

Technology Transfer Efforts for Center Pivot Irrigation (CP)

January 1, 2017 – January 29, 2019



BOOK CHAPTERS

Bell, J., R. Schwartz, K. McInnes, Q. Xue, and D. Porter. 2017. **Improving Water Management in Sorghum Cultivation**. Ch. 15 in: Achieving Sustainable Cultivation of Sorghum. William Rooney, editor. Burleigh Dodds Science Publishing. Cambridge, UK. (in press)

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Bordovsky, J.P. 2019. **Low-energy precision application (LEPA) irrigation: a forty-year review**. Trans. ASABE, 62(1), 1-11.
<https://doi.org/10.13031/trans.13117>.

Colaizzi, P. D., S. A. O'Shaughnessy, and S. R. Evett. 2018. **Calibration and tests of commercial wireless infrared thermometers**. Appl. Engr. Agric. 34(4): 647-658. ISSN 0883-8542 <https://doi.org/10.13031/aea.12577>.

Evett, S. R., G. W. Marek, P. D. Colaizzi, B. B. Ruthardt and K. S. Copeland. 2018. **A subsurface drip irrigation system for weighing lysimetry**. Appl. Engineer. Agric. 34(1):213-221. <https://dx.doi.org/10.13031/aea.12597>.

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Evett, S. R., K. S. Copeland, G. W. Marek, P. D. Colaizzi and D. K. Brauer. 2018. **2016 USDA-ARS Bushland Texas 15-minute research weather data**. NAL Ag Data Commons. DOI:
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Marek, G. W., T. H. Marek, Q. Xue, P. H. Gowda, S. R. Evett and D. K. Brauer. 2017. **Simulating evapotranspiration and corn response to irrigation management in the Texas High Plains using DSSAT-CERES-MAIZE**. Trans. ASABE. 60(3):837-846. ISSN 2151-0032.
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10.2134/agronj2018.09.0556

Chen, Y., G. Marek, T. Marek, J. Moorhead, K. Heflin, D. Brauer, P. Gowda and R. Srinivasan. 2018. **Assessment of Alternative Agricultural Land Use Options for Extending the Availability of the Ogallala Aquifer in the Northern High Plains of Texas**. Hydrology 2018, 5(4), 53;
doi:10.3390/hydrology5040053.

Zhao, J., Q. W. Xue, K. E. Jessup, X. B. Hou, B. Z. Hao, T. H. Marek, W. Xu, S. R. Evett, S. A. O'Shaughnessy and D. K. Brauer. 2018. **Shoot and root traits in drought tolerant maize (Zea mays L.) hybrids**. J. Integrative Agriculture 17(5): 1093-1105.

Zhao, J., Q. Xue, K. E. Jessup, B. Hao, X. Hou, T. H. Marek, W. Xu, S. R. Evett, S. A. O'Shaughnessy and Brauer, D. K. 2018. **Yield and water use of drought-tolerant maize hybrids in a semiarid environment**. Field Crops Research, 216, 1-9.

Xue, Qingwu, Thomas H. Marek, Wenwei Xu, and Jourdan Bell. 2017. **Irrigated Corn Production and Management in the Texas High Plains**. Universities Council on Water Resources, J. of Contemporary Water Research & Education. Issue 162, pp. 31-41, December 2017.

Schaefer, C., Ritchie, G. L., Bordovsky, J. P., Lewis, K. L., and Kelley, B. 2018. **Irrigation timing and rate on cotton boll production**. Agron.J. 110:1-10 (2018). Doi: 10.2134/agronj2017.06.0360.

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Yang, Y., J. Hu, D. Porter, T. Marek, C. Hillyer, and Sun, L. 2017. **Soil Moisture Sensor Placement**. Filed October 4, 2017. Texas A&M Office of Technology Commercialization. Patent Pending. International patent has been filed (December 2018).

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Schwartz, R.C., S.R. Evett and R.J. Lascano. 2018. Letter to the Editor: **Comments on "J. Singh et al., Performance assessment of factory and field calibrations for electromagnetic sensors in a loam soil"** [Agric. Water Manage. 196 (2018) 87-98]. Agric. Water Manage. 203(2018):236-239. <https://doi.org/10.1016/j.agwat.2018.02.029>. 2018.

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Kisekka, I., T. Oker, G. Nguyen, J. Aguilar and D. Rogers. 2017. **Revisiting Precision Mobile Drip Irrigation under Limited Water**. Irrigation Science. 1-18. DOI: 10.1007/s00271-017-0555-7.

NATIONAL AND INTERNATIONAL CONFERENCES

Andrade, M.A., S.A. O'Shaughnessy, S.R. Evett and P.D. Colaizzi. 2018. **"ARSmartPivot – A decision support system for variable rate center pivot irrigation systems"**, presented at the Sino-US Water Saving Technologies Meeting, Zhenjiang, China, Aug. 17, 2018.

Andrade, M.A., S.R. Evett and S.A. O'Shaughnessy. 2018. **Machine learning algorithms applied to the forecasting of crop water stress indicators**. In 2018 Irrigation Association Show and Education Conference Technical Session Proc. Irrigation Association, Fairfax, VA. <https://www.irrigation.org/IA/Resources/Technical-Paper-Library.aspx>.

Evett, S.R., R.C. Schwartz and H.S. Schomberg. 2018. **Electromagnetic and nuclear soil water sensing methods: Comparisons and newer technologies**. In Report of the Second Research Coordination Meeting of the Coordinated Research Project, "Nuclear Techniques for a Better Understanding of the Impact of Climate Change on Soil Erosion in Upland Agro-ecosystems (D1.50.17)", held in Rabat, Morocco, 16 to 20 April 2018.

Evett, S.R., S.A. O'Shaughnessy, M.A. Andrade and P.D. Colaizzi. 2018. **Technological Innovations to Improve Water Management in Alfalfa and Forage Crops**. pp. 54-58. In Proc. Second World Alfalfa Congress, Cordoba, Argentina. 11-14 November 2018. Instituto Nacional de Tecnología Agropecuaria (INTA), <http://www.worldalfalfacongress.org/>.

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Evett, S.R., H.S. Schomberg, A. Thompson, R.C. Schwartz, S.A. O'Shaughnessy and M.A. Andrade. 2018. **Water in the Cloud: A new system for field water monitoring with Cloud data access**. In 2018 Irrigation Association Show and Education Conference Technical Session Proc. Irrigation Association, Fairfax, VA. <https://www.irrigation.org/IA/Resources/Technical-Paper-Library.aspx>.

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Vories, E., K. Sudduth, S. Evett, S. O'Shaughnessy and A. Andrade. 2017. **Comparison of crop stress and soil maps to enhance variable rate irrigation prescriptions.** 7th Asian-Australasian Conference on Precision Agriculture, Hamilton, New Zealand, October 16-18, 2017.

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Porter, D., T. Marek, L. Sun, Y. Yang, J. Hu, and K. Heflin. 2018. **Integration of data and advanced technologies to improve center pivot irrigation management.** Paper No. 1801236. Annual International Meeting of the American Society of Agricultural and Engineers, Detroit, MI. July 29-Aug 1, 2018.

Heflin, K., T. Marek, G. Marek, J. Moorhead, D. Porter, Q. Xue, R. Schwartz, and Y. Chen. 2018. **Evaluating Soil Moisture Sensors: Comparing Types, Installation and Performance.** Paper No. 1800926. Annual International Meeting of the American Society of Agricultural and Engineers, Detroit, MI. July 29-Aug 1, 2018.

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Kothari, K., Ale, S., Bordovsky, J.P., and Munster, C. 2018. Presentation of **Assessing the impacts of climate change on seasonal irrigation and water use efficiency of grain sorghum and cotton in the Texas High Plains.** 2018 Annual International ASABE Meeting. July 29-Aug 1, 2018. Detroit, MI.

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Bordovsky, J.P., Mustian, J.P., Johnson, H., and Jordan, S. 2019. Presentation and paper **Leveraging rainfall with very limited irrigation in Texas High Plains cotton rotations.** Proc. Beltwide Cotton Conf. Memphis, TN: National Cotton Council.

Himanshu, S., Ale, S., Bordovsky, J., and Barnes, E. 2019. **Assessment of deficit irrigation strategies for cotton production in the Texas High Plains.** Beltwide Cotton Conf., New Orleans, LA. 8-10 Jan. 2019.

Ale, S., Himanshu, S., Omani, E., Bordovsky, J., Thorp, K., and Barnes, E. 2019. **Determining ideal irrigation termination dates under deficit irrigation strategies.** Beltwide Cotton Conf., New Orleans, LA. 8-10 Jan. 2019.

Rogers, D. H., J. Aguilar, G. A. Clark, S. W. Wiens. 2018. **Effect of collector size on center pivot water depth catch.** 2018 Irrigation Association Technical Conference, Dec. 3-7, 2018. Long Beach, CA. ID: 852-42682

Rogers, D. H. and J. Aguilar. 2018. **Kansas center pivot system uniformity evaluations overview.** 2018 Irrigation Association Technical Conference, Dec. 3-7, 2018. Long Beach, CA. ID: 852-42684.

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Lamm, F. R., T. A. Howell, and J. P. Bordovsky. 2017. **Erraticity of sprinkler-irrigated corn under drought.** In: Proc. 2017 Irrigation Association Technical Conference, Nov. 6-10, Orlando FL. 13 pp.

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Charles Swanson, C., G. Fipps, and C. Hillyer. 2017. **Evaluating Water Use and Management of Center Pivot Drag-line Drip Irrigation Systems**. In: Proc. 2017 Irrigation Association Technical Conference, Nov. 6-10, Orlando FL. 8 pp.

O'Shaughnessy, S. A., Andrade, M. A., Evett, S. R., and Colaizzi, P. D. 2017. **A GIS-based Precision Irrigation System Design for Irrigation in the Western U.S.** Oral presentation in: UCOWR/NIWR Annual Conference, Ft. Collins, CO. June 14, 2017.

Lamm, F. R. 2017. **Differential Corn Hybrid Response to Irrigation Management**. Oral presentation at ASABE annual international meeting, July 16-19, Spokane, Washington, USA.

Kothari, K., S. Ale, J. Bordovsky, K. Thorp, D. Porter, C. Munster. 2017. **Evaluation of irrigation management strategies and assessing the impacts of climate change on grain sorghum in the Texas High Plains**. Oral presentation. 2017 ASABE Annual International Meeting. Spokane, WA. July 16-19, 2017.

Porter, D., K. Wagner, J. Aguilar, D. Rogers, T. Marek, and G. Marek. 2017. **Education and Technology Transfer in Agricultural Water Management: Effective Communication with Stakeholders**. Universities Council on Water Resources / National Institutes of Water Resources Annual Conference. Ft. Collins, CO. June 13-15, 2017.

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Evett, S. R., S. A. O'Shaughnessy, M. A. Andrade, P. D. Colaizzi, H. S. Schomberg and J. LaRue. 2017. **Innovation in Irrigation Management: Fusing the Internet-Of-Things with Irrigation Decision Support Systems**. Keynote lecture at the international conf. "Advanced Technologies and their Applications in Agriculture", Cairo, Egypt, March 27-29, 2017, National Research Centre (NRC) of Egypt.

O'Shaughnessy, S. A., M. A. Andrade, and S. R. Evett. 2017. **Precision irrigation for improving crop water use efficiency.** Oral presentation In: The Precision Ag Summit. Jamestown, ND. January 16-17, 2017.

Jordan, S., Bordovsky, J. P. and Porter, D. O. 2017. **Comparison of multi-sensor capacitance and TDR soil moisture measurement methods in Texas South Plains irrigated cotton.** Poster presentation. 2017 Beltwide Cotton Conference. Dallas, TX. Jan. 3-4, 2017.

CENTRAL PLAINS IRRIGATION CONFERENCE

Marek, T. and D. Porter. 2018. **Think you understand center pivot safety and maintenance - Really?** In: Proc. 30th annual Central Plains Irrigation Conference, Feb. 20-21, 2018, Colby, KS. Available from CPIA, 760 N. Thompson, Colby, KS. pp. 8-14.

Lamm, F. R., D. M. O'Brien, and D. H. Rogers. 2018. **Using the K-State center pivot sprinkler and SDI economic comparison spreadsheet – 2018.** In: Proc. 30th annual Central Plains Irrigation Conference, Feb. 20-21, 2018, Colby, KS. Available from CPIA, 760 N. Thompson, Colby, KS. pp. 80-88.

Aguilar, J, D. Rogers, B. Golden, A. J. Foster, T. Oker and L. Haag. 2018. **Kansas MDI studies and water technology farms.** In: Proc. 30th annual Central Plains Irrigation Conference, Feb. 20-21, 2018, Colby, KS. Available from CPIA, 760 N. Thompson, Colby, KS. pp. 166-167.

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Colaizzi, P. and S. O'Shaughnessy. 2018. **Web/smart phone based control & feedback systems for irrigation systems.** In: Proc. 30th annual Central Plains Irrigation Conference, Feb. 20-21, 2018, Colby, KS. Available from CPIA, 760 N. Thompson, Colby, KS. pp. 199-208.

Aguilar, J., D. H. Rogers, I. Kisekka, and A. J. Foster. 2017. **Mobile drip irrigation results from farm demonstration sites.** In: Proc. 29th annual Central Plains Irrigation Conference, Feb. 21-22, 2017, Burlington, CO. Available from CPIA, 760 N. Thompson, Colby, KS. pp. 45-52.

Andrade, M. A., S. A. O'Shaughnessy and S. R. Evett. 2017. **ARSPIVOT, A sensor based decision support tool for the integrated irrigation management of VRI irrigation systems.** In: Proc. 29th annual Central Plains Irrigation Conference, Feb. 21-22, 2017, Burlington, CO. Available from CPIA, 760 N. Thompson, Colby, KS. pp. 5-14.

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Lamm, F. R. 2017. **Sprinkler irrigation management of modern corn hybrids under institutional constraints.** In: Proc. 29th annual Central Plains Irrigation Conference, Feb. 21-22, 2017, Burlington, CO. Available from CPIA, 760 N. Thompson, Colby, KS. pp. 53-65.

Rogers, D. H., J. P. Aguilar, I. Kisekka, and F. R. Lamm. 2017. **Center pivot irrigation system losses and efficiency.** In: Proc. 29th annual Central Plains Irrigation Conference, Feb. 21-22, 2017, Burlington, CO. Available from CPIA, 760 N. Thompson, Colby, KS. pp. 19-34.

Rudnick, D., S. Irmak, C. Ray, J. Schneekloth, M. Schipanski, I. Kisekka, A. Schlegel, J. Aguilar, D.H. Rogers, D. Mitchell, C. West, T. Marek, Q. Xue, W. Xu, and D. Porter. 2017. **Deficit Irrigation Management of Corn in the High Plains: A Review.** In: Proc. 29th annual Central Plains Irrigation Conference, Feb. 21-22, 2017, Burlington, CO. Available from CPIA, 760 N. Thompson, Colby, KS. pp. 66-84.

OTHER REGIONAL CONFERENCES

Bordovsky, J.P. 2018. Presentation of **Irrigation management with limited water.** 66th Annual West Texas Agricultural Chemicals Institute Conference. Lubbock, TX. Sept. 11, 2018.

Oker, T. 2018. **Comparing corn production under Mobile Drip Irrigation to LEPA and LESA.** Presentation to High Plains Irrigation Conference, Amarillo TX, February 7, 2018.

Bynum, E. 2018. **Revisiting chemigation for insect pest management.** Presentation to High Plains Irrigation Conference, Amarillo TX, February 7, 2018.

O'Shaughnessy, S. A., S. R. Evett, P. D. Colaizzi, and M. A. Andrade. 2018. **Irrigation Scheduling Technologies with Center Pivot Sprinklers.** Presentation to High Plains Irrigation Conference, Amarillo TX, February 7, 2018.

Colaizzi, P. D., G. Sokora, C. Ash and T. Schaffer. 2018. **Panel Discussion on Variable Frequency Drives.** Presentation to High Plains Irrigation Conference, Amarillo, TX, February 7, 2018.

Bordovsky, J.P. 2017. Oral presentation of **Irrigation management research using site-specific systems.** 2017 Central Texas Irrigation Summit. Gustine, TX. Dec. 12, 2017.

Porter, D. (coordinator). 2017. High Plains Irrigation Conference. Amarillo, TX. February 15, 2017.

Aguilar, J.P., I. Kisekka, T. Oker, G. Nguyen, D. Rogers and K. Shaw. 2017. Oral Presentation of **Applied Research in Irrigated Cropping Systems.** High Plains Irrigation Conference, Amarillo, TX., February 15, 2017.

Evett, S.R. 2017. Keynote lecture **Water Issues & Agriculture: The View from 30,000 Feet** presented at the Missouri Non-point Source Education Conference, Lake Ozark, MO, March 2-3. Sponsored by the Missouri Department of Natural Resources and University of Missouri.

Porter, D. 2017. **South Plains Irrigation Update.** Southern Mesa Crops Conference, Lamesa, TX. January 16, 2017.

Porter, D. 2017. **South Plains Irrigation Update.** West Plains Crop Conference. Brownfield, TX. January 17, 2017.

Porter, D. 2017. **New and Improved Irrigation Technology.** Llano Estacado Cotton Conference. Muleshoe, TX. January 30, 2017.

Porter, D. 2017. **Precision Irrigation Tools.** Hub of the Plains Ag Conference. Lubbock, TX. February 2, 2017.

Porter, D. and B. Auvermann. 2017. **Irrigation Research Programs and Developments in the High Plains.** High Plains Irrigation Conference. Amarillo, TX. February 15, 2017.

Porter, D. 2017. **Agricultural Irrigation.** Invited Panelist on "Planning Ahead: Groundwater Projects for Tomorrow's Needs". 2017 Texas Groundwater Summit, Texas Alliance of Groundwater Districts, San Marcos, TX. August 29-31, 2017.

MISCELLANEOUS TECHNOLOGY TRANSFER

Evett, S.R. 2018. **International Cooperation Strengthens All People.** CSA News, June 2018. 63(6):16-17. doi:10.2134/csa2018.63.0615. <https://dl.sciencesocieties.org/publications/csa/pdfs/63/6/16>

Evett, S.R. 2018. **The Wendell Irrigationist.** CSA News, August 2018. 63(8):16-17. <https://dx.doi.org/10.2134/csa2018.63.0816>.

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Evett, S.R., P.D. Colaizzi, G.W. Marek, J.E. Moorhead, D.K. Brauer, K.S. Copeland and B.B. Ruthardt. 2018. **"Evaporative Losses from Sprinkler and Subsurface Drip Irrigation in a Region of Large Evaporative Demand"**, presented at the 2018 Annual International Meeting of ASABE, July 29- Aug 1, 2018, Detroit, MI.

Peng B., X. Liu, X. Dong, Q. Xue, C. B. Neely, T. Marek, A. M. H. Ibrahim, G. Zhang, D. I. Leskovar and J. C. Rudd. 2018. **Effects of Environment×Genotype on Root Traits of Winter Wheat Varieties in Texas Wintergarden and High Plains.** 2018 OAP poster. Lubbock, Texas.

Porter D, T. H. Marek, L. Sun, Y. Yang, J. Hu, and K. R. Heflin. **Integration of data and advanced technologies to improve center pivot irrigation management.** 2018 ASABE Annual International Meeting. Detroit, MI, Aug. 2018.

Marek, G.W., K. R. Heflin. T. Marek, J. Moorhead, Q. Xue, R. Schwartz, Y. Chen and D. Porter. **Evaluating Soil Moisture Sensors: Comparing Types, Installation and Performance.** 2018 ASABE Annual International Meeting. Detroit, MI, Aug. 2018.

Marek, T., G.W. Marek and Dana Porter. **Innovative center pivot research and soils sensor study- 2018**. USDA-ARS /Texas AgriLife Summer Crops / Ogallala Aquifer Program Center Pivot Irrigation Field Day, Bushland Texas, August 9, 2018.

Porter, Dana, Dan Rogers, Thomas Marek, Paul Colaizzi, Jourdan Bell, and Jim Bordovsky. **Applying OAP Outcomes to Improve Technical Standards and Continuing Education**. Poster. 2018 Annual Research Planning Meeting of the Ogallala Aquifer Program. Lubbock, TX, March 27-29, 2018.

Porter, D., D. Rogers, J. Aguilar, J. Bell, T. Marek, S. Taghvaeian, B. Guerrero, G. Marek, T. D. Lashmet, F. Lamm, K. Ledbetter, P. Gowda, and J. Bordovsky. 2018. **OAP Technology Transfer: Educating Stakeholders in Agricultural Water Management Issues, Technologies and BMPs**. (Presented at OAP and Bushland). Irrigation Field Day, Bushland Texas, August 9, 2018.

Porter, D., F. Lamm, T. Marek, S. O'Shaughnessy, P. Colaizzi, S. Evett, G. Marek, J. Bordovsky, D. Rogers and J. Aguilar. 2018. **Celebrating 40 Years of Center Pivot Irrigation Research and Technology Transfer**. Poster. 2018 Annual Research Planning Meeting of the Ogallala Aquifer Program. Lubbock, TX, March 27-29, 2018.

Marek, G. and T. Marek. 2018. Participated in presentations and scientific discussions of Texas A&M AgriLife and Bushland center pivot system efforts/lysimeter designs/water management efforts for two Chinese delegations and two Ukrainian scientists and grower groups.

Amosson, S. H., S. Nair, T. Marek, D. Jones, J. Yates, B. Guerrero and M. Jones. 2018. **2019 High Plains Crop Profitability Analyzer"**. [software]. December 2018. Texas A&M AgriLife Extension Service, Amarillo, Texas. Available at: <https://amarillo.tamu.edu/>

Porter, D., D. Rogers, T. Marek, P. Colaizzi, J. Bell, J. Bordovksy. 2018. **Applying OAP Outcomes to Improve Technical Standards and Continuing Education**. Irrigation Field Day, Bushland Texas, August 9, 2018.

Porter, D., F. Lamm, T. Marek, S. O'Shaughnessy, P. Colaizzi, S. Evett, G. Marek, J. Bordovsky, D. Rogers and J. Aguilar. 2018. **Celebrating 40 Years of Center Pivot Irrigation Research and Technology Transfer**. Poster. 2018 Annual Research Planning Meeting of the Ogallala Aquifer Program. Irrigation Field Day, Bushland Texas, August 9, 2018.

Porter, D., T. Marek, J. Hu, Y. Yang, and J. Sun. 2018. **Automatic Center Pivot Speed Control for Irrigation Water Conservation**. Invited presentation for High Plains Underground Water Conservation District Board of Directors, Lubbock, TX. Sept. 11, 2018.

Porter, D., T. Marek, L. Sun, Y. Yang, J. Hu, and K. Heflin. 2018. **Smart Irrigation Advancement for Agriculture**. Texas A&M AgriLife Research. Corporate Technology. TAMU, College Station, Texas.

Bordovsky, J.P. 2018. Webcast presentation of **Irrigation management with limited water**. Plant Management Network, APS Crop Protection and Management Collection. <https://www.plantmanagementnetwork.org/edcenter/seminars/2018AgChemicalsConference/>

Bordovsky, J.P. 2018. Presentation of **A history of sprinkler irrigation on the Texas High Plains**. Luncheon Keynote Speaker. Summer Crops / OAP Center Pivot Irrigation Field Day. Conservation and Production Research Laboratory, Bushland, TX. Aug. 9, 2018.

Bordovsky, J.P. 2018. Presentation of **Leveraging rainfall with limited irrigation rotations using corn and grain sorghum**. Texas Corn Producers Board. Lubbock, TX. Nov. 8, 2018.

Porter, D., Bordovsky, J., and Marek, G. 2018. Presentation of **Promoting sensor-based technology to improve land and water resources conservation**. USDA-NRCS-CIG Annual Review. Goodwell, OK. Nov. 27, 2018.

Bordovsky, J.P. 2018. Presentation of **Leveraging rainfall with limited irrigation in non-traditional cotton rotations**. Cotton Incorporated, Texas State Support Committee annual review. Lubbock, TX. Nov. 28-29, 2018.

Akin, A. 2018. **Design of an in-canopy sprinkler monitoring system for center pivot irrigation.** ASABE Paper 1801387 Design of an In-Canopy Sprinkler Monitoring System for Center Pivot Irrigation. Advisor: Danny Rogers, Committee member, Jonathan Aguilar.

Poster presentation of **Design of an in-canopy sprinkler monitoring system for center pivot irrigation.** ASABE Poster 1801389. 2018. ASABE annual international meeting, July, 2018. Advisor: Danny Rogers, Committee member, Jonathan Aguilar.

Poster presentation of Lamm F. R. 2018. **The importance of pressure regulators for sprinkler irrigation systems** at the Center Pivot Technology Field Day at Roth Farm, Garden City, Kansas, August 15, 2018.

Poster presentation of Lamm F. R. 2018. **The Importance of Reliable Irrigation Systems** at the Center Pivot Technology Field Day at Roth Farm, Garden City, Kansas, August 15, 2018.

Poster presentation of Lamm F. R., J. Bordovsky, D. Rogers, D. Porter and T. Howell, Sr. 2018. **Navigating Towards Successful In-Canopy and Near-Canopy Sprinkler Irrigation: Question 1** at Roth Farm, Garden City, Kansas, August 15, 2018.

Poster presentation of Lamm F. R., J. Bordovsky, D. Rogers, D. Porter and T. Howell, Sr. 2018. **Navigating Towards Successful In-Canopy and Near-Canopy Sprinkler Irrigation: Question 2** at the Center Pivot Technology Field Day at Roth Farm, Garden City, Kansas, August 15, 2018.

Poster presentation of Lamm F. R., J. Bordovsky, D. Rogers, D. Porter and T. Howell, Sr. 2018. **Navigating Towards Successful In-Canopy and Near-Canopy Sprinkler Irrigation: Question 3** at the Center Pivot Technology Field Day at Roth Farm, Garden City, Kansas, August 15, 2018.

Poster presentation of Lamm F. R., J. Bordovsky, D. Rogers, D. Porter and T. Howell, Sr. 2018. **Navigating Towards Successful In-Canopy and Near-Canopy Sprinkler Irrigation: Question 4** at the Center Pivot Technology Field Day at Roth Farm, Garden City, Kansas, August 15, 2018.

Poster presentation of Lamm F. R., J. Bordovsky, D. Rogers, D. Porter and T. Howell, Sr. 2018. **Navigating Towards Successful In-Canopy and Near-Canopy Sprinkler Irrigation: Question 5** at the Center Pivot Technology Field Day at Roth Farm, Garden City, Kansas, August 15, 2018.

Poster presentation of Lamm, F. R. and D. H. Rogers. 2018. **Why should I use Irrigation Scheduling?** at the Center Pivot Technology Field Day at Roth Farm, Garden City, Kansas, August 15, 2018.

Poster presentation of Lamm, F. R., R. Schwartz, A. Schlegel, I. Kisekka, J. Bell, D. O'Brien, and P. Colaizzi. 2018. **Optimizing Land/Water Allocations for Irrigated Corn Production** at the Center Pivot Technology Field Day at Roth Farm, Garden City, Kansas, August 15, 2018.

Poster presentation of Lamm, F. R. 2018. **Post-Anthesis Irrigation Management for Corn** at the Center Pivot Technology Field Day at Roth Farm, Garden City, Kansas, August 15, 2018.

Poster presentation of Lamm, F. R., D. H. Rogers, A. J. Schlegel, N. L. Klocke, L. R. Stone and L. K. Shaw. 2018. **Assessment of residual soil water on corn fields of western Kansas** at the Center Pivot Technology Field Day at Roth Farm, Garden City, Kansas, August 15, 2018.

Poster presentation of Lamm, F. R. 2018. **Increasing water productivity through advanced irrigation scheduling,** Kansas State University at Roth Farm, Garden City, Kansas, August 15, 2018.

Poster presentation of Lamm F. R. 2018. **The importance of pressure regulators for sprinkler irrigation systems** at the Center Pivot Technology Field Day at USDA-ARS CPRL, Bushland, TX, Aug. 9, 2018.

Poster presentation of Lamm F. R. 2018. **The Importance of Reliable Irrigation Systems** at the Center Pivot Technology Field Day at USDA-ARS CPRL, Bushland, TX, Aug. 9, 2018.

Poster presentation of Lamm F. R., J. Bordovsky, D. Rogers, D. Porter and T. Howell, Sr. 2018. **Navigating Towards Successful In-Canopy and Near-Canopy Sprinkler Irrigation: Question 1** at the Center Pivot Technology Field Day at USDA-ARS CPRL, Bushland, TX, Aug. 9, 2018.

Poster presentation of Lamm F. R., J. Bordovsky, D. Rogers, D. Porter and T. Howell, Sr. 2018. **Navigating Towards Successful In-Canopy and Near-Canopy Sprinkler Irrigation: Question 2** at the Center Pivot Technology Field Day at USDA-ARS CPRL, Bushland, TX, Aug. 9, 2018.

Poster presentation of Lamm F. R., J. Bordovsky, D. Rogers, D. Porter and T. Howell, Sr. 2018. **Navigating Towards Successful In-Canopy and Near-Canopy Sprinkler Irrigation: Question 3** at the Center Pivot Technology Field Day at USDA-ARS CPRL, Bushland, TX, Aug. 9, 2018.

Poster presentation of Lamm F. R., J. Bordovsky, D. Rogers, D. Porter and T. Howell, Sr. 2018. **Navigating Towards Successful In-Canopy and Near-Canopy Sprinkler Irrigation: Question 4** at the Center Pivot Technology Field Day at USDA-ARS CPRL, Bushland, TX, Aug. 9, 2018.

Poster presentation of Lamm F. R., J. Bordovsky, D. Rogers, D. Porter and T. Howell, Sr. 2018. **Navigating Towards Successful In-Canopy and Near-Canopy Sprinkler Irrigation: Question 5** at the Center Pivot Technology Field Day at USDA-ARS CPRL, Bushland, TX, Aug. 9, 2018.

Poster presentation of Lamm, F. R. and D. H. Rogers. 2018. **Why should I use Irrigation Scheduling?** at the Center Pivot Technology Field Day at USDA-ARS CPRL, Bushland, TX, Aug. 9, 2018.

Poster presentation of Lamm, F. R., R. Schwartz, A. Schlegel, I. Kisekka, J. Bell, D. O'Brien, and P. Colaizzi. 2018. **Optimizing Land/Water Allocations for Irrigated Corn Production** at the Center Pivot Technology Field Day at USDA-ARS CPRL, Bushland, TX, Aug. 9, 2018.

Poster presentation of Lamm, F. R. 2018. **Post-Anthesis Irrigation Management for Corn** at the Center Pivot Technology Field Day at USDA-ARS CPRL, Bushland, TX, Aug. 9, 2018.

Poster presentation of Lamm, F. R., D. H. Rogers, A. J. Schlegel, N. L. Klocke, L. R. Stone and L. K. Shaw. 2018. **Assessment of residual soil water on corn fields of western Kansas** at the Center Pivot Technology Field Day at USDA-ARS CPRL, Bushland, TX, Aug. 9, 2018.

Poster presentation of Lamm, F. R. 2018. **Increasing water productivity through advanced irrigation scheduling**, Kansas State University at USDA-ARS CPRL, Bushland, TX, Aug. 9, 2018.

Evelt, S. 2018. Participated in the workshop, "The Future of Water for Irrigation in California and Israel", July 16-18, 2018, at the University of California, Davis. Dr. Evelt facilitated a discussion of Irrigation Water Quality and Water Reuse and described research results on comparative irrigation and crop water use efficiencies of SDI and sprinkler irrigation systems, and variable rate center pivot decision support systems and sensors.

Evelt, S. 2018. Presentation of "**Precision Agriculture and Irrigation - Current U.S. Perspectives**" at the 2018 American Society of Agricultural and Biological Engineers Annual International Meeting in Detroit, MI, Aug 1, 2018.

O'Shaughnessy, S. 2018. Presentation of "**Advantages and Disadvantages of Variable Rate Irrigation Using Mechanical Move Systems**" at the 2018 American Society of Agricultural and Biological Engineers Annual International Meeting in Detroit, MI, Aug 1, 2018.

Stone, K. 2018. Presentation of "**Variable Rate Irrigation Decision Support System: Evaluation and Experiences**" at the 2018 American Society of Agricultural and Biological Engineers Annual International Meeting in Detroit, MI, Aug 1, 2018. The talk centered on a system developed and patented by ARS at Bushland, TX, for center pivot systems.

Evelt, S. 2018. Presentation of presented, "**Evaporative Losses from Sprinkler and Subsurface Drip Irrigation in a Region of Large Evaporative Demand**" at the 2018 American Society of Agricultural and Biological Engineers Annual International Meeting in Detroit, MI, Aug 1, 2018.

Evelt, S. 2018. Participated in a panel discussion on, "Producing More Food with Less Water: Does technology, management, or policy provide the best bang for our buck?", in the General Session of the 2018 American Society of Agricultural and Biological Engineers Annual International Meeting in Detroit, MI, July 30, 2018.

Bordovsky, J.P. 2018. Poster presentation. **Increasing water productivity through advanced irrigation scheduling, Texas A&M Research.** USDA-ARS Ogallala Aquifer Program Annual Meeting. March 27-29, 2018. Lubbock, TX.

Kothari, L. Ale, S., Bordovsky, J., Porter, D., and Munster, C. 2018. Poster presentation. **Evaluation of efficient irrigation management strategies for grain sorghum production in the Texas High Plains.** USDA-ARS Ogallala Aquifer Program Annual Meeting. March 27-29, 2018. Lubbock, TX.

Bordovsky, J.P. 2018. Webinar. **Development, deployment, and demonstration of the dashboard for irrigation efficiency management (DIEM).** FY16-17 Water Seed Grant Final Report Symposium. April 20, 2018. College Station, TX. Unknown number of participants.

Andales, A., Rogers, D., & Bordovsky, J.P. 2018. Webinar. **Irrigation scheduling tools for improved water management & water use efficiency.** Climate Learning Network/ ANREP Climate Science Initiative in partnership with the Ogallala Water Coordinated Agriculture Project. May 10, 2018. Estimated participants ~ 100.

Evelt, S. Attended the Roundtable Discussion on the report, "Internet of Water: Sharing and Integrating Water Data for Sustainability" on February 23, 2018 in St. Louis, MO, with other irrigation and water resource professionals.

Evelt, S. Attended the Water Resource Research Planning Meeting, March 14-15, 2018 at Arkansas State University, Jonesboro, AR, where variable rate center pivot irrigation and partial drying techniques for rice cultivation under center pivots were discussed.

Evelt, S. Attended the Annual Meeting of the Alberta Alfalfa Seed Commission, March 27, 2018 in Brooks, Alberta, CA where he presented " Precision irrigation based on crop water stress", a discussion of the ARS irrigation scheduling supervisory control and data acquisition system for control of variable rate center pivot irrigation systems in response to plant and soil water status.

Evelt, S. Traveled to Amman, Jordan on April 8-13 where he assessed soil water monitoring data, developed plans for further soil water monitoring, and cooperated in developing a training program on precision irrigation management.

Evelt, S. Attended the Second Research Coordination Meeting – IAEA Coordinated Research Project D1.50.17, on April 15-20, 2018 in Rabat, Morocco where he presented on the relative efficacy of electromagnetic soil water sensors compared with the cosmic ray neutron probe (CRNP), and demonstrated that the CRNP was not suitable for irrigation management due to its shallow effective depth of reading.

Evelt, S. Met in Washington, DC, on May 24-25, 2018 with other national and international irrigation experts at the National Academy of Sciences, Engineering and Medicine BANR meeting to inform GAO on agricultural (irrigation) technologies and management practices for reducing demand on water supplies, and collaborated on sprinkler irrigation research work with ARS Beltsville MD.

Evelt, S. Met in Washington, DC, on June 21-22, 2018, with research funding agencies to discuss the important of irrigation research in the face of water scarcity and a changing climate. He met with representatives of ARS, DOE, DARPA-E, FFAR, NIFA and NSF.

Lamm, F. R. 2018. Poster presentation of **Increasing Water Productivity through Advanced Irrigation Scheduling, Kansas State University** at Ogallala Aquifer Program, March 27-29, 2018.

Porter, D. O. and F. R. Lamm. 2018. Powerpoint presentation of **Center Pivot Technology Transfer Effort** at Ogallala Aquifer Program, March 27-29, 2018.

Bordovsky, J. P. 2018. Oral presentation. **Irrigation Management Research (Timing with Deficit Irrigation)**. 2018 Plainview Agricultural Cooperative Annual Meeting, Plainview Country Club. Plainview, TX. Jan. 24, 2018.

Bordovsky, J. P. 2018. Oral presentation. **Irrigation Management Research (Timing with Deficit Irrigation)**. 2018 Llano Estacado Cotton Conference, Muleshoe, TX. Jan. 26, 2018.

Evelt, S. R. 2018. **Emerging Technologies for Water Management and Conservation: Fusing the Internet-Of-Things with Irrigation Decision Support Systems**. ILSI North America Annual Meeting Southampton, Bermuda, January 21-24, 2018.

Lamm, F.R. and D. M. O'Brien. 2018. Poster presentation of **Efficient Irrigation Technologies for Corn – A Comparison** at Kansas Corn Commission Research Poster Symposium, Manhattan, Kansas, January 25, 2018.

Bordovsky, J.P. 2017. Oral presentation of **Deficit irrigation research**. High Plains Underground Water Conservation District Board of Directors meeting. Lubbock, TX. October 10, 2017.

Porter, D., Bordovsky, J., Marek, T., Hillyer, C., Jordan, S., Marek, G., Heflin, K., Moorhead, J. 2017. Oral presentation of **Promoting sensor based technology to improve land and water resources conservation**. USDA-NRCS-CIG Annual Review. Goodwell, OK. Nov. 14, 2017.

Bordovsky, J.P. 2017. Oral presentation of **Leveraging rainfall with limited irrigation in non-traditional cotton rotations**. Cotton Incorporated, Texas State Support Committee annual review. Lubbock, TX. Nov. 29-30, 2017.

Evelt, S.R. 2017. **Precision Agriculture Perspectives: Sensing, IOT and Decision Support for Agricultural Management**, oral presentation at TETRARTITE 2017, Luton Hoo, UK, October 15-18, 2017.

Evett, S.R. 2017. **Crop thermal data – Tool for mapping crop water stress, it's variability & soil water status**, presented at The Subterranean Macrocope: Sensor Networks for Understanding, Modeling and Managing Soil Processes, an NSF-USDA sponsored workshop, November 1-2, 2017, Gleacher Centre, University of Chicago, Illinois.

Evett, S.R. 2017. **Natural resource management decision support systems: Satellite Remote Sensing, and Decision Support for Water Management**, Congressional Briefing, National Agriculture Library, Beltsville, Maryland, August 25, 2017.

Evett, S.R. 2017. **Water resource management and water saving agriculture**, oral presentation to delegation from China Agricultural University, August 3, 2017.

Rogers, D.H. 2017. Oral Presentation: **Review of Kansas Water Law and Changes in Irrigation Systems and Management** (included discussion of center pivot irrigation systems). Guest Speaker for ATM 661 Course, Watershed Assessment and Management, Manhattan, KS. November 30, 2017.

Rogers, D.H. 2017. Oral Presentation: **Review of Kansas Water Law and Changes in Irrigation Systems and Management** (included discussion of center pivot irrigation systems). Presentation at the WinField United Winter Conference, Manhattan, KS. December 12, 2017.

Porter, D. 2017. **Irrigation Management and Crop Water Management**. Guest Lecture in course, Crop Stress Management. Texas A&M University Department of Soil and Crop Sciences. October 3, 2017.

Porter, D. 2017. **Irrigation Water Quality and Salinity Management**. Guest Lecture in course, Crop Stress Management. (recorded presentation). Texas A&M University Department of Soil and Crop Sciences. October 5, 2017.

Porter, D. 2017. Dashboard for Irrigation Efficiency Management (DIEM) training for county agent beta testers. Lubbock, TX. February 23, 2017.

Porter, D. 2017. **Crop Water Use. Irrigation and Water Management**, training for county agent professional development. Lubbock, TX. March 30, 2017.

Porter, D. 2017. **Irrigation Management for Dairies**. Dairy Outreach Program Area workshop and field day. Dublin, TX. April 6, 2017.

Porter, D. 2017. **Irrigation Management for Cotton Production**. Texas A&M AgriLife Cotton Agent training. Lubbock, TX. July 26, 2017.

Porter, D. 2017. **Irrigation System Capabilities and Management**. Texas A&M AgriLife Research Corn Breeders Tour. Lubbock and Halfway, TX. August 16-17, 2017.

Porter, D. 2017. **Irrigation Water Quality and Irrigation Technologies**. Irrigation Training Program for Lower Rio Grande Valley. Weslaco, TX. September 12, 2017.

Porter, D. 2017. **Water Quality Issues in Irrigation**. Maverick County Agricultural Irrigation Field Day. Eagle Pass, TX. September 13, 2017.

Aguilar, J.P. 2017. Oral Presentation: **The Center Pivot Irrigation: Hands-on for Beginners**. Presentation at the IA Agriculture Faculty Academy, Grand Island, NE. June 8, 2017

Aguilar, J.P. 2017. Oral Presentation: **The Mobile Drip Irrigation**. Presentation at the IA Agriculture Faculty Academy, Grand Island, NE. June 9, 2017

Aguilar, J.P. 2017. Oral Presentation: **Irrigation Technologies: The Now and the Near Future**. Presentation for Kearney-Finney LEMA Informational Meeting, Deerfield, KS. June 6, 2017.

Aguilar, J.P. 2017. Oral Presentation: **Water Quantity and Irrigation Technology**. Presentation at the KARA Summer Field Diagnostic School, Manhattan, KS. July 11 and 13, 2017

Aguilar, J.P. 2017. Oral Presentation: **A Virtual Tour on Roth Water Technology Farm**. Presentation at the Kansas Water Congress. Garden City, KS. July 28, 2017.

Aguilar, J.P. 2017. Oral Presentation: **Center Pivot Irrigation System Demonstration**. Presentation at the Circle C Water Technology Farms Field Day, near Healy, KS. Aug. 11, 2017.

Aguilar, J.P. 2017. Oral Presentation: **Center Pivot Irrigation System Demonstration**. Presentation at the Hatcher Water Technology Farms Field Day, near Liberal, KS. Aug. 11, 2017.

Aguilar, J.P. 2017. Oral Presentation: **Center Pivot Irrigation System Demonstration**. Presentation at the T&O Water Technology Farms Field Day, near Garden City, KS. Aug. 15, 2017.

Aguilar, J.P. 2017. Oral Presentation: **Irrigation Highlights: From Research Plots to Water Technology Farms**. Presentation at the Liberal Rotary Club, Liberal, KS. Aug. 22, 2017.

Aguilar, J.P. 2017. Oral Presentation: **Center Pivot Irrigation System Demonstration**. Presentation at the ILS Water Technology Farms Field Day near Larned, KS. Aug. 23, 2017.

Bordovsky, J.P. Host tour for Nuffield Visiting Scholars, New South Wales, Australia. Toured irrigation research facilities and ongoing projects at Texas A&M AgriLife Research, Halfway, TX. June 23, 2017.

Bordovsky, J.P. 2017. **Irrigation research activities in the Southern High Plains**. Oral presentation and field tour. 4-H Water Ambassadors. Halfway, TX. July 14, 2017.

Bordovsky, J.P. 2017. **Deficit irrigation research and strategies**. Oral presentation. West Central Research and Extension Center Water and Crops Field Day. North Platte, NE. Aug. 24, 2017.

Bordovsky, J.P. 2017. **Deficit irrigation research**. Oral presentation. 12th Annual Texas Alliance for Water Conservation Field Day. Edmonson, TX. Sept 6, 2017.

O'Shaughnessy, S.A. 2017. **The Importance of Center Pivot Irrigation for Crop Production in the Texas High Plains Region**. Oral presentation and field tour for group of Australian visitors. Bushland, Texas. June 9, 2017.

O'Shaughnessy, S.A. 2017. **On-going Research with Variable Rate Irrigation Technology**. Oral presentation and field visit for the USDA-FAS China Delegation. Bushland, Texas, August 4, 2017.

O'Shaughnessy, S.A. 2017. **Sensor-based irrigation Management**. Oral presentation in: IFDC- Technology advances in agricultural production water and nutrient management workshop. Muscle Shoals, AL, August 21, 2017.

Rogers, D.H. 2017. Oral Presentation: **Center pivot Irrigation System Performance and Management**. Presentation for the Farm National Coop Tour at the ILS Water Technology Demonstration Farm, Larned, KS. July 11, 2017.

Rogers, D.H. 2017. Oral Presentation: **Kansas Irrigation Trends and Impacts** (included discussion of center pivot irrigation systems).

Presentation at the Kansas Youth Advocate Water Conference, Manhattan, KS. July 12, 2017.

Rogers, D.H. 2017. Oral Presentation: **Center pivot Irrigation System Performance and Management** at the Circle C Water Technology Demonstration Farm, Healy, KS. August 11, 2017.

Rogers, D.H. 2017. Oral Presentation: **Center pivot Irrigation System Performance and Management** at the Hatcher Water Technology Demonstration Farm, Liberal, KS. August 11, 2017.

Lamm, F. R. Discussion and brief tour of sprinkler irrigation technology with two producers from Iowa, July 29, 2017.

Center Pivot Irrigation Retreat, **Brainstorming and Brainstretching Event**, March 28-29, 2017, Amarillo, Texas.

Lamm, F. R. 2017. Summarization of all center pivot irrigation papers 1989 to 2017 from the Central Plains Irrigation Conference. Complete papers in Adobe PDF and MS-Excel file to access and search by author, year, title, and/or keyword.

Evelt, S. R. 2017. Summarization of all center pivot irrigation papers from USDA-ARS-CPRL Soil and Water Management Research Unit (SWMRU) from 1983-2017. All papers in Adobe PDF files can be accessed chronologically by year.

Aguilar, J.P. 2017. Oral Presentation of **The High Plains Aquifer: The Lifeblood of Western Kansas**. Garden City High School Technology Team, Garden City, KS., January 23, 2017.

Aguilar, J.P. 2017. Oral Presentation of **Updates: Water Technology Farms and Irrigation Technology Research**. Water Talk Series / GMD 4 Annual Meeting, Goodland, KS., February 1, 2017.

Aguilar, J.P. 2017. Panelist and Oral Presentation of **Updates: Water Technology Farms and Irrigation Technology Research**. Water Talk Series / GMD 1 Annual Meeting, Sharon Springs, KS., February 2, 2017.

Aguilar, J.P. 2017. Oral Presentation of **Updates: Water Technology Farms and Irrigation Technology Research**. Water Talk Series / WaterPACK Annual Meeting, St. John, KS., February 13, 2017.

Aguilar, J.P. 2017. Panelist and Oral Presentation of **Irrigation Technology Research and Water Technology Farms**. Water Talk Series / Upper Arkansas Regional Advisory Committee Meeting, Garden City, KS., February 14, 2017.

Aguilar, J.P. 2017. Oral Presentation of **Updates: Water Technology Farms and Irrigation Technology Research**. Water Talk Series / SW Irrigators Association Annual Meeting, Ulysses, KS., February 21, 2017.

Aguilar, J.P. 2017. Oral Presentation of **Irrigation Technologies**. Area 2 2017 State Conservation Commission Spring Workshops, Garden City, KS., March 8, 2017.

Aguilar, J.P. 2017. Oral Presentation of **Irrigation Scheduling and Soil Moisture Probes**. Wichita County Water Conservation Area Meeting, Leoti, KS., March 9, 2017.

Bordovsky, J.P. 2017. **LESA / LEPA water application systems**. Oral presentation. South Texas Irrigation Conferences, 2017 Center Pivot Workshop. Pleasanton, TX. Feb 7-8, 2017.

Bordovsky, J.P. 2017. **Texas High Plains cotton irrigation research**. Oral presentation. 2017 Oklahoma Irrigation Conference. Altus, OK. Mar. 1, 2017.

Bordovsky, J.P. 2017. **Optimizing limited water**. Oral presentation. 2017 Lubbock / Hale County Precision Irrigation Workshop. Abernathy, TX. Mar. 23, 2017.

Lamm, F. R. 2017. Oral presentation of **Sprinkler irrigation management of modern corn hybrids under institutional constraints**. Area 1 2017 SCC Spring Workshop, Grainfield, KS., March 7.

Porter, D.O. and Bordovsky, J.P. 2017. DIEM training for county agent beta testers, Workshop presentations. Lubbock, TX. Feb. 23, 2017.

Rogers, D.H. 2017. Oral Presentation of **Center Pivot Systems Sprinkler Package Options and Performance Evaluation and Review of Mobile Drip Irrigation Option for Center Pivot Systems**. Kaw Valley Irrigation Association Annual Meeting. Topeka, KS., February 9, 2017.

Rogers, D.H. 2017. Oral Presentation of **Review of Center Pivot Systems Sprinkler Package Options and Irrigation Efficiency**. Water PACK Irrigation Association Annual Meeting. St John, KS., February 13, 2017.

All project participants, miscellaneous producer and media contacts, 2017-2019.