 bushels (547 lb.) per acre in the 3 GPM field. Irrigation, rainfall, and net soil water totaled 28.92 inches in the 4 GPM field where production was 8.30 bushels (464 lb.) per inch. In the 5 GPM field, irrigation, rainfall, and net soil water totaled 30.52 inches where production was 7.76 bushels (435 lb.) per inch of total water.

Crop production costs were \$33.38 per acre more for the 4 GPM field than for the 3 GPM from increased fertilizer, irrigation, and harvest expenses. At \$3.63 per bushel, the 4 bushels per acre increased corn yield in the 4 GPM field amounted to \$14.52 more per acre than from the 3 GPM field. The 3 GPM field's net gain was \$18.86 per acre with 4.76 inches less irrigation used compared to production from the 4 GPM field. Value of the additional 1 bushel produced in the 5 GPM field compared to the 3 GPM was \$3.63 per acre. Production costs were \$40.41 more for the 5 GPM field. Net gain for the 3 GPM field was \$36.78 per acre more than from the 5 GPM with 6.36 inches less irrigation. At \$3.63 per bushel, the 3 bushel per acre increased yield from the 4 GPM field compared to the 5 GPM amounts to \$10.89. Crop production costs were \$7.03 more for the 5 GPM field from increased irrigation costs. The 4 GPM field's net gain compared to the 5 GPM field was \$17.92 per acre with 1.60 less inches of irrigation.

Net return from the 3 GPM field was \$454.70 per acre compared to \$435.85 from the 4 GPM field and \$417.93 from the 5 GPM field. Net return from each inch of irrigation was \$34.76 for the 3 GPM field compared to \$24.43 from the 4 GPM, and \$21.50 for the 5 GPM field. Net return from each inch of irrigation, rainfall, and net soil water was \$18.82 per acre for the 3 GPM field, \$15.07 from the 4 GPM, and \$13.69 for the 5 GPM field. A summary of the demonstration results are shown in Table 21 and Appendix B.

2017 Harvest Results “3-4-5 GPM” T-L PMDI Corn, Grall

The 3 GPM T-L PMDI field produced a 221 bushel per acre corn yield. Irrigation totaled 13.08 inches that included 1.13 inches of pre-water. Production in the 4 GPM field was 228 bushels per acre. Irrigation was 17.84 inches that included 2.25 inches of pre-water. Corn yield was 227 bushels per acre for the 5 GPM field. Irrigation totaled 19.44 inches that included 2.18 inches of pre-water.

The 4 GPM field produced 7 more bushels per acre than the 3 GPM field and irrigation was 4.76 inches more. The 5 GPM field produced 6 more bushels per acre than the 3 GPM with 6.36 more inches of irrigation. The 4 GPM yield was 1 more bushel per acre than that from the 5 GPM field with 1.60 less inches of irrigation.

Corn production was 16.89 bushels (946 lb.) per inch of irrigation in the 3 GPM field compared to 12.78 bushels (715 lb.) in the 4 GPM and 11.67 bushels (654 lb.) from the 5 GPM field. Production from each inch of irrigation, rainfall, and net soil water that totaled 24.16 inches was 9.15 bushels (512 lb.) per acre in the 3 GPM field. Irrigation, rainfall, and net soil water totaled 28.92 inches in the 4 GPM field where production was 7.88 bushels (441 lb.) per inch. In the 5 GPM field, irrigation, rainfall, and net soil water totaled 30.52 inches where production was 7.43 bushels (416 lb.) per inch of total water.

Crop production costs were \$36.28 per acre less for the 3 GPM field than for the 4 GPM field from reduced irrigation, fertilizer, and harvest expenses. At \$3.63 per bushel, the 7 bushels per acre increased corn yield in the 4 GPM field amounted to \$25.41 more per acre than from the 3 GPM field. The 3 GPM field's net gain was \$10.87 per acre with 4.76 inches less irrigation compared to production from the 4 GPM field. Value of the additional 6 bushels produced in the 5 GPM field compared to the 3 GPM was \$21.78 per acre. Production costs were \$45.23 more for the 5 GPM field. Net gain for the 3 GPM field was \$23.45 per acre more than from the 3 GPM with 6.36 inches less irrigation. At \$3.63 per bushel, the 1 bushel per acre increased yield from the 4 GPM field compared to the 5 GPM amounted to \$3.63. Crop production costs were \$8.95 more for the 5 GPM field from increased irrigation costs. The 4 GPM field's net gain compared to the 5 GPM field was \$12.58 per acre with 1.60 less inches of irrigation.

Net return from the 3 GPM field was \$414.73 per acre compared to \$403.86 from the 4 GPM field and \$391.28 from the 5 GPM field. Net return from each inch of irrigation is \$31.71 for the 3 GPM field compared to \$22.64 from the 4 GPM and \$20.13 for the 5 GPM field. Net return from each inch of irrigation, rainfall, and net soil water was \$17.16 for the 3 GPM field, \$13.96 from the 4 GPM, and \$12.82 for the 5 GPM field. A summary of the demonstration results are shown in Table 21 and Appendix B.

Table 21: 2017 LEPA Shroud Demonstration Results, Grall

GPM	Irrigation (in)	Total Water (in)	Production		Gross Crop Value @ \$3.63/bu		
			bu/ac	lb/ac-in of Irrigation	per acre (\$)	Acre-inch of Irrigation (\$)	Acre-inch of Total Water (\$)
3 GPM LEPA	13.08	24.16	236	1010	\$856.68	\$65.49	\$35.46
4 GPM LEPA	17.84	28.92	240	753	\$871.20	\$48.83	\$30.12
5 GPM LEPA	19.44	30.52	237	682	\$860.31	\$44.25	\$28.19
All fields include 0.00 inches of soil water within 5 feet of soil, only rainfall and irrigation.							

Table 22: 2017 T-L PMDI Demonstration Results, Grall

GPM	Irrigation (in)	Total Water (in)	Production		Gross Crop Value @ \$3.63/bu		
			bu/ac	lb/ac-in of Irrigation	per acre (\$)	Acre-inch of Irrigation (\$)	Acre-in of Total Water (\$)
3 GPM PMDI	13.08	24.16	221	946	\$802.23	\$61.33	\$33.20
4 GPM PMDI	17.84	28.92	228	715	\$827.64	\$46.39	\$28.62
5 GPM PMDI	19.44	30.52	227	654	\$824.01	\$42.38	\$27.00
All fields include 0.00 inches of soil water within 5 feet of soil, only rainfall and irrigation.							

2017 Harvest Results LEPA Shroud and T-L PMDI Corn, Grall

The 3 GPM LEPA Shroud field produced a 236 bushel per acre corn yield. Seasonal irrigation totaled 13.08 inches that included 1.13 inches of pre-water. Production in the 3 GPM T-L PMDI field was 221 bushels per acre. The 3 GPM LEPA field produced 15 more bushels per acre than the T-L PMDI field with the same 13.08 inches of irrigation. Corn production was 18.04 bushels (1,010 lb.) per inch of irrigation in the 3 GPM LEPA Shroud field and 16.89 bushels (946 lb.) in the 3 T-L PMDI field.

Yield was 240 bushels per acre in the 4 GPM LEPA field with 17.84 inches of irrigation that included 2.25 inches of pre-water. Production in the 4 GPM T-L PMDI field was 228 bushels per acre with the same 17.84 inches of irrigation. Production was 13.45 bushels (753 lb.) from each inch of irrigation for the 4 GPM LEPA field and 12.78 (715 lb.) for the 4 T-L PMDI field.

Yield was 237 bushels per acre in the 5 GPM LEPA field with 19.44 inches of irrigation and 227 bushels in the T-L PMDI. Production was 12.19 bushels (682 lb.) from each inch of irrigation for the 5 GPM LEPA and 11.67 bushels (654 lb.) for the 5 GPM T-L PMDI.

Production from each inch of irrigation, rainfall, and net soil water that totaled 24.16 inches was 9.77 bushels (547 lb.) per acre for the 3 GPM LEPA Shroud field. Irrigation, rainfall, and net soil water totaled 24.16 inches for the 3 GPM T-L PMDI field from which production was 9.15 bushels (512 lb.) per inch.

Production from each inch of total water that was 28.92 inches in the 4 GPM fields was 8.30 bushels (465lbs) per acre in the 4 GPM LEPA Shroud field and 7.88 bushels (442lbs) per acre in the 4 GPM T-L PMDI field.

Irrigation, rainfall, and net soil water was 30.52 inches for the 5 GPM LEPA field. Production was 7.76 bushels (435 lb.) from each inch of total water. Total water was 30.52 inches for the 5 GPM T-L PMDI from which production was 7.43 bushels (416 lb.) per inch.

Crop production costs for irrigation, seed, fertilizer, and harvest costs were \$401.97 per acre for the 3 GPM LEPA Shroud and \$387.50 for the 3 GPM T-L PMDI fields. At \$3.63 per bushel, value of the 15 bushel per acre additional yield for the LEPA Shroud was \$54.45 per acre. Net return from the 3 GPM

LEPA field was \$39.98 per acre more than that from 3 GPM PMDI. Net return from each inch of irrigation is \$31.71 for the T-L PMDI field and \$34.76 for 3 GPM LEPA.

Production costs totaled \$435.45 for the 4 GPM LEPA and \$423.78 for T-L PMDI. Value of the 12 additional bushels per acre at \$3.63 per bushel was \$43.56. Net return was \$31.49 per acre more for 4 GPM LEPA. Net return from each inch of irrigation was \$22.64 for the T-L PMDI and \$24.43 for 4 GPM LEPA.

Production costs were \$442.38 for the 5 GPM LEPA field and \$432.73 for the T-L PMDI field. At \$3.63 per bushel, value of the 10 additional bushels produced in the 5 GPM LEPA field was \$36.30 per acre. Additional net return for the 5 GPM LEPA field was \$26.65 per acre. Net return from each inch of irrigation was \$20.13 for 5 GPM T-L PMDI field and \$21.50 for the LEPA Shroud field.

Net return from each inch of irrigation, rainfall, and net soil water that totaled 24.16 inches was \$18.82 per inch for the 3 GPM LEPA Shroud field and \$17.16 per inch for the T-L PMDI field. Irrigation, rainfall, and net soil water totaled 28.92 inches in the 4 GPM LEPA field from which net return was \$15.07. Total water was 28.92 inches in the 4 GPM T-L PMDI with a net return of \$13.96 from each inch. For the 5 GPM LEPA field, irrigation, rainfall, and net soil water totaled 30.52 inches from which net return was \$13.69 per inch. Total water was 30.52 inches in T-L PMDI field from which net return was \$12.82 per inch.

The 2017 LEPA Shroud and T-L PMDI demonstration are an excellent comparison of two high efficiency water application center pivot irrigation systems. Both LEPA Shroud and T-L PMDI 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 GPM” project. 2017 was the final year of the “3-4-5 GPM” demonstration project; however, the District continues to provide information for potential ready grower adoption. A summary of the 2017 LEPA Shroud and T-L PMDI demonstration results are shown in Table 21 and Table 22 above and in Appendix B.

Danny Krienke's 2017 Ochiltree County Corn Demonstration

2017 Planting and Crop Information, LEPA Corn, Krienke

Danny Krienke strip tilled and planted 180 acres of corn in three quarters of a 240 acre circle in Section 47, for his “3-4-5 GPM” demonstration. Danny added an early planted 3 GPM field, “3 GPM-E”, to his 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. 0 to 90 degrees was his 3 GPM-Early planted field, 180 to 300 degrees was the 3 GPM field, 300 to 330 degrees was his 4 GPM field, and 330 to 0 degrees was the 5 GPM field. From 90 to 180 degrees, there was a fallow field. Krienke planted his 3 GPM-Early field to Golden Acres hybrid GA4173ADG at 32,000 seeds per acre on May 9. His 3-4-5 GPM fields were planted to GA7007DG on May 31. Seeding rates were 28,000 for the 3 GPM, 4 GPM and 5 GPM fields. Center pivot travel speed was by Lindsey Mfg. Field Net. Krienke used 2 irrigation plans to rotate 1.10 inches per week applications between his 3 GPM-Early planted acres and the 3 GPM late planted acres, guided by plant growth stage and soil water sensors. Center pivot travel speed was also programed 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. Advanced technology soil moisture sensors guided reduced irrigation amounts. Seasonal weekly water meter readings averaged 533 GPM, which is 2.96 GPM per acre irrigation capacity. Irrigation was with Senninger's LEPA shroud UP-3 bubbler attached to drops spaced 30 inches apart. Timely beneficial rainfall contributed to producing the crop in combination with well managed timely irrigation. Planting and crop information for “Krienke 3 GPM-E”, Krienke 3 GPM”, “Krienke 4 GPM”, and “Krienke 5 GPM” are shown in Table 23 below.

Table 23: 2017 Planting and Crop Information, LEPA Corn, Danny Krienke

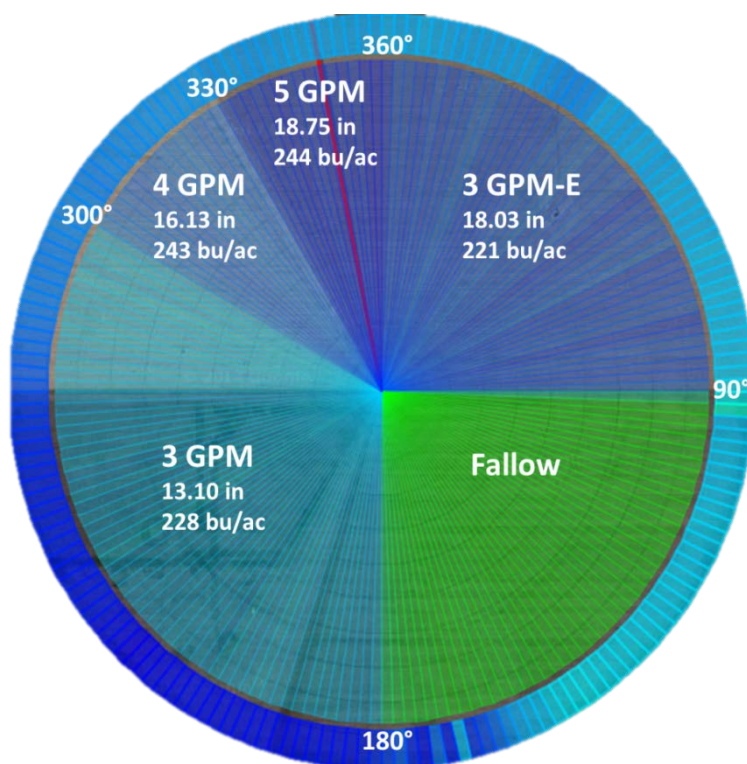
3 GPM-Early Demonstration Site: 0 - 90 degrees					
Planted		May 9		Harvested	October 21
Hybrid		GA4173ADG		Seeding Rate	32,000
Row Width		30 inches		Tillage	Strip Till
No. Acres		60.00		GPM per acre	2.96
Total Water		27.52 inches		Soil Type	Sherman Silty Clay Loam
Irrigation		18.03 inches		Insecticide	None
3 GPM Demonstration Site: 180 - 300 degrees					
Planted		May 31		Harvested	November 12
Hybrid		GA7007DG		Seeding Rate	28,000
Row Width		30 inches		Tillage	Strip Till
No. Acres		80.00		GPM per acre	2.96
Total Water		23.58 inches		Soil Type	Sherman Silty Clay Loam
Irrigation		13.10 inches		Insecticide	None

Table 23: 2017 Planting and Crop Information, LEPA Corn, Danny Krienke (continued)

4 GPM Demonstration Site: 300 - 330 degrees						
Planted		May 31		Harvested		November 12
Hybrid		GA7007DG		Seeding Rate		28,000
Row Width		30 inches		Tillage		Strip Till
No. Acres		20.00		GPM per acre		3.95
Total Water		27.73 inches		Soil Type		Sherman Silty Clay Loam
Irrigation		16.13 inches		Insecticide		None
5 GPM Demonstration Site: 330 - 0 degrees						
Planted		May 31		Harvested		November 12
Hybrid		GA7007DG		Seeding Rate		28,000
Row Width		30 inches		Tillage		Strip Till
No. Acres		20.00		GPM per acre		4.93
Total Water		29.23 inches		Soil Type		Sherman Silty Clay Loam
Irrigation		18.75 inches		Insecticide		None

2017 Irrigation Intensity Map, LEPA Corn, Krienke

Danny Krienke used 80 acres from 180 to 300 degrees in the circle for his 3 GPM field, 300 to 330 degrees for his 4 GPM, 330 to 360 degrees for his 5 GPM field and 0 to 90 degrees for his 3 GPM-Early planted field. 90 to 180 degrees was fallow. Seasonal water meter readings for the one irrigation well averaged 533 gallons per minute (gpm) making the irrigation capacity 2.96 GPM per acre for 180 acres of corn. **Figure 28: 2017 Irrigation Intensity Map, LEPA Corn, Krienke**



Water Profile and Growing Season Rainfall, LEPA Corn, Krienke

“3 GPM-Early” Demonstration Site

Rainfall prior to planting provided good beginning soil water levels to 5 feet. Plants developed root systems to use soil water from 2 feet by the second week in July, in addition to irrigation and rainfall. Plant roots grew into the 3rd foot root zone by mid-July depleting available soil water stored at 2 feet and most at 3 feet plus rainfall and irrigation. Basically, no soil water was used from 4 and 5 feet indicating superior plant root development in the upper 3 feet root zone. There was no beneficial rainfall in July and September, but 4.28 inches in August significantly contributed and 2.52 inches in October helped finish the crop. Periodic rainfall totaled 9.49 inches from planting until grain maturity in mid-October. Soil moisture sensors show the plants had adequate water during the growing season. Late season rainfall refilled the soil profile to 5 feet. Soil is Sherm silty clay loam that stores 2.00 inches of available water per foot and no indication of caliche to that depth.

“3 GPM” Demonstration Site

Beginning soil water was good at 1, 2, 3, 4 and 5 feet. Weekly gypsum block readings indicated the crop used soil water stored at 1 and 2 feet in July when there was no beneficial rainfall and depleted water stored at 3 feet in August. None of the 3.98 inches of August rainfall reached the soil moisture sensor positioned at 3 feet. The sensors show no soil water was used from 4 and 5 feet, likely because sufficient water was available from the upper root zone. Sensors show the crop had adequate soil water during the growing season. Rainfall from planting until grain black layer totaled 10.48 inches. Gypsum blocks were installed in early-June following planting. 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. No caliche was encountered when installing the gypsum block sensors to 5 feet in the plant root zone.

“4 GPM” Demonstration Site

Early season soil water was good at 1, 2, 3, 4 and 5 feet in the crop root zone. 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 late July and continued using available water from that depth during August and September, plus irrigation and rainfall. Soil water sensors show plants did not use water from 4 and 5 feet. Weekly gypsum block readings show good soil moisture levels were maintained at 1, 2, 3, 4 and 5 feet during the growing season from periodic, timely beneficial rainfall and well guided irrigation. The crop used 1.12 inches of soil water mostly from 3 feet in the soil root zone in addition to rainfall and irrigation producing the crop. Soil moisture sensors show the crop had sufficient soil water during the growing season. Rainfall from planting through black layer totaled 10.48 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. There was no indication of caliche to the 5 feet depth in the plant root zone.

“5 GPM” Demonstration Site

Beginning soil water was good at 1, 2, 3, 4 and 5 feet at planting. Soil moisture sensors show plants needed more water than irrigation and rainfall provided in late July and early August, using additional amounts from 1 and 2 feet from the root zone. Additional soil water was used from 3 feet in the root

zone during September when there was no beneficial rainfall. Weekly irrigation amounts were reduced in late September guided by soil moisture sensors. Weekly gypsum block moisture sensors show the crop had sufficient available soil water during the entire growing season. The sensors show the crop root zone was refilled by late season rainfall in October that finished producing the corn yield. Rainfall was 10.48 inches. Irrigation totaled 18.75 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. No caliche soil was encountered installing soil water sensors to 5 feet in the plant root zone.

Table 24: 2017 Monthly Rainfall Data, LEPA Corn, Krienke

GPM	May (in)	June (in)	July (in)	August (in)	September (in)	October (in)	Total (in)
3-E	0.85	1.21	0.37	4.28	0.26	2.52	9.49
3	0.00	1.15	0.42	3.98	0.15	4.78	10.48
4	0.00	1.15	0.42	3.98	0.15	4.78	10.48
5	0.00	1.15	0.42	3.98	0.15	4.78	10.48

2017 Growing Season Water Tracking, LEPA Corn, Krienke

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 five gypsum block soil moisture sensors was installed at 1, 2, 3, 4 and 5 feet and an AquaSpy™ soil moisture probe was installed down to 4 feet in the root zone at one location to monitor soil water levels in the “3 GPM” field. Another set of the same type of sensors were installed in each “3 GPM-Early”, “4 GPM” and “5 GPM” fields. 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 showed soil moisture at 4 inch increments to 48 inches and monitored plant root growth. The website lists all Aquaspy soil probes in the 3, 4, 5, GPM project and is available to all cooperators and district personnel. Another 24/7 Pivotrak 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 GPM” Project Leader collectively monitored, controlled and managed irrigation from the Pivotrak website.

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

Figure 29: 2017 Gypsum Block Readings, “3 GPM-Early” LEPA Corn, 221 bu/ac, Krienke

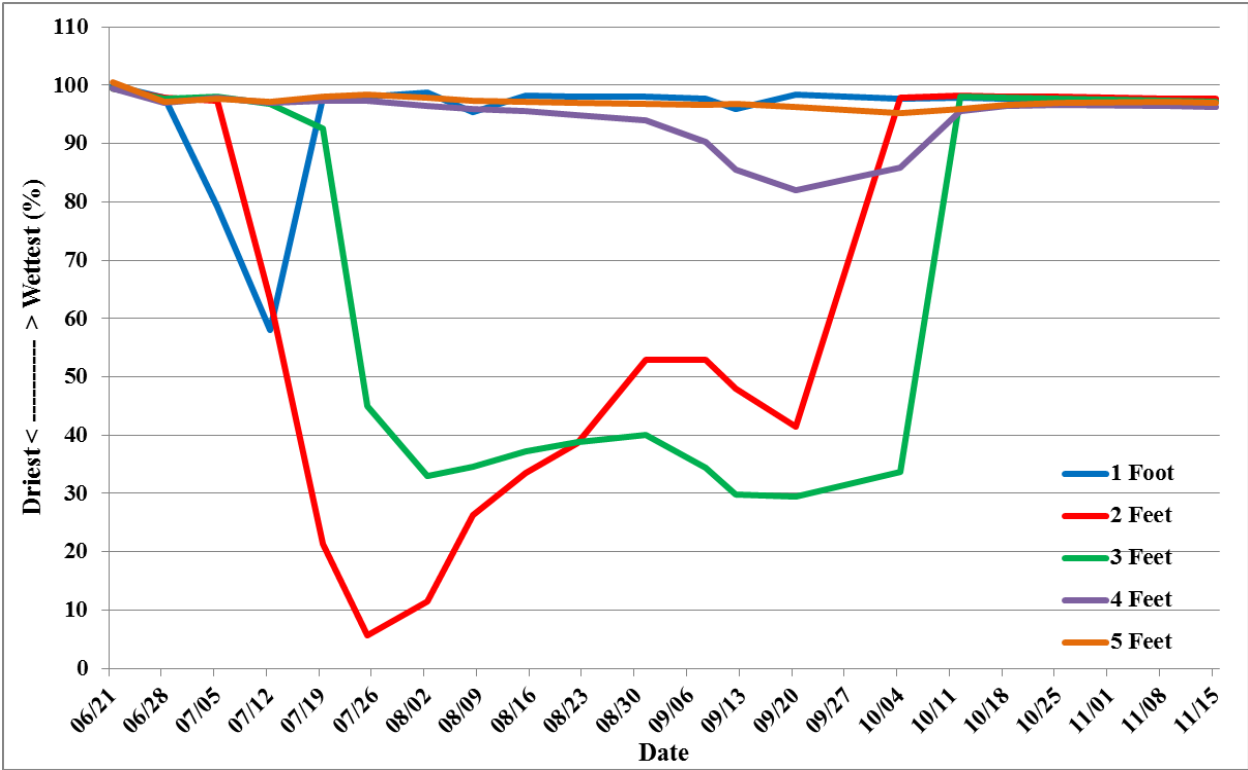


Figure 30: 2017 Growing Season Water Tracking, “3 GPM-Early” LEPA Corn, 221 bu/ac, Krienke

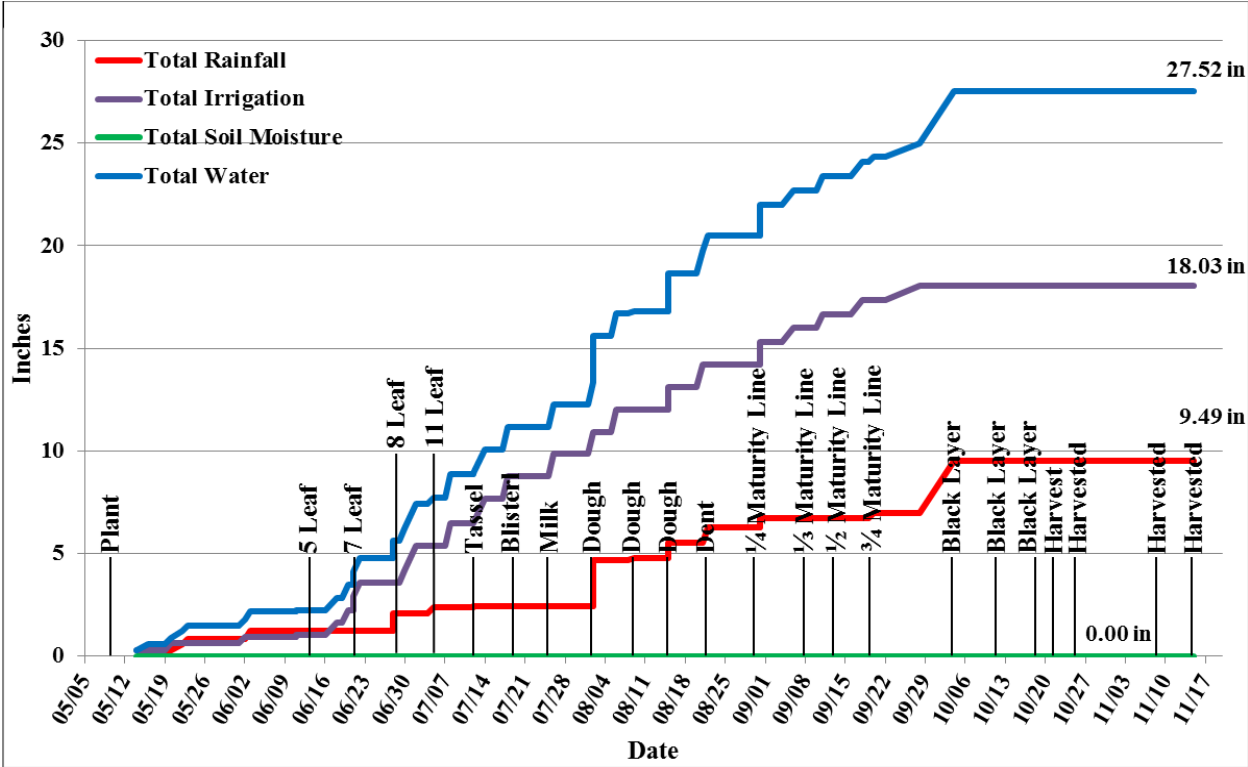


Table 25: 2017 Field Data, “3 GPM-Early” LEPA Corn, 221 bu/ac, Krienke

Date	Time	Rainfall (inches)	Irrigation (inches)	Water Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigated	Well (GPM)	Pivot Rotation	Tracking Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet					
04/21		0.91		980.86							234				Pivotrac
04/30		1.19													Pivotrac
05/03		0.78													Pivotrac
05/09				980.86	plant						234			stop	Danny
05/10	07:15 AM										234			stop	Pivotrac
05/12	10:00 AM			980.86							3-E			move dry	Pivotrac
05/13	12:30 PM			980.86							90	start		ccw	Pivotrac
05/14	02:20 AM		0.29	982.30							0	3-E	565	stop	Pivotrac
05/16		0.27									0			stop	Pivotrac
05/19	03:05 PM										0	start		ccw	Pivotrac
05/20	06:10 PM		0.33	983.84							90	3-E	600	stop	Pivotrac
05/22		0.32													Pivotrac
05/23		0.26													Pivotrac
06/01	03:10 PM										90	start		ccw	Pivotrac
06/02	06:15 AM		0.31	985.56							0	3-E	565	into 5	Pivotrac
06/02	11:15 AM			986.08							330	5	565	into 4	Pivotrac
06/02	04:20 PM			986.61							300	4	565	into 3	Pivotrac
06/03	12:35 PM	0.37		988.73							180	3	565	stop	Pivotrac
06/04														stop	Pivotrac
06/05	07:00 PM										180	3		start cw	Pivotrac
06/06	12:45 PM			990.59							300	3	565	into 4	Pivotrac
06/06	10:55 PM			991.65							1	4 & 5	565	into 3-E	stop
06/07	08:45 AM										1	3-E	565	start	Pivotrac
06/07	10:35 AM			991.74							12	3-E	554	ccw	Curtis
06/07	12:40 PM		0.08	992.07							360	3-E	565	into 5	Pivotrac
06/07	05:10 PM			992.54							330	5		into 4	Pivotrac
06/07	09:40 PM			993.02							300	4	565	into 3	Pivotrac
06/08	04:10 PM			994.95							180	3	565	stop	Pivotrac
06/10	02:50 PM										90			move dry	Pivotrac
06/10	03:10 PM										90	3-E		start ccw	Pivotrac
06/11	08:50 PM		0.61	998.03							0	3-E	560	stop	Pivotrac
06/12	05:30 PM										0	3-E	560	start cw	Pivotrac
06/13	11:30 PM		0.62	1001.14							90	3-E	560	stop	Pivotrac
06/14	10:05 AM			1000.78	5 leaf						90		off		Curtis
06/15	10:15 AM										90	3-E		start ccw	Pivotrac
06/16	06:00 PM		0.66	1004.43							0	3-E	560	reverse	Pivotrac
06/18	01:45 AM		0.66	1007.72							90	3-E	560	move dry	Pivotrac
06/18	06:55 PM										180	3		start cw	Pivotrac
06/20	11:35 AM			1011.87							300	into 4	550		Pivotrac
06/20	09:20 PM			1012.86							330	into 5	550		Pivotrac
06/21	07:55 AM			1013.93							360	into 3-E	550		Pivotrac
06/21	02:35 PM			1013.63	7 leaf	99.9	99.5	99.4	99.5	100.5	20	3-E	525		Curtis
06/21	08:50 PM										38	3-E		stop	Pivotrac
06/22	04:30 PM										38	3-E		start cw	Pivotrac
06/22	07:45 PM										48			stop	Pivotrac
06/22	08:10 PM										48	3-E		start cw	Pivotrac
06/22	10:30 PM										55	3-E		stop	Pivotrac
06/23	09:10 AM										55	3-E		start cw	Pivotrac
06/23	09:10 AM		0.62	1017.04							90	3-E	550	reverse	Pivotrac
06/26	06:45 AM		1.17	1022.91							0	into 5	550	ccw	Pivotrac
06/27	02:20 AM			1024.90							330	into 4	550	ccw	Pivotrac
06/27	05:45 PM			1026.47							300	into 3	550	ccw	Pivotrac
06/28	11:00 AM	0.84		1026.57	8 leaf	97.8	97.8	97.7	97.0	97.2	257	3	546		Curtis
06/29	05:35 PM			1031.34							180	3	550		Pivotrac
06/29	10:35 PM			1031.85							90	into 3-E	550	ccw	Pivotrac
07/02	05:35 AM		1.12	1037.46							0	into 5	550	ccw	Pivotrac
07/03	12:40 AM			1039.40							330	into 4	550	ccw	Pivotrac
07/03	04:15 PM			1040.99							300	into 3	550	ccw	Pivotrac
07/05	11:40 AM	0.31		1043.37	11 leaf	79.2	97.3	98.0	97.8	97.6	189	3	550		Curtis
07/05	03:30 PM			1045.80							180	move dry	550	ccw	Pivotrac
07/05	11:40 PM										90	start		ccw	Pivotrac
07/08	09:10 AM		1.17	1051.65							0	into 5	550	ccw	Pivotrac
07/09	04:00 AM			1053.57							330	into 4	550	ccw	Pivotrac
07/09	07:25 PM			1055.14							300	into 3	550	ccw	Pivotrac
07/11	06:10 PM			1059.90							180	move dry	550	ccw	Pivotrac
07/11	11:15 PM										90	start		ccw	Pivotrac
07/12	09:30 AM	0.06		1058.77	tassel	58.0	63.4	96.8	97.0	97.2	75	3-E	546	ccw	Curtis
07/14	06:40 AM		1.11	1065.45							0	into 5	540	ccw	Pivotrac
07/15	01:30 AM			1067.33							330	into 4	540	ccw	Pivotrac
07/15	04:45 PM			1068.85							300	into 3	540	ccw	Pivotrac
07/16	06:30 PM										233	stop			Pivotrac
07/16	07:40 PM										233	start		ccw	Pivotrac
07/17	04:20 PM			1073.49							180		540	move dry	Pivotrac
07/17	11:30 PM										90	3-E		start ccw	Pivotrac
07/19	10:55 AM			1074.92	blister	97.8	21.4	92.6	97.4	98.0	32	3-E	536		Curtis
07/20	06:05 AM		1.09	1078.95							0	into 5	540	ccw	Pivotrac
07/21	01:05 AM			1080.85							330	into 4	540	ccw	Pivotrac

Table 25: 2017 Field Data, “3 GPM-Early” LEPA Corn, 221 bu/ac, Krienke (continued)

Date	Time	Rainfall (inches)	Irrigation (inches)	Water Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigated	Well (GPM)	Pivot Rotation	Tracking Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet					
07/21	04:20 PM			1082.38							300	into 3	540	ccw	Pivotrac
07/23	02:55 PM			1087.04							180	move dry	540	ccw	Pivotrac
07/24	12:20 AM										90	start		ccw	Pivotrac
07/25	01:05 PM			1088.89	milk	98.0	5.6	45.0	97.3	98.4	28	3-E	531		Curtis
07/26	05:35 AM		1.06	1092.36							0	into 5	540	ccw	Pivotrac
07/27	12:35 AM			1094.26							330	into 4	540	ccw	Pivotrac
07/27	03:35 PM			1095.76							300	into 3	540	ccw	Pivotrac
07/29	04:35 PM			1100.66							180	move dry	540	ccw	Pivotrac
07/29	09:35 PM										90	start		ccw	Pivotrac
08/01	07:00 AM		1.13	1106.30							0	into 5	530	ccw	Pivotrac
08/02	03:45 AM			1108.33							330	into 4	530	ccw	Pivotrac
08/02	10:35 AM	2.25		1106.78	dough	98.7	11.5	33.0	96.5	97.8	316	4	529		Curtis
08/02	08:15 PM			1109.95							300	into 3	530	ccw	Pivotrac
08/04	08:20 PM			1114.67							180	into fallow	530	ccw	Pivotrac
08/05	08:20 AM			1115.85							151	reverse	530	ccw	Pivotrac
08/05	09:50 AM										180	start		ccw	Pivotrac
08/07	10:20 AM			1120.61							300	into 4	530	ccw	Pivotrac
08/08	02:35 AM			1122.21							330	into 5	530	ccw	Pivotrac
08/08	11:00 AM	0.11		1120.67	dough	95.4	26.3	34.6	96.0	97.4	343	5	525	ccw	Curtis
08/08	10:25 PM			1124.15							360	into 3-E	530	ccw	Pivotrac
08/11	06:50 AM		1.08	1129.59							90	into fallow	530	ccw	Pivotrac
08/11	08:50 AM			1129.79							93	move dry	530	ccw	Pivotrac
08/11	01:50 PM										180	start		ccw	Pivotrac
08/13	02:35 PM			1134.58							300	into 4	530	ccw	Pivotrac
08/14	06:45 AM			1136.16							330	into 5	530	ccw	Pivotrac
08/15	02:30 AM			1138.10							360	into 3-E	530	ccw	Pivotrac
08/15	10:25 AM	0.72		1136.52	dough	98.2	33.5	37.2	95.5	97.2	12	3-E	530		Curtis
08/17	11:15 AM		1.11	1143.67							90	into fallow	530	ccw	Pivotrac
08/17	12:00 PM			1143.75							92	move dry	530	ccw	Pivotrac
08/17	04:45 PM										180	start		ccw	Pivotrac
08/18	02:45 AM										204	stop			Pivotrac
08/18	11:00 AM										204	start		ccw	Pivotrac
08/20	01:50 AM			1150.89							300	into 4	530	ccw	Pivotrac
08/20	05:45 PM			1152.46							330	into 5	530	ccw	Pivotrac
08/21	02:00 PM			1154.44							360	into 3-E	530	ccw	Pivotrac
08/22	10:25 AM	0.76		1151.62	dent	98.1	38.7	38.9	94.8	96.9	32	3-E	519		Curtis
08/23	11:55 PM		1.07	1159.81							90	move dry	500	ccw	Pivotrac
08/25	11:30 AM										180	start		ccw	Pivotrac
08/27	10:55 PM			1165.31							300	into 4	500	ccw	Pivotrac
08/28	06:45 PM			1167.15							330	into 5	500	ccw	Pivotrac
08/29	03:50 PM			1169.10							360	into 3-E	500	ccw	Pivotrac
08/31	05:35 AM		0.70	1172.59							90	3-E	500	ccw	Pivotrac
08/31	10:35 AM	0.44		1168.54	¼ mat line	98.1	52.9	40.0	93.9	96.8	139	move dry		ccw	Curtis
08/31	02:45 PM										180	start		ccw	Pivotrac
09/03	02:20 AM			1178.11							300	into 4	500	ccw	Pivotrac
09/03	10:30 PM			1179.98							330	into 5	500	ccw	Pivotrac
09/04	06:55 PM			1181.87							360	into 3-E	500	ccw	Pivotrac
09/06	08:00 AM		0.68	1185.31							90	move dry	500	ccw	Pivotrac
09/06	12:10 PM										180	start		ccw	Pivotrac
09/08	10:15 AM			1186.48	½ mat line	97.7	52.9	34.4	90.3	96.7	272	3	529		Curtis
09/08	11:30 PM			1190.08							300	into 4	500	ccw	Pivotrac
09/09	07:15 PM			1191.91							330	into 5	500	ccw	Pivotrac
09/10	03:50 PM			1193.82							360	into 3-E	500	ccw	Pivotrac
09/11	02:25 PM										54	3-E		stop	Pivotrac
09/11	02:40 PM										54	3-E		start	Pivotrac
09/12	04:55 AM		0.68	1197.23							90	3-E	500	move dry	Pivotrac
09/12	09:05 AM										180			start	Pivotrac
09/12	12:45 PM			1195.65	½ mat line	95.9	48.0	29.8	85.6	96.8	187	3	541		Curtis
09/14	08:05 PM			1202.69							300	into 4	500	ccw	Pivotrac
09/15	03:35 PM			1204.50							330	into 5	500	ccw	Pivotrac
09/16	12:35 PM			1206.44							360	into 3-E	500	ccw	Pivotrac
09/18	01:30 AM		0.68	1209.86							90	3-E	500	move dry	Pivotrac
09/18	05:40 AM										180	3		start	Pivotrac
09/20	02:20 PM	0.26		1214.13	¾ mat line	98.4	41.4	29.5	82.0	96.2	295	3	530		C & L
09/20	04:45 PM			1215.33							300	into 4	500	ccw	Pivotrac
09/21	12:40 PM			1217.18							330	into 5	500		
09/22	10:25 AM			1219.19							360		500	stop	Danny
09/28	02:30 PM			1218.41							0			off	Curtis
10/04	01:35 PM	2.52		1218.41	black layer	97.7	97.8	33.7	85.9	95.2	1			off	Curtis
10/12	10:30 AM	2.44		1218.41	black layer	97.8	98.3	98.0	95.5	95.9	1			off	Curtis
10/18	10:40 AM			1218.41	black layer	97.6	98.1	97.8	96.5	96.6	1			off	Curtis
10/21					harvest						move dry				Danny
10/25	10:40 AM			1218.41	harvested	97.5	98.0	97.7	96.6	97.0	332			off	Curtis
11/09	10:50 AM			1218.41	harvested	97.1	97.7	97.4	96.5	97.2	9			off	Curtis
11/15	10:25 AM			1218.41	harvested	97.1	97.6	97.2	96.3	97.0	9			off	Curtis
Total		9.49	18.03			0.0	0.0	0.0	0.0	0.0	= 0.0	Soil Moisture			Leon
Net soil moisture is 0.00 inches.															
Rainfall (9.49 in), Irrigation (18.03 in), and Net Soil Moisture (0.00 in) is Total Water (27.52 in).															
*Numbers in red are not counted in the total rainfall.															

Figure 31: 2017 Gypsum Block Readings, “3 GPM” LEPA Corn, 228 bu/ac, Krienke

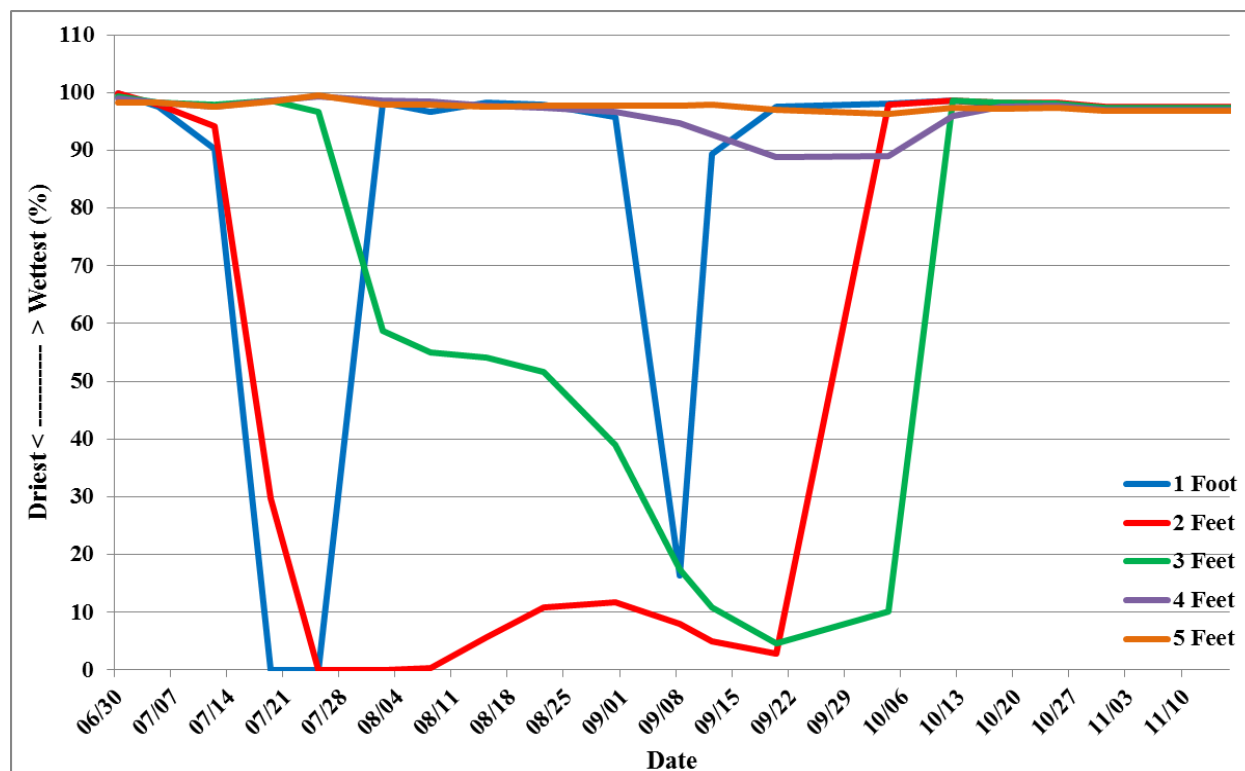


Figure 32: 2017 Growing Season Water Tracking, “3 GPM” LEPA Corn, 228 bu/ac, Krienke

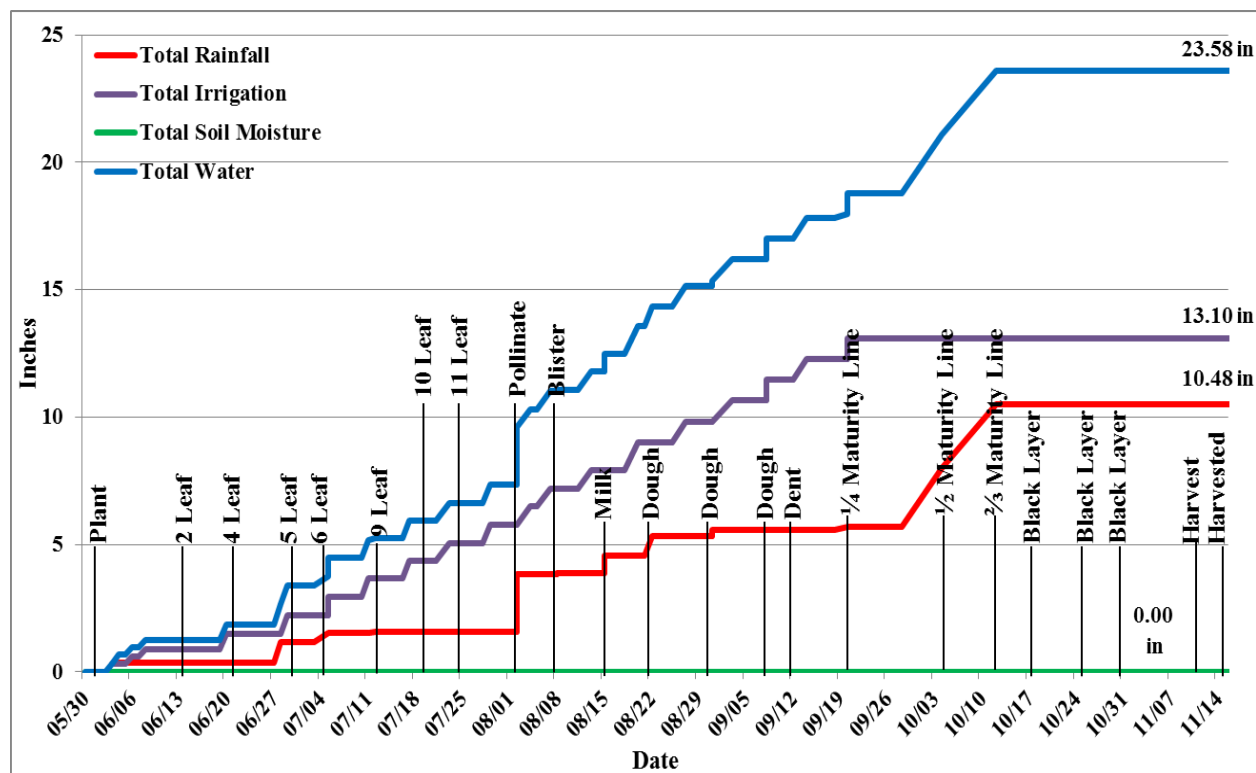


Table 26: 2017 Field Data, “3 GPM” LEPA Corn, 228 bu/ac, Krienke

Date	Time	Rainfall (inches)	Irrigation (inches)	Water Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigated	Well (GPM)	Pivot Rotation	Tracking Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet					
04/21		0.91													Pivotrac
04/30		1.19													Pivotrac
05/03		0.78		980.86							234				Pivotrac
05/10	07:15 AM										234				Pivotrac
05/12	10:00 AM										90			move dry	Pivotrac
05/13	12:30 PM			980.86							90			start ccw	Pivotrac
05/14	02:20 PM			982.30							0	3-E	565	stop	Pivotrac
05/16		0.27												stop	Pivotrac
05/19	03:05 PM										0	3-E		start ccw	Pivotrac
05/20	06:10 PM			983.84							90	3-E	600	stop	Pivotrac
05/22		0.32												stop	Pivotrac
05/23		0.26												move dry	Pivotrac
05/31					plant										Danny
06/01	03:10 PM										90	3-E		start ccw	Pivotrac
06/02	06:15 AM			985.56							0	3-E	565	into 5	
06/02	11:15 AM			986.08							330	5	565	into 4	Pivotrac
06/02	04:20 PM			986.61							300	4	565	into 3	Pivotrac
06/03	12:35 PM		0.31	988.73							180	3	565	stop	Pivotrac
06/04		0.37													Pivotrac
06/05	07:00 PM										180	3		start cw	Pivotrac
06/06	12:45 PM		0.28	990.59							300	3	565	into 4	Pivotrac
06/06	10:55 PM			991.65							1	4 & 5	565	into 3-E	stop
06/07	08:45 AM										1		565	start cw	Pivotrac
06/07	10:35 AM			991.74							13	3-E	554	3-E	Curtis
06/07	12:40 PM			992.07							360	3-E	565	into 5	Pivotrac
06/07	05:10 PM			992.54							330	5		into 4	Pivotrac
06/07	09:40 PM			993.02							300	4	565	into 3	Pivotrac
06/08	04:10 PM		0.29	994.95							180	3	565	stop	Pivotrac
06/10	02:50 PM										90			move dry	Pivotrac
06/10	03:10 PM										90	3-E		start ccw	Pivotrac
06/11	08:50 PM			998.03							0	3-E	560	stop	Pivotrac
06/12	05:30 PM										0	3-E		start cw	Pivotrac
06/13	11:30 PM			1001.14							90	3-E	560	stop	Pivotrac
06/14	10:05 AM			1000.78	2 leaf						90			off	Curtis
06/15	10:15 AM										90	3-E		start ccw	Pivotrac
06/16	06:00 PM			1004.43							0	3-E	560	reverse	Pivotrac
06/18	01:45 AM			1007.72							90	3-E	560	move dry	Pivotrac
06/19	06:55 PM										180	3		start	Pivotrac
06/20	11:35 AM		0.62	1011.87							300	3	550	into 4	Pivotrac
06/20	09:20 PM			1012.86							330	4	550	into 5	Pivotrac
06/21	07:55 AM			1013.93	4 leaf						360	5	550	into 3-E	Pivotrac
06/21	02:35 PM			1013.63							20	3-E	525	3-E	Curtis
06/21	08:50 PM										38	3-E		stop	Pivotrac
06/22	04:30 PM										38	3-E		start cw	Pivotrac
06/22	07:45 PM										48			stop	Pivotrac
06/22	08:10 PM										48	3-E		start	Pivotrac
06/22	10:30 PM										55	3-E		stop	Pivotrac
06/22	09:10 AM										55	3-E		start cw	Pivotrac
06/22	09:10 AM			1017.04							90	3-E	550	reverse	Pivotrac
06/26	06:45 AM			1022.91							0	3-E	550	into 5	Pivotrac
06/27	02:20 AM			1024.90							330	5	550	into 4	Pivotrac
06/27	05:45 PM			1026.47							300	4	550	into 3	Pivotrac
06/28	11:00 AM	0.78		1026.57	5 leaf						257	3	548	3	Curtis
06/29	05:35 PM		0.73	1031.34							180	3	550	3	Pivotrac
06/29	10:35 PM			1031.85							90	fallow	550	into 3-E	Pivotrac
06/30	10:30 AM				5 leaf	99.8	99.9	99.3	98.9	98.3					Curtis
07/02	05:35 AM			1037.46							0	3-E	550	into 5	Pivotrac
07/03	12:40 AM			1039.40							330	5	550	into 4	Pivotrac
07/03	04:15 PM			1040.99							300	4	550	into 3	Pivotrac
07/05	11:40 AM	0.36		1043.37	6 leaf	97.5	97.9	98.3	98.2	98.3	189	3	550	3	Curtis
07/05	03:30 PM		0.72	1045.80							180	3	550	move dry	Pivotrac
07/05	11:40 PM										90	3-E		start ccw	Pivotrac
07/08	09:10 AM			1051.65							0	3-E	550	into 5	Pivotrac
07/09	04:00 AM			1053.57							330	5	550	into 4	Pivotrac
07/10	07:25 PM			1055.14							300	4	550	into 3	Pivotrac
07/11	06:10 PM		0.71	1059.90							180	3	550	move dry	Pivotrac
07/11	11:15 PM										90	3-E		start ccw	Pivotrac
07/12	09:30 AM	0.06		1058.77	9 leaf	90.3	94.1	97.9	97.6	97.5	75	3-E	546	3-E	Curtis
07/14	06:40 AM			1065.45							0	3-E	540	into 5	Pivotrac
07/15	01:30 AM			1067.33							330	5	540	into 4	Pivotrac
07/15	04:45 PM			1068.85							300	4	540	into 3	Pivotrac
07/16	06:30 PM										233	3		stop	Pivotrac
07/16	07:40 PM										233	3		start ccw	Pivotrac
07/17	04:20 PM		0.69	1073.49							180	3	540	move dry	Pivotrac
07/17	11:30 PM										90	3-E		start	Pivotrac
07/19	10:55 AM			1074.92	10 leaf	0.0	29.8	98.6	98.6	98.4	32	3-E	536	3-E	Curtis
07/20	06:05 AM			1078.95							0	3-E	540	into 5	Pivotrac
07/21	01:05 AM			1080.85							330	5	540	into 4	Pivotrac

Table 26: 2017 Field Data, “3 GPM” LEPA Corn, 228 bu/ac, Krienke (continued)

Date	Time	Rainfall (inches)	Irrigation (inches)	Water Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigated	Well (GPM)	Pivot Rotation	Tracking Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet					
07/21	04:20 PM			1082.38							300	4	540	into 3	Pivotrac
07/23	02:55 PM		0.70	1087.04							180	3	540	move dry	Pivotrac
07/24	12:20 AM										90	3-E		start	Pivotrac
07/25	01:12 PM			1088.89	11 leaf	0.0	0.0	96.7	99.4	99.6	28	3-E	531	3-E	Curtis
07/26	05:35 AM			1092.36							0	3-E	540	into 5	Pivotrac
07/27	12:35 AM			1094.26							330	5	540	into 4	Pivotrac
07/28	03:35 PM			1095.76							300	4	540	into 3	Pivotrac
07/29	04:35 PM		0.73	1100.66							180	3	540	move dry	Pivotrac
07/30	09:35 PM										90	3-E		start	Pivotrac
08/01	07:00 AM			1106.30							0	3-E	530	into 5	Pivotrac
08/02	03:45 AM			1108.33							330	5	530	into 4	Pivotrac
08/02	10:35 AM	2.25		1106.78	pollinate	98.3	0.0	58.7	98.6	98.0	316	4	529	3	Curtis
08/02	08:15 PM			1109.95							300	4	530	into 3	Pivotrac
08/04	08:20 PM		0.71	1114.67							180	3	530	intofallow	Pivotrac
08/05	08:20 AM			1115.85							151	fallow	530	reverse	Pivotrac
08/05	09:50 AM										180	3		start	Pivotrac
08/07	10:20 AM		0.71	1120.61							300	3	530	into 4	Pivotrac
08/08	02:35 AM			1122.21							330	4	530	into 5	Pivotrac
08/08	11:00 AM	0.06		1120.67	blister	96.7	0.4	55.0	98.5	97.9	343	4	525	4	Curtis
08/08	10:25 PM			1124.15							360	5	530	into 3-E	Pivotrac
08/11	06:50 AM			1129.59							90	3-E	530	into fallow	Pivotrac
08/11				1129.79							93	fallow	530	move dry	Pivotrac
08/11	01:50 PM										180	3		start	Pivotrac
08/13	02:35 PM		0.72	1134.58							300	3	530	into 4	Pivotrac
08/14	06:45 AM			1136.16							330	4	530	into 5	Pivotrac
08/15	02:30 AM			1138.1							360	5	530	into 3-E	Pivotrac
08/15	10:25 AM	0.69		1136.52	milk	98.2	5.6	54.2	97.7	97.6	12	3-E	530	3-E	Curtis
08/17	11:15 AM			1143.67							90	3-E	530	intofallow	Pivotrac
08/17	12:00 PM			1143.75							92	fallow	530	move dry	Pivotrac
08/17	04:45 PM										180	3		start	Pivotrac
08/18	02:45 AM										204	3		stop	Pivotrac
08/18	11:00 AM										204	3		start	Pivotrac
08/20	01:50 AM		1.07	1150.89							300	3	530	into 4	Pivotrac
08/20	05:45 PM			1152.46							330	4	530	into 5	Pivotrac
08/21	02:00 PM			1154.44							360	5	530	into 3-E	Pivotrac
08/22	10:25 AM	0.76		1151.62	dough	98.0	10.8	51.7	97.4	97.7	32	3-E	519	3-E	Curtis
08/23	11:55 PM			1159.81							90	3-E	500	move dry	Pivotrac
08/25	11:30 AM										180	3		start	Pivotrac
08/27	10:55 PM		0.82	1165.31							300	3	500	into 4	Pivotrac
08/28	06:45 PM			1167.15							330	4	500	into 5	Pivotrac
08/29	03:50 PM			1169.10							360	5	500	into 3-E	Pivotrac
08/31	05:35 AM			1172.59							90	3-E	500	move dry	Pivotrac
08/31	10:35 AM	0.22		1168.54	dough	95.8	11.8	39.0	96.7	97.8	139	fallow		move dry	Curtis
08/31	02:45 PM										180	3		start	Pivotrac
09/03	02:20 AM		0.83	1178.11							300	3	500	into 4	Pivotrac
09/03	10:30 PM			1179.98							330	4	500	into 5	Pivotrac
09/04	06:55 PM			1181.87							360	5	500	into 3-E	Pivotrac
09/06	08:00 AM			1185.31							90	3-E	500	move dry	Pivotrac
09/06	12:10 PM										180	3		start	Pivotrac
09/08	10:15 AM			1186.48	dough	16.3	8.0	17.5	94.7	97.8	272	3	529	3	Curtis
09/08	11:30 PM		0.82	1190.08							300	3	500	into 4	Pivotrac
09/09	07:15 PM			1191.91							330	4	500	into 5	Pivotrac
09/10	03:50 PM			1193.82							360	5	500	into 3-E	Pivotrac
09/11	02:25 PM										54	3-E		stop	Pivotrac
09/11	02:40 PM										54	3-E		start	Pivotrac
09/12	04:55 AM			1197.23							90	3-E	500	move dry	Pivotrac
09/12	09:05 AM										180	3		start	Pivotrac
09/12	12:50 PM			1195.65	dent	89.4	4.9	10.8	92.8	98.0	187	3	541	3	Curtis
09/14	08:05 PM		0.82	1202.69							300	3	500	into 4	Pivotrac
09/15	03:35 PM			1204.50							330	4	500	into 5	Pivotrac
09/16	12:35 PM			1206.44							360	5	500	into 3-E	Pivotrac
09/18	01:30 AM			1209.86							90	3-E	500	move dry	Pivotrac
09/18	05:40 AM										180	3		start	Pivotrac
09/20	02:20 PM	0.15		1214.13	¼ mat line	97.5	2.8	4.6	88.9	97.0	295	3	530	3	C & L
09/20	04:45 PM		0.82	1215.33							300	3	500	into 4	Pivotrac
09/21	12:40 PM			1217.18							330	4	500	into 5	Pivotrac
09/22	10:25 AM			1219.19							360	5	500	stop	Pivotrac
09/28	02:30 PM			1218.41							0			off	Danny
10/04	01:35 PM	2.30		1218.41	½ mat line	98.1	97.9	10.1	89.1	96.3	1			off	Curtis
10/12	10:30 AM	2.48		1218.41	¾ mat line	98.6	98.7	98.6	95.9	97.3	1			off	Curtis
10/18	10:40 AM			1218.41	black layer	98.0	98.2	98.2	97.6	97.2	1			off	Curtis
10/25	10:00 AM			1218.41	black layer	97.7	98.3	98.1	97.7	97.4	332	3-E		off	Pivotrac
10/31	11:25 AM			1218.41	black layer	97.1	97.5	97.4	97.1	96.9	332		off	move dry	Curtis
11/01	08:15 PM										9	move dry	off	start ccw	Pivotrac
11/09	10:50 AM			1218.41							9			off	Curtis
11/12					harvest										Danny
11/15				1218.41	harvested	97.1	97.3	97.2	97.0	97.1	9		off	stop	Curtis
Total		10.48	13.10			0.0	0.0	0.0	0.0	0.0	= 0.0	Soil Moisture			Leon
Net Soil Moisture is 0.00 inches.															
Rainfall (9.49 in), Irrigation (18.03 in), and Net Soil Moisture (0.00 in) is Total Water (23.58 in).															
*Numbers in red are not counted in the Total Rainfall.															

Figure 33: 2017 Gypsum Block Readings, “4 GPM” LEPA Corn, 243 bu/ac, Krienke

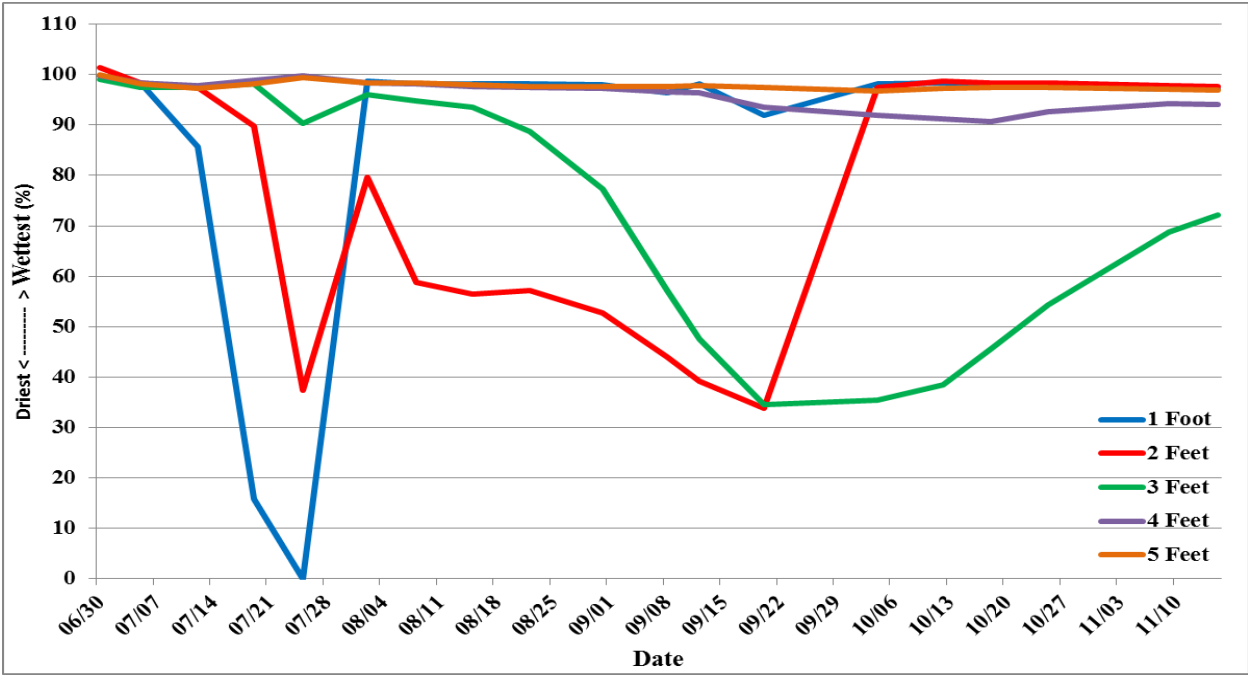


Figure 34: 2017 Growing Season Water Tracking, “4 GPM” LEPA Corn, 243 bu/ac, Krienke

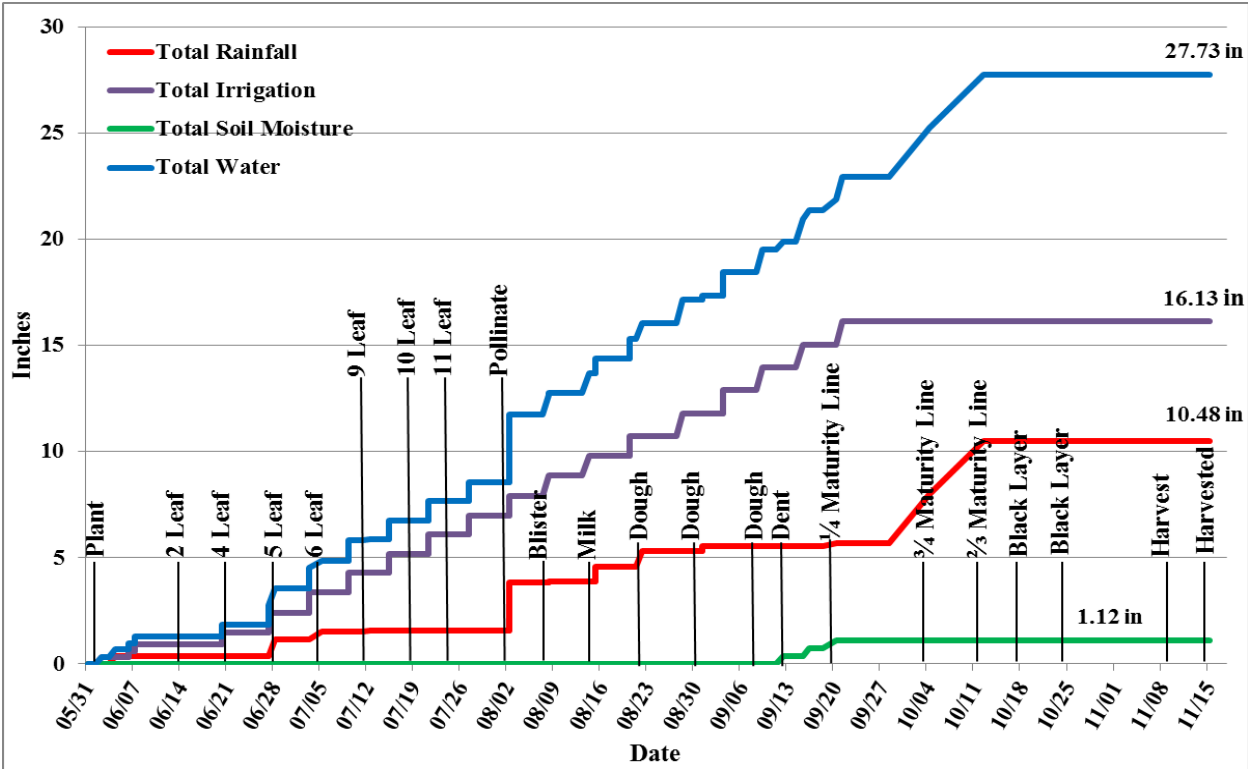


Table 27: 2017 Field Data, “4 GPM” LEPA Corn, 243 bu/ac, Krienke

Date	Time	Rainfall (inches)	Irrigation (inches)	Water Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well (GPM)	Pivot Rotation	Tracking Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet					
04/21		0.91													Pivotrac
04/30		1.19													Pivotrac
05/03		0.78		980.86							234				Pivotrac
05/10	07:15 AM										234				Pivotrac
05/12	10:00 AM										90			move dry	Pivotrac
05/13	12:30 PM			980.86							90			start	Pivotrac
05/14	02:20 PM			982.30							0	3-E	565	stop	Pivotrac
05/16		0.27												stop	Pivotrac
05/19	03:05 PM										0	3-E		start	Pivotrac
05/20	06:10 PM			983.84							90	3-E	600	stop	Pivotrac
05/22		0.32												stop	Pivotrac
05/23		0.26												move dry	Pivotrac
05/31					plant									ccw	Danny
06/01	03:10 PM										90	3-E		start	Pivotrac
06/02	06:15 AM			985.56							0	3-E	565	into 5	
06/02	11:15 AM			986.08							330	5	565	into 4	Pivotrac
06/02	04:20 PM		0.31	986.61							300	4	565	into 3	Pivotrac
06/03	12:35 PM			988.73							180	3	565	stop	Pivotrac
06/04		0.37													Pivotrac
06/05	07:00 PM										180	3		start	Pivotrac
06/06	12:45 PM			990.59							300	3	565	into 4	Pivotrac
06/06	10:55 PM		0.31	991.65							1	4 & 5	565	into 3-E	stop
06/07	08:45 AM										1		565	start	Pivotrac
06/07	10:35 AM			991.74							13	3-E	554	3-E	Curtis
06/07	12:40 PM			992.07							360	3-E	565	into 5	Pivotrac
06/07	05:10 PM			992.54							330	5		into 4	Pivotrac
06/07	09:40 PM		0.28	993.02							300	4	565	into 3	Pivotrac
06/08	04:10 PM			994.95							180	3	565	stop	Pivotrac
06/10	02:50 PM										90			move dry	Pivotrac
06/10	03:10 PM										90	3-E		start	Pivotrac
06/11	08:50 PM			998.03							0	3-E	560	stop	Pivotrac
06/12	05:30 PM										0	3-E		start	Pivotrac
06/13	11:30 PM			1001.14							90	3-E	560	stop	Pivotrac
06/14	10:05 AM			1000.78	2 leaf						90			off	Curtis
06/15	10:15 AM										90	3-E		start	Pivotrac
06/16	06:00 PM			1004.43							0	3-E	560	reverse	Pivotrac
06/18	01:45 AM			1007.72							90	3-E	560	move dry	Pivotrac
06/18	06:55 PM										180	3		start	Pivotrac
06/20	11:35 AM			1011.87							300	3	550	into 4	Pivotrac
06/20	09:20 PM		0.59	1012.86							330	4	550	into 5	Pivotrac
06/21	07:55 AM			1013.93							360	5	550	into 3-E	Pivotrac
06/21	02:35 PM			1013.63	4 leaf						20	3-E	525	3-E	Curtis
06/21	08:50 PM										38	3-E		stop	Pivotrac
06/22	04:30 PM										38	3-E		start	Pivotrac
06/22	07:45 PM										48			stop	Pivotrac
06/22	08:10 PM										48	3-E		start	Pivotrac
06/22	10:30 PM										55	3-E		stop	Pivotrac
06/23	09:10 AM										55	3-E		start	Pivotrac
06/23	09:10 AM			1017.04							90	3-E	550	reverse	Pivotrac
06/26	06:45 AM			1022.91							0	3-E	550	into 5	Pivotrac
06/27	02:20 AM			1024.90							330	5	550	into 4	Pivotrac
06/27	05:45 PM		0.93	1026.47							300	4	550	into 3	Pivotrac
06/28	11:00 AM	0.78		1026.57	5 leaf						257	3	548	3	Curtis
06/29	05:35 PM			1031.34							180	3	550	3	Pivotrac
06/29	10:35 PM			1031.85							90	fallow	550	into 3-E	Pivotrac
06/30	10:30 AM				5 leaf	99.8	101.4	99.0	99.8	100.0					Curtis
07/02	05:35 AM			1037.46							0	3-E	550	into 5	Pivotrac
07/03	12:40 AM			1039.40							330	5	550	into 4	Pivotrac
07/03	04:15 PM		0.94	1040.99							300	4	550	into 3	Pivotrac
07/05	11:40 AM	0.36		1043.37	6 leaf	98.4	98.4	97.5	98.3	98.1	189	3	550	3	Curtis
07/05	03:30 PM			1045.80							180	3	550	move dry	Pivotrac
07/05	11:40 PM										90	3-E		start	Pivotrac
07/08	09:10 AM			1051.65							0	3-E	550	into 5	Pivotrac
07/09	04:00 AM			1053.57							330	5	550	into 4	Pivotrac
07/09	07:25 PM		0.93	1055.14							300	4	550	into 3	Pivotrac
07/11	06:10 PM			1059.90							180	3	550	move dry	Pivotrac
07/11	11:15 PM										90	3-E		start	Pivotrac
07/12	09:30 AM	0.06		1058.77	9 leaf	85.6	97.4	97.5	97.8	97.3	75	3-E	546	3-E	Curtis
07/14	06:40 AM			1065.45							0	3-E	540	into 5	Pivotrac
07/15	01:30 AM			1067.33							330	5	540	into 4	Pivotrac
07/15	04:45 PM		0.90	1068.85							300	4	540	into 3	Pivotrac
07/16	06:30 PM										233	3		stop	Pivotrac
07/16	07:40 PM										233	3		start	Pivotrac
07/17	04:20 PM			1073.49							180	3	540	move dry	Pivotrac
07/17	11:30 PM										90	3-E		start	Pivotrac
07/19	10:55 AM			1074.92	10 leaf	15.8	89.7	98.1	98.8	98.2	32	3-E	536	3-E	Curtis
07/20	06:05 AM			1078.95							0	3-E	540	into 5	Pivotrac

Table 27: 2017 Field Data, “4 GPM” LEPA Corn, 243 bu/ac, Krienke (continued)

Date	Time	Rainfall (inches)	Irrigation (inches)	Water Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well (GPM)	Pivot Rotation	Tracking Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet					
07/21	01:05 AM			1080.85							330	5	540	into 4	Pivotrac
07/21	04:20 PM		0.90	1082.38							300	4	540	into 3	Pivotrac
07/23	02:55 PM			1087.04							180	3	540	move dry	Pivotrac
07/24	12:20 AM										90	3-E		start	Pivotrac
07/25	01:12 PM			1088.89	11 leaf	0	37.4	90.3	99.7	99.4	28	3-E	531	3-E	Curtis
07/26	05:35 AM			1092.36							0	3-E	540	into 5	Pivotrac
07/27	12:35 AM			1094.26							330	5	540	into 4	Pivotrac
07/27	03:35 PM		0.88	1095.76							300	4	540	into 3	Pivotrac
07/29	04:35 PM			1100.66							180	3	540	move dry	Pivotrac
07/29	09:35 PM										90	3-E		start	Pivotrac
08/01	07:00 AM			1106.30							0	3-E	530	into 5	Pivotrac
08/02	03:45 AM			1108.33							330	5	530	into 4	Pivotrac
08/02	10:35 AM	2.25		1106.78	pollinate	98.6	79.7	96.0	98.4	98.4	316	4	529	3	Curtis
08/02	08:15 PM		0.95	1109.95							300	4	530	into 3	Pivotrac
08/04	08:20 PM			1114.67							180	3	530	intofallow	Pivotrac
08/05	08:20 AM			1115.85							151	fallow	530	reverse	Pivotrac
08/05	09:50 AM										180	3		start	Pivotrac
08/07	10:20 AM			1120.61							300	3	530	into 4	Pivotrac
08/08	02:35 AM		0.94	1122.21							330	4	530	into 5	Pivotrac
08/08	11:00 AM	0.06		1120.67	blister	98.1	58.7	94.8	98.1	98.3	343	4	525	4	Curtis
08/08	10:25 PM			1124.15							360	5	530	into 3-E	Pivotrac
08/11	06:50 AM			1129.59							90	3-E	530	intofallow	Pivotrac
08/11				1129.79							93	fallow	530	move dry	Pivotrac
08/11	01:50 PM										180	3		start	Pivotrac
08/13	02:35 PM			1134.58							300	3	530	into 4	Pivotrac
08/14	06:45 AM		0.94	1136.16							330	4	530	into 5	Pivotrac
08/15	02:30 AM			1138.1							360	5	530	into 3-E	Pivotrac
08/15	10:25 AM	0.69		1136.52	milk	98.1	56.5	93.6	97.7	98.0	12	3-E	530	3-E	Curtis
08/17	11:15 AM			1143.67							90	3-E	530	intofallow	Pivotrac
08/17	12:00 PM			1143.75							92	fallow	530	move dry	Pivotrac
08/17	04:45 PM										180	3		start	Pivotrac
08/18	02:45 AM										204	3		stop	Pivotrac
08/18	11:00 AM										204	3		start	Pivotrac
08/20	01:50 AM			1150.89							300	3	530	into 4	Pivotrac
08/20	05:45 PM		0.92	1152.46							330	4	530	into 5	Pivotrac
08/21	02:00 PM			1154.44							360	5	530	into 3-E	Pivotrac
08/22	10:25 AM	0.76		1151.62	dough	98.1	57.2	88.7	97.4	97.7	32	3-E	519	3-E	Curtis
08/23	11:55 PM			1159.81							90	3-E	500	move dry	Pivotrac
08/25	11:30 AM										180	3		start	Pivotrac
08/27	10:55 PM			1165.31							300	3	500	into 4	Pivotrac
08/28	06:45 PM		1.08	1167.15							330	4	500	into 5	Pivotrac
08/29	03:50 PM			1169.10							360	5	500	into 3-E	Pivotrac
08/31	05:35 AM			1172.59							90	3-E	500	move dry	Pivotrac
08/31	10:35 AM	0.22		1168.54	dough	97.9	52.7	77.3	97.2	97.6	139	fallow		move dry	Curtis
08/31	02:45 PM										180	3		start	Pivotrac
09/03	02:20 AM			1178.11							300	3	500	into 4	Pivotrac
09/03	10:30 PM		1.10	1179.98							330	4	500	into 5	Pivotrac
09/04	06:55 PM			1181.87							360	5	500	into 3-E	Pivotrac
09/06	08:00 AM			1185.31							90	3-E	500	move dry	Pivotrac
09/06	12:10 PM										180	3		start	Pivotrac
09/08	10:15 AM			1186.48	dough	96.4	44.0	57.1	96.6	97.6	272	3	529	3	Curtis
09/08	11:30 PM			1190.08							300	3	500	into 4	Pivotrac
09/09	07:15 PM		1.08	1191.91							330	4	500	into 5	Pivotrac
09/10	03:50 PM			1193.82							360	5	500	into 3-E	Pivotrac
09/11	02:25 PM										54	3-E		stop	Pivotrac
09/11	02:40 PM										54	3-E		start	Pivotrac
09/12	04:55 AM			1197.23							90	3-E	500	move dry	Pivotrac
09/12	09:05 AM										180	3		start	Pivotrac
09/12	12:50 PM			1195.65	dent	98.2	39.1	47.6	96.3	97.8	187	3	541	3	Curtis
09/14	08:05 PM			1202.69							300	3	500	into 4	Pivotrac
09/15	03:35 PM		1.06	1204.50							330	4	500	into 5	Pivotrac
09/16	12:35 PM			1206.44							360	5	500	into 3-E	Pivotrac
09/18	01:30 AM			1209.86							90	3-E	500	move dry	Pivotrac
09/18	05:40 AM										180	3		start	Pivotrac
09/20	02:20 PM	0.15		1214.13	¼ mat line	92.0	33.9	34.6	93.6	97.5	295	3	530	3	C & L
09/20	04:45 PM			1215.33							300	3	500	into 4	Pivotrac
09/21	12:40 PM		1.09	1217.18							330	4	500	into 5	Pivotrac
09/22	10:25 AM			1219.19							360	5	500	stop	Pivotrac
09/28	02:30 PM			1218.41							0			off	Danny
10/04	01:35 PM	2.30		1218.41	¾ mat line	98.2	97.4	35.4	91.9	96.7	1			off	Curtis
10/12	10:30 AM	2.48		1218.41	¾ mat line	98.4	98.6	38.5	91.2	97.2	1			off	Curtis
10/18	10:40 AM			1218.41	black layer	98.1	98.4	45.6	90.6	97.4	1			off	Curtis
10/25	10:00 AM			1218.41	black layer	97.8	98.3	54.4	92.7	97.4	332	3-E		off	Curtis
10/31	11:25 AM			1218.41							332			off	Curtis
10/31	08:15 AM													move dry	Pivotrac
11/09	10:50 AM			1218.41	black layer	97.0	97.8	68.7	94.2	97.1	9			off	Curtis
11/09					harvest										Danny
11/15	10:25 AM			1218.41	harvested	97.0	97.6	72.1	94.1	96.9				off	Curtis
Total		10.48	16.13	1218.41		0.00	0.00	0.82	0.30	0.00	= 1.12"	Soil Moisture			Leon

Net soil moisture is 1.12 inches.

Rainfall (10.48 in), irrigation (16.13 in), and net soil moisture (1.12 in) is total water (27.73 in).

*Numbers in red are not counted in the total rainfall.

Figure 35: 2017 Gypsum Block Readings, “5 GPM” LEPA Corn, 244 bu/ac, Krienke

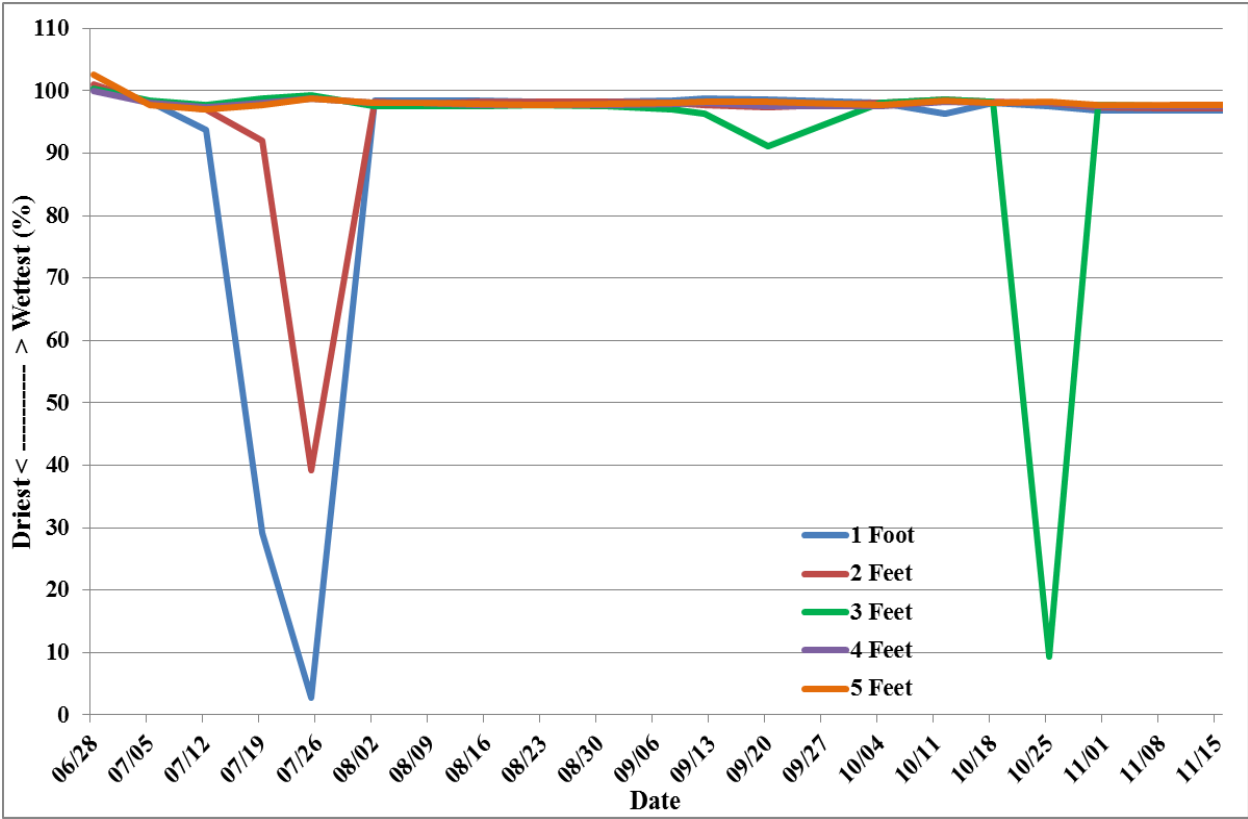


Figure 36: 2017 Growing Season Water Tracking, “5 GPM” LEPA Corn, 244 bu/ac, Krienke

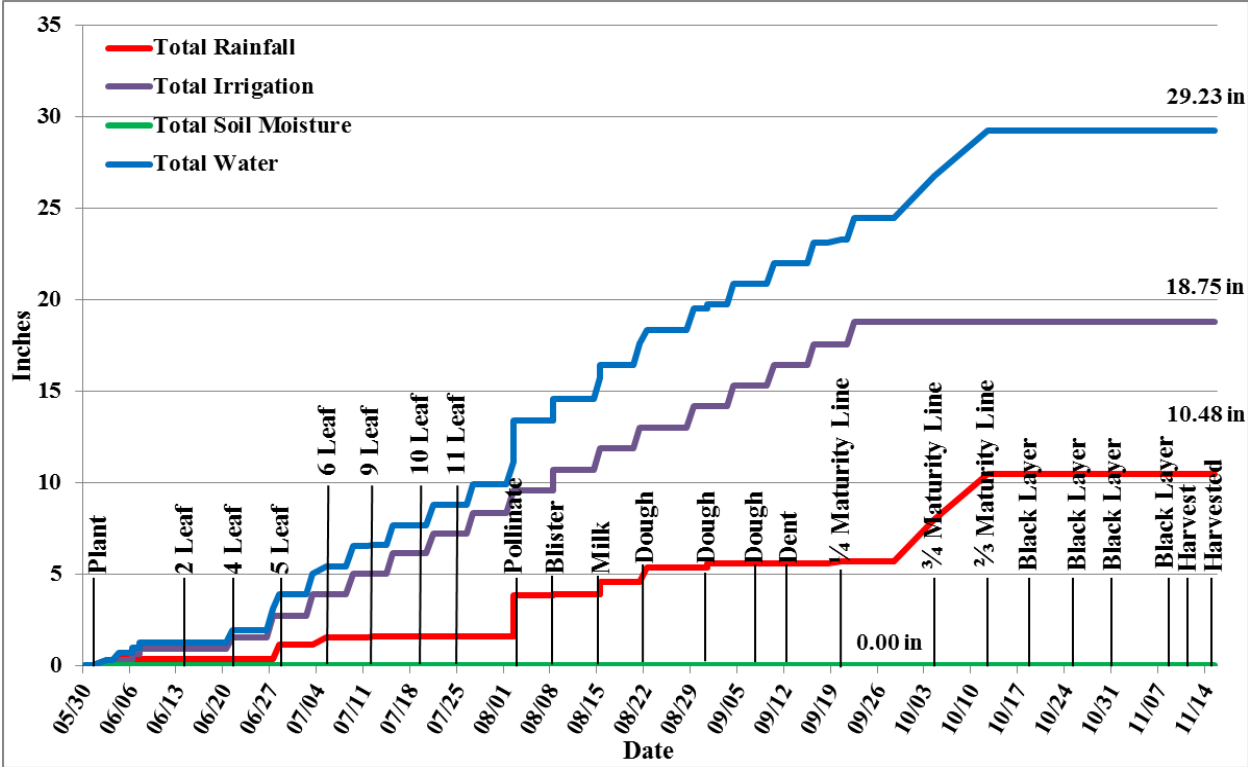


Table 28: 2017 Field Data, “5 GPM” LEPA Corn, 244 bu/ac, Krienke

Date	Time	Rainfall (inches)	Irrigation (inches)	Water Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well (GPM)	Pivot Rotation	Tracking Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet					
04/21		0.91													Pivotrac
04/30		1.19													Pivotrac
05/03		0.78		980.86							234				Pivotrac
05/10	07:15 AM										234				Pivotrac
05/12	10:00 AM										90			move dry	Pivotrac
05/13	12:30 PM			980.86							90			start	Pivotrac
05/14	02:20 PM			982.30							0	3-E	565	stop	Pivotrac
05/16		0.27												stop	Pivotrac
05/19	03:05 PM										0	3-E		start	Pivotrac
05/20	06:10 PM			983.84							90	3-E	600	stop	Pivotrac
05/22		0.32												stop	Pivotrac
05/23		0.26												move dry	Pivotrac
05/31					plant										Danny
06/01	03:10 PM										90	3-E		start	Pivotrac
06/02	06:15 AM			985.56							0	3-E	565	into 5	
06/02	11:15 AM		0.31	986.08							330	5	565	into 4	Pivotrac
06/02	04:20 PM			986.61							300	4	565	into 3	Pivotrac
06/03	12:35 PM			988.73							180	3	565	stop	Pivotrac
06/04		0.37													Pivotrac
06/05	07:00 PM										180	3		start	Pivotrac
06/06	12:45 PM			990.59							300	3	565	into 4	Pivotrac
06/06	10:55 PM		0.31	991.65							1	4 & 5	565	into 3-E	stop
06/07	08:45 AM										1		565	start	Pivotrac
06/07	10:35 AM			991.74							13	3-E	554	3-E	Curtis
06/07	12:40 PM			992.07							360	3-E	565	into 5	Pivotrac
06/07	05:10 PM		0.28	992.54							330	5		into 4	Pivotrac
06/07	09:40 PM			993.02							300	4	565	into 3	Pivotrac
06/08	04:10 PM			994.95							180	3	565	stop	Pivotrac
06/10	02:50 PM										90			move dry	Pivotrac
06/10	03:10 PM										90	3-E		start	Pivotrac
06/11	08:50 PM			998.03							0	3-E	560	stop	Pivotrac
06/12	05:30 PM										0	3-E		start	Pivotrac
06/13	11:30 PM			1001.14							90	3-E	560	stop	Pivotrac
06/14	10:05 AM			1000.78	2 leaf						90			off	Curtis
06/15	10:15 AM										90	3-E		start ccw	Pivotrac
06/16	06:00 PM			1004.43							0	3-E	560	reverse	Pivotrac
06/18	01:45 AM			1007.72							90	3-E	560	move dry	Pivotrac
06/18	06:55 PM										180	3		start cw	Pivotrac
06/20	11:35 AM			1011.87							300	3	550	into 4	Pivotrac
06/20	09:20 PM			1012.86							330	4	550	into 5	Pivotrac
06/21	07:55 AM		0.64	1013.93							360	5	550	into 3-E	Pivotrac
06/21	02:35 PM			1013.63	4 leaf						20	3-E	525	3-E	Curtis
06/21	08:50 PM										38	3-E		stop	Pivotrac
06/22	04:30 PM										38	3-E		start cw	Pivotrac
06/22	07:45 PM										48			stop	Pivotrac
06/22	08:10 PM										48	3-E		start cw	Pivotrac
06/22	10:30 PM										55	3-E		stop	Pivotrac
06/23	09:10 AM										55	3-E		start cw	Pivotrac
06/23	09:10 AM			1017.04							90	3-E	550	reverse	Pivotrac
06/26	06:45 AM			1022.91							0	3-E	550	into 5 ccw	Pivotrac
06/27	02:20 AM		1.18	1024.90							330	5	550	into 4	Pivotrac
06/27	05:45 PM			1026.47							300	4	550	into 3	Pivotrac
06/28	11:00 AM	0.78		1026.57	5 leaf	100.5	101.1	100.3	99.9	102.5	257	3	548	3	Curtis
06/29	05:35 PM			1031.34							180	3	550	3	Pivotrac
06/29	10:35 PM			1031.85							90	fallow	550	into 3-E	Pivotrac
07/02	05:35 AM			1037.46							0	3-E	550	into 5	Pivotrac
07/03	12:40 AM		1.15	1039.40							330	5	550	into 4	Pivotrac
07/03	04:15 PM			1040.99							300	4	550	into 3	Pivotrac
07/05	11:40 AM	0.36		1043.37	6 leaf	98.3	98.1	98.4	98.1	97.7	189	3	550	3	Curtis
07/05	03:30 PM			1045.80							180	3	550	move dry	Pivotrac
07/05	11:40 PM										90	3-E		start ccw	Pivotrac
07/08	09:10 AM			1051.65							0	3-E	550	into 5	Pivotrac
07/09	04:00 AM		1.13	1053.57							330	5	550	into 4	Pivotrac
07/09	07:25 PM			1055.14							300	4	550	into 3	Pivotrac
07/11	06:10 PM			1059.90							180	3	550	move dry	Pivotrac
07/11	11:15 PM										90	3-E		start ccw	Pivotrac
07/12	09:30 AM	0.06		1058.77	9 leaf	93.7	97.1	97.8	97.3	97.0	75	3-E	546	3-E	Curtis
07/14	06:40 AM			1065.45							0	3-E	540	into 5	Pivotrac
07/15	01:30 AM		1.11	1067.33							330	5	540	into 4	Pivotrac
07/15	04:45 PM			1068.85							300	4	540	into 3	Pivotrac
07/16	06:30 PM										233	3		stop	Pivotrac
07/16	07:40 PM										233	3		start ccw	Pivotrac
07/17	04:20 PM			1073.49							180	3	540	move dry	Pivotrac
07/17	11:30 PM										90	3-E		start	Pivotrac
07/19	10:55 AM			1074.92	10 leaf	29.1	92.0	98.7	98.0	97.8	32	3-E	536	3-E	Curtis
07/20	06:05 AM			1078.95							0	3-E	540	into 5	Pivotrac
07/21	01:05 AM		1.12	1080.85							330	5	540	into 4	Pivotrac

Table 28: 2017 Field Data, “5 GPM” LEPA Corn, 244 bu/ac, Krienke (continued)

Date	Time	Rainfall (inches)	Irrigation (inches)	Water Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well (GPM)	Pivot Rotation	Tracking Source
						1 Foot	2 Feet	3 Feet	4 Feet	5 Feet					
07/21	04:20 PM			1082.38							300	4	540	into 3	Pivotrac
07/23	02:55 PM			1087.04							180	3	540	move dry	Pivotrac
07/24	12:20 AM										90	3-E		start ccw	Pivotrac
07/25	01:12 PM			1088.89	11 leaf	2.8	39.2	99.2	98.8	98.8	28	3-E	531	3-E	Curtis
07/26	05:35 AM			1092.36							0	3-E	540	into 5	Pivotrac
07/27	12:35 AM		1.12	1094.26							330	5	540	into 4	Pivotrac
07/27	03:35 PM			1095.76							300	4	540	into 3	Pivotrac
07/29	04:35 PM			1100.66							180	3	540	move dry	Pivotrac
07/29	09:35 PM										90	3-E		start ccw	Pivotrac
08/01	07:00 AM			1106.30							0	3-E	530	into 5	Pivotrac
08/02	03:45 AM		1.20	1108.33							330	5	530	into 4	Pivotrac
08/02	10:35 AM	2.25		1106.78	pollinate	98.4	98.3	97.5	98.1	98.1	316	4	529	3	Curtis
08/02	08:15 PM			1109.95							300	4	530	into 3	Pivotrac
08/04	08:20 PM			1114.67							180	3	530	into fallow	Pivotrac
08/05	08:20 AM			1115.85							151	fallow	530	reverse	Pivotrac
08/05	09:50 AM										180	3		start cw	Pivotrac
08/07	10:20 AM			1120.61							300	3	530	into 4	Pivotrac
08/08	02:35 AM			1122.21							330	4	530	into 5	Pivotrac
08/08	11:00 AM	0.06		1120.67	blister	98.5	97.9	97.5	98.0	98.0	343	4	525	5	Curtis
08/08	10:25 PM		1.15	1124.15							360	5	530	into 3-E	Pivotrac
08/11	06:50 AM			1129.59							90	3-E	530	into fallow	Pivotrac
08/11				1129.79							93	fallow	530	move dry	Pivotrac
08/11	01:50 PM										180	3		start cw	Pivotrac
08/13	02:35 PM			1134.58							300	3	530	into 4	Pivotrac
08/14	06:45 AM			1136.16							330	4	530	into 5	Pivotrac
08/15	02:30 AM		1.14	1138.1							360	5	530	into 3-E	Pivotrac
08/15	10:25 AM	0.69		1136.52	milk	98.4	98.3	97.5	97.8	97.9	12	3-E	530	3-E	Curtis
08/17	11:15 AM			1143.67							90	3-E	530	into fallow	Pivotrac
08/17	12:00 PM			1143.75							92	fallow	530	move dry	Pivotrac
08/17	04:45 PM										180	3		start cw	Pivotrac
08/18	02:45 AM										204	3		stop	Pivotrac
08/18	11:00 AM										204	3		start	Pivotrac
08/20	01:50 AM			1150.89							300	3	530	into 4	Pivotrac
08/20	05:45 PM			1152.46							330	4	530	into 5	Pivotrac
08/21	02:00 PM		1.17	1154.44							360	5	530	into 3-E	Pivotrac
08/22	10:25 AM	0.76		1151.62	dough	98.3	98.2	97.7	97.8	97.8	32	3-E	519	3-E	Curtis
08/23	11:55 PM			1159.81							90	3-E	500	move dry	Pivotrac
08/25	11:30 AM										180	3		start	Pivotrac
08/27	10:55 PM			1165.31							300	3	500	into 4	Pivotrac
08/28	06:45 PM			1167.15							330	4	500	into 5	Pivotrac
08/29	03:50 PM		1.15	1169.10							360	5	500	into 3-E	Pivotrac
08/31	05:35 AM			1172.59							90	3-E	500	move dry	Pivotrac
08/31	10:35 AM	0.22		1168.54	dough	98.3	98.2	97.6	97.8	97.9	139	fallow		move dry	Curtis
08/31	02:45 PM										180	3		start cw	Pivotrac
09/03	02:20 AM			1178.11							300	3	500	into 4	Pivotrac
09/03	10:30 PM			1179.98							330	4	500	into 5	Pivotrac
09/04	06:55 PM		1.12	1181.87							360	5	500	into 3-E	Pivotrac
09/06	08:00 AM			1185.31							90	3-E	500	move dry	Pivotrac
09/06	12:10 PM										180	3		start cw	Pivotrac
09/08	10:15 AM			1186.48	dough	98.4	98.1	97.0	97.9	98.1	272	3	529	3	Curtis
09/08	11:30 PM			1190.08							300	3	500	into 4	Pivotrac
09/09	07:15 PM			1191.91							330	4	500	into 5	Pivotrac
09/10	03:50 PM		1.13	1193.82							360	5	500	into 3-E	Pivotrac
09/11	02:25 PM										54	3-E		stop	Pivotrac
09/11	02:40 PM										54	3-E		start	Pivotrac
09/12	04:55 AM			1197.23							90	3-E	500	move dry	Pivotrac
09/12	09:05 AM										180	3		start cw	Pivotrac
09/12	12:50 PM			1195.65	dent	98.7	97.8	96.3	98.0	98.3	187	3	541	3	Curtis
09/14	08:05 PM			1202.69							300	3	500	into 4	Pivotrac
09/15	03:35 PM			1204.50							330	4	500	into 5	Pivotrac
09/16	12:35 PM		1.15	1206.44							360	5	500	into 3-E	Pivotrac
09/18	01:30 AM			1209.86							90	3-E	500	move dry	Pivotrac
09/18	05:40 AM										180	3		start cw	Pivotrac
09/20	02:20 PM	0.15		1214.13	¼ mat line	98.6	97.4	91.2	97.6	98.2	295	3	530	3	C & L
09/20	04:45 PM			1215.33							300	3	500	into 4	Pivotrac
09/21	12:40 PM			1217.18							330	4	500	into 5	Pivotrac
09/22	10:25 AM		1.19	1219.19							360	5	500	stop	Pivotrac
09/28	02:30 PM			1218.41							0			off	Danny
10/04	01:35 PM	2.30		1218.41	¼ mat line	98.0	98.0	98.0	97.6	97.7	1			off	Curtis
10/12	10:30 AM	2.48		1218.41	½ mat line	96.4	98.6	98.6	98.3	98.4	1			off	Curtis
10/18	10:40 AM			1218.41	black layer	98.0	98.2	98.3	98.0	98.1	1			off	Curtis
10/25	10:00 AM			1218.41	black layer	97.5	98.0	9.3	98.1	98.2	332			off	Curtis
10/31	11:25 AM			1218.41	black layer	96.9	97.4	97.7	97.6	97.7	332			off	Curtis
10/31	08:15 PM										9	move dry			Pivotrac
11/09	10:50 AM			1218.41	black layer	96.8	97.2	97.6	97.5	97.7	9			off	Curtis
11/12					harvest										Danny
11/15	10:25 AM			1218.41	harvested	97.0	97.2	97.5	97.4	97.7				off	Curtis
Total		10.48	18.75	1218.45		0.0	0.0	0.0	0.0	0.0	= 0.0	Soil Moisture	533		Leon
Net soil moisture is 0.00 inches.															
Rainfall (10.48 in), Irrigation (18.75 in), and Net Soil Moisture (0.00 in) is Total Water (29.23 in).															
*Numbers in red are not counted in the total rainfall.															

2017 Harvest Results LEPA Corn, Krienke

The 3 GPM-Early field produced a 221 bushel per acre corn yield. Irrigation totaled 18.03 inches. Production in the 3 GPM field was 228 bushels per acre. Seasonal irrigation totaled 13.10 inches. Corn yield was 243 bushels per acre for the 4 GPM field. Irrigation totaled 16.13 inches. Production in the 5 GPM field was 244 bushels per acre. Total irrigation was 18.75 inches. There was no pre-season irrigation.

The 3 GPM-Early field produced 7 less bushels per acre than the 3 GPM field and irrigation was 4.93 inches more. The 4 GPM field produced 15 more bushels per acre than the 3 GPM with 3.03 more inches of irrigation. Production in the 5 GPM field was 16 more bushels per acre than the 3 GPM with 5.65 more inches of irrigation. The 5 GPM yield was 1 more bushel per acre than from the 4 GPM field with 2.62 additional inches of irrigation.

Corn production was 12.25 bushels (686 lb.) per inch of irrigation in the 3 GPM-Early field compared to 17.40 bushels (974 lb.) in the 3 GPM, 15.06 (843 lb.) in the 4 GPM and 13.01 bushels (729 lb.) from the 5 GPM field. Production from each inch of irrigation, rainfall and net soil water that totaled 27.52 inches was 8.03 bushels (450 lb.) per acre in the 3 GPM-Early field. Irrigation, rainfall and net soil water totaled 23.58 inches in the “3 GPM” field where production was 9.67 bushels (541 lb.) per inch. In the 4 GPM field, irrigation, rainfall and net soil water totaled 27.73 inches where production was 8.76 bushels (491 lb.) per inch of total water. Irrigation, rainfall and net soil water totaled 29.23 inches in the 5 GPM field where production was 8.34 bushels (467 lb.) per inch.

Crop production costs were \$37.12 per acre more for the 3-Early GPM field than for the 3 GPM from increased irrigation and seed expenses. At \$3.63 per bushel, the 7 bushels per acre increased corn yield in the 3 GPM field amounts to \$ 24.41 more per acre than from the 3 GPM-Early field. The 3 GPM field’s net gain is \$62.53 per acre with 4.93 inches less irrigation used compared to production from the 3 GPM-Early field. At \$3.63 per bushel, the 22 bushel per acre increased yield from the 4 GPM field compared to the 3 GPM-Early amounts to \$79.86. Crop production costs were \$3.88 more for the 3 GPM-Early field. The 4 GPM field’s net gain compared to the 3 GPM-Early field is \$83.74 per acre with 1.90 less inches of irrigation. Value of the 23 additional bushels produced in the 5 GPM field compared to the 3 GPM-Early field is \$83.49. Production costs were \$13.34 more for the 5 GPM field than the 3 GPM-Early. Net gain for the 5 GPM field is \$70.15 per acre with 0.72 inches more irrigation.

Net return from the 3 GPM-Early planted field was \$370.72 per acre compared to \$433.25 for the 3 GPM field, \$454.45 per acre for the 4 GPM field, and \$440.87 from the 5 GPM field. Net return from each inch of irrigation was \$20.56 per acre for the 3 GPM-Early field compared to \$33.07 from the 3 GPM field, \$28.17 for the 4 GPM, and \$23.51 for the 5 GPM field. A summary of the demonstration results are shown in Table 29 and Appendix B.

Table 29: 2017 Demonstration Results, LEPA Corn, Krienke

GPM	Irrigation (in)	Total Water (in)	Production		Gross Crop Value @ \$3.63/bu		
			bu/ac	lb/ac-in of Irrigation	per acre (\$)	Acre-inch of Irrigation	Acre-in of Total Water
3-E	18.03	27.52 ^a	221	686	802.22	44.49	29.15
3	13.10	23.58 ^b	228	974	827.64	63.18	35.10
4	16.13	27.73 ^c	243	843	882.00	54.68	31.81
5	18.75	29.23 ^d	244	729	885.72	47.23	30.30

^aIncludes 0.00 inches of soil water removed within 5 feet of soil. Net water is rainfall and irrigation.

^bIncludes 0.00 inches of soil water removed within 5 feet of soil. Net water is rainfall and irrigation.

^cIncludes 1.12 inches of net soil water removed within 5 feet of soil, plus rainfall and irrigation.

^dIncludes 0.00 inches of net soil water removed within 5 feet of soil. Net water is rainfall and irrigation.

Harold Grall's 2017 PMDI Irrigation Systems Corn Demonstration

2017 Planting and Crop Information, PMDI Irrigation Systems, Corn, Grall

Harold Grall strip tilled and planted 120 acres of corn in the SW ¼ of section 414 for his “PMDI Irrigation Systems” demonstration. The T-L center pivot was equipped with T-L PMDI drag lines prior to the 2015 growing season. PMDI drag lines were installed 30 inches apart on all spans of the quarter mile center pivot, except span 1 where Senninger LDN LESA applicators remain. The PMDI field was planted to Pioneer P1151AMX hybrid. Seeding rate for the PMDI field was 29,270 seeds per acre. Center pivot tracking was by Pivotrac. Center pivot travel speed was approximately a 7 day circle that applied about 1.00 inch each revolution. Seasonal water meter readings averaged 338 GPM. Periodic, timely rainfall helped provide good in-season soil water levels in producing the crop. Planting and crop information for the “Grall PMDI Irrigation System” demonstration is in Table 30 below.

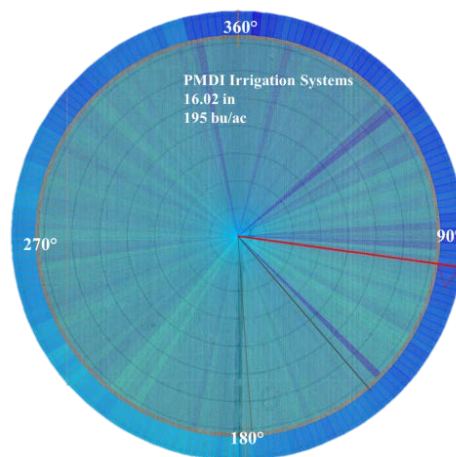
Table 30: 2017 Planting and Crop Information, PMDI Irrigation Systems, Harold Grall

PMDI Irrigation Systems				
Planted	May 30	Harvested	November 4	
Hybrid	Pioneer P1151AMX	Seeding Rate	29,270	
Row Width	30 inches	Tillage	Strip Till	
No. Acres	120.00	GPM/Acre	2.81	
Total Water	28.71 inches	Soil Type	Sherm Silty Clay Loam	
Irrigation	16.02 inches	Insecticide	Capture, Comite	
Herbicide	Verdict, Strut, Roundup	Fertilizer	238-78-0-0	
Herbicide	Balance Flexx, Atrazine	Fungicide	Satori, Aproach	

2017 Irrigation Intensity Map, PMDI Irrigation Systems, Corn, Grall.

Corn was located from 0 to 360 degrees in the circle. Irrigation capacity was 2.81 GPM/acre. Seasonal irrigation totaled 16.02 inches per acre with a yield of 195 bushels per acre. VRI variable rate travel speed control was not available for the 3, 4, 5 GPM Project at this location. Water Intensity Map (courtesy of Pivotrac) was developed for the “3-4-5 GPM” project.

Figure 37: 2017 Irrigation Intensity Map, PMDI Irrigation Systems, Corn, Grall



2017 “PMDI Irrigation Systems” Demonstration Site, Corn, Grall

Rainfall in April and May established a full profile of soil water beginning the season. Soil water was good at 1, 2, 3, 4, and 5 feet at planting. Soil moisture sensors showed the crop had good soil water during the growing season. Weekly gypsum block readings indicated good crop root growth and limited water use from 2 and 3 feet and basically, no water use from 4 and 5 feet producing the crop. Sensors showed the crop used all water stored in the 1 foot root zone plus rainfall in October finishing the crop. Timely, beneficial rainfall in August and October contributed to producing the crop. Rainfall from planting until grain maturity black layer totaled 10.64 inches and was more than normal in August for this location. The crop was produced in Sherm silty clay loam soil that can store approximately 2.00 inches of available water per foot for potential crop use.

Table 31: 2017 Monthly Rainfall Data, PMDI Irrigation Systems, Corn, Grall

GPM	June (in)	July (in)	August (in)	September (in)	October (in)	Total (in)
PMDI	0.25	0.31	8.23	0.46	1.39	10.64

2017 Growing Season Water Tracking, PMDI Irrigation Systems, Corn, Grall

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 five gypsum block soil moisture sensors was installed at 1, 2, 3, 4, and 5 feet, and an AquaSpy™ soil moisture probe was installed down to five feet in the root zone at one location to monitor soil water levels in the “PMDI Irrigation System” demonstration field. Both the gypsum block sensors and the soil probe were installed in close proximity to each other in the field. Gypsum blocks, water meter, rain gauges, and crop growth were read, recorded, and utilized weekly by district personnel. The AquaSpy® probe was installed following crop emergence. A 24/7 Aquaspy probe website showed soil moisture at four inch increments to 48 inches and monitored plant root growth. The website listed all Aquaspy soil probes in the “3-4-5 GPM” project and was available to all cooperators and district personnel. Another 24/7 Pivotrak website tracked each center pivot system and monitored and controlled irrigation. Both the cooperating grower and district “3-4-5 GPM” Project Leader collectively monitored, controlled, and managed irrigation from the Pivotrak website.

Following this paragraph, a series of graphs and tables shows weekly gypsum block readings for the season; growing season water, including rainfall, irrigation, and soil moisture at various growth stages; and the order of irrigation and rainfall events for the T-L PMDI Irrigation System demonstration field. Finally, a form describes the protocols for each field. “Total Water,” as shown on the graph for growing season water, is the sum of seasonal irrigation, rainfall, and net soil water

Figure 38: 2017 Gypsum Block Readings, “PMDI Irrigation Systems”, 195 bu/ac, Grall

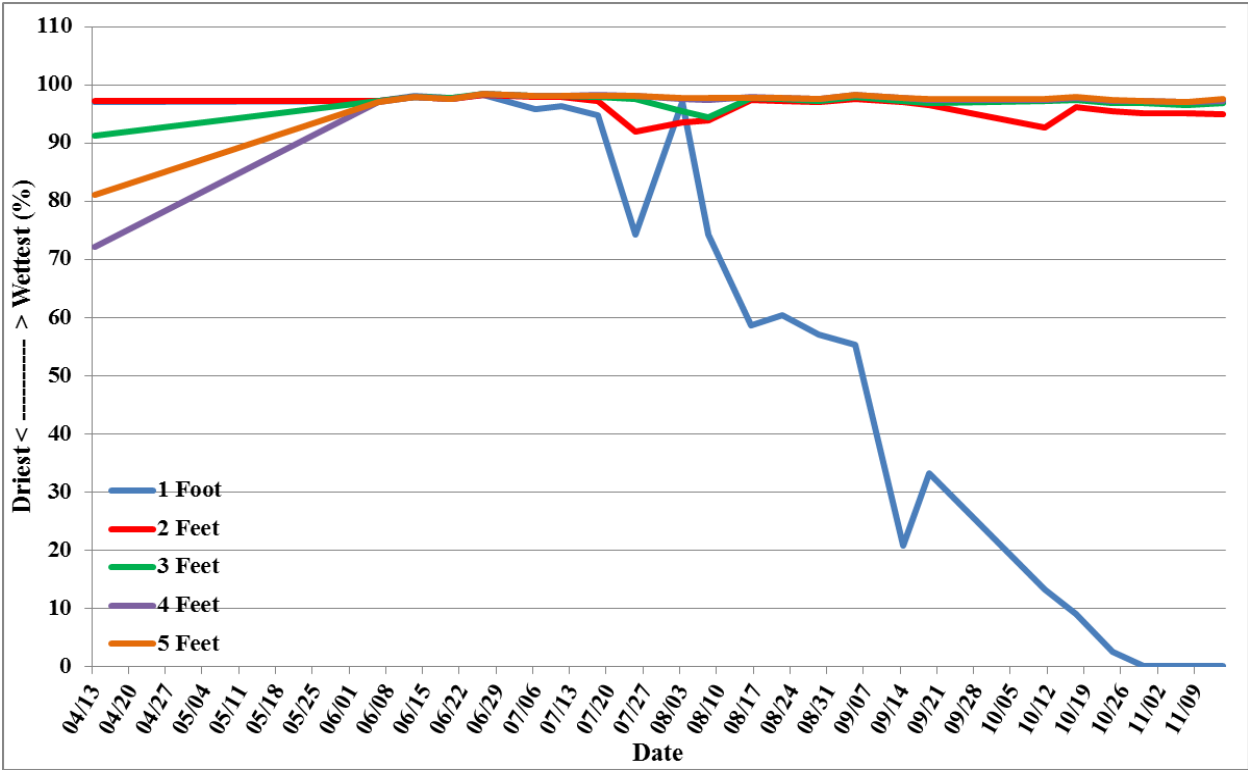


Figure 39: 2017 Growing Season Water Tracking, “PMDI Irrigation Systems”, 195 bu/ac, Grall

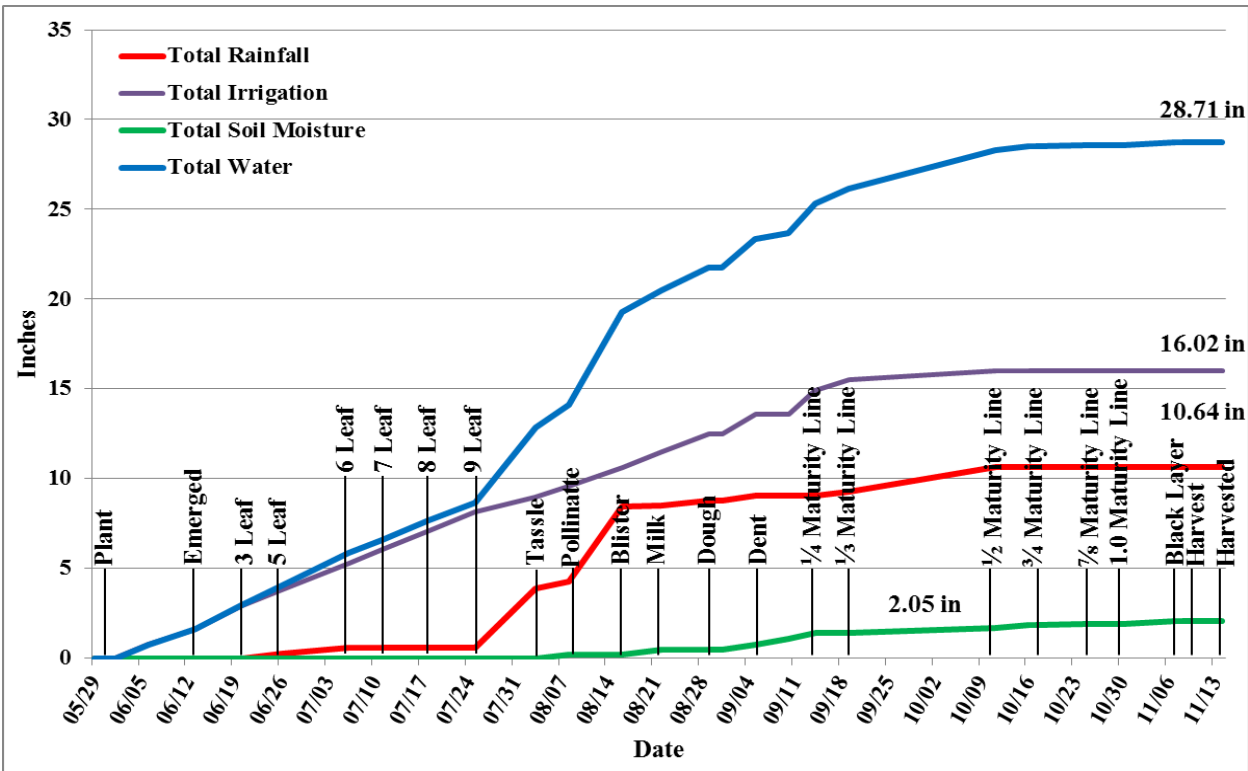


Table 32: 2017 Field Data, “PMDI Irrigation Systems”, 195 bu/ac, Grall

Date	Time	Rainfall (inches)	Irrigation (inches)	Water Meter	Hour Meter	Growth Stage	Soil Moisture					Pivot Position	Crop Irrigate	Well (GPM)	Tracking Source
							1 Foot	2 Feet	3 Feet	4 Feet	5 Feet				
04/13	04:20 PM			420733	none		97.1	97.2	91.2	72.2	81.1	169		off	C & L
04/21		1.19													Pivotrac
04/26		0.35													Pivotrac
04/29		1.11													Pivotrac
04/30		0.28													Pivotrac
05/03		0.21													Pivotrac
05/10		0.47													Pivotrac
05/11		0.20													Pivotrac
05/16		0.20													Pivotrac
05/22		0.36													Pivotrac
05/30						plant									Harold
06/01	09:50 AM		start	420733								340	PMDI		Pivotrac
06/06	09:30 AM		0.76	445643			97.3	97.3	97.2	97.1	97.1	182	PMDI	358	Curtis
06/13	09:45 AM		0.85	481659		emerged	98.1	97.9	97.9	97.9	97.9	128	PMDI	345	Curtis
06/20	10:20 AM		1.33	517056		3 leaf	97.7	97.5	97.7	97.6	97.6	95	PMDI	323	Curtis
06/26	04:15 PM	0.25	0.85	544133		5 leaf	98.3	98.2	98.4	98.5	98.5	355	PMDI	315	Curtis
07/06	09:45 AM	0.31	1.48	592549		6 leaf	95.8	97.9	98.1	98.1	98.1	87	PMDI	350	Curtis
07/11	10:10 AM		0.76	617401		7 leaf	96.3	97.9	98.1	98.1	98.1	314	PMDI	329	Curtis
07/18	09:45 AM		1.06	651956		8 leaf	94.8	97.3	98.0	98.2	98.1	275	PMDI	341	Curtis
07/25	11:00 AM		1.03	685450		9 leaf	74.3	92.0	97.6	98.1	98.1	231	PMDI	315	Paul
08/03	09:35 AM	3.32	0.85	712619		tassle	97.1	93.6	95.4	97.6	97.8	88	off		Curtis
08/08	02:20 PM	0.41	0.62	732944		pollinate	74.3	93.9	94.5	97.4	97.8	348	PMDI	345	Curtis
08/16	01:50 PM	4.14	1.05	767331		blister	58.6	97.4	97.8	97.9	97.8	12	PMDI	345	Curtis
08/22	02:55 PM	0.09	0.85	795033		milk	60.4	97.2	97.6	97.7	97.7	328	PMDI	339	Curtis
08/29	10:20 AM	0.27	1.01	828046		dough	57.1	97.0	97.3	97.5	97.5	327	PMDI	317	Curtis
09/05	01:50 PM	0.23	1.08	863295		dent	55.3	97.6	98.0	98.2	98.2	26	PMDI	337	Curtis
09/14	01:40 PM		1.34	906902		¼ mat line	20.7	97.0	97.3	97.8	97.8	64	PMDI	342	Curtis
09/19	10:35 AM	0.23	0.58	925993		½ mat line	33.3	96.5	96.8	97.4	97.5	266	PMDI	371	Curtis
10/11	01:15 PM	1.39	0.52	942819		½ mat line	13.3	92.6	97.3	97.4	97.5	65	off		Curtis
10/17	02:10 PM			942819		¾ mat line	9.0	96.1	97.4	97.7	97.9	65	off		Curtis
10/24	02:15 PM			942819		¾ mat line	2.6	95.4	96.9	97.3	97.4	65	off		Curtis
10/30	02:20 PM			942819		1.0 mat line	0.0	95.1	96.9	97.2	97.3	65	off		Curtis
11/07	11:35 AM			942819		black layer	0.0	95.1	96.6	97.0	97.1	163	move dry		Curtis
11/08						harvest									Harold
11/14	12:00 noon			942819		harvested	0.0	94.9	96.9	97.3	97.6	184	move dry		Curtis
Total		10.64	16.02				1.90	0.15	0.00	0.00	0.00	= 2.05"	Soil Moisture	338 gpm	Leon
Net soil moisture is 2.05 inches.															
Rainfall (10.64 in), irrigation (16.02 in), and net soil moisture (2.05 in) is total water (28.71 in).															
*Numbers in red are not counted in the total rainfall.															

2017 Harvest Results, PMDI Irrigation Systems, Corn, Grall

T-L PMDI field produced a 195 bushel per acre corn yield; irrigation totaled 16.02 inches per acre. Corn production was 12.17 bushels (681 lb.) from each inch of irrigation. Production from each inch of irrigation, rainfall, and net soil water that totaled 28.71 inches was 6.79 bushels (380 lb.) per acre. Crop production costs were \$384.98 per acre for irrigation, fertilizer, seed, and harvest expenses. At \$3.63 per bushel, the 195 bushels per acre amounted to \$707.85. Net return for the PMDI field was \$322.87 per acre. Net return from each inch of irrigation was \$20.15. Net return from each inch of irrigation, rainfall, and net soil water was \$11.24. There was sufficient available water throughout the growing season to produce the crop. A summary of the T-L PMDI Irrigation System demonstration results are shown in Table 33 and in Appendix A. Results from another PMDI drag line demonstration are located in the Grall 328 PMDI Irrigation Systems section of this report.

Table 33: 2017 PMDI Irrigation Systems Demonstration Results, Corn, Grall

GPM	Irrigation (in)	Total Water (in)	Production		Gross Crop Value @ \$3.63/bu		
			bu/ac	lb/ac-in of Irrigation	per acre (\$)	Acre-inch of Irrigation (\$)	Acre-in of Total Water (\$)
PMDI	16.02	28.71	195	681	\$707.85	\$44.18	\$24.65
Includes 2.05 inches of soil water removed within 5 feet of the plant root zone.							

Stan Spain's 2017 Moore County SDI "3-4-5 GPM" Cotton Demonstration



2017 Planting and Crop Information, SDI Cotton, Spain

Stan Spain strip tilled and planted 18.75 acres of cotton in the south half of section 47 for the "3-4-5 GPM" SDI cotton demonstration. The SDI acres were positioned between two LEPA center pivot irrigation systems at the District's WCC. There are 16 irrigation zones in the SDI system divided in the north and south by a field road. Cotton was planted in the south acres of the SDI irrigation system. Each south zone was

2.345 acres. Zone 11 was Spain's 3 GPM field, zone 12 was the 4 GPM field, and zone 13 was the 5 GPM field. Three irrigation plans were developed and run by Field Net to apply the project's weekly irrigation amounts. Each plan irrigated two zones simultaneously three times each week. The irrigation 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 north 19.44 SDI acres were planted to corn and irrigated in sequence with the south cotton acres. Spain planted each "3, 4, 5 GPM" field to Dynagro DG3385B2XF cotton variety. Seeding rate was 55,000 seeds per acre for the 3 GPM, 4 GPM, and 5 GPM acres. Seasonal water meter readings averaged 148 GPM (2.00-2.345 acre zones). Irrigation was with Netafim 13 mil Typhoon series SDI tape laterals spaced 30 inches apart with 0.18 GPH TurbONet emitters spaced 24 inches. Planting and crop information for "Spain 3 GPM", "Spain 4 GPM", and "Spain 5 GPM" SDI cotton are shown in Table 33 below.

Table 34: 2017 Planting and Crop Information, SDI Cotton, Stan Spain

3 GPM Demonstration Site: SDI Zone 11						
Planted		May 17		Harvested		December 13
Hybrid		Dynagro DG3385B2XF		Seeding Rate		55,000
Row Width		30 inches		Tillage		Strip Till
No. Acres		2.345		GPM per acre		3.00
Total Water		23.13 inches		Soil Type		Sherman Clay Silty Loam
Irrigation		6.42 inches		Insecticide		Acephate
4 GPM Demonstration Site: SDI Zone 12						
Planted		May 17		Harvested		December 13
Hybrid		Dynagro DG3385B2XF		Seeding Rate		55,000
Row Width		30 inches		Tillage		Strip Till
No. Acres		2.345		GPM per acre		4.00
Total Water		22.27 inches		Soil Type		Sherman Clay Silty Loam
Irrigation		7.50 inches		Insecticide		Acephate

Table 34: 2017 Planting and Crop Information, SDI Cotton, Stan Spain (continued)

5 GPM Demonstration Site: SDI Zone 13					
Planted		May 17		Harvested	December 13
Hybrid		Dynagro DG3385B2XF		Seeding Rate	55,000
Row Width		30 inches		Tillage	Strip Till
No. Acres		2.345		GPM per acre	5.00
Total Water		23.65 inches		Soil Type	Sherman Clay Silty Loam
Irrigation		8.58 inches		Insecticide	Acephate

2017 Soil Water Profile and Growing Season Rainfall “3 GPM” SDI Cotton Demonstration Site

Preseason soil water was good at 1, 2, 3, 4, and 5 feet and at planting. Weekly gypsum block readings indicated the crop used more water than irrigation and rainfall provided by week three in July at the bloom growth stage using 95% of that stored at 1 foot. The crop used all water stored at 1, 2, and 3 feet during September plus irrigation and rainfall. Rainfall in September refilled the profile at 1, 2, and 3 feet, but did not penetrate to 4 and 5 feet. Plant roots developed into 4 and 5 feet in October using about 60% of that stored at 4 feet and 25% from 5 feet, additional amounts from 1, 2, and 3 feet plus rainfall. The sensors showed 3.54 inches of soil water were used from 1, 2, 3, 4, and 5 feet in the root zone during September and October finishing the crop. Sensors indicated 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. Rainfall from planting until plant termination totaled 13.17 inches.

“4 GPM” SDI Demonstration Site

Soil water was good at 1, 2, 3, 4, and 5 feet at planting from preseason rainfall. Soil moisture sensors showed plant roots began using water from 1, 2, and 3 feet in the root zone at the bloom growth stage in late-August in addition to irrigation and rainfall. All soil water stored at 1, 2, and 3 feet was used by mid- September. September rainfall refilled the soil profile at 1 and 2 feet to beginning levels but only partially at 3 feet. Sensors showed no soil water was used from 4 and 5 feet producing the crop, which is significantly different from soil water use in the 3 GPM field. Weekly gypsum block readings showed the crop had adequate soil moisture during the growing season. Sensors showed 2.20 inches of net soil water was used. A total of 13.17 inches of rainfall was recorded from planting through harvest. Soil was 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 from preseason rainfall. Soil moisture sensors showed plant roots removed water from 1 foot the third week in July at the bloom growth stage in addition to irrigation and rainfall. Plants used about 85% of the water stored at 1 foot that was soon refilled by irrigation and rainfall. Plants used all water stored at 1, 2, and 3 feet in late August and September plus irrigation and rainfall. Rainfall in October refilled the soil profile to the levels at

planting. Weekly gypsum block moisture sensor readings show the crop had sufficient available soil water during the entire growing season. Sensors showed plants removed 1.90 inches of net soil water from 1, 2, 3, and 4 feet during October and November finishing the crop. Rainfall totaled 13.17 inches from planting through plant termination. Cotton was produced in Sherm silty clay loam soil that holds 2.00 inches of available water per foot for potential crop use.

Table 35: 2017 Monthly Rainfall Data, SDI Cotton, Spain

GPM	May (in)	June (in)	July (in)	August (in)	September (in)	October (in)	Total (in)
3, 4, 5	0.38	1.86	0.54	6.54	2.77	1.08	13.17

2017 Growing Season Water Tracking, SDI Cotton, Spain

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 five gypsum block soil moisture sensors was installed at 1, 2, 3, 4, and 5 feet, and an AquaSpy™ soil moisture probe was installed down to four feet in the root zone at one location to monitor soil water levels in the “3 GPM” field. Another set of the same type of sensors were installed in each “4 GPM” 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. Each AquaSpy® probe was installed following crop emergence. A 24/7 Aquaspy probe website showed soil moisture at four inch increments to 48 inches and monitored plant root growth as well as soil moisture levels. The website listed all Aquaspy soil probes in the “3, 4, 5, GPM” project and was available to all cooperators and district personnel. Another 24/7 Pivotrak website tracked each center pivot system and monitored and controlled irrigation. The SDI irrigation plans were written to apply 1.14 inches (“3 GPM”), 1.50 inches (“4 GPM”), and 1.86 inches (“5 GPM”) and was managed from the Field Net website. The website tracked irrigation by zone being irrigated. Both the cooperating grower and district “3-4-5 GPM” Project Leader collectively monitored, controlled, and managed irrigation from the Field Net website.

Following this paragraph, a series of graphs and tables shows weekly gypsum block readings for the season; growing season water, including rainfall, irrigation, and soil moisture at various growth stages; and the order of irrigation and rainfall events for each “3, 4, 5, GPM” field. “Water Summary,” as shown on the graph for growing season water, is the sum of seasonal irrigation, rainfall and net soil water. Graphs and tables for the 3 GPM acres are shown first, followed by the same illustrations for each 4 GPM and 5 GPM.

Figure 40: 2017 Gypsum Block Readings, “3 GPM” SDI Cotton, 1189 lb/ac, Spain

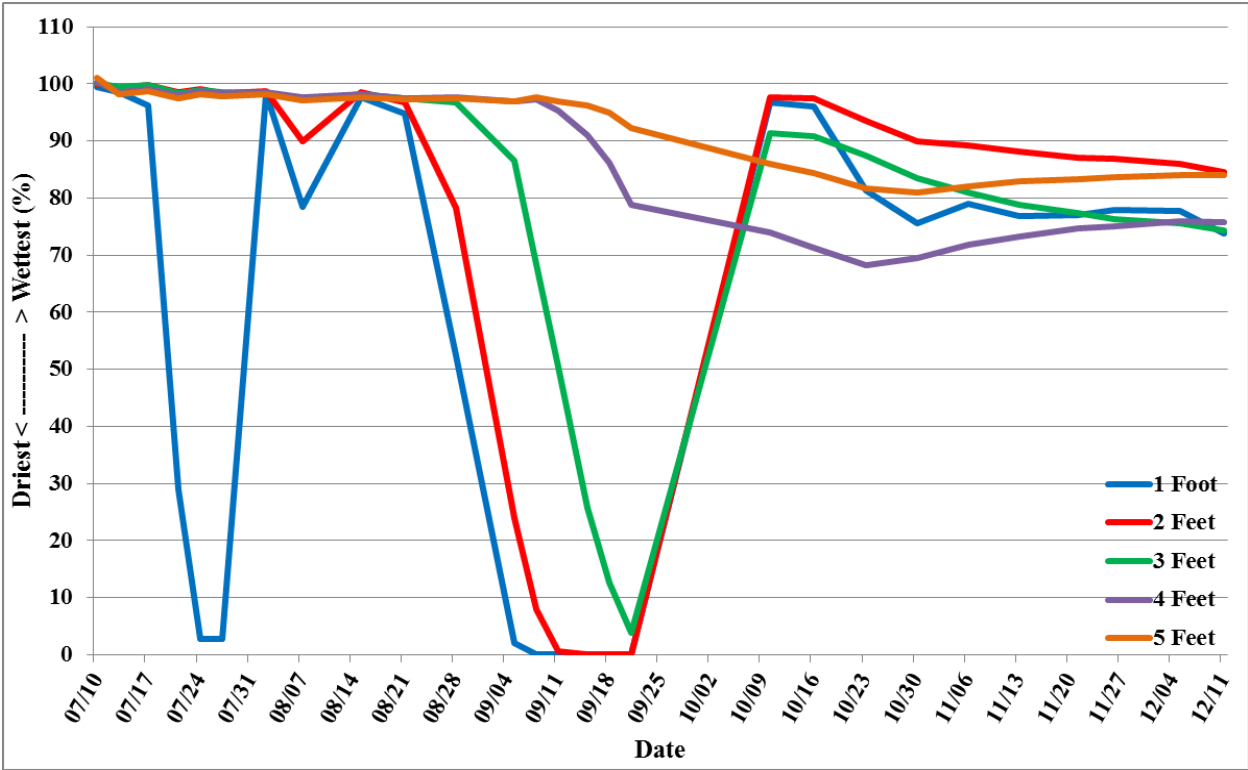


Figure 41: 2017 Growing Season Water Tracking, “3 GPM” SDI Cotton, 1189 lb/ac, Spain

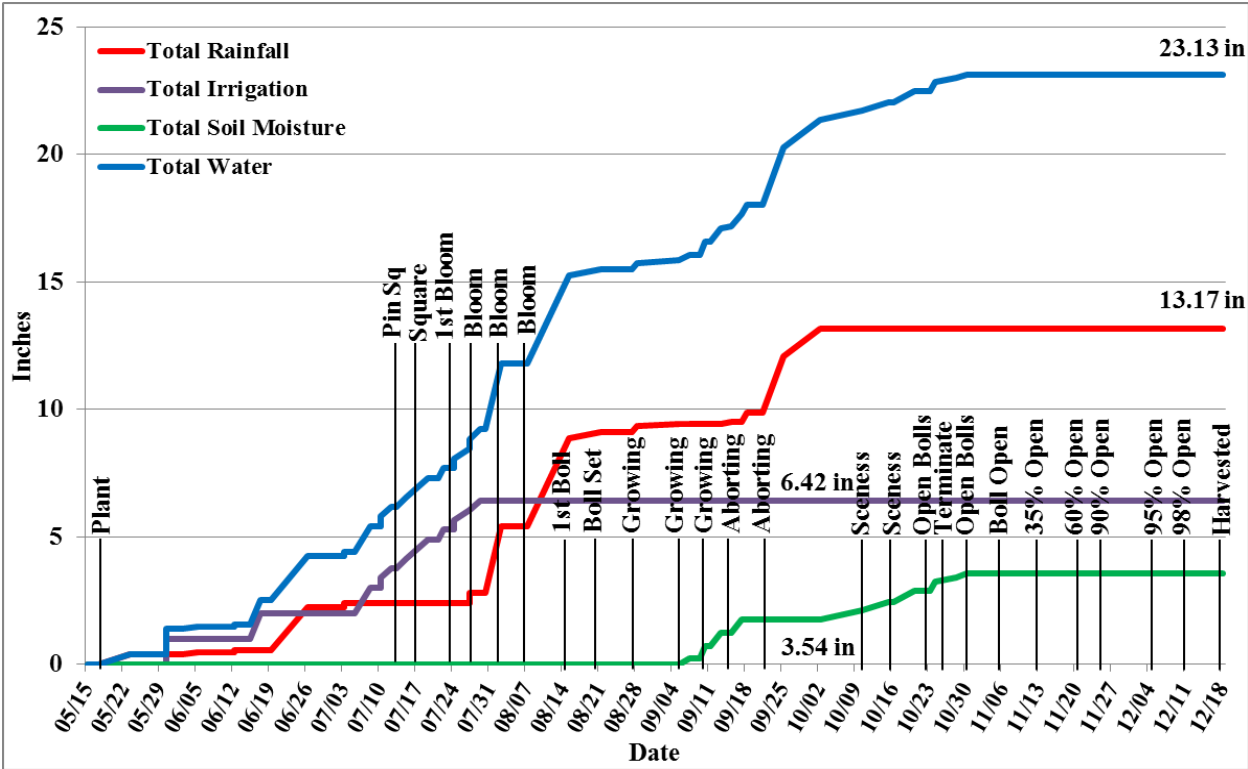


Table 36: 2017 Field Data, “3 GPM” SDI Cotton, 1189 lb/ac, Spain

Date	Time	Rainfall (inches)	Irrigation (inches)	Crop Irrigate	Filter Sta. Meter AF	Field Meter AF	Growth Stage	Soil Moisture					Zone Irrigating	Filter Sta. Meter GPM	Filter Sta. PSI	Field Meter GPM	Zone Man. PSI	Zone Man. PSI	Tracking Source
								1 Foot	2 Feet	3 Feet	4 Feet	5 Feet							
03/27		0.33																	Curtis
04/03		2.06																	Curtis
04/10	10:05 AM	0.58			55.59	27.14							off						C & L
04/24		0.77																	Curtis
05/01		1.51																	Curtis
05/15		0.48																	Curtis
05/17							plant												Stan
05/23		0.38		off									off						Curtis
05/28	03:10 PM			start	55.59	27.14							11,12						Stan
05/30	10:05 AM			cotton	56.81	27.14							13,14	149	14.5	0	14.5	11.0	Curtis
05/30	10:05 PM		0.99	stop	57.14	27.14							9,10						S & FN
05/31	07:20 AM			start	57.14	27.14							1,2						S & FN
06/02	03:40 PM			stop									7,8						S & FN
06/05	01:55 PM	0.09			58.77	28.77							off						Curtis
06/12	02:30 PM			start	58.77	28.77							1,2						S & FN
06/12	02:50 PM	0.07		corn	58.79	28.78							1 & 2		150	14.0	148	12.5	Curtis
06/14	04:25 PM			stop	60.33	30.32							7,8						S & FN
06/15	08:50 AM			start	60.33	30.32							11,12						S & FN
06/17	05:55 PM		0.99	stop	61.88	30.32							9,10						S & FN
06/19	10:40 AM				61.88	30.32							off						Curtis
06/26	01:45 PM	1.70			62.09	30.32							off						Curtis
06/28				start	62.11	30.32							1,2						Stan
07/03	02:20 AM			stop	64.60	32.81							7,8						S & FN
07/03	08:00 PM	0.17			64.60	32.81							off						Curtis
07/05	04:20 PM			start	64.60	32.81							9,10						S & FN
07/08	01:20 AM		1.02	stop	66.20	32.81							15,16						S & FN
07/08	02:30 AM			Plan 1	66.20	32.81							1,2						S & FN
07/08	02:30 AM			start	66.20	32.81							1,2						S & FN
07/10	09:45 AM			cotton	67.71	33.60		99.5	99.9	100.2	100.3	101.1	15 & 16	141	15.0	0	14.5	10.5	Curtis
07/10	11:30 AM		0.38	into corn									15,16						FN
07/12	08:35 PM		0.38	into corn									15,19						FN
07/13	11:25 AM			corn	69.64	34.78	pin sq	98.6	99.3	99.4	98.5	98.2	3 & 4	150	15.0	150	13.5	11.0	Curtis
07/15	05:40 AM		0.38		70.80	35.15							15,16						S & FN
07/15	05:45 AM			Plan 2	70.80	35.15							Plan 2						S & FN
07/15	05:45 AM			start	70.80	35.15							1,2						FN
07/17	02:50 PM		0.38	into corn									1,2						S & FN
07/17	03:55 PM			corn	72.49	36.07	square	96.2	99.8	99.8	99.1	98.7	1 & 2	160	16.0	159	15.0	12.5	Curtis
07/19	11:50 PM		0.38	into corn									15,16						S & FN
07/21	10:05 AM			cotton	75.13	37.82	square	29.0	98.5	98.4	98.0	97.5	9 & 10	153	17.0	0	16.0	12.0	Curtis
07/22	08:50 AM		0.38	into corn									15,16						FN
07/24	01:45 PM			cotton	77.32	38.12	1st bloom	2.8	99.0	98.9	98.7	98.1	15 & 16	150	16.0	0	16.0	14.0	Paul
07/24	06:35 PM		0.38	into corn									15,16						FN
07/27	03:55 AM		0.38	into corn									15,16						FN
07/27	02:00 PM	0.37		corn	79.43	39.92	bloom	2.7	98.4	98.5	98.3	97.9	3 & 6	163	na	160		16.0	Paul
07/29	01:00 PM		0.38	cotton	80.79	40.51							15,16						S & FN
07/29	01:05 PM			Plan 3									Plan 3						S & FN
07/29	01:05 PM			start	80.79	40.51							1,2						S & FN
07/30	05:40 PM			stop	81.66	41.35							7,8						S & FN
08/02	04:15 PM	2.61			81.66	41.35	bloom	98.3	98.7	98.4	98.5	98.1	off						Curtis
08/07	09:40 AM				81.66	41.35	bloom	78.5	89.9	97.3	97.6	97.1	off						Curtis
08/15	03:45 PM	3.45			81.66	41.35	1st boll	97.7	98.5	98.2	98.2	97.6	off						Curtis
08/21	11:00 AM	0.24			81.66	41.35	boll set	94.8	96.8	97.4	97.5	97.2	off						Curtis
08/23	11:10 AM			Corn	81.66	41.35							Corn						S & FN
08/23	11:10 AM			start	81.66	41.35							1,2						S & FN
08/24	03:40 PM			into 1,2									7,8						FN
08/25	08:10 PM			into 1,2									7,8						FN
08/27	12:40 AM			stop	84.19	43.85							7,8						S & FN
08/28	12:05 PM	0.24			84.19	43.85	growing	52.4	78.2	96.8	97.6	97.5	off						Curtis
09/05	11:30 AM	0.11			84.19	43.85	growing	2.1	23.9	86.6	96.9	97.0	off						Curtis
09/07	09:20 AM			start	84.19	43.85							1,2						S & FN
09/08	01:50 PM			into 1,2			growing						7,8						S & FN
09/08	03:30 PM			corn	85.07	44.73	growing	0.0	7.9	68.4	97.3	97.7	1 & 2	155	15.0	155	14.0	12.0	Curtis
09/09	06:20 PM			into 1,2									7,8						S & FN
09/10	10:45 PM			stop	86.67	46.31							7,8						S & FN
09/11	11:35 AM				86.67	46.31	growing	0.0	0.5	50.5	95.3	96.9	off						Curtis
09/15	02:40 PM	0.08			86.67	46.31	aborting	0.0	0.0	25.7	91.0	96.2	off						Curtis
09/18	03:05 PM	0.34			86.67	46.31	aborting	0.0	0.0	12.6	86.1	94.9	off						Curtis
09/19	10:40 AM			start	86.67	46.31							1,2						S & FN
09/20	03:10 PM			into 1,2									7,8						S & FN
09/21	11:00 AM			corn	88.10	47.74	aborting	0.0	0.0	3.9	78.8	92.2	4 & 5	157	16.0	155	15.0	12.0	Curtis
09/21	07:40 PM			stop	88.35	47.97							7,8						S & FN
09/25	10:40 AM	2.24			88.35	47.97							off						Curtis
10/02	10:25 AM	1.08			88.35	47.97							off						Curtis
10/10	04:00 PM				88.35	47.97	sceneness	96.8	97.7	91.4	73.9	86.0	off						Curtis
10/16	03:10 PM				88.35	47.97	sceneness	96.0	97.5	90.9	71.3	84.3	off						Curtis
10/23	03:10 PM				88.35	47.97	open boll	81.3	93.6	87.4	68.2	81.6	off						Curtis
10/24							terminate												Stan
10/30	11:45 AM				88.35	47.97	open boll	75.6	89.9	83.4	69.5	80.9	off						Curtis
11/06	10:50 AM				88.35	47.97	boll open	78.9	89.3	80.9	71.9	82.1	off						Curtis
11/13	01:45 PM	0.08			88.35	47.97	85% open	76.9	88.1	78.8	73.2	82.9	off						Curtis
11/21	09:45 AM				88.35	47.97	90% open	77.0	87.1	77.3	74.6	83.3	off						Curtis
11/26	01:50 PM				88.35	47.97	90% open	77.9	86.9	76.3	75.0	83.6	off						Curtis
12/05	10:50 AM				88.35	47.97	95% open	77.7	85.9	75.5	75.9	84.0	off						Curtis
12/11	11:15 AM				88.35	47.97	98% open	73.7	84.6	74.3	75.8	84.0	off						Curtis
12/13							harvest												Stan
12/18	02:45 PM				88.35	47.97	harvested						off						Curtis
Total		13.17	6.42					0.80	0.60	0.79	0.76	0.59	= 3.54"	Soil Moisture					Leon

Net soil moisture is 3.54 inches.

Rainfall (13.17 in), irrigation (6.42 in), and net soil moisture (3.54 in) is total water (23.13 in).

*Numbers in red are not counted in the total rainfall.

Figure 42: 2017 Gypsum Block Readings, “4 GPM” SDI Cotton, 1186 lb/ac, Spain

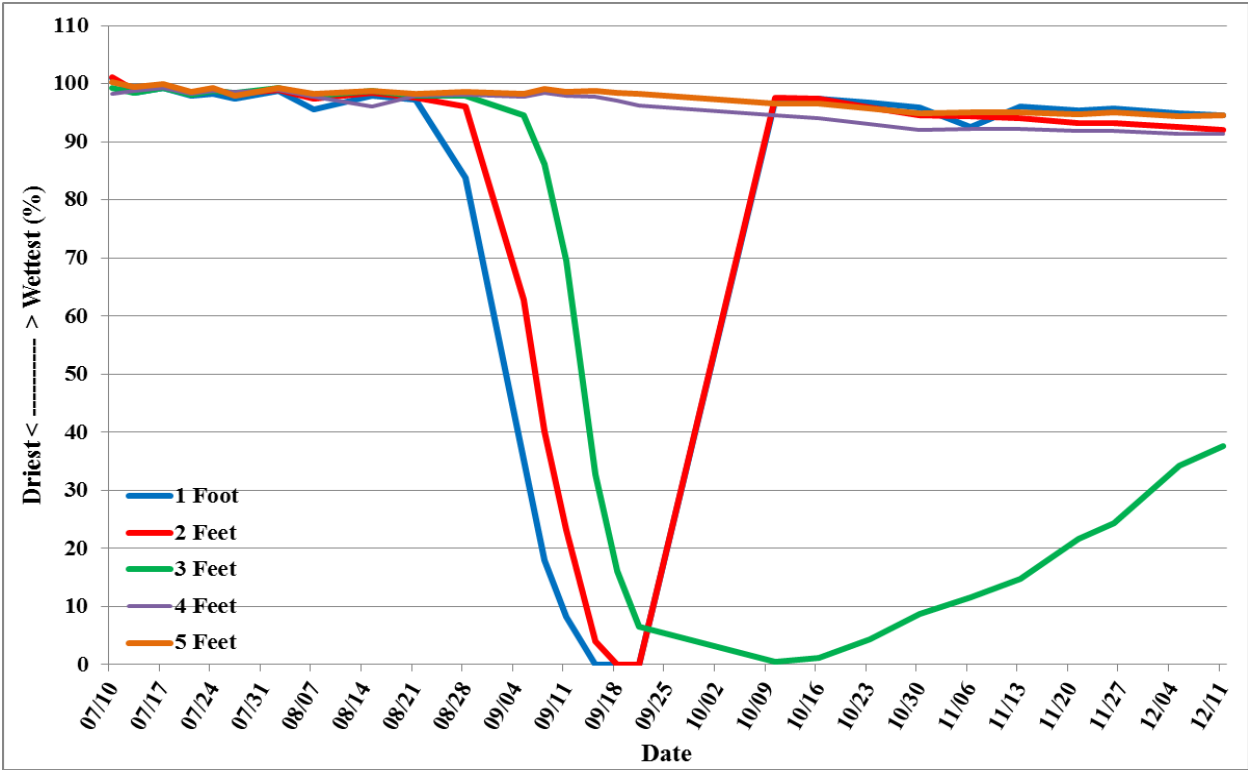


Figure 43: 2017 Growing Season Water Tracking, “4 GPM” SDI Cotton, 1186 lb/ac, Spain

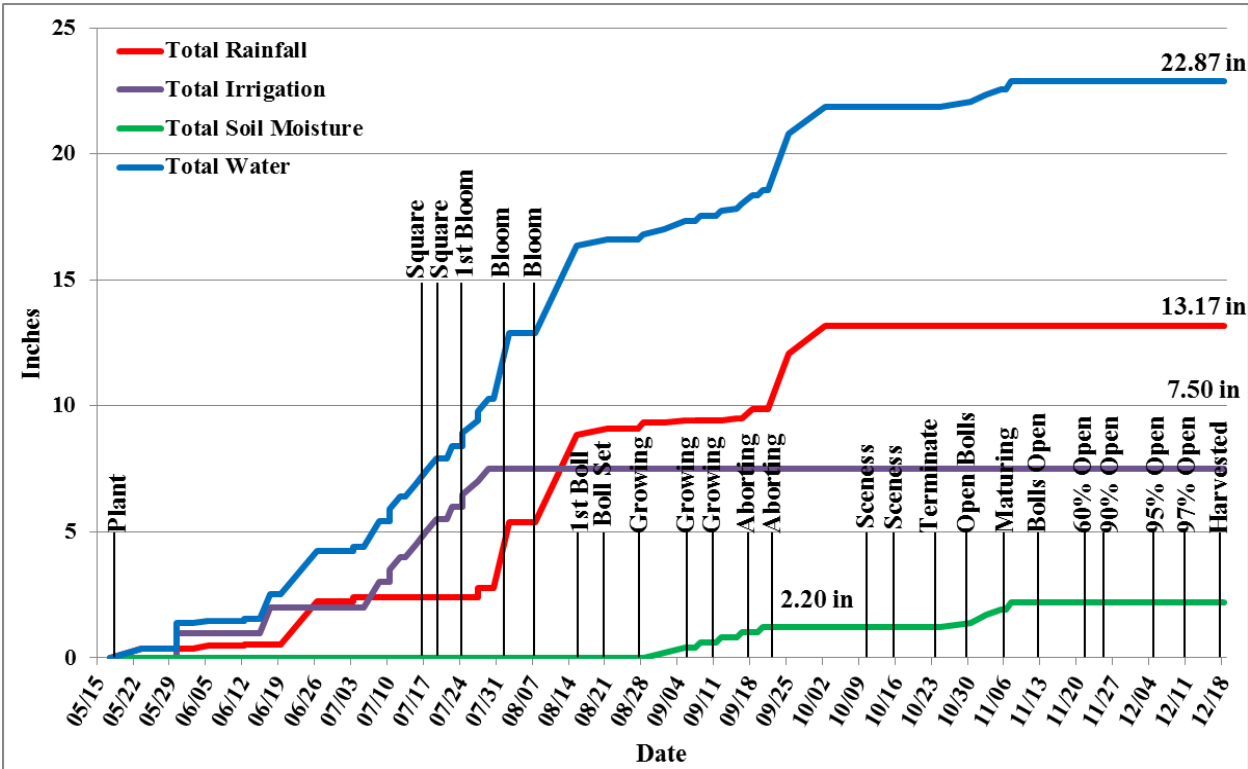


Table 37: 2017 Field Data, “4 GPM” SDI Cotton, 1186 lb/ac, Spain

Date	Time	Rainfall (inches)	Irrigation (inches)	Crop Irrigate	Filter Sta. Meter AF	Field Meter AF	Growth Stage	Soil Moisture					Zone Irrigating	Filter Sta. Meter GPM	Filter Sta. PSI	Field Meter GPM	Zone Man. PSI	Zone Man. PSI	Tracking Source
								1 Foot	2 Feet	3 Feet	4 Feet	5 Feet							
03/27		0.33																	Curtis
04/03		2.06																	Curtis
04/10	10:05 AM	0.58		off	55.59	27.14							off						C & L
04/24		0.77																	Curtis
05/01		1.51																	Curtis
05/15		0.48																	Curtis
05/17							plant												Stan
05/23		0.38		off									off						Curtis
05/28	03:10 PM			start	55.59	27.14							11,12						Stan
05/30	10:05 AM			cotton	56.81	27.14							13,14	149	14.5	0	14.5	11.0	Curtis
05/30	10:05 PM	0.99		stop	57.14	27.14							9,10						S & FN
05/31	07:20 AM			start	57.14	27.14							1,2						S & FN
06/02	03:40 PM			stop									7,8						S & FN
06/05	01:55 PM	0.09			58.77	28.77							off						Curtis
06/12	02:30 PM			start	58.77	28.77							1,2						S & FN
06/12	02:50 PM	0.07		corn	58.79	28.78							1 & 2		150	14.0	148	12.5	Curtis
06/14	04:25 PM			stop	60.33	30.32							7,8						S & FN
06/15	08:50 AM			start	60.33	30.32							11,12						S & FN
06/17	05:55 PM	0.99		stop	61.88	30.32							9,10						S & FN
06/19	10:40 AM				61.88	30.32							off						Curtis
06/26	01:45 PM	1.70			62.09	30.32							off						Curtis
06/28				start	62.11	30.32							1,2						Stan
07/03	02:20 AM			stop	64.60	32.81							7,8						S & FN
07/03	08:00 PM	0.17			64.60	32.81							off						Curtis
07/05	04:20 PM			start	64.60	32.81							9,10						S & FN
07/08	01:20 AM	1.02		stop	66.20	32.81							15,16						S & FN
07/08	02:30 AM			Plan 1	66.20	32.81							1,2						S & FN
07/08	02:30 AM			start	66.20	32.81							1,2						S & FN
07/10	09:45 AM			cotton	67.71	33.60		100.9	101.1	99.2	98.2	100.3	15 & 16	141	15.0	0	14.5	10.5	Curtis
07/10	11:30 AM	0.50		stop									15,16						FN
07/12	08:35 PM	0.50		into corn									15,19						FN
07/13	11:25 AM			corn	69.64	34.78		98.5	98.9	98.5	98.8	99.4	3 & 4	150	15.0	150	13.5	11.0	Curtis
07/15	05:40 AM	0.50			70.80	35.15							15,16						S & FN
07/15	05:45 AM			Plan 2	70.80	35.15							Plan 2						S & FN
07/15	05:45 AM			start	70.80	35.15							1,2						FN
07/17	2:50 PM	0.50		into corn									1,2						S & FN
07/17	03:55 PM			corn	72.49	36.07	square	99.3	99.7	99.3	99.3	99.9	1 & 2	160	16.0	159	15.0	12.5	Curtis
07/19	11:50 PM	0.50		into corn									15,16						S & FN
07/21	10:05 AM			cotton	75.13	37.82	square	97.9	98.4	98.1	98.2	98.6	9 & 10	153	17.0	0	16.0	12.0	Curtis
07/22	08:50 AM	0.50		into corn									15,16						FN
07/24	01:45 PM			cotton	77.32	38.12	1st bloom	98.2	98.9	98.8	98.8	99.2	15 & 16	150	16.0	0	16.0	14.0	Paul
07/24	06:35 PM	0.50		into corn									15,16						FN
07/27	03:55 AM	0.50		into corn									15,16						FN
07/27	02:00 PM	0.37		corn	79.43	39.92	bloom	97.5	98.2	98.5	98.6	98.0	3 & 6	163	na	160		16.0	Paul
07/29	01:00 PM	0.50		cotton	80.79	40.51							15,16						FN
07/29	01:05 PM			Plan 3									Plan 3						S & FN
07/29	01:05 PM			start	80.79	40.51							1,2						S & FN
07/30	05:40 PM			stop	81.66	41.35							7,8						S & FN
08/02	04:15 PM	2.61			81.66	41.35	bloom	98.8	98.9	99.2	99.0	99.3	off						Curtis
08/07	09:40 AM				81.66	41.35	bloom	95.5	97.5	98.0	97.8	98.2	off						Curtis
08/15	03:45 PM	3.45			81.66	41.35	1st boll	98.0	98.4	98.7	96.1	98.8	off						Curtis
08/21	11:00 AM	0.24			81.66	41.35	boll set	97.3	97.6	97.9	97.9	98.3	off						Curtis
08/23	11:10 AM			Corn	81.66	41.35							Corn						S & FN
08/23	11:10 AM			start	81.66	41.35							1,2						S & FN
08/24	03:40 PM			into 1,2									7,8						FN
08/25	08:10 PM			into 1,2									7,8						FN
08/27	12:40 AM			stop	84.19	43.85							7,8						S & FN
08/28	12:05 PM	0.24			84.19	43.85	growing	83.8	96.1	98.0	98.1	98.6	off						Curtis
09/05	11:30 AM	0.11			84.19	43.85	growing	35.3	62.8	94.6	97.7	98.3	off						Curtis
09/07	09:20 AM			start	84.19	43.85							1,2						S & FN
09/08	01:50 PM			into 1,2									7,8						S & FN
09/08	03:30 PM			corn	85.07	44.73	growing	18.0	40.1	86.1	98.4	99.1	1 & 2	155	15.0	155	14.0	12.0	Curtis
09/09	06:20 PM			into 1,2									7,8						S & FN
09/10	10:45 PM			stop	86.67	46.31							7,8						S & FN
09/11	11:35 AM				86.67	46.31	growing	8.3	23.1	69.6	97.9	98.6	off						Curtis
09/15	02:40 PM	0.08			86.67	46.31	aborting	0.0	4.0	32.8	97.8	98.8	off						Curtis
09/18	03:05 PM	0.34			86.67	46.31	aborting	0.0	0.0	16.2	97.1	98.5	off						Curtis
09/19	10:40 AM			start	86.67	46.31							1,2						S & FN
09/20	03:10 PM			into 1,2									7,8						S & FN
09/21	11:00 AM			corn	88.10	47.74	aborting	0.0	0.0	6.5	96.3	98.2	4 & 5	157	16.0	155	15.0	12.0	Curtis
09/21	07:40 PM			stop	88.35	47.97							7,8						S & FN
09/25	10:40 AM	2.24			88.35	47.97							off						Curtis
10/02	10:25 AM	1.08			88.35	47.97							off						Curtis
10/10	04:00 PM				88.35	47.97	scenness	97.1	97.6	0.5	94.6	96.6	off						Curtis
10/16	03:10 PM				88.35	37.97	scenness	97.4	97.5	1.2	94.0	96.6	off						Curtis
10/23	03:10 PM				88.35	47.97	scenness	96.7	95.9	4.4	93.0	95.8	off						Curtis
10/24							terminate												Stan
10/30	11:45 AM				88.35	47.97	open bolls	95.9	94.5	8.8	92.1	94.9	off						Curtis
11/06	10:50 AM				88.35	47.97	maturing	92.6	94.4	11.5	92.2	95.0	off						Curtis
11/13	01:45 PM	0.08			88.35	47.97	polls oper	96.0	94.0	14.8	92.2	95.1	off						Curtis
11/21	09:45 AM				88.35	47.97	50% oper	95.4	93.3	21.7	91.8	94.8	off						Curtis
11/26	01:50 PM				88.35	47.97	90% oper	95.7	93.3	24.4	91.9	95.0	off						Curtis
12/05	10:50 AM				88.35	47.97	95% oper	94.9	92.6	34.2	91.3	94.4	off						Curtis
12/11	11:15 AM				88.35	47.97	97% oper	94.5	92.0	37.7	91.3	94.6	off						Curtis
12/13							harvest												Stan
12/18	02:45 PM				88.35	47.97	harvested						off						Curtis
Total		13.17	7.50					0.2	0.3	1.3	0.3	0.2	= 2.20"	Soil Moisture					Leon
Net soil moisture is 2.20 inches.																			
Rainfall (13.17 in), irrigation (7.50 in), and net soil moisture (2.20 in) is total water (22.87 in).																			
*Numbers in red are not counted in the total rainfall.																			

Figure 44: 2017 Gypsum Block Readings, “5 GPM” SDI Cotton, 767 lb/ac, Spain

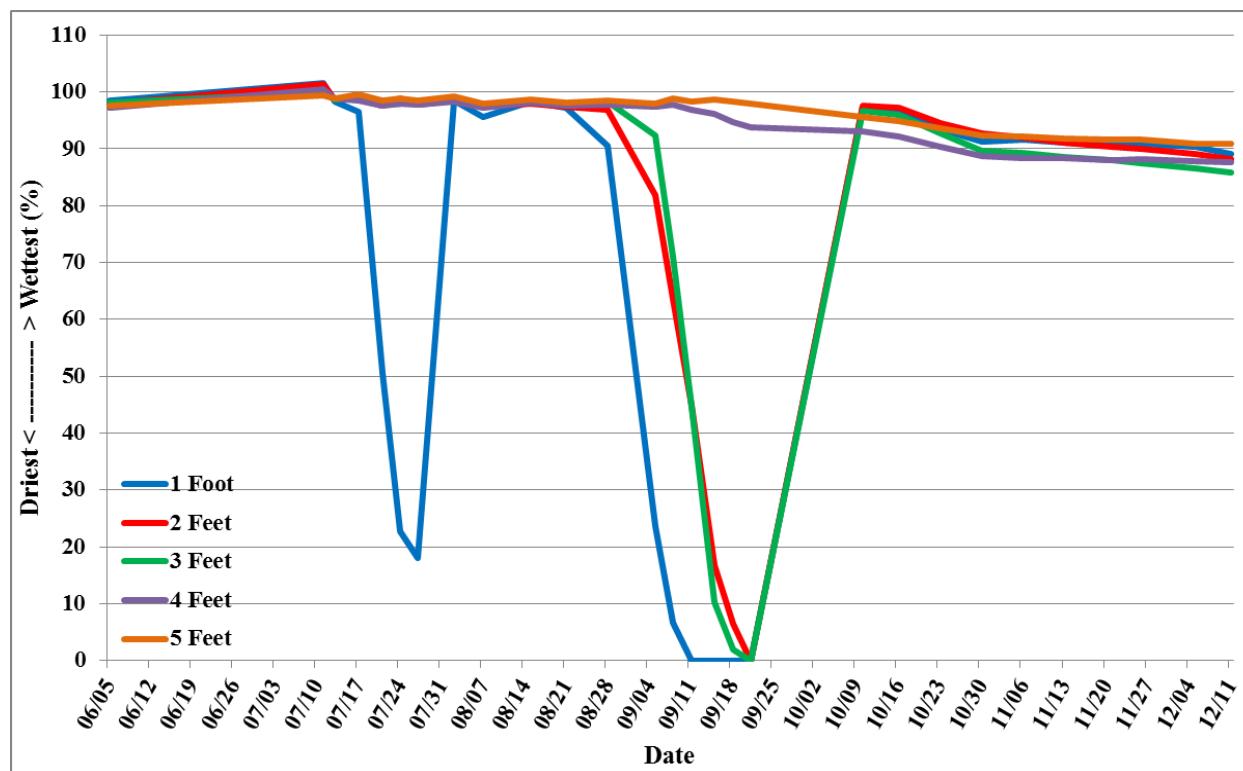


Figure 45: 2017 Growing Season Water Tracking, “5 GPM” SDI, 767 lb/ac, Spain

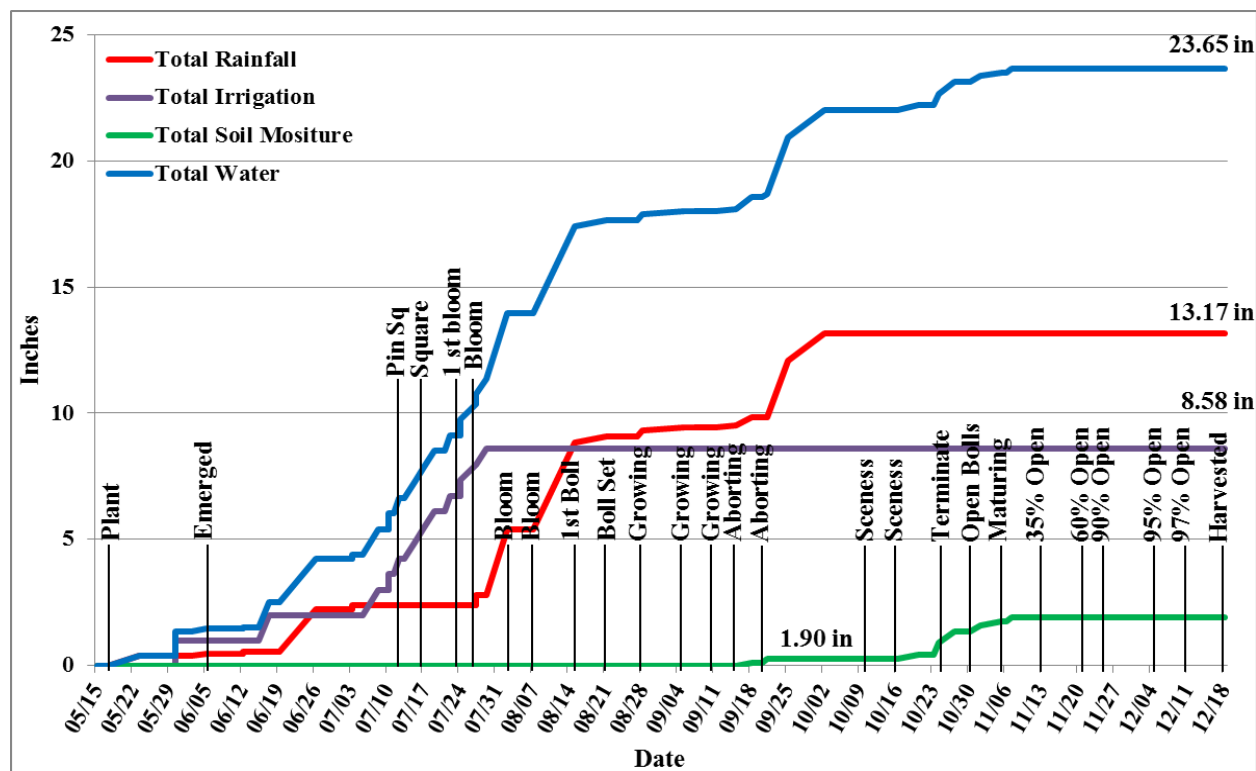


Table 38: 2017 Field Data, “5 GPM”, SDI Cotton, 767 lb/ac, Spain

Date	Time	Rainfall (inches)	Irrigation (inches)	Growth Stage	Soil Moisture					Zone Irrigating	Filter Sta. Meter GPM	Filter Sta. PSI	Field Meter GPM	Zone Man. PSI	Zone Man. PSI	Tracking Source
					1 Foot	2 Feet	3 Feet	4 Feet	5 Feet							
03/27		0.33														Curtis
04/03		2.06														Curtis
04/10	10:05 AM	0.58								off						C & L
04/24		0.77														Curtis
05/01		1.51														Curtis
05/15		0.48														Curtis
05/17				plant												Stan
05/23		0.38								off						Stan
05/28	03:10 PM															Curtis
05/29	07:40 PM									off						Curtis
05/30	10:05 AM									13,14	149	14.5	0	14.5	11.0	Curtis
05/30	10:05 PM		0.99							15,16						S & FN
05/31	07:20 AM									1,2						S & FN
06/02	03:40 PM									7,8						S & FN
06/05	01:55 PM	0.09		emerged	98.5	97.9	98.1	97.1	97.5	off						Curtis
06/12	02:30 PM															S & FN
06/12	02:50 PM	0.07								1 & 2		150	14.0	148	12.5	Curtis
06/14	04:25 PM									7,8						S & FN
06/15	08:50 AM									11,12						S & FN
06/17	05:55 PM		0.99							9,10						S & FN
06/19	10:40 AM									off						Curtis
06/26	01:45 PM	1.70								off						Curtis
06/28										1,2						Stan
07/03	02:20 AM									7,8						S & FN
07/03	08:00 PM	0.17								off						Curtis
07/05	04:20 PM									9,10						S & FN
07/08	01:20 AM		1.02							15,16						S & FN
07/08	02:30 AM									1,2						S & FN
07/08	02:30 AM									1,2						S & FN
07/10	09:45 AM									15 & 16	141	15.0	0	14.5	10.5	Curtis
07/10	11:30 AM		0.62							15,16						FN
07/11					101.5	101.3	99.9	100.5	99.3							Curtis
07/12	08:35 PM		0.62							15,19						FN
07/13	11:25 AM			pin sq.	98.2	98.7	98.7	98.8	98.8	3 & 4	150	15.0	150	13.5	11.0	Curtis
07/15	05:40 AM		0.62							15,16						S & FN
07/15	05:45 AM									Plan 2						S & FN
07/15	05:45 AM									1,2						FN
07/17	02:50 PM		0.62							1,2						S & FN
07/17	03:55 PM			square	96.4	98.7	98.9	98.5	99.6	1 & 2	160	16.0	159	15.0	12.5	Curtis
07/19	11:50 PM		0.62							15,16						S & FN
07/21	10:05 AM			square	50.5	97.6	97.7	97.6	98.4	9 & 10	153	17.0	0	16.0	12.0	Curtis
07/22	08:50 AM		0.62							15,16						FN
07/24	01:45 PM			1st bloom	22.8	98.8	98.0	97.9	98.8	15 & 16	150	16.0	0	16.0	14.0	Paul
07/24	06:35 PM		0.62							15,16						FN
07/27	03:55 AM		0.62							15,16						FN
07/27	02:00 PM	0.37		bloom	18.0	97.8	97.9	97.7	98.5	3 & 6	163	na	160		16.0	Paul
07/29	01:00 PM		0.62							15,16						FN
07/29	01:05 PM									Plan 3						S & FN
07/29	01:05 PM									1,2						S & FN
07/29	01:05 PM									1,2						S & FN
07/29	05:40 PM									7,8						S & FN
08/02	04:15 PM	2.61		bloom	98.5	98.4	98.5	98.3	99.1	off						Curtis
08/07	09:40 AM			bloom	95.6	97.3	97.4	97.2	97.9	off						Curtis
08/15	03:45 PM	3.45		1st boll	98.2	98.0	98.2	98.1	98.6	off						Curtis
08/21	11:00 AM	0.24		boll set	97.1	97.4	97.8	97.5	98.1	off						Curtis
08/23	11:10 AM									1,2						S & FN
08/24	03:40 PM									7,8						FN
08/25	08:10 PM									7,8						FN
08/27	12:40 AM									7,8						S & FN
08/28	12:05 PM	0.24		growing	90.5	96.9	98.2	97.8	98.5	off						Curtis
09/05	11:30 AM	0.11		growing	23.7	81.8	92.3	97.3	98.0	off						Curtis
09/07	09:20 AM									1,2						S & FN
09/08	01:50 PM			growing						7,8						S & FN
09/08	03:30 PM			growing	6.7	63.6	71.0	97.8	98.9	1 & 2	155	15.0	155	14.0	12.0	Curtis
09/09	6:20 PM									7,8						S & FN
09/10	10:45 PM									7,8						S & FN
09/11	11:35 AM			growing	0.0	44.8	44.6	96.9	98.3	off						Curtis
09/15	02:40 PM	0.08		aborting	0.0	16.7	10.2	96.1	98.6	off						Curtis
09/18	03:05 PM	0.34		aborting	0.0	6.5	2.0	94.7	98.3	off						Curtis
09/19	10:40 AM									1,2						S & FN
09/20	03:10 PM									7,8						S & FN
09/21	11:00 AM			aborting	0.0	0.0	0.0	93.8	97.9	4 & 5	157	16.0	155	15.0	12.0	Curtis
09/21	07:40 PM									7,8						S & FN
09/25	10:40 AM	2.24								off						Curtis
10/02	10:25 AM	1.08								off						Curtis
10/10	04:00 PM			sceness	97.4	97.6	96.6	93.0	95.6	off						Curtis
10/16	03:10 PM			sceness	96.9	97.2	95.9	92.1	94.8	off						Curtis
10/23	03:10 PM			sceness	93.4	94.5	92.6	90.4	93.6	off						Curtis
10/24				terminate												Stan
10/30	11:45 AM			open bolls	91.2	92.6	89.6	88.7	92.4	off						Curtis
11/06	10:50 AM			maturing	91.6	92.0	89.3	88.3	92.1	off						Curtis
11/13	01:45 PM	0.08		35% open	91.1	91.1	88.6	88.3	91.8	off						Curtis
11/21	09:45 AM			60% open	90.7	90.3	87.9	88.0	91.6	off						Curtis
11/26	01:50 PM			90% open	90.9	90.0	87.5	88.1	91.6	off						Curtis
12/05	10:50 AM			95% open	90.3	89.0	86.6	87.8	90.9	off						Curtis
12/11	11:15 AM			97% open	89.1	88.2	85.8	87.7	90.9	off						Curtis
12/13				harvest												Stan
12/18	02:45 PM			harvested						off						Curtis
Total		13.17	8.58		0.30	0.42	0.50	0.41	0.27	= 1.90"						Leon

Net soil moisture is 1.90 inches.
Rainfall (13.17 in), irrigation (8.58 in), and net soil moisture (1.90 in) is total water (23.65 in).
*Numbers in red are not counted in the total rainfall.

2017 Cotton Harvest Results, SDI, Spain

The 3 GPM field produced 1189 pound per acre cotton yield; irrigation totaled 6.42 inches. Production in the 4 GPM field was 1186 pounds per acre; seasonal irrigation totaled 7.50 inches. Cotton yield was 767 pounds per acre for the 5 GPM field; irrigation totaled 8.58 inches. There was no pre-season irrigation.

The 3 GPM field produced 3 more pounds per acre than the 4 GPM field. Irrigation was 1.08 inches more for the 4 GPM field. The 3 GPM field produced 422 more pounds per acre than the 5 GPM with 2.16 less inches of irrigation. The 4 GPM yield was 419 more pounds per acre than that from 5 GPM field with 1.08 less inches of irrigation.

Cotton production was 185 pounds per inch of irrigation in the 3 GPM field compared to 158 pounds in the 4 GPM and 89 pounds from the 5 GPM field. Production from each inch of irrigation, rainfall, and net soil water that totaled 23.13 inches was 51 pounds per acre in the 3 GPM field. Irrigation, rainfall, and net soil water totaled 22.87 inches in the 4 GPM field where production was 52 pounds per inch. In the 5 GPM field, irrigation, rainfall, and net soil water totaled 23.65 inches where production was 32 pounds per inch of total water.

At \$0.5668 per pound of lint cotton produced, gross value from each inch of irrigation applied was \$104.97 for the 3 GPM field compared to \$89.63 for the 4 GPM and \$50.67 for the 5 GPM field. Gross value of each inch of irrigation, rainfall, and net soil water measured that totaled 23.13 inches in the 3 GPM field was \$29.13. Value of the 22.87 inches of irrigation, rainfall, and net soil water measured in the 4 GPM field was \$29.13. Irrigation, rainfall, and net soil water totaled 23.65 inches in the 5 GPM field for which the gross value was \$18.38. Gross value of cotton produced in the 3 GPM field was \$673.92 per acre compared to \$672.22 for the 4 GPM and \$434.73 for the 5 GPM. A summary of the demonstration results are shown in Table 39 and Appendix K.

Table 39: 2017 SDI Cotton Demonstration Results, Spain

GPM	Irrigation (in)	Total Water (in)	Production		Gross Crop Value @ \$0.5668/lb		
			lbs	lb/ac-in of Irrigation	per acre (\$)	Acre-in of Irrigation (\$)	Acre-in of Total Water (\$)
3 GPM	6.42	^a 23.13	1189	185	\$673.92	\$104.97	\$29.13
4 GPM	7.50	^b 22.87	1186	158	\$672.22	\$89.63	\$29.39
5 GPM	8.58	^c 23.65	767	89	\$434.74	\$50.67	\$18.38

^aIncludes 3.54 inches of soil water removed within 5 feet of soil in addition to rainfall and irrigation

^aIncludes 2.20 inches of soil water removed within 5 feet of soil in addition to rainfall and irrigation

^aIncludes 1.90 inches of soil water removed within 5 feet of soil in addition to rainfall and irrigation

2017 Conclusion/Summary “3-4-5 GPM” Demonstrations

Corn production averaged 20.40 bushels (1,142 lb.) per acre inch of irrigation in the 3 GPM field compared to 16.34 bushels (915 lb.) in the 4 GPM field, and 14.38 bushels (805 lb.) per inch in the 5 GPM field. Net return from each inch of irrigation averaged \$39.96 per acre in the 3 GPM field, \$30.73 in the 4 GPM field, and \$26.54 per inch in the 5 GPM field. Irrigation averaged 12.19 inches in the 3 GPM field compared to 15.38 inches in the 4 GPM field, and 17.64 inches in the 5 GPM field. Corn production averaged 244 bushels (13,686 lb.) per acre in the 3 GPM field, 245 bushels (13,703 lb.) in the 4 GPM field, and 249 bushels (13,921 lb.) per acre in the 5 GPM field. Production was 14.38 bushels (889 lb.) per inch of irrigation in the 3 GPM-E field. Net return from each inch was \$20.56. Irrigation was 18.03 inches. Corn production was 221 bushels (12,376 lb.) per acre.

Net return averaged \$477.19 per acre from the 3 GPM field, \$457.67 from the 4 GPM field, and \$454.86 per acre from the 5 GPM field. Net return from the 3 GPM-E field was \$370.72 per acre. Average net return from the additional 3.19 inches of irrigation applied to the 4 GPM fields than the 3 GPM fields was -\$6.12 per inch. Average net return from the additional 5.45 inches of irrigation applied to the 5 GPM fields than the 3 GPM fields was (minus) -\$4.10 per inch. Average net return from the additional 2.26 inches of irrigation applied to the 5 GPM fields than the 4 GPM acres was -\$1.24 per inch. Average net return from the 4 GPM fields than the 3 GPM fields with 3.19 inches more irrigation was -\$19.52 per acre. Average net return from the 5 GPM fields where irrigation was 5.45 inches more than the 3 GPM acres was -\$22.33 per acre. Average net return from the 5 GPM fields than the 4 GPM acres where irrigation was 2.26 inches more was -\$2.81 per acre.

Irrigation, rainfall, and net soil water averaged 23.95 inches per acre in the 3 GPM field, 27.55 inches in the 4 GPM field, and 29.40 inches for the 5 GPM field. Rainfall averaged 11.76 inches per acre in the 3 GPM field, 11.72 inches in the 4 GPM field, and 11.76 inches in the 5 GPM field. Average net soil water used by the crop was 0.00 inches in the 3 GPM field, 0.45 inches in the 4 GPM field, and 0.00 inches in the 5 GPM field. Average net return from each inch of irrigation, rainfall, and net soil water was \$19.92 for the 3 GPM field, \$16.97 for the 4 GPM field, and \$15.47 for the 5 GPM field. Average net return per bushel of corn produced in the 3 GPM field was \$1.95, \$1.88 in the 4 GPM field, and \$1.84 in the 5 GPM field.

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 GPM” field. **Appendix C** describes bushels produced from each inch of irrigation for “3-4-5 GPM” 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 “3-4-5 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 “3-4-5 GPM” field.

“3-4-5 GPM” 2017 Project

In **Stan Spain’s SDI** “3-4-5 GPM” demonstration, irrigation totaled 10.33 inches per acre in the 3 GPM field, 12.49 inches in the 4 GPM field, and 14.65 inches in the 5 GPM field. There was no pre-season irrigation. Net return per acre from each inch of irrigation was \$54.96 for the 3 GPM field compared to \$42.24 for the 4 GPM field and \$34.73 for the 5 GPM field. Irrigation, rainfall, and net soil water totaled 23.86 inches per acre in the 3 GPM field, 26.02 inches in the 4 GPM field, and 28.18 inches in the 5 GPM field. Net return from each inch of total water was \$23.79 for the 3 GPM field, \$20.27 for the 4 GPM field, and \$18.06 for the 5 GPM field. Net return per acre from the 3 GPM field was \$567.59 compared to \$527.54 from the 4 GPM field and \$508.82 from the 5 GPM field.

In **Stan Spain’s LEPA** “3-4-5” GPM demonstration, irrigation totaled 11.38 inches per acre in the 3 GPM field, 13.67 inches in the 4 GPM field, and 15.94 inches in the 5 GPM field. There was no pre-season irrigation. Net return from each inch of irrigation was \$45.32 for the 3 GPM field compared to \$38.64 for the 4 GPM field, and \$32.25 for the 5 GPM field. Irrigation, rainfall, and net soil water totaled 24.00 inches per acre in the 3 GPM field, 26.29 inches in the 4 GPM field, and 28.56 inches in the 5 GPM field. Net return from each inch of total water was \$21.49 for the 3 GPM field, \$20.09 for the 4 GPM field, and \$18.00 for the 5 GPM field. Net return from the 3 GPM field was \$515.76 per acre compared to \$528.22 from the 4 GPM field and \$514.14 from the 5 GPM field.

For **Harold Grall’s LEPA**, irrigation totaled 13.08 inches per acre in the 3 GPM field, 17.84 inches in the 4 GPM field, and 19.44 inches for the 5 GPM field. Pre-season irrigation was 1.13 inches in the 3 GPM field, 2.25 inches in the 4 GPM field, and 2.18 inches in the 5 GPM field. Net return from each inch of irrigation was \$34.76 per acre for the 3 GPM field compared to \$24.43 from the 4 GPM field and \$21.50 for the 5 GPM field. Irrigation, rainfall, and net soil water totaled 24.16 inches per acre in the 3 GPM field, 28.92 inches in the 4 GPM field, and 30.52 inches in the 5 GPM field. Net return from each inch of irrigation, rainfall, and net soil water was \$18.82 per acre for the 3 GPM field, \$15.07 for the 4 GPM field, and \$13.69 per acre for the 5 GPM field. Net return per acre from the 3 GPM field was \$454.70 compared to \$435.85 from the 4 GPM field and \$417.93 from the 5 GPM field.

For **Danny Krienke’s LEPA**, irrigation totaled 18.03 inches per acre in the 3 GPM-Early planted field, 13.10 inches for the 3 GPM field, 16.13 inches for the 4 GPM field, and 18.75 inches in the 5 GPM field. There was no pre-season irrigation. Net return from each inch of irrigation was \$20.56 for the 3 GPM-Early planted field compared to \$33.07 from the 3 GPM field, \$28.17 from the 4 GPM field, and \$23.51 for the 5 GPM field. Irrigation, rainfall, and net soil water totaled 27.52 inches for the 3 GPM-Early planted field, 23.58 inches per acre in the 3 GPM field, 27.73 inches in the 4 GPM field, and 29.23 inches of total water for the 5 GPM field. Net return from each inch of total water was \$13.47 for the 3 GPM-Early planted field, \$18.37 for the 3 GPM field, \$16.39 for the 4 GPM, and \$15.08 for the 5 GPM field. Net return from the 3 GPM-Early planted field was \$370.72 per acre and \$433.25 per acre for the 3 GPM compared to \$454.45 from the 4 GPM field and \$440.87 from the 5 GPM field.

For **Harold Grall's PMDI**, irrigation totaled 13.08 inches per acre in the 3 GPM field, 17.84 inches in the 4 GPM field, and 19.44 inches for the 5 GPM field. Pre-season irrigation was 1.13 inches in the 3 GPM field, 2.25 inches in the 4 GPM field, and 2.18 inches in the 5 GPM field. Net return from each inch of irrigation was \$31.71 per acre for the 3 GPM field compared to \$22.64 from the 4 GPM field, and \$20.13 for the 5 GPM field. Irrigation, rainfall, and net soil water totaled 24.16 inches per acre in the 3 GPM field, 28.92 inches in the 4 GPM field, and 30.52 inches in the 5 GPM field. Net return from each inch of irrigation, rainfall, and net soil water was \$17.16 per acre for the 3 GPM field, \$13.96 for the 4 GPM field, and \$12.82 per acre for the 5 GPM field. Net return from the 3 GPM field was \$414.73 per acre compared to \$403.86 from the 4 GPM field, and \$391.28 from the 5 GPM field.

Irrigation Systems Demonstrations: The NPWD utilized the “3-4-5 GPM” demonstration project to also obtain comparative crop production information from optional improved water application efficiency irrigation systems cooperating growers within the project used. That information supports strategic groundwater management opportunities for ready grower adoption and follows below.

In **Harold Grall's LEPA Shroud versus T-L PMDI drag line irrigation systems demonstration**, irrigation was 13.08 inches in each 3 GPM field, and net return from each inch of irrigation was \$31.71 for the PMDI field compared to \$34.76 for the LEPA field. Irrigation totaled 17.84 inches in both the 4 GPM LEPA and PMDI fields, and net return from each inch of irrigation was \$24.43 for LEPA and \$22.64 for PMDI. In both 5 GPM fields, irrigation totaled 19.44 inches per acre and net return inch was \$21.50 for LEPA and \$20.13 for the PMDI.

Irrigation, rainfall, and net soil water totaled 24.16 inches per acre in the 3 GPM LEPA field and 3 GPM PMDI field. Net return from each inch of total water was \$18.82 for 3 GPM LEPA and \$17.16 for 3 GPM PMDI. Irrigation, rainfall, and net soil water totaled 28.92 inches in the 4 GPM LEPA field and the 4 GPM PMDI field. Net return was \$15.07 from each inch for the 4 GPM LEPA field compared to \$13.96 for PMDI acres. Irrigation, rainfall, and net soil water totaled 30.52 inches in the 5 GPM LEPA field and the 5 GPM PMDI field. Net return was \$13.69 from each inch for the 5 GPM LEPA field compared to \$12.82 for PMDI. In the 3 GPM acres, net return was \$454.70 per acre for LEPA and \$414.73 per acre for PMDI. For the 4 GPM fields, net return was \$435.85 per acre for LEPA and \$403.86 for PMDI. Net return was \$417.93 per acre for the 5 GPM LEPA field and \$391.28 per acre for 5 GPM PMDI.

In **Stan Spain's LEPA versus SDI irrigation systems demonstration**, irrigation was 11.38 inches per acre in the 3 GPM LEPA field and 10.33 inches for the SDI field. Net return from each inch of irrigation was \$45.32 for the LEPA field compared to \$54.96 for the SDI field. Irrigation totaled 13.67 inches for the 4 GPM LEPA field and 12.49 inches for the SDI field. Net return from each inch of irrigation was \$38.64 for LEPA acres and \$42.24 for SDI fields. In the 5 GPM fields, irrigation totaled 15.94 inches for LEPA and 14.65 inches for SDI. Net return was \$32.25 per inch in the 5 GPM LEPA acres and \$34.73 for the SDI fields.

Irrigation, rainfall, and net soil water totaled 24.00 inches per acre in the 3 GPM LEPA field and 23.86 inches in the 3 GPM SDI. Net return from each inch of total water was \$21.49 for LEPA and \$23.79 for

3 GPM SDI. Irrigation, rainfall plus net soil water totaled 26.29 inches in the 4 GPM LEPA field and 26.02 inches in the SDI. Net return was \$20.09 from each inch for the 4 GPM LEPA field compared to \$20.27 for SDI. In the 5 GPM fields, total water was 28.56 inches for the LEPA field and 28.18 inches for the SDI field. Net return from each inch was \$18.00 for LEPA and \$18.06 for SDI. Net return per acre was \$515.76 for the 3 GPM LEPA and \$567.59 for the SDI field. For the 4 GPM fields, net return was \$528.22 per acre for LEPA and \$527.54 for SDI. Net return was \$514.14 per acre for the 5 GPM LEPA field and \$508.82 per acre for 5 GPM SDI.

Summary

The North Plains Groundwater Conservation District's (District) "3-4-5 GPM" 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 retrofit adjustments can be made to existing center pivots, especially in conjunction with current NRCS cost share funding, to significantly improve water application efficiency that gets more of the groundwater pumped to the crop. We also learned that soil health is improved from crop residue, strip or no till management practices. We learned it is easy to over water corn with 4.0 GPM and especially 5.0 GPM per acre when rainfall is more normal and that soil moisture sensors can help manage soil water levels. Also, we learned that drought tolerant hybrids were commonly planted mostly in May and early-June performed well and reduced seasonal irrigation by 2 to 4 inches. 2017 was a challenging corn production year. Growers encountered another growing season in which strategic management practices can lead to additional monetary benefit from available groundwater.

When the **technologies and methods** utilized by the "3-4-5 GPM" demonstrations provide can be translated to three 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 annual water savings can prolong the viability of agriculture irrigation in the area.

"3-4-5 GPM" Project 3-Year Summary

For the three years (2015, 2016, 2017) the "3-4-5 GPM" project was conducted, planting dates averaged May 23 for the 3 GPM and 4 GPM fields, May 22 for the 5 GPM fields, and May 1 for the 3 GPM-Early planted fields. Seeding rates averaged 29,733 seeds per acre for the 3 GPM fields, 30,310 for the 4 GPM fields, 30,733 for the 5 GPM fields, and 30,500 for 3 GPM-Early planted fields. Pre-water application rates averaged 0.49 inches per acre in the 3 GPM fields, 0.57 inches in the 4 GPM fields, 0.63 inches in the 5 GPM fields, and 0.0 inches for the 3 GPM-Early planted fields. Irrigation was 12.61 inches per acre for the 3 GPM fields, 15.28 inches for the 4 GPM fields, 17.36 inches for the 5 GPM fields, and 15.57 inches for the 3 GPM-Early planted fields. Net soil water used by the crop averaged 2.28 inches per acre for the 3 GPM fields, 1.21 inches for the 4 GPM fields, 0.84 inches for the 5 GPM fields, and 2.10 inches for the 3 GPM-Early planted acres. Rainfall was 10.78 inches per acre for the 3 GPM fields, 10.90 inches for the 4 GPM fields, 10.74 inches for the 5 GPM fields, and 11.68 inches for the 3 GPM-

Early planted fields. Irrigation, rainfall, and net soil water averaged 25.66 inches per acre for the 3 GPM fields, 27.39 inches for the 4 GPM fields, 28.94 inches for 5 GPM fields, and 29.34 inches for 3 GPM-Early planted fields. Corn yields averaged 223 bushels per acre for the 3 GPM fields, 232 bushels for the 4 GPM fields, 242 bushels for the 5 GPM fields, and 226 bushels per acre for the 3 GPM-Early planted fields. Corn production averaged 18.17 bushels (1,017 lb.) per acre inch of irrigation in the 3 GPM fields compared to 15.66 bushels (877 lb.) in the 4 GPM fields, 14.40 bushels (806 lb.) in the 5 GPM fields, and 14.94 bushels (836 lb.) in the 3 GPM-Early planted fields.

Net return from each inch of irrigation averaged \$33.08 per acre in the 3 GPM fields, \$27.66 in the 4 GPM fields, \$25.05 per inch in the 5 GPM fields, and \$25.96 in the 3 GPM-Early planted fields. Net return from each inch of irrigation, rainfall, and net soil water averaged \$16.25 from the 3 GPM fields, \$15.43 from the 4 GPM fields, \$15.03 from the 5 GPM fields, and \$13.78 from the 3 GPM-Early planted fields. Net return per acre averaged \$417.08 from the 3 GPM fields, \$422.59 from the 4 GPM fields, \$434.94 from the 5 GPM fields, and \$404.16 from the 3 GPM-Early planted fields.

Average net return from the additional 2.67 inches of irrigation applied to the 4 GPM fields than the 3 GPM was -\$2.03 per inch. Average net return from the additional 4.75 inches of irrigation applied to the 5 GPM fields than the 3 GPM was -\$1.69 per inch. Average net return from the additional 2.08 inches of irrigation applied to the 5 GPM fields than the 4 GPM was -\$1.25 per inch.

Production costs averaged \$27.16 more per acre for the 4 GPM fields than the 3 GPM. At \$3.63 per bushel, value of the 9 additional bushels produced in the 4 GPM field is \$32.67. Net gain for the 4 GPM field is \$5.51 per acre more than for the 3 GPM fields with 2.67 inches more of irrigation. Production costs averaged \$51.11 per acre more in the 5 GPM fields than the 3 GPM. Value of the additional 19 bushels produced per acre in the 5 GPM field compared to the 3 GPM is \$68.97 per acre. Net gain for the 5 GPM fields is \$17.86 per acre more than from the 3 GPM fields with 4.75 more inches of irrigation. Average production costs were \$23.95 more for the 5 GPM fields than the 4 GPM. At \$3.63 per bushel, value of the additional 10 bushels produced in the 5 GPM fields is \$36.30 per acre. Net gain is \$12.35 per acre more for the 5 GPM field than the 4 GPM fields with 2.08 inches more irrigation.

The crop production costs and net returns are based on 2017 costs as follows: \$6.20 per inch of irrigation, \$3.33 per thousand seeds planted per acre, \$0.36 per bushel harvest expense, nutrient costs provided by Better Harvest, and corn priced at \$3.63 per bushel. 2017 completed the 3-year “3-4-5 GPM” demonstration project.

Appendix G summarizes the 3-year planting dates, seeding rates, irrigation, rainfall, net soil water amounts, and harvest results. **Appendix H** describes 3-year corn yield per inch of irrigation applied by all cooperating growers in each 3-4-5 field. **Appendix I** describes 3-year bushels produced from each inch of irrigation for the 3, 4, 5 fields by field and grower. **Appendix J** shows 3-year bushels produced from each inch of total water by 3, 4, 5 GPM field and grower.

Appendix A: 2017 Corn Hybrids Planted, Seeding Rates, and Irrigation Systems, “3-4-5 GPM” Project

Grower	County	Field	Planting Date	Corn Hybrid	Seeding Rate	Yield (bu/ac)	Total Irrigation (in)	Yield @ bu/ac-in of Irrigation	Acres	Previous Crop	Irrigation by System
Krienke - LEPA	Ochiltree	3 GPM	05/31	GA7007	28,000	228	13.10	17.40	80.00	Corn	LEPA
		4 GPM	05/31	GA7007	28,000	243	16.13	15.06	20.00	Corn	LEPA
		5 GPM	05/31	GA7007	28,000	244	18.75	13.01	20.00	Corn	LEPA
		3 GPM-Early	05/09	GA4173A	32,000	221	18.03	12.26	60.00	Corn	LEPA
Grall - PMDI	Moore	328 - 3 GPM	05/27	P1151AMX	28,000	221	13.08	16.89	1.69	Corn	PMDI
		328 - 4 GPM	05/27	P1151AMX	28,000	228	17.84	12.78	1.69	Corn	PMDI
		328 - 5 GPM	05/27	P1151AMX	28,000	227	19.44	11.67	1.69	Corn	PMDI
		414 - 4 GPM	05/30	P1151AMX	29,270	195	16.02	12.17	120.00	Corn	PMDI
Grall - LEPA	Moore	328 - 3 GPM	05/27	P1151AMX	28,000	236	13.08	18.04	79.86	Corn	LEPA
		328 - 4 GPM	05/27	P1151AMX	28,000	240	17.84	13.45	8.00	Corn	LEPA
		328 - 5 GPM	05/27	P1151AMX	28,000	237	19.44	12.19	8.00	Corn	LEPA
Spain - SDI	Moore	3 GPM	05/24	D58VC53	32,000	277	10.33	26.82	2.43	Corn	SDI
		4 GPM	05/24	D58VC53	32,000	267	12.49	21.38	2.43	Corn	SDI
		5 GPM	05/24	D58VC53	32,000	265	14.65	18.09	2.43	Corn	SDI
Spain - LEPA	Moore	3 GPM	05/24	P1197AMT	32,000	260	11.38	22.85	18.30	Corn	LEPA
		4 GPM	05/24	P1197AMT	32,000	270	13.67	19.75	18.30	Corn	LEPA
		5 GPM	05/24	P1197AMT	32,000	270	15.94	16.94	18.30	Corn	LEPA
		North - 4 GPM	05/25	P1197AMT	32,000	270	13.64	19.79	55.00	Corn	LEPA

Appendix B: 2017 Summary by Grower, Corn Yield Bushels/Acre-Inch of Irrigation, “3-4-5 GPM” Project

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 @ \$3.63/bu	Net Return/Ac-In Irrigation (\$)
Krienke - LEPA	3 GPM	05/31	0.00	13.10	13.10	10.48	23.58	0.00	23.58	228	17.40	9.67	\$433.25	\$33.07
Krienke - LEPA	4 GPM	05/09	0.00	16.13	16.13	10.48	26.61	1.12	27.73	243	15.06	8.76	\$454.45	\$28.17
Krienke - LEPA	5 GPM	05/31	0.00	18.75	18.75	10.48	29.23	0.00	29.23	244	13.01	8.34	\$440.87	\$23.51
Krienke - LEPA	3 GPM-Early	05/31	0.00	18.03	18.03	9.49	27.52	0.00	27.52	221	12.26	8.03	\$370.72	\$20.56
Grall - PMDI	328 - 3 GPM	05/27	1.13	11.95	13.08	11.08	24.16	0.00	24.16	221	16.89	9.15	\$414.72	\$31.71
Grall - PMDI	328 - 4 GPM	05/27	2.25	15.59	17.84	11.08	28.92	0.00	28.92	228	12.78	7.88	\$403.86	\$22.64
Grall - PMDI	414 - 4 GPM	05/27	0.00	16.02	16.02	10.64	26.66	2.05	28.71	195	12.17	6.79	\$322.87	\$20.15
Grall - PMDI	328 - 5 GPM	05/27	2.18	17.26	19.44	11.08	30.52	0.00	30.52	227	11.67	7.43	\$391.28	\$20.12
Grall - LEPA	328 - 3 GPM	05/27	1.13	11.95	13.08	11.08	24.16	0.00	24.16	236	18.04	9.77	\$454.70	\$34.76
Grall - LEPA	328 - 4 GPM	05/27	2.25	15.59	17.84	11.08	28.92	0.00	28.92	240	13.45	8.30	\$435.85	\$24.43
Grall - LEPA	328 - 5 GPM	05/30	2.18	17.26	19.44	11.08	30.52	0.00	30.52	237	12.19	7.76	\$417.97	\$21.50
Spain - SDI	3 GPM	05/25	0.00	10.33	10.33	13.53	23.86	0.00	23.86	277	26.82	11.61	\$567.59	\$54.96
Spain - SDI	4 GPM	05/24	0.00	12.49	12.49	13.53	26.02	0.00	26.02	267	21.38	10.26	\$527.54	\$42.24
Spain - SDI	5 GPM	05/24	0.00	14.65	14.65	13.53	28.18	0.00	28.18	265	18.09	9.40	\$508.82	\$34.73
Spain - LEPA	3 GPM	05/24	0.00	11.38	11.38	12.62	24.00	0.00	24.00	260	22.85	10.83	\$515.76	\$45.32
Spain - LEPA	North - 4 GPM	05/24	0.00	13.64	13.64	12.62	26.26	0.00	26.26	270	19.79	10.28	\$528.22	\$38.64
Spain - LEPA	4 GPM	05/24	0.00	13.67	13.67	12.62	26.29	0.00	26.29	270	19.75	10.27	\$528.22	\$38.64
Spain - LEPA	5 GPM	05/24	0.00	15.94	15.94	12.62	28.56	0.00	28.56	270	16.94	9.45	\$514.14	\$32.25
Average	3 GPM	05/27	0.45	11.74	12.19	11.76	23.95	0.00	23.95	244	20.40	10.21	\$477.19	\$39.96
Average	4 GPM	05/25	0.64	14.73	15.38	11.72	27.55	0.45	27.55	245	16.34	8.94	\$457.67	\$30.73
Average	5 GPM	05/25	0.87	16.77	17.64	11.76	29.40	0.00	29.40	249	14.38	8.48	\$454.86	\$26.54
Average	3 GPM-E	05/09	0.00	18.03	18.03	9.49	27.52	0.00	27.52	221	12.26	8.03	\$370.72	\$20.56

Appendix C: 2017 Summary by Field, Corn Yield Bushels/Acre-Inch Irrigation, “3-4- 5 GPM” Project

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 @ \$3.63/bu	Net Return/Ac-In Irrigation (\$)
Spain - SDI	3 GPM	05/24	0.00	10.33	10.33	13.53	23.86	0.00	23.86	277	26.82	11.61	\$567.59	\$54.96
Spain - LEPA	3 GPM	05/24	0.00	11.38	11.38	12.62	24.00	0.00	24.00	260	22.85	10.83	\$515.76	\$45.32
Spain - SDI	4 GPM	05/24	0.00	12.49	12.49	13.53	26.02	0.00	26.02	267	21.38	10.26	\$527.54	\$42.24
Spain - LEPA	North - 4 GPM	05/25	0.00	13.64	13.64	12.62	26.26	0.00	26.26	270	19.79	10.28	\$528.22	\$38.64
Spain - LEPA	4 GPM	05/24	0.00	13.67	13.67	12.62	26.29	0.00	26.29	270	19.75	10.27	\$528.22	\$38.64
Spain - SDI	5 GPM	05/24	0.00	14.65	14.65	13.53	28.18	0.00	28.18	265	18.09	9.40	\$508.82	\$34.73
Grall - LEPA	328 - 3 GPM	05/27	1.13	11.95	13.08	11.08	24.16	0.00	24.16	236	18.04	9.77	\$454.70	\$34.76
Krienke - LEPA	3 GPM	05/31	0.00	13.10	13.10	10.48	23.58	0.00	23.58	228	17.40	9.67	\$433.25	\$33.07
Spain - LEPA	5 GPM	05/24	0.00	15.94	15.94	12.62	28.56	0.00	28.56	270	16.94	9.45	\$514.14	\$32.25
Grall - PMDI	328 - 3 GPM	05/27	1.13	11.95	13.08	11.08	24.16	0.00	24.16	221	16.89	9.15	\$414.73	\$31.71
Krienke - LEPA	4 GPM	05/31	0.00	16.13	16.13	10.48	26.61	1.12	27.73	243	15.06	8.76	\$454.45	\$28.17
Grall - LEPA	328 - 4 GPM	05/27	2.25	15.59	17.84	11.08	28.92	0.00	28.92	240	13.45	8.30	\$435.85	\$24.43
Krienke - LEPA	5 GPM	05/31	0.00	18.75	18.75	10.48	29.23	0.00	29.23	244	13.01	8.34	\$440.87	\$23.51
Grall - PMDI	328 - 4 GPM	05/27	2.25	15.59	17.84	11.08	28.92	0.00	28.92	228	12.78	7.88	\$403.86	\$22.64
Krienke - LEPA	3 GPM-Early	05/09	0.00	18.03	18.03	9.49	27.52	0.00	27.52	221	12.26	8.03	\$370.72	\$20.56
Grall - LEPA	328 - 5 GPM	05/27	2.18	17.26	19.44	11.08	30.52	0.00	30.52	237	12.19	7.76	\$417.93	\$21.50
Grall - PMDI	414 - 4 GPM	05/30	0.00	16.02	16.02	10.64	26.66	2.05	28.71	195	12.17	6.79	\$391.28	\$20.12
Grall - PMDI	328 - 5 GPM	05/27	2.18	17.26	19.44	11.08	30.52	0.00	30.52	227	11.67	7.43	\$322.87	\$20.13
Average	3 GPM	05/27	0.45	11.74	12.19	11.76	23.95	0.00	23.95	244	20.40	10.21	\$477.19	\$39.96
Average	4 GPM	05/25	0.64	14.73	15.38	11.72	27.55	0.45	27.55	245	16.34	8.94	\$457.67	\$30.73
Average	5 GPM	05/25	0.87	16.77	17.64	11.76	29.40	0.00	29.40	249	14.38	8.48	\$454.86	\$26.54
Average	3 GPM-E	05/09	0.00	18.03	18.03	9.49	27.52	0.00	27.52	221	12.26	8.03	\$370.72	\$20.56

Appendix D: 2017 Water Summary by Net Return/Acre-Inch Irrigation by Field, “3-4-5 GPM” Project

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 @ \$3.63/bu	Net Return/ Ac-In Irrigation (\$)
Spain - SDI	3 GPM	05/24	0.00	10.33	10.33	13.53	23.86	0.00	23.86	277	26.82	11.61	\$567.59	\$54.96
Spain - LEPA	3 GPM	05/24	0.00	11.38	11.38	12.62	24.00	0.00	24.00	260	22.85	10.83	\$515.76	\$45.32
Spain - SDI	4 GPM	05/24	0.00	12.49	12.49	13.53	26.02	0.00	26.02	267	21.38	10.26	\$527.54	\$42.24
Spain - LEPA	4 GPM	05/24	0.00	13.67	13.67	12.62	26.29	0.00	26.29	270	19.75	10.27	\$528.22	\$38.64
Spain - LEPA	North - 4 GPM	05/25	0.00	13.64	13.64	12.62	26.26	0.00	26.26	270	19.79	10.28	\$528.22	\$38.64
Grall - LEPA	328 - 3 GPM	05/27	1.13	11.95	13.08	11.08	24.16	0.00	24.16	236	18.04	9.77	\$454.70	\$34.76
Spain - SDI	5 GPM	05/24	0.00	14.65	14.65	13.53	28.18	0.00	28.18	265	18.09	9.40	\$508.82	\$34.73
Krienke - LEPA	3 GPM	05/31	0.00	13.10	13.10	10.48	23.58	0.00	23.58	228	17.40	9.67	\$433.25	\$33.07
Spain - LEPA	5 GPM	05/24	0.00	15.94	15.94	12.62	28.56	0.00	28.56	270	16.94	9.45	\$514.14	\$32.25
Grall - PMDI	328 - 3 GPM	05/27	1.13	11.95	13.08	11.08	24.16	0.00	24.16	221	16.89	9.15	\$414.73	\$31.71
Krienke - LEPA	4 GPM	05/31	0.00	16.13	16.13	10.48	26.61	1.12	27.73	243	15.06	8.76	\$454.45	\$28.17
Grall - LEPA	328 - 4 GPM	05/27	2.25	15.59	17.84	11.08	28.92	0.00	28.92	240	13.45	8.30	\$435.85	\$24.43
Krienke - LEPA	5 GPM	05/31	0.00	18.75	18.75	10.48	29.23	0.00	29.23	244	13.01	8.34	\$440.87	\$23.51
Grall - PMDI	328 - 4 GPM	05/27	2.25	15.59	17.84	11.08	28.92	0.00	28.92	228	12.78	7.88	\$403.86	\$22.64
Grall - LEPA	328 - 5 GPM	05/27	2.18	17.26	19.44	11.08	30.52	0.00	30.52	237	12.19	7.76	\$417.93	\$21.50
Krienke - LEPA	3 GPM-Early	05/09	0.00	18.03	18.03	9.49	27.52	0.00	27.52	221	12.26	8.03	\$370.72	\$20.56
Grall - PMDI	328 - 5 GPM	05/27	2.18	17.26	19.44	11.08	30.52	0.00	30.52	227	11.67	7.43	\$322.87	\$20.13
Grall - PMDI	414 - 4 GPM	05/30	0.00	16.02	16.02	10.64	26.66	2.05	28.71	195	12.17	6.79	\$391.28	\$20.12
Average	3 GPM	05/27	0.45	11.74	12.19	11.76	23.95	0.00	23.95	244	20.40	10.21	\$477.19	\$39.96
Average	4 GPM	05/25	0.64	14.73	15.38	11.72	27.55	0.45	27.55	245	16.34	8.94	\$457.67	\$30.73
Average	5 GPM	05/25	0.87	16.77	17.64	11.76	29.40	0.00	29.40	249	14.38	8.48	\$454.86	\$26.54
Average	3 GPM-E	05/09	0.00	18.03	18.03	9.49	27.52	0.00	27.52	221	12.25	8.03	\$370.72	\$20.56

Appendix E: 2017 Water Summary by Net Return/Acre-In of Total Water by Field and by Grower, “3-4-5 GPM” Project

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 @ \$3.63/bu	Net Return/Ac-In Irrigation (\$)	Net Return/Ac-In Total Water (\$)
Spain - SDI	3 GPM	05/24	0.00	10.33	10.33	13.53	23.86	0.00	23.86	277	26.82	11.61	\$567.59	\$54.96	\$23.79
Spain - LEPA	3 GPM	05/24	0.00	11.38	11.38	12.62	24.00	0.00	24.00	260	22.85	10.83	\$515.76	\$45.32	\$21.49
Spain - SDI	4 GPM	05/24	0.00	12.49	12.49	13.53	26.02	0.00	26.02	267	21.38	10.26	\$527.54	\$42.24	\$20.27
Spain - LEPA	North - 4 GPM	05/25	0.00	13.64	13.64	12.62	26.26	0.00	26.26	270	19.79	10.28	\$528.22	\$38.64	\$20.12
Spain - LEPA	4 GPM	05/24	0.00	13.67	13.67	12.62	26.29	0.00	26.29	270	19.75	10.27	\$528.22	\$38.64	\$20.09
Grall - LEPA	328 - 3 GPM	05/27	1.13	11.95	13.08	11.08	24.16	0.00	24.16	236	18.04	9.77	\$454.70	\$34.76	\$18.82
Krienke - LEPA	3 GPM	05/31	0.00	13.10	13.10	10.48	23.58	0.00	23.58	228	17.40	9.67	\$433.25	\$33.07	\$18.37
Spain - SDI	5 GPM	05/24	0.00	14.65	14.65	13.53	28.18	0.00	28.18	265	18.09	9.40	\$508.82	\$34.73	\$18.06
Spain - LEPA	5 GPM	05/24	0.00	15.94	15.94	12.62	28.56	0.00	28.56	270	16.94	9.45	\$514.14	\$32.25	\$18.00
Grall - PMDI	328 - 3 GPM	05/27	1.13	11.95	13.08	11.08	24.16	0.00	24.16	221	16.89	9.15	\$414.73	\$31.71	\$17.16
Krienke - LEPA	4 GPM	05/31	0.00	16.13	16.13	10.48	26.61	1.12	27.73	243	15.06	8.76	\$454.45	\$28.17	\$16.39
Krienke - LEPA	5 GPM	05/31	0.00	18.75	18.75	10.48	29.23	0.00	29.23	244	13.01	8.34	\$440.87	\$23.51	\$15.08
Grall - LEPA	328 - 4 GPM	05/27	2.25	15.59	17.84	11.08	28.92	0.00	28.92	240	13.45	8.30	\$435.85	\$24.43	\$15.07
Grall - PMDI	328 - 4 GPM	05/27	2.25	15.59	17.84	11.08	28.92	0.00	28.92	228	12.78	7.88	\$403.86	\$22.64	\$13.96
Grall - LEPA	328 - 5 GPM	05/27	2.18	17.26	19.44	11.08	30.52	0.00	30.52	237	12.19	7.76	\$417.93	\$21.50	\$13.69
Krienke - LEPA	3 GPM-Early	05/09	0.00	18.03	18.03	9.49	27.52	0.00	27.52	221	12.26	8.03	\$370.72	\$20.56	\$13.47
Grall - PMDI	328 - 5 GPM	05/27	2.18	17.26	19.44	11.08	30.52	0.00	30.52	227	11.67	7.43	\$322.87	\$20.13	\$12.82
Grall - PMDI	414 - 4 GPM	05/30	0.00	16.02	16.02	10.64	26.66	2.05	28.71	195	12.17	6.79	\$391.28	\$20.12	\$11.24
Average	3 GPM	05/27	0.45	11.74	12.19	11.76	23.95	0.00	23.95	244	20.40	10.21	\$477.19	\$39.96	\$19.92
Average	4 GPM	05/25	0.64	14.73	15.38	11.72	27.55	0.45	27.55	245	16.34	8.94	\$457.67	\$30.73	\$16.97
Average	5 GPM	05/25	0.87	16.77	17.64	11.76	29.40	0.00	29.40	249	14.38	8.48	\$454.86	\$26.54	\$15.47
Average	3 GPM-E	05/09	0.00	18.03	18.03	9.49	27.52	0.00	27.52	221	12.25	8.03	\$370.72	\$20.56	\$13.47

Appendix F: 2017 Water Summary by Net Return/Acre by Field and Grower, “3-4-5 GPM” Project

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 @ \$3.63/bu	Net Return/Ac-In Irrigation (\$)	Net Return/Ac-In Total Water (\$)
Spain - SDI	3 GPM	05/24	0.00	10.33	10.33	13.53	23.86	0.00	23.86	277	26.82	11.61	\$567.59	\$54.96	\$23.79
Spain - LEPA	North - 4 GPM	05/25	0.00	13.64	13.64	12.62	26.26	0.00	26.26	270	19.79	10.28	\$528.22	\$38.64	\$20.12
Spain - LEPA	4 GPM	05/24	0.00	13.67	13.67	12.62	26.29	0.00	26.29	270	19.75	10.27	\$528.22	\$38.64	\$20.09
Spain - SDI	4 GPM	05/24	0.00	12.49	12.49	13.53	26.02	0.00	26.02	267	21.38	10.26	\$527.54	\$42.24	\$20.27
Spain - LEPA	3 GPM	05/24	0.00	11.38	11.38	12.62	24.00	0.00	24.00	260	22.85	10.83	\$515.76	\$45.32	\$21.49
Spain - LEPA	5 GPM	05/24	0.00	15.94	15.94	12.62	28.56	0.00	28.56	270	16.94	9.45	\$514.14	\$32.25	\$18.00
Spain - SDI	5 GPM	05/24	0.00	14.65	14.65	13.53	28.18	0.00	28.18	265	18.09	9.40	\$508.82	\$34.73	\$18.06
Grall - LEPA	328 - 3 GPM	05/27	1.13	11.95	13.08	11.08	24.16	0.00	24.16	236	18.04	9.77	\$454.70	\$34.76	\$18.82
Krienke - LEPA	4 GPM	05/31	0.00	16.13	16.13	10.48	26.61	1.12	27.73	243	15.06	8.76	\$454.45	\$28.17	\$16.39
Krienke - LEPA	5 GPM	05/31	0.00	18.75	18.75	10.48	29.23	0.00	29.23	244	13.01	8.34	\$440.87	\$23.51	\$15.08
Grall - LEPA	328 - 4 GPM	05/27	2.25	15.59	17.84	11.08	28.92	0.00	28.92	240	13.45	8.30	\$435.85	\$24.43	\$15.07
Krienke - LEPA	3 GPM	05/31	0.00	13.10	13.10	10.48	23.58	0.00	23.58	228	17.40	9.67	\$433.25	\$33.07	\$18.37
Grall - LEPA	328 - 5 GPM	05/27	2.18	17.26	19.44	11.08	30.52	0.00	30.52	237	12.19	7.76	\$417.93	\$21.50	\$13.69
Grall - PMDI	328 - 3 GPM	05/27	1.13	11.95	13.08	11.08	24.16	0.00	24.16	221	16.89	9.15	\$414.73	\$31.71	\$17.16
Grall - PMDI	328 - 4 GPM	05/27	2.25	15.59	17.84	11.08	28.92	0.00	28.92	228	12.78	7.88	\$403.86	\$22.64	\$13.96
Grall - PMDI	414 - 4 GPM	05/30	0.00	16.02	16.02	10.64	26.66	2.05	28.71	195	12.17	6.79	\$391.28	\$20.12	\$11.24
Krienke - LEPA	3 GPM-Early	05/09	0.00	18.03	18.03	9.49	27.52	0.00	27.52	221	12.26	8.03	\$370.72	\$20.56	\$13.47
Grall - PMDI	328 - 5 GPM	05/27	2.18	17.26	19.44	11.08	30.52	0.00	30.52	227	11.67	7.43	\$322.87	\$20.13	\$12.82
Average	3 GPM	05/27	0.45	11.74	12.19	11.76	23.95	0.00	23.95	244	20.40	10.21	\$477.19	\$39.96	\$19.92
Average	4 GPM	05/25	0.64	14.73	15.38	11.72	27.55	0.45	27.55	245	16.34	8.94	\$457.67	\$30.73	\$16.97
Average	5 GPM	05/25	0.87	16.77	17.64	11.76	29.40	0.00	29.40	249	14.38	8.48	\$454.86	\$26.54	\$15.47
Average	3 GPM-E	05/09	0.00	18.03	18.03	9.49	27.52	0.00	27.52	221	12.25	8.03	\$370.72	\$20.56	\$16.39

Appendix G: 3-Year Summary (2015, 2016, 2017) Planting Dates, Seeding Rates, Irrigation, Rainfall, Net Soil Water Amounts, and Harvest Results, “3-4-5 GPM” Project

Grower	Field	Year	Planting Date	Seeding Rate	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
Grall - LESA	3 GPM	2015	05/12	26,000	2.63	11.84	14.47	11.61	26.08	3.97	30.05	222	15.34	7.38
Grall - LEPA	3 GPM	2016	05/25	30,000	0.00	13.57	13.57	8.78	22.35	1.52	23.87	203	14.96	8.50
Grall - LEPA	3 GPM	2017	05/27	28,000	1.13	11.95	13.08	11.08	24.16	0.00	24.16	236	18.04	9.77
Grall - LESA	4 GPM	2015	05/12	26,000	2.63	14.59	17.22	11.61	28.83	1.83	30.66	230	13.35	7.50
Grall - LEPA	4 GPM	2016	05/25	30,000	0.00	14.85	14.85	8.78	23.63	1.84	25.47	191	12.86	7.50
Grall - LEPA	4 GPM	2017	05/27	28,000	2.25	15.59	17.84	11.08	28.92	0.00	28.92	240	13.45	8.30
Grall - LESA	5 GPM	2015	05/12	26,000	2.63	17.20	19.83	11.61	31.44	2.45	33.89	233	11.75	6.87
Grall - LEPA	5 GPM	2016	05/25	30,000	0.00	15.82	15.82	8.78	24.60	1.67	26.27	190	12.01	7.23
Grall - LEPA	5 GPM	2017	05/27	28,000	2.18	19.44	19.44	11.08	30.52	0.00	30.52	237	12.19	7.76
Grall - PMDI	3 GPM	2016	05/25	30,000	0.00	13.57	13.57	8.78	22.35	4.02	26.37	216	15.91	8.19
Grall - PMDI	3 GPM	2017	05/27	28,000	1.13	11.95	13.08	11.08	24.16	0.00	24.16	221	16.89	9.15
Grall - PMDI	4 GPM	2016	05/25	30,000	0.00	14.85	14.85	8.78	23.63	1.93	25.56	200	13.47	7.82
Grall - PMDI	4 GPM	2017	05/27	28,000	2.25	15.59	17.84	11.08	28.92	0.00	28.92	228	12.78	7.88
Grall - PMDI	414 - 4 GPM	2017	05/30	29,270	0.00	16.02	16.02	10.64	26.66	2.05	28.71	195	12.17	6.79
Grall - PMDI	5 GPM	2016	05/25	30,000	0.00	15.82	15.82	8.78	24.60	0.00	24.60	198	12.51	8.05
Grall - PMDI	5 GPM	2017	05/27	28,000	2.18	17.26	19.44	11.08	30.52	0.00	30.52	227	11.67	7.43
Krienke - LEPA	3 GPM-Early	2016	04/25	29,000	0.00	13.11	13.11	13.86	26.97	4.19	31.16	231	17.62	7.41
Krienke - LEPA	3 GPM-Early	2017	05/09	32,000	0.00	18.03	18.03	9.49	27.52	0.00	27.52	221	12.26	8.03
Krienke - LEPA	3 GPM	2015	05/31	26,000	0.00	8.81	8.81	10.77	19.58	3.38	22.96	203	23.04	8.84
Krienke - LEPA	3 GPM	2016	05/30	26,000	0.00	11.07	11.07	12.31	23.36	3.35	26.73	207	18.70	7.74
Krienke - LEPA	3 GPM	2017	05/31	28,000	0.00	13.10	13.10	10.48	23.58	0.00	23.58	228	17.40	9.67
Krienke - LEPA	4 GPM	2015	05/31	27,000	0.00	10.69	10.69	11.79	22.48	2.66	25.14	209	19.55	8.31
Krienke - LEPA	4 GPM	2016	05/30	29,000	0.00	10.80	10.80	11.74	22.54	2.28	24.82	212	19.63	8.54
Krienke - LEPA	4 GPM	2017	05/31	28,000	0.00	16.13	16.13	10.48	26.61	1.12	27.73	243	15.06	8.76
Krienke - LEPA	5 GPM	2015	05/31	28,000	0.00	12.70	12.70	10.77	23.47	2.65	26.12	219	17.24	8.38
Krienke - LEPA	5 GPM	2016	05/30	33,000	0.00	11.07	11.07	11.74	22.81	1.22	24.03	217	19.60	9.03
Krienke - LEPA	5 GPM	2017	05/31	28,000	0.00	18.75	18.75	10.48	29.23	0.00	29.23	244	13.01	8.34

Appendix G: 3-Year Summary (2015, 2016, 2017) Planting Dates, Seeding Rates, Irrigation, Rainfall, Net Soil Water Amounts, and Harvest Results, “3-4-5 GPM” Project (continued)

Grower	Field	Year	Planting Date	Seeding Rate	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
Spain - LEPA	3 GPM	2015	05/29	32,000	1.31	8.45	9.76	12.77	22.53	3.80	26.33	227	23.26	8.62
Spain - LEPA	3 GPM	2016	05/27	32,000	0.00	14.82	14.82	6.41	21.23	6.35	27.58	195	13.15	7.07
Spain - LEPA	3 GPM	2017	05/24	32,000	0.00	11.38	11.38	12.62	24.00	0.00	24.00	260	22.85	10.83
Spain - LEPA	4 GPM	2015	05/29	32,000	1.31	10.40	11.71	12.77	23.31	2.31	26.79	239	20.41	8.92
Spain - LEPA	4 GPM	2016	05/27	32,000	0.00	18.10	18.10	6.41	24.51	1.31	25.82	217	11.99	8.40
Spain - LEPA	4 GPM	2017	05/24	32,000	0.00	13.67	13.67	12.62	26.29	0.00	26.29	270	19.75	10.27
Spain - LEPA	North-4 GPM	2017	05/24	32,000	0.00	13.64	13.64	12.62	26.26	0.00	26.26	270	19.79	10.28
Spain - LEPA	5 GPM	2015	05/29	32,000	1.31	12.30	13.61	12.77	26.38	0.71	27.09	260	19.10	9.59
Spain - LEPA	5 GPM	2016	05/27	32,000	0.00	18.91	18.91	6.41	25.32	4.20	29.52	260	13.75	8.81
Spain - LEPA	5 GPM	2017	05/24	32,000	0.00	15.94	15.94	12.62	28.56	0.00	28.56	270	16.94	9.45
Spain - SDI	3 GPM	2016	05/27	32,000	0.00	13.76	13.76	7.01	20.77	5.49	26.26	191	13.88	7.27
Spain - SDI	3 GPM	2017	05/24	32,000	0.00	10.33	10.33	13.53	23.86	0.00	23.86	277	26.81	11.61
Spain - SDI	4 GPM	2016	05/27	32,000	0.00	16.46	16.46	7.01	23.47	4.05	27.52	211	12.82	7.66
Spain - SDI	4 GPM	2017	05/24	32,000	0.00	12.49	12.49	13.53	26.02	0.00	26.02	267	21.38	10.26
Spain - SDI	5 GPM	2016	05/27	32,000	0.00	17.44	17.44	7.01	24.45	2.07	26.52	246	14.10	9.27
Spain - SDI	5 GPM	2017	05/24	32,000	0.00	14.65	14.65	13.53	28.18	0.00	28.18	265	18.09	9.40
Yoder - LESA	3 GPM	2015	05/12	32,000	1.22	12.29	13.51	16.60	30.11	-2.04	28.07	251	18.58	8.94
Yoder - LESA	3 GPM	2016	05/14	32,000	0.00	14.84	14.84	7.84	22.68	4.30	26.98	203	13.68	7.52
Yoder - LESA	4 GPM	2015	05/12	32,000	1.22	16.40	17.62	16.60	34.22	-3.50	30.72	276	15.66	8.98
Yoder - LESA	4 GPM	2016	05/14	36,000	0.00	19.90	19.90	7.84	27.74	2.61	30.35	239	12.01	7.87
Yoder - LESA	5 GPM	2015	05/12	32,000	1.22	20.57	21.79	16.60	38.39	-3.52	34.87	307	14.09	8.80
Yoder - LESA	5 GPM	2016	05/14	38,000	0.00	25.19	25.19	7.84	33.03	1.18	34.21	252	10.00	7.36
Overall 3-4-5 Demonstration Averages	3 GPM		05/23	29,733	0.49	12.12	12.61	10.78	23.39	2.28	25.66	223	18.17	8.74
	4 GPM		05/23	30,310	0.57	14.72	15.28	10.90	26.12	1.21	27.39	232	15.66	8.47
	5 GPM		05/22	30,733	0.63	16.87	17.36	10.74	28.10	0.84	28.94	242	14.40	8.38
	3 GPM-Early		05/01	30,500	0.00	15.57	15.57	11.68	27.25	2.10	29.34	226	14.94	7.72

Appendix H: 3-Year Summary (2015, 2016, 2017) Corn Yield/Acre-Inch of Irrigation Applied by all Cooperating Growers, “3-4-5 GPM” Project

Grower	Field	Year	Planting Date	Seeding Rate	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
Grall - LEPA	3 GPM	2017	05/27	28,000	1.13	11.95	13.08	11.08	24.16	0.00	24.16	236	18.04	9.77
Grall - LESA	3 GPM	2015	05/12	26,000	2.63	11.84	14.47	11.61	26.08	3.97	30.05	222	15.34	7.38
Grall - LEPA	3 GPM	2016	05/25	30,000	0.00	13.57	13.57	8.78	22.35	1.52	23.87	203	14.96	8.50
Grall - LEPA	4 GPM	2017	05/27	28,000	2.25	15.59	17.84	11.08	28.92	0.00	28.92	240	13.45	8.30
Grall - LESA	4 GPM	2015	05/12	26,000	2.63	14.59	17.22	11.61	28.83	1.83	30.66	230	13.35	7.50
Grall - LEPA	4 GPM	2016	05/25	30,000	0.00	14.85	14.85	8.78	23.63	1.84	25.47	191	12.86	7.50
Grall - LEPA	5 GPM	2017	05/27	28,000	2.18	19.44	19.44	11.08	30.52	0.00	30.52	237	12.19	7.76
Grall - LEPA	5 GPM	2016	05/25	30,000	0.00	15.82	15.82	8.78	24.60	1.67	26.27	190	12.01	7.23
Grall - LESA	5 GPM	2015	05/12	26,000	2.63	17.20	19.83	11.61	31.44	2.45	33.89	233	11.75	6.87
Grall - PMDI	3 GPM	2017	05/27	28,000	1.13	11.95	13.08	11.08	24.16	0.00	24.16	221	16.89	9.15
Grall - PMDI	3 GPM	2016	05/25	30,000	0.00	13.57	13.57	8.78	22.35	4.02	26.37	216	15.91	8.19
Grall - PMDI	4 GPM	2016	05/25	30,000	0.00	14.85	14.85	8.78	23.63	1.93	25.56	200	13.47	7.82
Grall - PMDI	4 GPM	2017	05/27	28,000	2.25	15.59	17.84	11.08	28.92	0.00	28.92	228	12.78	7.88
Grall - PMDI	5 GPM	2016	05/25	30,000	0.00	15.82	15.82	8.78	24.60	0.00	24.60	198	12.51	8.05
Grall - PMDI	414 - 4 GPM	2017	05/30	29,270	0.00	16.02	16.02	10.64	26.66	2.05	28.71	195	12.17	6.79
Grall - PMDI	5 GPM	2017	05/27	28,000	2.18	17.26	19.44	11.08	30.52	0.00	30.52	227	11.67	7.43
Krienke - LEPA	3 GPM	2015	05/31	26,000	0.00	8.81	8.81	10.77	19.58	3.38	22.96	203	23.04	8.84
Krienke - LEPA	4 GPM	2016	05/30	29,000	0.00	10.80	10.80	11.74	22.54	2.28	24.82	212	19.63	8.54
Krienke - LEPA	5 GPM	2016	05/30	33,000	0.00	11.07	11.07	11.74	22.81	1.22	24.03	217	19.60	9.03
Krienke - LEPA	4 GPM	2015	05/31	27,000	0.00	10.69	10.69	11.79	22.48	2.66	25.14	209	19.55	8.31
Krienke - LEPA	3 GPM	2016	05/30	26,000	0.00	11.07	11.07	12.31	23.36	3.35	26.73	207	18.70	7.74
Krienke - LEPA	3 GPM-Early	2016	04/25	29,000	0.00	13.11	13.11	13.86	26.97	4.19	31.16	231	17.62	7.41
Krienke - LEPA	3 GPM	2017	05/31	28,000	0.00	13.10	13.10	10.48	23.58	0.00	23.58	228	17.40	9.67
Krienke - LEPA	5 GPM	2015	05/31	28,000	0.00	12.70	12.70	10.77	23.47	2.65	26.12	219	17.24	8.38
Krienke - LEPA	4 GPM	2017	05/31	28,000	0.00	16.13	16.13	10.48	26.61	1.12	27.73	243	15.06	8.76
Krienke - LEPA	5 GPM	2017	05/31	28,000	0.00	18.75	18.75	10.48	29.23	0.00	29.23	244	13.01	8.34
Krienke - LEPA	3 GPM-Early	2017	05/09	32,000	0.00	18.03	18.03	9.49	27.52	0.00	27.52	221	12.26	8.03

Appendix H: 3-Year Summary (2015, 2016, 2017) Corn Yield/Acre-Inch of Irrigation Applied by all Cooperating Growers, “3-4-5 GPM” Project (continued)

Grower	Field	Year	Planting Date	Seeding Rate	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
Spain - LEPA	3 GPM	2015	05/29	32,000	1.31	8.45	9.76	12.77	22.53	3.80	26.33	227	23.26	8.62
Spain - LEPA	3 GPM	2017	05/24	32,000	0.00	11.38	11.38	12.62	24.00	0.00	24.00	260	22.85	10.83
Spain - LEPA	4 GPM	2015	05/29	32,000	1.31	10.40	11.71	12.77	23.31	2.31	26.79	239	20.41	8.92
Spain - LEPA	North-4 GPM	2017	05/24	32,000	0.00	13.64	13.64	12.62	26.26	0.00	26.26	270	19.79	10.28
Spain - LEPA	4 GPM	2017	05/24	32,000	0.00	13.67	13.67	12.62	26.29	0.00	26.29	270	19.75	10.27
Spain - LEPA	5 GPM	2015	05/29	32,000	1.31	12.30	13.61	12.77	26.38	0.71	27.09	260	19.10	9.59
Spain - LEPA	5 GPM	2017	05/24	32,000	0.00	15.94	15.94	12.62	28.56	0.00	28.56	270	16.94	9.45
Spain - LEPA	5 GPM	2016	05/27	32,000	0.00	18.91	18.91	6.41	25.32	4.20	29.52	260	13.75	8.81
Spain - LEPA	3 GPM	2016	05/27	32,000	0.00	14.82	14.82	6.41	21.23	6.35	27.58	195	13.15	7.07
Spain - LEPA	4 GPM	2016	05/27	32,000	0.00	18.10	18.10	6.41	24.51	1.31	25.82	217	11.99	8.40
Spain - SDI	3 GPM	2017	05/24	32,000	0.00	10.33	10.33	13.53	23.86	0.00	23.86	277	26.81	11.61
Spain - SDI	4 GPM	2017	05/24	32,000	0.00	12.49	12.49	13.53	26.02	0.00	26.02	267	21.38	10.26
Spain - SDI	5 GPM	2017	05/24	32,000	0.00	14.65	14.65	13.53	28.18	0.00	28.18	265	18.09	9.40
Spain - SDI	5 GPM	2016	05/27	32,000	0.00	17.44	17.44	7.01	24.45	2.07	26.52	246	14.10	9.27
Spain - SDI	3 GPM	2016	05/27	32,000	0.00	13.76	13.76	7.01	20.77	5.49	26.26	191	13.88	7.27
Spain - SDI	4 GPM	2016	05/27	32,000	0.00	16.46	16.46	7.01	23.47	4.05	27.52	211	12.82	7.66
Yoder - LESA	3 GPM	2015	05/12	32,000	1.22	12.29	13.51	16.60	30.11	-2.04	28.07	251	18.58	8.94
Yoder - LESA	4 GPM	2015	05/12	32,000	1.22	16.40	17.62	16.60	34.22	-3.50	30.72	276	15.66	8.98
Yoder - LESA	5 GPM	2015	05/12	32,000	1.22	20.57	21.79	16.60	38.39	-3.52	34.87	307	14.09	8.80
Yoder - LESA	3 GPM	2016	05/14	32,000	0.00	14.84	14.84	7.84	22.68	4.30	26.98	203	13.68	7.52
Yoder - LESA	4 GPM	2016	05/14	36,000	0.00	19.90	19.90	7.84	27.74	2.61	30.35	239	12.01	7.87
Yoder - LESA	5 GPM	2016	05/14	38,000	0.00	25.19	25.19	7.84	33.03	1.18	34.21	252	10.00	7.36
Overall 3-4-5 Demonstration Averages	3 GPM		05/23	29,733	0.49	12.12	12.61	10.78	23.39	2.28	25.66	223	18.17	8.74
	4 GPM		05/23	30,310	0.57	14.72	15.28	10.90	26.12	1.21	27.39	232	15.66	8.47
	5 GPM		05/22	30,733	0.63	16.87	17.36	10.74	28.10	0.84	28.94	242	14.40	8.38
	3 GPM-Early		05/01	30,500	0.00	15.57	15.57	11.68	27.25	2.10	29.34	226	14.94	7.72

Appendix I: 3-Year Summary (2015, 2016, 2017) Bushel Yield Produced from Each Inch of Irrigation, “3-4-5 GPM” Project

Grower	Field	Year	Planting Date	Seeding Rate	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
Spain - SDI	3 GPM	2017	05/24	32,000	0.00	10.33	10.33	13.53	23.86	0.00	23.86	277	26.81	11.61
Spain - LEPA	3 GPM	2015	05/29	32,000	1.31	8.45	9.76	12.77	22.53	3.80	26.33	227	23.26	8.62
Krienke - LEPA	3 GPM	2015	05/31	26,000	0.00	8.81	8.81	10.77	19.58	3.38	22.96	203	23.04	8.84
Spain - LEPA	3 GPM	2017	05/24	32,000	0.00	11.38	11.38	12.62	24.00	0.00	24.00	260	22.85	10.83
Spain - SDI	4 GPM	2017	05/24	32,000	0.00	12.49	12.49	13.53	26.02	0.00	26.02	267	21.38	10.26
Spain - LEPA	4 GPM	2015	05/29	32,000	1.31	10.40	11.71	12.77	23.31	2.31	26.79	239	20.41	8.92
Spain - LEPA	North-4 GPM	2017	05/24	32,000	0.00	13.64	13.64	12.62	26.26	0.00	26.26	270	19.79	10.28
Spain - LEPA	4 GPM	2017	05/24	32,000	0.00	13.67	13.67	12.62	26.29	0.00	26.29	270	19.75	10.27
Krienke - LEPA	4 GPM	2016	05/30	29,000	0.00	10.80	10.80	11.74	22.54	2.28	24.82	212	19.63	8.54
Krienke - LEPA	5 GPM	2016	05/30	33,000	0.00	11.07	11.07	11.74	22.81	1.22	24.03	217	19.60	9.03
Krienke - LEPA	4 GPM	2015	05/31	27,000	0.00	10.69	10.69	11.79	22.48	2.66	25.14	209	19.55	8.31
Spain - LEPA	5 GPM	2015	05/29	32,000	1.31	12.30	13.61	12.77	26.38	0.71	27.09	260	19.10	9.59
Krienke - LEPA	3 GPM	2016	05/30	26,000	0.00	11.07	11.07	12.31	23.36	3.35	26.73	207	18.70	7.74
Yoder - LESA	3 GPM	2015	05/12	32,000	1.22	12.29	13.51	16.60	30.11	-2.04	28.07	251	18.58	8.94
Spain - SDI	5 GPM	2017	05/24	32,000	0.00	14.65	14.65	13.53	28.18	0.00	28.18	265	18.09	9.40
Grall - LEPA	3 GPM	2017	05/27	28,000	1.13	11.95	13.08	11.08	24.16	0.00	24.16	236	18.04	9.77
Krienke - LEPA	3 GPM-Early	2016	04/25	29,000	0.00	13.11	13.11	13.86	26.97	4.19	31.16	231	17.62	7.41
Krienke - LEPA	3 GPM	2017	05/31	28,000	0.00	13.10	13.10	10.48	23.58	0.00	23.58	228	17.40	9.67
Krienke - LEPA	5 GPM	2015	05/31	28,000	0.00	12.70	12.70	10.77	23.47	2.65	26.12	219	17.24	8.38
Spain - LEPA	5 GPM	2017	05/24	32,000	0.00	15.94	15.94	12.62	28.56	0.00	28.56	270	16.94	9.45
Grall - PMDI	3 GPM	2017	05/27	28,000	1.13	11.95	13.08	11.08	24.16	0.00	24.16	221	16.89	9.15
Grall - PMDI	3 GPM	2016	05/25	30,000	0.00	13.57	13.57	8.78	22.35	4.02	26.37	216	15.91	8.19
Yoder - LESA	4 GPM	2015	05/12	32,000	1.22	16.40	17.62	16.60	34.22	-3.50	30.72	276	15.66	8.98
Grall - LESA	3 GPM	2015	05/12	26,000	2.63	11.84	14.47	11.61	26.08	3.97	30.05	222	15.34	7.38
Krienke - LEPA	4 GPM	2017	05/31	28,000	0.00	16.13	16.13	10.48	26.61	1.12	27.73	243	15.06	8.76
Grall - LEPA	3 GPM	2016	05/25	30,000	0.00	13.57	13.57	8.78	22.35	1.52	23.87	203	14.96	8.50
Spain - SDI	5 GPM	2016	05/27	32,000	0.00	17.44	17.44	7.01	24.45	2.07	26.52	246	14.10	9.27

Appendix I: 3-Year Summary (2015, 2016, 2017) Bushel Yield Produced from Each Inch of Irrigation, “3-4-5 GPM” Project (continued)

Grower	Field	Year	Planting Date	Seeding Rate	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
Yoder - LESA	5 GPM	2015	05/12	32,000	1.22	20.57	21.79	16.60	38.39	-3.52	34.87	307	14.09	8.80
Spain - SDI	3 GPM	2016	05/27	32,000	0.00	13.76	13.76	7.01	20.77	5.49	26.26	191	13.88	7.27
Spain - LEPA	5 GPM	2016	05/27	32,000	0.00	18.91	18.91	6.41	25.32	4.20	29.52	260	13.75	8.81
Yoder - LESA	3 GPM	2016	05/14	32,000	0.00	14.84	14.84	7.84	22.68	4.30	26.98	203	13.68	7.52
Grall - PMDI	4 GPM	2016	05/25	30,000	0.00	14.85	14.85	8.78	23.63	1.93	25.56	200	13.47	7.82
Grall - LEPA	4 GPM	2017	05/27	28,000	2.25	15.59	17.84	11.08	28.92	0.00	28.92	240	13.45	8.30
Grall - LESA	4 GPM	2015	05/12	26,000	2.63	14.59	17.22	11.61	28.83	1.83	30.66	230	13.35	7.50
Spain - LEPA	3 GPM	2016	05/27	32,000	0.00	14.82	14.82	6.41	21.23	6.35	27.58	195	13.15	7.07
Krienke - LEPA	5 GPM	2017	05/31	28,000	0.00	18.75	18.75	10.48	29.23	0.00	29.23	244	13.01	8.34
Grall - LEPA	4 GPM	2016	05/25	30,000	0.00	14.85	14.85	8.78	23.63	1.84	25.47	191	12.86	7.50
Spain - SDI	4 GPM	2016	05/27	32,000	0.00	16.46	16.46	7.01	23.47	4.05	27.52	211	12.82	7.66
Grall - PMDI	4 GPM	2017	05/27	28,000	2.25	15.59	17.84	11.08	28.92	0.00	28.92	228	12.78	7.88
Grall - PMDI	5 GPM	2016	05/25	30,000	0.00	15.82	15.82	8.78	24.60	0.00	24.60	198	12.51	8.05
Krienke - LEPA	3 GPM-Early	2017	05/09	32,000	0.00	18.03	18.03	9.49	27.52	0.00	27.52	221	12.26	8.03
Grall - LEPA	5 GPM	2017	05/27	28,000	2.18	19.44	19.44	11.08	30.52	0.00	30.52	237	12.19	7.76
Grall - PMDI	414 - 4 GPM	2017	05/30	29,270	0.00	16.02	16.02	10.64	26.66	2.05	28.71	195	12.17	6.79
Grall - LEPA	5 GPM	2016	05/25	30,000	0.00	15.82	15.82	8.78	24.60	1.67	26.27	190	12.01	7.23
Yoder - LESA	4 GPM	2016	05/14	36,000	0.00	19.90	19.90	7.84	27.74	2.61	30.35	239	12.01	7.87
Spain - LEPA	4 GPM	2016	05/27	32,000	0.00	18.10	18.10	6.41	24.51	1.31	25.82	217	11.99	8.40
Grall - LESA	5 GPM	2015	05/12	26,000	2.63	17.20	19.83	11.61	31.44	2.45	33.89	233	11.75	6.87
Grall - PMDI	5 GPM	2017	05/27	28,000	2.18	17.26	19.44	11.08	30.52	0.00	30.52	227	11.67	7.43
Yoder - LESA	5 GPM	2016	05/14	38,000	0.00	25.19	25.19	7.84	33.03	1.18	34.21	252	10.00	7.36
Overall 3-4-5 Demonstration Averages	3 GPM		05/23	29,733	0.49	12.12	12.61	10.78	23.39	2.28	25.66	223	18.17	8.74
	4 GPM		05/23	30,310	0.57	14.72	15.28	10.90	26.12	1.21	27.39	232	15.66	8.47
	5 GPM		05/22	30,733	0.63	16.87	17.36	10.74	28.10	0.84	28.94	242	14.40	8.38
	3 GPM-Early		05/01	30,500	0.00	15.57	15.57	11.68	27.25	2.10	29.34	226	14.94	7.72

Appendix J: 3-Year Summary (2015, 2016, 2017) Bushel Yield Produced from Each Inch of Total Water by Field and Grower, “3-4-5 GPM” Project

Grower	Field	Year	Planting Date	Seeding Rate	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
Spain - SDI	3 GPM	2017	05/24	32,000	0.00	10.33	10.33	13.53	23.86	0.00	23.86	277	26.81	11.61
Spain - LEPA	3 GPM	2017	05/24	32,000	0.00	11.38	11.38	12.62	24.00	0.00	24.00	260	22.85	10.83
Spain - LEPA	North-4 GPM	2017	05/24	32,000	0.00	13.64	13.64	12.62	26.26	0.00	26.26	270	19.79	10.28
Spain - LEPA	4 GPM	2017	05/24	32,000	0.00	13.67	13.67	12.62	26.29	0.00	26.29	270	19.75	10.27
Spain - SDI	4 GPM	2017	05/24	32,000	0.00	12.49	12.49	13.53	26.02	0.00	26.02	267	21.38	10.26
Grall - LEPA	3 GPM	2017	05/27	28,000	1.13	11.95	13.08	11.08	24.16	0.00	24.16	236	18.04	9.77
Krienke - LEPA	3 GPM	2017	05/31	28,000	0.00	13.10	13.10	10.48	23.58	0.00	23.58	228	17.40	9.67
Spain - LEPA	5 GPM	2015	05/29	32,000	1.31	12.30	13.61	12.77	26.38	0.71	27.09	260	19.10	9.59
Spain - LEPA	5 GPM	2017	05/24	32,000	0.00	15.94	15.94	12.62	28.56	0.00	28.56	270	16.94	9.45
Spain - SDI	5 GPM	2017	05/24	32,000	0.00	14.65	14.65	13.53	28.18	0.00	28.18	265	18.09	9.40
Spain - SDI	5 GPM	2016	05/27	32,000	0.00	17.44	17.44	7.01	24.45	2.07	26.52	246	14.10	9.27
Grall - PMDI	3 GPM	2017	05/27	28,000	1.13	11.95	13.08	11.08	24.16	0.00	24.16	221	16.89	9.15
Krienke - LEPA	5 GPM	2016	05/30	33,000	0.00	11.07	11.07	11.74	22.81	1.22	24.03	217	19.60	9.03
Yoder - LESA	4 GPM	2015	05/12	32,000	1.22	16.40	17.62	16.60	34.22	-3.50	30.72	276	15.66	8.98
Yoder - LESA	3 GPM	2015	05/12	32,000	1.22	12.29	13.51	16.60	30.11	-2.04	28.07	251	18.58	8.94
Spain - LEPA	4 GPM	2015	05/29	32,000	1.31	10.40	11.71	12.77	23.31	2.31	26.79	239	20.41	8.92
Krienke - LEPA	3 GPM	2015	05/31	26,000	0.00	8.81	8.81	10.77	19.58	3.38	22.96	203	23.04	8.84
Spain - LEPA	5 GPM	2016	05/27	32,000	0.00	18.91	18.91	6.41	25.32	4.20	29.52	260	13.75	8.81
Yoder - LESA	5 GPM	2015	05/12	32,000	1.22	20.57	21.79	16.60	38.39	-3.52	34.87	307	14.09	8.80
Krienke - LEPA	4 GPM	2017	05/31	28,000	0.00	16.13	16.13	10.48	26.61	1.12	27.73	243	15.06	8.76
Spain - LEPA	3 GPM	2015	05/29	32,000	1.31	8.45	9.76	12.77	22.53	3.80	26.33	227	23.26	8.62
Krienke - LEPA	4 GPM	2016	05/30	29,000	0.00	10.80	10.80	11.74	22.54	2.28	24.82	212	19.63	8.54
Grall - LEPA	3 GPM	2016	05/25	30,000	0.00	13.57	13.57	8.78	22.35	1.52	23.87	203	14.96	8.50
Spain - LEPA	4 GPM	2016	05/27	32,000	0.00	18.10	18.10	6.41	24.51	1.31	25.82	217	11.99	8.40
Krienke - LEPA	5 GPM	2015	05/31	28,000	0.00	12.70	12.70	10.77	23.47	2.65	26.12	219	17.24	8.38
Krienke - LEPA	5 GPM	2017	05/31	28,000	0.00	18.75	18.75	10.48	29.23	0.00	29.23	244	13.01	8.34
Krienke - LEPA	4 GPM	2015	05/31	27,000	0.00	10.69	10.69	11.79	22.48	2.66	25.14	209	19.55	8.31

Appendix J: 3-Year Summary (2015, 2016, 2017) Bushel Yield Produced from Each Inch of Total Water by Field and Grower, “3-4-5 GPM” Project (continued)

Grower	Field	Year	Planting Date	Seeding Rate	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
Grall - LEPA	4 GPM	2017	05/27	28,000	2.25	15.59	17.84	11.08	28.92	0.00	28.92	240	13.45	8.30
Grall - PMDI	3 GPM	2016	05/25	30,000	0.00	13.57	13.57	8.78	22.35	4.02	26.37	216	15.91	8.19
Grall - PMDI	5 GPM	2016	05/25	30,000	0.00	15.82	15.82	8.78	24.60	0.00	24.60	198	12.51	8.05
Krienke - LEPA	3 GPM-Early	2017	05/09	32,000	0.00	18.03	18.03	9.49	27.52	0.00	27.52	221	12.26	8.03
Grall - PMDI	4 GPM	2017	05/27	28,000	2.25	15.59	17.84	11.08	28.92	0.00	28.92	228	12.78	7.88
Yoder - LESA	4 GPM	2016	05/14	36,000	0.00	19.90	19.90	7.84	27.74	2.61	30.35	239	12.01	7.87
Grall - PMDI	4 GPM	2016	05/25	30,000	0.00	14.85	14.85	8.78	23.63	1.93	25.56	200	13.47	7.82
Grall - LEPA	5 GPM	2017	05/27	28,000	2.18	19.44	19.44	11.08	30.52	0.00	30.52	237	12.19	7.76
Krienke - LEPA	3 GPM	2016	05/30	26,000	0.00	11.07	11.07	12.31	23.36	3.35	26.73	207	18.70	7.74
Spain - SDI	4 GPM	2016	05/27	32,000	0.00	16.46	16.46	7.01	23.47	4.05	27.52	211	12.82	7.66
Yoder - LESA	3 GPM	2016	05/14	32,000	0.00	14.84	14.84	7.84	22.68	4.30	26.98	203	13.68	7.52
Grall - LESA	4 GPM	2015	05/12	26,000	2.63	14.59	17.22	11.61	28.83	1.83	30.66	230	13.35	7.50
Grall - LEPA	4 GPM	2016	05/25	30,000	0.00	14.85	14.85	8.78	23.63	1.84	25.47	191	12.86	7.50
Grall - PMDI	5 GPM	2017	05/27	28,000	2.18	17.26	19.44	11.08	30.52	0.00	30.52	227	11.67	7.43
Krienke - LEPA	3 GPM-Early	2016	04/25	29,000	0.00	13.11	13.11	13.86	26.97	4.19	31.16	231	17.62	7.41
Grall - LESA	3 GPM	2015	05/12	26,000	2.63	11.84	14.47	11.61	26.08	3.97	30.05	222	15.34	7.38
Yoder - LESA	5 GPM	2016	05/14	38,000	0.00	25.19	25.19	7.84	33.03	1.18	34.21	252	10.00	7.36
Spain - SDI	3 GPM	2016	05/27	32,000	0.00	13.76	13.76	7.01	20.77	5.49	26.26	191	13.88	7.27
Grall - LEPA	5 GPM	2016	05/25	30,000	0.00	15.82	15.82	8.78	24.60	1.67	26.27	190	12.01	7.23
Spain - LEPA	3 GPM	2016	05/27	32,000	0.00	14.82	14.82	6.41	21.23	6.35	27.58	195	13.15	7.07
Grall - LESA	5 GPM	2015	05/12	26,000	2.63	17.20	19.83	11.61	31.44	2.45	33.89	233	11.75	6.87
Grall - PMDI	414 - 4 GPM	2017	05/30	29,270	0.00	16.02	16.02	10.64	26.66	2.05	28.71	195	12.17	6.79
Overall 3-4-5 Demonstration Averages	3 GPM		05/23	29,733	0.49	12.12	12.61	10.78	23.39	2.28	25.66	223	18.17	8.74
	4 GPM		05/23	30,310	0.57	14.72	15.28	10.90	26.12	1.21	27.39	232	15.66	8.47
	5 GPM		05/22	30,733	0.63	16.87	17.36	10.74	28.10	0.84	28.94	242	14.40	8.38
	3 GPM-Early		05/01	30,500	0.00	15.57	15.57	11.68	27.25	2.10	29.34	226	14.94	7.72

Appendix K: 2017 Cotton “3-4-5 GPM” Project, Spain

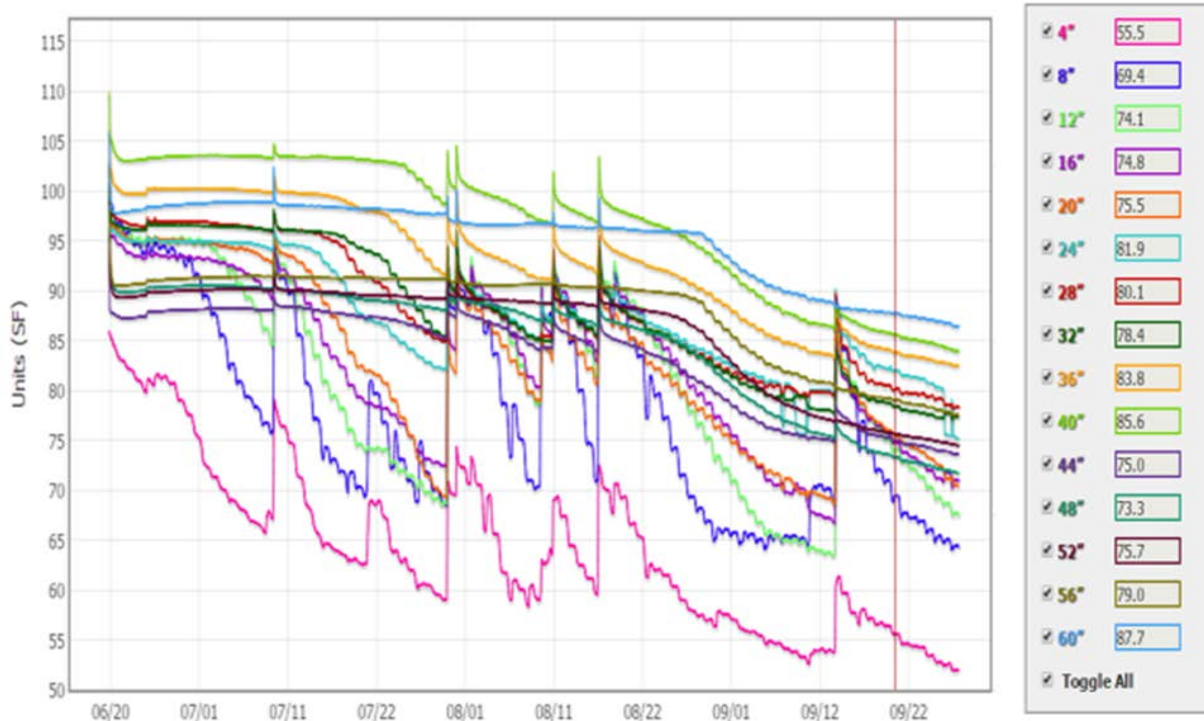
Grower	Field	Planting Date	Pre-Water (in)	Irrigation (in)	Total Irrigation (in)	Rainfall (in)	Total Rain & Irrigation (in)	Net Soil Water (in)	Total Water (in)	Cotton Yield (lb/ac)	Yield @ lb/ac-in Irrigation	Yield @ lb/ac-in Total Water
Spain SDI	3 GPM	5/17	0.00	6.42	6.42	13.17	19.59	3.54	23.13	1189	185	51
Spain SDI	4 GPM	5/17	0.00	7.50	7.50	13.17	20.67	2.20	22.87	1186	158	53
Spain SDI	5 GPM	5/17	0.00	8.58	8.58	13.17	21.75	1.90	23.65	767	89	32



Soil Moisture Probes Guided Plant Water Management by:

- * Showing Daily Available Soil Water,
- * Plant Root Growth into the Root Zone, and
- * Rainfall and Irrigation Movement into the Root Zone.

Danny Krienke - 3 GPM



Soil Moisture Sensors Show Available Water at 4-Inch Increments.



Crop Residue Shades the Soil, Maintains Cooler Soil Temperature & Reduces Evaporation

