

3-4-5 Gallon Production Maximization Final Project Report

Project 1413581737

by
Steven Walthour
Kirk Welch



North Plains Groundwater Conservation District

P.O. Box 795, 603 E. 1st St.
Dumas, Texas 79029
June 2019



This page is intentionally blank.

North Plains Groundwater Conservation District



3-4-5 Gallon Production Maximization Final Project Report

by
Steven Walthour
Kirk Welch

June 2019

This project was funded in part by the Texas Water Development Board.

North Plains Groundwater Conservation District

Table of Contents

| | | |
|-----|--|----|
| 1 | Executive summary | 1 |
| 2 | Introduction..... | 2 |
| 2.1 | Project summary | 2 |
| 2.2 | Water savings..... | 3 |
| 3 | 2015 Project Summary | 4 |
| 3.1 | Stan Spain | 4 |
| 3.2 | Danny Krienke | 4 |
| 3.3 | Zac Yoder..... | 5 |
| 3.4 | Harold Grall | 5 |
| 3.4 | Conclusion | 6 |
| 3 | 2016 Project Summary | 7 |
| 3.1 | Danny Krienke | 7 |
| 3.2 | Harold Grall | 7 |
| 3.3 | Stan Spain | 8 |
| 3.4 | Zac Yoder..... | 10 |
| 3.5 | Dennis Buss | 10 |
| 3.6 | Conclusion | 10 |
| 4 | 2017 Project Summary | 11 |
| 4.1 | Stan Spain SDI Fields | 11 |
| 4.2 | Stan Spain LEPA Fields..... | 11 |
| 4.3 | Harold Grall LEPA Fields..... | 11 |
| 4.4 | Danny Krienke LEPA Fields | 12 |
| 4.5 | Harold Grall PMDI Fields..... | 12 |
| 4.6 | Irrigation Systems - Harold Grall LEPA and PMDI Fields | 13 |
| 4.7 | Irrigation Systems - Stan Spain LEPA and SDI Fields..... | 13 |
| 4.8 | Irrigation Systems - Harold Grall T-L PMDI Field | 14 |
| 4.9 | Stan Spain “3-4-5 GPM” SDI Cotton Fields | 14 |
| 5 | Project 3-Year Summary | 15 |
| 5.1 | Table 5-1 Project 3-Year Summary..... | 16 |
| 6 | Acknowledgements | 17 |
| 7 | Figures | 17 |
| 7.1 | Table 7-1 2015 Summary | 18 |
| 7.2 | Table 7-2 2016 Summary | 19 |
| 7.3 | Table 7-3 2017 Summary | 20 |

List of Tables

| | |
|---------------------------------------|----|
| Table 5-1 Project 3-Year Summary..... | 16 |
| Table 7-1 2015 Summary..... | 18 |
| Table 7-2 2016 Summary..... | 19 |
| Table 7-3 2017 Summary..... | 20 |

1 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.

Following results and data from the previous five-year “200-12” project, the “3-4-5 GPM” project was established to provide information on how 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.

Direct water savings as a result of the “3-4-5 GPM” project was calculated by comparing the difference between the water used by the 3 and 4 GPM fields with the amount used by the 5 GPM fields. Savings totaled 67.49 acre-feet (1.16 inches per acre) in 2015, 95.24 acre-feet (1.75 inches per acre) in 2016, and 113 acre-feet (2.63 inches per acre) in 2017, for a three-year total of 275.73 acre-feet of water saved. The demonstration showed 1.77 inches average irrigation water savings per acre annually.

As a result of the “3-4-5 GPM” project, the District collected and analyzed data from multiple production-scale field demonstrations, over three growing seasons, showing the water efficiency and economic benefits of lower GPM systems when compared to higher GPM approaches. In addition, the demonstrations have shown that 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.

We learned that retrofit adjustments can be made to existing center pivots to significantly improve water application efficiency to deliver more of the groundwater to the crop. We also learned that soil health is improved from crop residue from strip-till or no-till management practices. We learned it is easy to over water corn with 4 GPM and especially 5 GPM per acre when rainfall is in the normal range, and that soil moisture sensors can help manage soil water levels and aid in optimized irrigation scheduling. Also, we learned that drought tolerant hybrids, commonly planted in May and early-June, performed well and reduced seasonal irrigation by 2 to 4 inches. The “3-4-5 GPM” project taught project directors, cooperators and observers that strategic management practices can lead to additional monetary benefit from available groundwater, while eliminating over-watering and waste.

2 Introduction

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 gallons (4 GPM), and 600 gallons (5 GPM) as typically used by most growers. Similarly, a 500 acre half mile center pivot was nozzled to apply 1500 gallons (3 GPM), 2000 gallons (4 GPM), and 2500 gallons (5GPM).

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, three growers provided 515 acres for the demonstrations. The growers also demonstrated the benefit of high efficiency water application including Low Energy Precision Application (LEPA), Precision Mobile Drip Irrigation (PMDI) center pivot irrigation systems, and Subsurface Drip Irrigation (SDI) within the “3-4-5 GPM” project.

2.1 Project 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 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.

2.2 Water savings

Direct water savings as a result of the “3-4-5 GPM” project was calculated by comparing the difference between the water used by the 3 and 4 GPM fields with the amount used by the 5 GPM fields. Savings totaled 67.49 acre-feet (1.16 inches per acre) in 2015, 95.24 acre-feet (1.75

inches per acre) in 2016, and 113 acre-feet (2.63 inches per acre) in 2017, for a three-year total of 275.73 acre-feet of water saved. The demonstration showed 1.77 inches average irrigation water savings per acre annually.

While the cumulative direct and average annual water savings from the three years of demonstrations is significant, the real purpose of the demonstrations is to encourage adoption of these practices throughout the district. To achieve this technology-transfer the district promoted the multi-dimensional conservation approach through social and traditional media, annual field days and presentations at various agricultural events.

When the technologies and methods utilized by the “3-4-5 GPM” project alone can be translated into 1.77 inches of reduced irrigation over the one million acres of corn and other crops in the district, groundwater savings will be 147,500 acre-feet of water per year. This annual water savings can prolong the viability of agriculture irrigation in the area.

3 2015 Project Summary

In 2015, the “3-4-5 GPM” project’s first year, five cooperating growers committed 700 acres to achieve initial field demonstration results. Harold Grall dedicated 360 acres in Moore County; Danny Krienke, 120 acres in Ochiltree County; Zac Yoder, 105 acres in Dallam County; Dennis Buss, 60 acres in Hartley County and Stan Spain, 55 acres in Moore County. Two of Grall’s 120 acre fields demonstrated the use of high efficiency water application center pivot systems.

Table 7-1 summarizes the net return from each inch of irrigation by grower and field.

3.1 Stan Spain

Stan Spain, in Moore County, produced 12 more bushels per acre in his 4 GPM field than the 3 GPM field. Irrigation was 1.95 inches more. The 5 GPM field produced 33 more bushels per acre than the 3 GPM with 3.85 more inches of irrigation. The 5 GPM yield was 21 more bushels per acre than that from 4 GPM field with 1.90 additional inches of irrigation. Corn production was 23.26 bushels (1302lbs) per inch of irrigation in the 3 GPM field compared to 20.41 bushels (1143lbs) in the 4 GPM and 19.10 bushels (1070lbs) from the 5 GPM field. The 4 GPM field’s net gain is \$23.04 per acre with 1.95 inches more irrigation used compared to production from the 3 GPM field. The 5 GPM field’s net gain compared to the 3 GPM field is \$71.38 per acre with 3.85 additional inches of irrigation. Net gain for the 5 GPM field is \$48.34 per acre more than the 4 GPM with 1.90 inches more irrigation. Net return from each inch of irrigation is \$47.59 for the 3 GPM field compared to \$41.64 from the 4 GPM and \$39.37 for the 5 GPM field. Net return from each inch of total water is \$17.64 for the 3 GPM field, \$18.20 for the 4 GPM and \$19.78 for the 5 GPM field.

3.2 Danny Krienke

Danny Krienke, in Ochiltree County, produced 6 more bushels per acre in the 4 GPM field than the 3 GPM field and irrigation was 1.88 inches more. The 5 GPM field produced 16 more bushels per acre than the 3 GPM with 3.89 more inches of irrigation. The 5 GPM yield was 10 more bushels per acre than that from the 4 GPM field with 2.01 additional inches of irrigation. Corn production was 23.04 bushels (1290lbs) per inch of irrigation in the 3 GPM field compared to 19.55 bushels (1095lbs) in the 4 GPM and 17.24 bushels (965lbs) from the 5 GPM field. The 4 GPM field's net gain is \$3.13 per acre with 1.89 inches more irrigation used compared to production from the 3 GPM field. The 5 GPM field's net gain compared to the 3 GPM field is \$16.69 per acre with 3.89 additional inches of irrigation. Net gain for the 5 GPM field compared to the 4 GPM is \$13.56 per acre with 2.01 inches more irrigation. Net return from each inch of irrigation is \$48.16 for the 3 GPM field compared to \$39.99 from the 4 GPM and \$34.73 for the 5 GPM field. Net return from each inch of total water is \$18.48 for his 3 GPM field, \$17.00 for the 4 GPM and \$16.88 for the 5 GPM field.

3.3 Zac Yoder

Zac Yoder, in Dallam County, produced 25 more bushels per acre in his 4 GPM field than the 3 GPM and irrigation was 4.11 inches more. The 5 GPM field produced 56 more bushels per acre than the 3 GPM with 8.28 more inches of irrigation. The 5 GPM yield was 31 more bushels per acre than that from 4 GPM field with 4.17 additional inches of irrigation. Corn production was 18.58 bushels (1040lbs) per inch of irrigation in the 3 GPM field compared to 15.66 bushels (877lbs) in the 4 GPM and 14.09 bushels (789lbs) from the 5 GPM field. The 4 GPM field's net gain is \$47.65 per acre with 4.11 inches more irrigation used compared to production from the 3 GPM field. The 5 GPM fields' net gain compared to the 3 GPM field is \$111.98 per acre with 8.28 additional inches of irrigation. Net gain for the 5 GPM field is \$64.33 per acre more than the 4 GPM with 4.17 inches more irrigation. Net return from each inch of irrigation is \$37.84 for the 3 GPM field compared to \$31.72 from the 4 GPM and \$28.60 for the 5 GPM field. Net return from each inch of irrigation, rainfall and net soil water is \$18.21 for the 3 GPM field, \$18.19 from the 4 GPM and \$17.87 for the 5 GPM field.

3.4 Harold Grall

Harold Grall, in Hartley County, produced 8 more bushels per acre in his 4 GPM field than the 3 GPM field and irrigation was 2.75 inches more. The 5 GPM field produced 11 more bushels per acre than the 3 GPM with 5.36 more inches of irrigation. The 5 GPM yield was 3 more bushels per acre than that from 4 GPM field with 2.61 additional inches of irrigation. Corn production was 15.34 bushels (859lbs) per inch of irrigation in the 3 GPM field compared to 13.35 bushels (747lbs) in the 4 GPM and 11.75 bushels (658lbs) from the 5 GPM field. The 4 GPM field's net gain is \$7.68 per acre with 2.75 inches more irrigation used compared to production from the 3 GPM field. The 5 GPM fields' net gain compared to the 3 GPM field is \$2.19 per acre with 5.36 additional inches of irrigation. Net gain for the 5 GPM field compared to the 4 GPM is minus \$5.49 (lost \$5.49) per acre with 2.61 inches more irrigation. Net return from each inch of irrigation is \$30.90 for the 3 GPM field compared to \$26.41 from the 4 GPM and \$22.66 for the 5 GPM field. Net return from each inch of total water is \$14.88 for Grall's 3 GPM, \$14.83 for the 4 GPM and \$13.26 for his 5 GPM field.

Harold Grall's Irrigation Systems, in Moore County, produced 21.07 bushels (1180lbs) per inch of irrigation in both the LEPA Shroud and T-L Precision Mobile Drip Irrigation fields. Net return from each inch of irrigation is \$43.98 for both systems and fields. Net return from each inch of irrigation, rainfall and net soil water that totaled 26.18 inches is \$19.45 per inch for the LEPA Shroud and T-L PMDI fields.

Harold Grall's PMDI Drag Line Irrigation Systems, in Moore County, produced 12.61 bushels (706 lbs.) from each inch of irrigation. Net return from each inch of irrigation is \$22.66. Net return from each inch of irrigation, rainfall and net soil water that totaled 26.08 inches is \$12.40. Corn yield was less than anticipated without a clear reason why. There was sufficient available water throughout the growing season. The yield monitor indicates normal uniform yield within the circle. One speculation is that the 58, 54 and 56 degree overnight temperatures on July 7, 8 and 9 stopped plant growth at the 3 to 4 leaf stage at a previous fast rate. It then required too much time for plants to recover resulting in reduced corn yields.

3.4 Conclusion

We learned that adjustments can be made to existing center pivots, especially in conjunction with NRCS cost share funding, to improve water application efficiency that gets more of the water pumped to the crop. Also, that soil health is improved from crop residue and strip or no till practices. We learned it is easy to over water corn with 4 GPM and especially 5 GPM per acre when rainfall is in a more normal range and that soil moisture sensors can help manage that. Also, we learned that drought tolerant hybrids were commonly planted, mostly in May and early June, performed well and reduced seasonal irrigation. 2015 was a much-improved corn production year with more rainfall and cooler temperatures. Beginning soil moisture was superior following abundant rainfall in April and May.

3 2016 Project Summary

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

Table 7-2 lists net return from each inch of irrigation by field and grower plus water and harvest data.

3.1 Danny Krienke

Danny Krienke, in Ochiltree County, produced 5 more bushels per acre in the 4 GPM field than the 3 GPM field, and irrigation was 0.27 inches less. The 5 GPM field produced 10 more bushels per acre than the 3 GPM with the same 11.07 inches of irrigation. The 5 GPM yield was 5 more bushels per acre than that from the 4 GPM field with 0.27 additional inches of irrigation. Corn production was 18.70 bushels (1122 lb) per inch of irrigation in the 3 GPM field compared to 19.63 bushels (1177 lb) in the 4 GPM and 19.60 bushels (1176 lb) from the 5 GPM field. The 4 GPM field's net gain is \$3.25 per acre with 0.27 inches less irrigation used compared to production from the 3 GPM field. The 5 GPM field's net loss compared to the 3 GPM field is \$3.11 per acre with the same 11.07 inches of irrigation. Net loss for the 5 GPM field compared to the 4 GPM is \$6.36 per acre with 0.27 inches more of irrigation. Net return from each inch of irrigation is \$31.14 for the 3 GPM field compared to \$32.22 from the 4 GPM and \$30.86 for the 5 GPM field. Net return from each inch of total water is \$12.90 for his 3 GPM field, \$14.02 for the 4 GPM and \$14.22 for the 5 GPM field. Krienke's 3 GPM-Early planted (April 25) field produced 231 bushels per acre. The 3 GPM-Early produced 24 bushels more per acre than his 3 GPM, 19 bushels more than the 4 GPM, and 14 bushels more than the 5 GPM. Irrigation was 13.11 inches, being 2.04 inches more than the 3 GPM and 5 GPM and 2.31 inches more than 4 GPM. Net return from each inch of irrigation was \$29.00 for the 3 GPM-Early, \$31.14 for 3 GPM, \$32.22 for 4 GPM, and \$30.86 for 5 GPM. Net return per acre was \$380.29 for the 3 GPM-Early, \$344.79 for 3 GPM, \$348.04 for 4 GPM, and \$341.68 for 5 GPM.

3.2 Harold Grall

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

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

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

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

3.3 Stan Spain

Stan Spain-SDI in Moore County produced 21 more bushels per acre in his 4 GPM field than the 3 GPM field. Irrigation was 2.70 inches more. The 5 GPM field produced 55 more bushels per acre than the 3 GPM with 3.68 more inches of irrigation. The 5 GPM yield was 35 more bushels per acre

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

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

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

3.4 Zac Yoder

Zac Yoder, in Dallam County, produced 36 more bushels per acre in his 4 GPM field than the 3 GPM, and irrigation was 5.06 inches more. The 5 GPM field produced 49 more bushels per acre than the 3 GPM with 10.35 more inches of irrigation. The 5 GPM yield was 13 more bushels per acre than that from 4 GPM field with 5.29 additional inches of irrigation. Corn production was 13.68 bushels (820 lb) per inch of irrigation in the 3 GPM field compared to 12.01 bushels (720 lb) in the 4 GPM and 10.00 bushels (600 lb) from the 5 GPM field. The 4 GPM field's net gain is \$43.26 per acre with 5.06 inches more irrigation used compared to production from the 3 GPM field. The 5 GPM field's net gain compared to the 3 GPM field is \$31.61 per acre with 10.35 additional inches of irrigation. Net gain for the 5 GPM field is -\$11.65 per acre less than the 4 GPM with 5.29 inches more of irrigation. Net return from each inch of irrigation is \$19.42 for the 3 GPM field compared to \$16.65 from the 4 GPM and \$12.69 for the 5 GPM field. Net return from each inch of irrigation, rainfall, and net soil water is \$10.68 for the 3 GPM field, \$10.92 from the 4 GPM, and \$9.35 for the 5 GPM field.

3.5 Dennis Buss

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

3.6 Conclusion

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

4 2017 Project Summary

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 with LEPA and PMDI center pivot irrigation systems within the “3-4-5 GPM” project.

Table 7-3 lists net return from each inch of irrigation by field and grower plus water and harvest data.

4.1 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.

4.2 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.

4.3 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.

4.4 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 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.

4.5 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.

4.6 Irrigation Systems - 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.

4.7 Irrigation Systems - 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.

4.8 Irrigation Systems - 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.

4.9 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.

5 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. 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, the 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. The 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.

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.

Table 5-1. This table summarizes the irrigation, rainfall, soil water, yield, and net return on irrigation for all demonstrations throughout the 2015, 2016, and 2017 growing seasons.

3-year summary of net return

| Field | Planted | Irrigation (in.) | Rainfall (in.) | Total rainfall & irrigation (in.) | Net soil water (in.) | Total water (in.) | Yield (bu/ac) | Bu/ac-in of irrigation | Bu/ac-in of total water |
|--------------|----------------|-------------------------|-----------------------|--|-----------------------------|--------------------------|----------------------|-------------------------------|--------------------------------|
| 3 gpm | 5/23 | 12.61 | 10.78 | 23.39 | 2.28 | 25.66 | 223 | 18.17 | 8.74 |
| 4 gpm | 5/23 | 15.28 | 10.90 | 26.12 | 1.21 | 27.39 | 232 | 15.66 | 8.47 |
| 5 gpm | 5/22 | 17.36 | 10.74 | 28.10 | 0.84 | 28.94 | 242 | 14.40 | 8.38 |
| 3 gpm-e | 5/1 | 15.57 | 11.68 | 27.25 | 2.10 | 29.34 | 226 | 14.94 | 7.72 |

Note: The e notation next to the field indicates early planted corn.

6 Acknowledgements

North Plains Groundwater Conservation District would like to thank Leon New for consulting on this project, collecting data, and analyzing the results. We also appreciate Texas Water Development Board for funding this project, as well as the cooperators who offered their fields and data to help advance agricultural water conservation.

7 Tables

7.1 Table 7-1 2015 Summary

Table 7-1

This table summarizes the irrigation, rainfall, soil water, yield, and net return on irrigation for the 12 demonstration farms in 2015.

Summary of net return from each inch of irrigation by grower and 3-4-5 field

| Producer | Field | Planted | Pre-water (in.) | Irrigation (in.) | Total irrigation (in.) | Rainfall (in.) | Total rainfall & irrigation (in.) | Net soil water (in.) | Total water (in.) | Yield (bu/ac) | Bu/ac-in of irrigation | Bu/ac-in of total water | Net return (\$/ac) | Net return per ac-in of irrigation (\$) |
|----------|-------|---------|-----------------|------------------|------------------------|----------------|-----------------------------------|----------------------|-------------------|---------------|------------------------|-------------------------|--------------------|---|
| Danny | 3 gpm | May 31 | 0.00 | 8.81 | 8.81 | 10.77 | 19.58 | 3.38 | 22.96 | 203 | 23.04 | 8.84 | 424.34 | 48.16 |
| Stan | 3 gpm | May 29 | 1.31 | 8.45 | 9.76 | 12.77 | 22.53 | 3.80 | 26.33 | 227 | 23.26 | 8.62 | 464.46 | 47.59 |
| Stan | 4 gpm | May 29 | 1.31 | 10.40 | 11.71 | 12.77 | 23.31 | 2.31 | 26.79 | 239 | 20.41 | 8.92 | 487.50 | 41.63 |
| Danny | 4 gpm | May 31 | 0.00 | 10.69 | 10.69 | 11.79 | 22.48 | 2.66 | 25.14 | 209 | 19.55 | 8.31 | 427.47 | 39.99 |
| Stan | 5 gpm | May 29 | 1.31 | 12.30 | 13.61 | 12.77 | 26.38 | 0.71 | 27.09 | 260 | 19.10 | 9.59 | 535.84 | 39.37 |
| Zac | 3 gpm | May 12 | 1.22 | 12.29 | 13.51 | 16.60 | 30.11 | -2.04 | 28.07 | 251 | 18.58 | 8.94 | 511.34 | 37.84 |
| Danny | 5 gpm | May 31 | 0.00 | 12.70 | 12.70 | 10.77 | 23.47 | 2.65 | 26.12 | 219 | 17.24 | 8.38 | 441.03 | 34.53 |
| Zac | 4 gpm | May 12 | 1.22 | 16.40 | 17.62 | 16.60 | 34.22 | -3.50 | 30.72 | 276 | 15.66 | 8.98 | 558.99 | 31.68 |
| Harold | 3 gpm | May 12 | 2.63 | 11.84 | 14.47 | 11.61 | 26.08 | 3.97 | 30.05 | 222 | 15.34 | 7.39 | 447.19 | 30.90 |
| Zac | 5 gpm | May 12 | 1.22 | 20.57 | 21.79 | 16.60 | 38.39 | -3.52 | 34.87 | 307 | 14.01 | 8.80 | 623.32 | 28.63 |
| Harold | 4 gpm | May 12 | 2.63 | 14.59 | 17.22 | 11.61 | 28.83 | 1.83 | 30.66 | 230 | 13.35 | 7.50 | 454.87 | 26.41 |
| Harold | 5 gpm | May 12 | 2.63 | 17.20 | 19.83 | 11.61 | 31.44 | 2.45 | 33.89 | 233 | 11.75 | 6.87 | 449.38 | 22.66 |
| AVG | 3 gpm | May 21 | 1.29 | 10.35 | 11.64 | 12.94 | 24.58 | 2.28 | 26.85 | 225.75 | 20.06 | 8.45 | 461.83 | 41.12 |
| AVG | 4 gpm | May 21 | 1.29 | 13.02 | 14.31 | 13.19 | 27.21 | 0.83 | 28.33 | 238.50 | 17.24 | 8.43 | 482.21 | 34.93 |
| AVG | 5 gpm | May 21 | 1.29 | 15.69 | 16.98 | 12.94 | 29.92 | 0.57 | 30.49 | 254.75 | 15.53 | 8.41 | 512.39 | 31.30 |

7.2 Table 7-2 2016 Summary

Table 7-2

This table summarizes the irrigation, rainfall, soil water, yield, and net return on irrigation for the 19 demonstration farms in 2016.

2016 summary of net return from each inch of irrigation by grower and 3-4-5 field

| Grower | Field | Planted | Irrigation (in.) | Total irrigation (in.) | Rainfall (in.) | Total rainfall & irrigation (in.) | Net soil water (in.) | Total water (in.) | Yield (bu/ac) | Bu/ac-in of irrigation | Bu/ac-in of total water | Net return (\$/ac) | Net return per ac-in of irrigation (\$) |
|----------------|-------------|---------|------------------|------------------------|----------------|-----------------------------------|----------------------|-------------------|---------------|------------------------|-------------------------|--------------------|---|
| Danny | 4 gpm | May 30 | 10.80 | 10.80 | 11.74 | 22.54 | 2.28 | 24.82 | 212 | 19.63 | 8.54 | 348.04 | 32.22 |
| Danny | 5 gpm | May 30 | 11.07 | 11.07 | 11.74 | 22.81 | 1.22 | 24.03 | 217 | 19.60 | 9.03 | 341.68 | 30.86 |
| Danny | 3 gpm | May 30 | 11.07 | 11.07 | 12.31 | 23.36 | 3.35 | 26.73 | 207 | 18.70 | 7.74 | 344.79 | 31.14 |
| Danny | 3 gpm- e | Apr 25 | 13.11 | 13.11 | 13.86 | 26.97 | 4.19 | 31.16 | 231 | 17.62 | 7.41 | 380.29 | 29.00 |
| Harold PMDI | 3 gpm | May 25 | 13.57 | 13.57 | 8.78 | 22.35 | 4.02 | 26.37 | 216 | 15.91 | 8.91 | 336.41 | 24.79 |
| Harold LEPA | 3 gpm | May 25 | 13.57 | 13.57 | 8.78 | 22.35 | 1.52 | 23.87 | 203 | 14.96 | 8.50 | 303.83 | 22.39 |
| Stan SDI | 5 gpm | May 27 | 17.44 | 17.44 | 7.01 | 24.45 | 2.07 | 26.52 | 246 | 14.10 | 9.27 | 379.64 | 21.77 |
| Stan SDI | 3 gpm | May 27 | 13.76 | 13.76 | 7.01 | 20.77 | 5.49 | 26.26 | 191 | 13.88 | 7.27 | 264.83 | 19.24 |
| Zac | 3 gpm | May 14 | 14.84 | 14.84 | 7.84 | 22.68 | 4.30 | 26.98 | 203 | 13.68 | 7.52 | 288.20 | 19.42 |
| Stan LEPA | 5 gpm | May 27 | 18.91 | 18.91 | 6.41 | 25.32 | 4.20 | 29.52 | 260 | 13.75 | 8.81 | 405.66 | 21.45 |
| Harold PMDI | 4 gpm | May 25 | 14.85 | 14.85 | 8.78 | 23.63 | 1.93 | 25.56 | 200 | 13.47 | 7.82 | 288.69 | 19.44 |
| Stan LEPA | 3 gpm | May 27 | 14.82 | 14.82 | 6.41 | 21.23 | 6.35 | 27.58 | 195 | 13.15 | 7.07 | 270.91 | 18.28 |
| Harold LEPA | 4 gpm | May 25 | 14.85 | 14.85 | 8.78 | 23.63 | 1.84 | 25.47 | 191 | 12.86 | 7.50 | 266.29 | 17.93 |
| Stan SDI | 4 gpm | May 27 | 16.46 | 16.46 | 7.01 | 23.47 | 4.05 | 27.52 | 211 | 12.82 | 7.66 | 300.90 | 18.28 |
| Harold PMDI | 5 gpm | May 25 | 15.82 | 15.82 | 8.78 | 24.60 | 0 | 24.60 | 198 | 12.51 | 8.05 | 277.89 | 17.56 |
| Harold LEPA | 5 gpm | May 25 | 15.82 | 15.82 | 8.78 | 24.60 | 1.67 | 26.27 | 190 | 12.01 | 7.23 | 257.98 | 16.31 |
| Zac | 4 gpm | May 14 | 19.90 | 19.90 | 7.84 | 27.74 | 2.61 | 30.35 | 239 | 12.01 | 7.87 | 331.46 | 16.65 |
| Stan LEPA | 4 gpm | May 27 | 10.10 | 10.10 | 6.41 | 24.51 | 1.31 | 25.82 | 217 | 11.99 | 8.40 | 303.48 | 16.76 |
| Zac | 5 gpm | May 14 | 25.19 | 25.19 | 7.84 | 33.03 | 1.18 | 34.21 | 252 | 10.00 | 7.36 | 319.81 | 12.69 |
| AVG | 3 gpm | | 13.53 | 13.53 | 9.28 | 22.82 | 4.17 | 26.99 | 206.57 | 15.41 | 7.67 | 312.75 | 23.47 |
| AVG | 4 gpm | | 15.83 | 15.83 | 8.43 | 24.25 | 2.34 | 26.59 | 211.67 | 13.80 | 7.97 | 306.48 | 20.21 |
| AVG | 5 gpm | | 17.38 | 17.38 | 8.43 | 26.80 | 1.72 | 27.53 | 227.17 | 13.66 | 8.29 | 330.44 | 20.11 |

Note: None of the fields pre-watered. The e notation next to the field indicates early planted corn.

7.3 Table 7-3 2017 Summary

Table 7-3

This table summarizes the irrigation, rainfall, soil water, yield, and net return on irrigation for the 18 demonstration farms in 2017.

2017 summary of net return from each inch of irrigation by grower and 3-4-5 field

| Grower | Field | Planted | Pre-water (in.) | Irrigation (in.) | Total irrigation (in.) | Rainfall (in.) | Total rainfall & irrigation (in.) | Net soil water (in.) | Total water (in.) | Yield (bu/ac) | Bu/ac-in of irrigation | Bu/ac-in of total water | Net return (\$/ac) | Net return per ac-in of irrigation (\$) |
|--------------|-------------|---------|-----------------|------------------|------------------------|----------------|-----------------------------------|----------------------|-------------------|---------------|------------------------|-------------------------|--------------------|---|
| Spain SDI | 3 gpm | May 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 | May 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 | May 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 | May 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 | May 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 | May 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 | May 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 | May 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 | May 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 | May 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 | May 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 | May 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 | May 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 | 328-4 | May 27 | 2.25 | 15.59 | 17.84 | 11.08 | 28.92 | 0.00 | 28.92 | 228 | 12.78 | 7.88 | \$403.86 | \$22.64 |

| | | | | | | | | | | | | | | |
|---------|-------|--------|------|-------|-------|-------|-------|------|-------|-----|-------|-------|----------|---------|
| PMDI | gpm | | | | | | | | | | | | | |
| Krienke | 3 gpm | May 9 | 0.00 | 18.03 | 18.03 | 9.49 | 27.52 | 0.00 | 27.52 | 221 | 12.26 | 8.03 | \$370.72 | \$20.56 |
| LEPA | early | | | | | | | | | | | | | |
| Grall | 328-5 | May 27 | 2.18 | 17.26 | 19.44 | 11.08 | 30.52 | 0.00 | 30.52 | 237 | 12.19 | 7.76 | \$417.93 | \$21.50 |
| LEPA | gpm | | | | | | | | | | | | | |
| Grall | 414-4 | May 30 | 0.00 | 16.02 | 16.02 | 10.64 | 26.66 | 2.05 | 28.71 | 195 | 12.17 | 6.79 | \$391.28 | \$20.12 |
| PMDI | gpm | | | | | | | | | | | | | |
| Grall | 328-5 | May 27 | 2.18 | 17.26 | 19.44 | 11.08 | 30.52 | 0.00 | 30.52 | 227 | 11.67 | 7.43 | \$322.87 | \$20.13 |
| PMDI | gpm | | | | | | | | | | | | | |
| AVG | 3 gpm | May 27 | 0.45 | 11.74 | 12.19 | 11.76 | 23.95 | 0.00 | 23.95 | 244 | 20.40 | 10.21 | \$477.19 | \$39.96 |
| AVG | 4 gpm | May 25 | 0.64 | 14.73 | 15.38 | 11.72 | 27.55 | 0.45 | 27.55 | 245 | 16.34 | 8.94 | \$457.67 | \$30.73 |
| AVG | 5 gpm | May 25 | 0.87 | 16.77 | 17.64 | 11.76 | 29.40 | 0.00 | 29.40 | 249 | 14.38 | 8.48 | \$454.86 | \$26.54 |
| AVG | 3 | May 9 | 0.00 | 18.03 | 18.03 | 9.49 | 27.52 | 0.00 | 27.52 | 221 | 12.26 | 8.03 | \$370.72 | \$20.56 |
| | gpm-e | | | | | | | | | | | | | |

Note: The *e* notation next to the field indicates early planted corn. Several Grall fields are noted with three digits preceding the gpm. This indicated a plot number, since some plots were under the same irrigation regime.

DRAFT REPORT

| CONTRACT # 1413581737 | CONTRACTOR North Plains Groundwater Conservation District (NPGCD) | DATE AND INITIALS RM |
|--|---|---|
| Contract Administration ROSIE MARTINEZ <u>ext. 8149</u> Name and Phone # | <input type="checkbox"/> Draft Report received; Date: <u>7/31/19</u> <input type="checkbox"/> Enter receipt of draft report in Worklog <input type="checkbox"/> Date stamp and label with contract info <input type="checkbox"/> Create DRAFT Report Folder <input type="checkbox"/> Request reviewers' names from CM <input type="checkbox"/> Create a pdf of the SOW for the contract <input type="checkbox"/> Create a Draft Report Review Memo and update applicable instructions <input type="checkbox"/> Forward a copy of the Memo, SOW and the Draft Report to the reviewers <input type="checkbox"/> Enter in CAS (on Contracts Reports tab) receipt of draft report. Upload Draft Report into CAS <input type="checkbox"/> Place Draft Report Folder in pending | RM 7/23/19 AW RM 10/25/16 RM 10/25/19 RM 10/25/19 RM 7/31/19 11/6/19 RM |
| Contract Administration ROSIE MARTINEZ <hr/> Name Angela Cameron Sam Hermitte | Once comments are received from CM <input type="checkbox"/> Prepare Draft Report Comment Letter and Comments for routing; save as pdf documents <input type="checkbox"/> Upload DocuSign pdf into CAS under Contract Reports tab <input type="checkbox"/> Update the Worklog | 11/6/19 RM 11/6/19 RM <i>AW</i> 11/21/2019 <i>A</i> 11/22/2019 <i>SMT</i> 11/22/2019 |
| Director <input type="checkbox"/> Mark Wyatt <input type="checkbox"/> Larry French <input type="checkbox"/> Carla Guthrie <input type="checkbox"/> Kevin Kluge <i>KK</i> 11/25/2019 <input type="checkbox"/> Temple McKinnon <input type="checkbox"/> Saul Nuccitelli | Deputy Executive Administrator <input type="checkbox"/> Edna Jackson <input type="checkbox"/> Richard Wade <input type="checkbox"/> John Dupnik <i>JD</i> 11/26/2019 <input type="checkbox"/> Jessica Zuba | |

Texas Water Development Board

P.O. Box 13231, 1700 N. Congress Ave.
Austin, TX 78711-3231, www.twdb.texas.gov
Phone (512) 463-7847, Fax (512) 475-2053

Steven Walthour
P.O. Box 795, 603 E. 1st St.
Dumas, Texas 79029

RE: North Plains Groundwater Conservation District - NPGCD; Contract No. 1413581737,
Comments on Draft Report Entitled "3-4-5 Gallon Production Maximization Final Project
Report ""

Dear Mr. Walthour:

Staff members of the Texas Water Development Board (TWDB) have completed a review of the draft report prepared under the above-referenced contract. ATTACHMENT 1 provides the comments resulting from this review. As stated in the TWDB contract, North Plains Groundwater Conservation District will consider revising the final report in response to comments from the Executive Administrator and other reviewers. In addition, North Plains Groundwater Conservation District will include a copy of the Executive Administrator's draft report comments in the Final Report.

Please note: The TWDB logo should not be used in the Final Report.

The TWDB's Contract Administration staff looks forward to receiving one (1) electronic copy of the entire Final Report in Portable Document Format (PDF) and five (5) bound double-sided copies. **Please further note, that in compliance with Texas Administrative Code Chapters 206 and 213 (related to Accessibility and Usability of State Web Sites), the digital copy of the final report must comply with the requirements and standards specified in statute. For more information, visit <http://www.sos.state.tx.us/tac/index.shtml>.** If you have any questions on accessibility, please contact David Carter with the Contract Administration Division at (512) 936-6079 or david.carter@twdb.texas.gov.

North Plains Groundwater Conservation District shall also submit one (1) electronic copy of any computer programs or models, and, if applicable, an operations manual developed under the terms of this Contract.

If you have any questions or need any further information, please feel free to contact Cameron Turner of our Agricultural Water Conservation staff at 512- 936-6090 or Cameron.Turner@twdb.texas.gov

Sincerely,



John T. Dupnik, P.G.
Deputy Executive Administrator
Water Science and Conservation

Date: 11/26/2019

Attachment
c w/o att.: Cameron Turner, Agricultural Water Conservation

| | |
|---|---|
| <p>Our Mission :</p> <p>To provide leadership, information, education, and support for planning, financial assistance, and outreach for the conservation and responsible development of water for Texas</p> | <p>Board Members :</p> <p>Peter M. Lake, Chairman Kathleen Jackson, Board Member Brooke T. Paup, Board Member</p> <p>Jeff Walker, Executive Administrator</p> |
|---|---|

ATTACHMENT 1

TWDB Comments to Draft Report

Contract No. 1413581737

North Plains Groundwater Conservation District – (NPGCD)
“3-4-5 Gallon Production Maximization Final Project”

Page 1, Executive Summary

- Clearly define “GPM” when referring to the well pumping capacity (gallons per minute), versus the project name (Gallon Production Maximization). GPM was used for both cases.
- Provide a brief background on the 200-12 Project, for context, and reference the final report for that project (TWDB agricultural water conservation contract #1103581252).
- Highlight the District’s outreach efforts through this project and include picture(s) from the event(s).

Pages 2–14

- Consider restructuring this section to ensure the report addresses each of the tasks included in the scope of work.
- Consider simplifying the data analysis in the Project Summary and individual producer field site descriptions, as the data is available in the tables in Section 7.
- Include summary findings for each participating producer and/or field site, such as how the producer’s LEPA sites compared to their SDI or PMDI field sites in terms of economic returns and water savings.
- Include testimonials from the participating producers, if available.

Page 17

- Consider including a conclusion section to summarize the project results and mention the District’s current efforts to put the 200-12 and 3-4-5 Projects’ findings into action. (Master Irrigator Program, equipment cost-share projects, Water Conservation Center demonstrations, etc.)