Research activities and interests for

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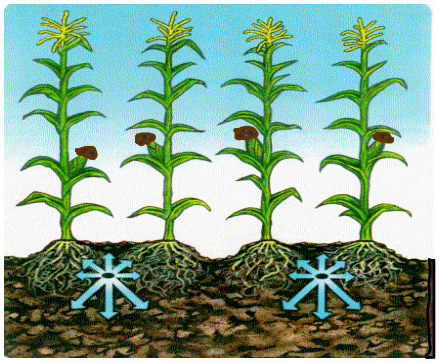
SDI website: http://www.ksre.ksu.edu/sdi/
General irrigation website: http://www.ksre.ksu.edu/irrigate/
Career publication list of Freddie Lamm: http://www.ksre.ksu.edu/sdi/Reports/2011/FRLCarPub.pdf

Current Study Areas (Field research in progress or research analyses in progress)

SDI Studies (Design, operation and management)



- Longevity of SDI systems (Data has been collected since 1989)
- Evaluation of SDI soil water redistribution (In progress)
- Timng of of nitrogen fertigation under deficit irrigation (In progress)
- Comparison of SDI and LEPA sprinklers (In progress)
- Evaluation of Plant Growth Regulators with SDI (In progress
- Evaluation of Temperature-Time Thresholds for SDI Scheduling (Fieldwork and analysis In progress)
- Alfalfa production under SDI (Publication and further work in progress)

Irrigation Macromanagement Studies

- Deficit irrigation management to conserve Ogallala aquifer water (Final analyses and publications in progress)
- Improving criteria for terminating the corn irrigation season (Analysis in progress)
- Effect of early season water stress on corn production (Analysis In progress and new fieldwork initiated)

Center Pivot Sprinkler Irrigation Studies

- Deficit sprinkler irrigation of corn (In progress)
- Deficit sprinkler irrigation of sunflower (In progress)
- Plant growth regulator effects on sprinkler-irrigated corn (In progress)
- Modeling the effect of sprinkler irrigation capacity on summer crop production (Recent publication and Ongoing)
- Concepts of in-canopy and near-canopy sprinkler irrigation (Publication in progress)
- Comparison of various irrigation systems (In progress)

Research interests and rationale

The four following research interests are often closely interrelated and are generally focused towards improving crop water productivity (aka water use efficiency) by decreasing water inputs or by increasing crop economic yield output. Thus, some overlap in the discussion may be apparent.

Management of advanced irrigation systems (microirrigation and sprinklers)

Although furrow irrigation systems can be managed efficiently, management considerations (time and labor resources, soils variability, etc.) often preclude attainment of high application efficiency. Microirrigation and center pivot sprinkler systems allow for smaller, more frequent irrigation events, which are becoming important factors in advanced irrigation management strategies. Interests here include development of direct irrigation water saving schemes, substituting degraded waters for fresh waters, combined irrigation/nutrient management, benchmarking system performance and determining inherent system characteristics.

Irrigation macromanagement

Several excellent methods can be used to schedule corn irrigation on a real time, daily, or short-term basis throughout the season. Essentially, these methods achieve water conservation by delaying any unnecessary irrigation event with the prospect that the irrigation season might end before the next irrigation event is required. However, larger irrigation management issues can have a greater impact on water conservation, water use efficiency, and economic utilization of the water resource than the step-by-step, periodic scheduling procedures. These issues will be defined as macromanagement and can entail several different strategies, some of which are discussed by Lamm et al. (1996) (Available at http://www.ksre.ksu.edu/irrigate/Reports/macro.pdf). Strategies of particular interest are decisions about initiation and termination of the irrigation season, efficiency of dormant season irrigation, optimal allocation of water and land resources, and combined irrigation and nutrient management. Macromanagement offers great potential at reducing irrigator uncertainty which is a great detriment to water conservation. An implicit assumption of macromanagement is that efficient irrigation scheduling is used throughout the season.

Irrigation uniformity (spatial, temporal and crop partitioning effects)

In-canopy sprinkler irrigation and microirrigation can present some unique uniformity challenges and opportunities for water management. Particular spatial uniformity interests include sprinkler nozzle and dripline spacing aspects as related to crop location and orientation. The timing and duration of posed uniformity deficiencies can ultimately determine whether these uniformity problems are acceptable. Another interest is partitioning and redistribution of the applied irrigation amount by the crop as affected by sprinkler and microirrigation characteristics. In this context partitioning might mean the different flow paths (e.g. stemflow, throughfall, interception storage runoff, deep percolation, etc.) or maybe separating the evaporation and transpiration components. Irrigation uniformity issues and the resultant crop uniformity issues offer considerable water management potential.

Formation of corn yield from emergence to physiological maturity

A better understanding of the corn yield formation processes (vegetative, reproduction and grain filling) and their subparts and triggers coupled with an understanding of the capabilities of modern advanced irrigation systems might allow for greater water productivity through both higher and more consistent yields and also through water savings by eliminating unnecessary irrigation events. For example, although it is well documented that limited irrigation strategies for corn are difficult to successfully implement without yield reductions, would it be possible to spoon feed small frequent (daily or multiple times daily), but deficit amounts of water through SDI allowing kernel set (a key yield formation point), yet saving irrigation. Different strategies might be used at other times in the season. Research by Lamm and Trooien, (2001) (at http://www.ksre.ksu.edu/sdi/Reports/2001/icpp.pdf) indicate that daily SDI amounts of as small as 0.10 inch/day can ensure kernel set even under extremely dry conditions.

Selected Recent Publications, 2007-2011

BOOKS AND BOOK CHAPTERS

Lamm, F. R., J. E. Ayars, and F. S. Nakayama (Eds.). 2007. **Microirrigation for Crop Production - Design, Operation and Management**. Elsevier Publications. 608 pp.

Lamm, F.R. and C.R. Camp. 2007. **Subsurface drip irrigation**. Chapter 13 in Microirrigation for Crop Production - Design, Operation and Management. F.R. Lamm, J.E. Ayars, and F.S. Nakayama (Eds.), Elsevier Publications. pp. 473-551.

Ayars, J. E., D. A. Bucks, F. R. Lamm, and F.S. Nakayama. 2007. **Introduction**. Chapter 1 in Microirrigation for Crop Production - Design, Operation and Management. F.R. Lamm, J.E. Ayars, and F.S. Nakayama (Eds.), Elsevier Publications. pp. 1-26.

REFEREED JOURNALS

Lamm, F. R., A. A. Aboukheira, and T. P. Trooien. 2010. **Sunflower, soybean, and grain sorghum crop production as affected by dripline depth**. Appl. Engr. in Agric. 26(5):873-882.

Arbat, G., F. R. Lamm, and A. A. Aboukheira. 2010. **Subsurface drip irrigation emitter spacing effects on soil water redistribution, corn yield and water productivity.** Appl. Engr. in Agric. 26(3):391-399.

Puig-Bargués, J., F. R. Lamm, T. P. Trooien, and G. A. Clark. 2010. **Effect of dripline flushing on subsurface drip irrigation systems.** Trans ASABE 53(1): 147-155.

Lamm, F. R., R. M. Aiken, and A. A. Abou Kheira. 2009. **Corn yield and water use characteristics as affected by tillage, plant density and irrigation.** Trans. ASAE: 52(1):133-143.

Stone, L.R., F.R. Lamm, A. J. Schlegel, and N. L. Klocke. 2008. **Storage efficiency of off-season irrigation. Agron J. 100:1185–1192.**

Lamm, F. R., L. R. Stone, and D. M. O'Brien. 2007. **Crop production and economics in Northwest Kansas as related to irrigation capacity.** Appl. Engr in Agric. 23(6):737-745.

NATIONAL AND INTERNATIONAL CONFERENCE PROCEEDINGS

Lamm, F. R., J. P. Bordovsky, L. J. Schwankl, G. L. Grabow, J. Enciso-Medina, R. T. Peters, P. D. Colaizzi, T. P. Trooien, and D. O. Porter. 2010. **Subsurface drip irrigation: Status of the technology in 2010.** In: Proc. 5th National Decennial Irrigation Conf., ASABE and the IA, Phoenix, Arizona, December 5-8. 14 pp.

Lamm, F. R., P. D. Colaizzi, J. P. Bordovsky, T. P. Trooien, J. Enciso-Medina, D. O. Porter, D. H. Rogers, and D. M. O'Brien. 2010. **Can Subsurface Drip Irrigation (SDI) be a Competitive Irrigation System in the Great Plains Region for Commodity Crops?** In: Proc. 5th National Decennial Irrigation Conf., ASABE and the IA, Phoenix, Arizona, December 5-8. 15 pp.

Lamm, F. R. 2009. **Unique challenges with subsurface drip irrigation.** ASABE paper no. 095927. ASABE, St. Joseph, MI. 25 pp.

Lamm, F. R. and A. A. Abou Kheira. 2008. **Effects of early-season water stresses on corn production.** Proc. 29th Annual Int'l. Irrigation Assoc. Tech. Conf., Anaheim, California, Nov. 2-4, 2008. Available from Irrigation Association, Falls Church, VA. Paper No IA09-1052. 10 pp.

Lamm, F. R., T. A. Howell, and J. P. Bordovsky. 2007. **Ensuring Equal Opportunity Sprinkler Irrigation.** Proc. 28th Annual Int'l. Irrigation Assoc. Tech. Conf., San Diego, California, December 9-11, 2007. Irrigation Assoc., Falls Church, VA. Paper No. IA07-1013. 7 pp.

Lamm, F. R. T. P. Trooien, and A. J. Schlegel. 2007. **Application and utilization of livestock effluent through SDI systems.** Intr'l Symposium on Air Quality and Waste Management for Agriculture, Broomfield, Colorado, Sept. 15-19, 2007. ASABE. 8 pp.

Major External Funding Sources

USDA-ARS Ogallala Aquifer Program

USDA-NIFA Special Project Water Conservation-Increased Efficiency in Usage

Syngenta Chemical Corporation

Kansas Corn Commission

National Sunflower Association