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Technology Transfer: Promoting Irrigation Progress and Best Management Practices

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Abstract. *Educational efforts promoting irrigation best management practices are designed to increase adoption of these practices and increase public understanding of the importance of irrigation. They increase visibility and impact of the Ogallala Aquifer Program and promote affiliated research and extension programs to agricultural producers, consultants and water resources managers. Building upon existing programs and collaborations, successful programs are being expanded to accommodate additional audiences and applications. Improved quality, effectiveness and efficiency of educational programs are made possible through improved communication and complementary expertise of the collaborators. A variety of methods and media (electronic and print; modular educational packages; mass media; and traditional Extension field days and workshops) are being used to reach an expanding and diverse audience. Evaluation surveys and levels of participation in education events indicate that audience response has been very positive.*

Keywords. irrigation, educational methods, best management practices, Ogallala Aquifer, irrigation management, water conservation

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Introduction

Efficient advanced irrigation technologies and best management practices (BMPs) have been developed, evaluated and made widely available through the combined efforts of research, extension, the irrigation industry and end-users. Successful application of these technologies and management strategies has proven cost-effective, technically feasible and effective in achieving water savings and/or increased water use efficiency. However, adoption of irrigation BMPs, as well as proficiency and appropriateness of applications, have been highly variable. This implies that BMPs are not well understood, and that additional educational efforts are warranted to promote proper adoption and implementation.

Technology transfer efforts supported in part through the USDA-ARS Ogallala Aquifer Program (OAP) (USDA-ARS, 2010) were initiated to increase public awareness of program-related research and improve accessibility and application of associated research products and information resources. Objectives of this ongoing work include 1) promoting adoption of efficient irrigation technologies and management practices through easily accessible, audience-appropriate educational materials; 2) increasing public awareness of irrigation research activities, innovations, and technology contributions of participants in the OAP and research/extension programs of associated universities and agencies; 3) promoting use of information resources, including evapotranspiration networks and related tools, for improved irrigation scheduling and management; and 4) increasing value of the OAP research and technology transfer products. These efforts should promote a positive public perception of the OAP by providing a range of practical, accessible information and educational resources and opportunities. This paper describes how the OAP and related technology transfer efforts are reaching the diverse needs of target audiences through a variety of educational methods, and how audience feedback is used to assess and improve effectiveness of the technology transfer program.

Target Audiences

The primary target audiences for these technology transfer efforts are agricultural producers, crop consultants, technical service providers, irrigation professionals and similarly interested professionals working with irrigated agriculture. Most of these audiences are college educated and familiar to some degree with crop production systems, irrigation technologies and irrigation water resources. They have access to a variety of information sources, including trade journals, Internet, and conferences/workshops sponsored by industry, trade/irrigation associations, and agencies (Extension/university, USDA-NRCS, groundwater districts, irrigation districts). They are increasingly technologically sophisticated; many are rapid adopters of new technology. They are generally the primary decision makers (or advisors) regarding irrigation technology selection and irrigation management.

A second, yet still very key group of audiences include agribusiness professionals, bankers, off-site landowners (absentee landlords), research scientists, policy makers and others who are interested in agricultural irrigation (in particular) or in agriculture and/or water issues in general. These audiences generally are college educated and interested in the subject matter, but they may be less familiar with specific irrigation technologies, methods and management. While not generally involved in field level irrigation scheduling and management, they can have strong influence in some irrigation decisions (technology selection, investments in equipment, and methods of irrigation).

Youth and general public audiences are becoming increasingly important target audiences. Goals for these audiences include increasing water awareness and literacy, support for water conservation programs, and understanding of the economic significance of irrigated agriculture on local, regional and national scales.

It is reasonable to conclude that there is overlap among the audiences, their needs and expectations, and that individuals do not necessarily fit readily into categories. There also is a growing need for irrigation outreach for small scale landowners (Parker, 2010). Many small scale landowners are highly educated professionals, but lack experience in rural and agricultural settings. Many are seeking information related to agricultural irrigation (pastures, vineyards, horticultural and specialty crops) on a smaller scale. A high percentage of this group prefers electronic, web-based information access (Brunson and Price, 2009). While this group does not consume the largest amount of resources, they are nonetheless a very important voting constituency and can be key supporters of water conservation programs.

Educational Methods

As the audience base becomes increasingly broad, more highly educated, and technologically sophisticated, their information needs and information delivery mechanism expectations continue to expand. Traditional on-farm demonstrations, as well as workshops, conferences, classes, crop tours, and other "face to face" formats continue to be important and effective for many, particularly for the traditional primary target audiences. While venue, agenda topics and presentation quality are very important in successful technology transfer, these occasions also seem to derive much of their value as social networking events and general information sharing opportunities. Given that the number of extension personnel is decreasing on a national scale, resources to support effective in-person program delivery likely will become more limited. Evaluation instruments are being used to monitor and improve effectiveness of these delivery formats and events.

On-farm demonstrations are a traditional Extension technology transfer format wherein technologies and BMPs are "proven" locally effective and applicable in commercial farm settings. Often with participating local grower/cooperators, these short-term or multi-season demonstrations afford opportunities for on-farm training for individuals, as well as for local educational events. Experts from universities, agencies and industry interact with producers in settings that are comfortable to the audiences and afford opportunities for hands-on learning. Examples of such programs include on-farm center pivot studies to verify and promote the KanSched tools (Rogers and Alam, 2007) and other irrigation management tools and strategies; on-farm subsurface drip irrigation (SDI) system evaluations; center pivot uniformity evaluations (*i.e.* IrriGage catch can tests); and center pivot in-canopy nozzle package performance evaluations, such as those conducted by the Kansas State University Irrigation Research and Extension Mobile Irrigation Lab (Kansas State University, 2010).

Targeted meetings and workshops often attract producers, crop consultants and irrigation professionals by offering Continuing Education Units necessary for maintenance of licenses and certifications (*i.e.* pesticide applicator licensees, Certified Crop Advisers, IA Certified Agricultural Irrigation Specialists, etc.). They can be stand-alone events, or they may be held in conjunction with farm shows or larger conferences. They may even be developed as coordinated series. Examples of such events and results of evaluation surveys are summarized in the results section.

Secondary audiences (and increasingly the primary audiences) often prefer alternative technology transfer mechanisms, including Internet–based delivery that allows them to access information any time, anonymously and on-demand. They often prefer concise "sound bite"

answers over more comprehensive educational packages, and they expect higher level web-based packaging of resources (web-based video, iTunes™ Podcasts, online calculators). Development of these packages requires additional web programming skills, hardware and software maintenance, and visual design expertise. Yet the overall delivery and potential to reach an expansive audience base makes electronic delivery very efficient.

Examples of decision support software and other online irrigation technology transfer include the Texas High Plains Evapotranspiration Network (Porter et al., 2005) and the KSU Mobile Irrigation Lab (Kansas State University, 2010; Rogers et al., 2006). The Texas High Plains Evapotranspiration Network website (http://txhighplainset.tamu.edu) provides evapotranspiration and related meteorological data for the Texas Panhandle, Southern High Plains and Rolling Plains. The KSU Mobile Irrigation Lab (http://www.ksre.ksu.edu/mil/) provides access for software downloads and technical support information for farm-level tools such as KanSched2, an ET-based irrigation scheduling tool (Rogers and Alam, 2007); FuelCost, a calculator to estimate seasonal irrigation costs based upon well depth, system pressure, fuel types and values, and irrigation amounts (Rogers et al., 2006); Crop Water Allocator, a seasonal planning tool to optimize net return from combinations of crops, irrigation amounts, and land allocations (Klocke et al., 2006); Compare Energy Costs, a calculator to simplify comparing fuels for irrigation pumping (Kansas State University, 2010), and others. Seminars, meetings and hands-on training events have supported adoption of these decision support tools, and they have provided opportunities to obtain user feedback useful for ongoing program improvement and support. Other important OAP associated irrigation technology transfer resource websites include the USDA-ARS Conservation and Production Laboratory Soil and Water Management Unit (http://www.cprl.ars.usda.gov/swmru_research.htm), Subsurface Drip Irrigation in the Great Plains (http://www.ksre.ksu.edu/sdi/), Irrigation at K-State Research and Extension (http://www.ksre.ksu.edu/irrigate/), Texas AgriLife Research and Extension Center at Lubbock (http://lubbock.tamu.edu/), and Texas AgriLife Research and Extension Center at Amarillo (http://amarillo.tamu.edu/index.php).

Meteorological data made available through evapotranspiration networks are essential to application of various irrigation scheduling tools (including KanSched and various ET-based calculators.) Application of these tools has been further promoted through expansion of information delivery and improved data management by existing ET networks. Related outreach efforts include development (updating) of the user interface and data query pull-down menus for the database driven TXHPET Network website. Terminology and query tools have been improved to be more intuitive for a wider range of end users. User manuals, special bulletins, newsletter features and invited papers are available in hardcopy and electronic (Internet-based delivery) formats. The resources have been featured in Extension and other public meetings; technical, professional, and similarly targeted meetings; Extension curricula and workshop series; strategic planning documentation and other venues.

General public and youth audiences often have no specific goal in learning about irrigation technology and management. Yet, the need for better public understanding of water issues and of the value of efficient agricultural irrigation warrants effective outreach to these audiences. A variety of media and formats designed to engage them in context of other events can be more effective than traditional meetings or classes. An off-shoot of the KSU Mobile Irrigation Lab is a mobile exhibit used at county fairs and youth water festivals. Computer based interactive games and quizzes engage audiences and invite them to become more involved in water issues and more familiar with available educational resources. Internet websites; presentations at public meetings, fairs and festivals; articles in newspapers; and features on local news television and radio broadcasts expand the opportunities for public access to bulletins, fact sheets, videos and other educational resources.

Results

Evaluation of effectiveness of educational programs is increasingly emphasized, as agencies are required to document program outcomes. Evaluation survey instruments have been developed to document program effectiveness, and seek feedback from audiences to further improve program quality and relevance. Survey results, such as those summarized in Table 1, provide agency leaders a quick assessment of program venue, content, audience and outcomes.

Detailed item-by-item results from the surveys provide useful information to event coordinators and speakers. They answer critical questions. Was the agenda appropriate for the audience? Which speakers were well received, and which speakers were less well received, and why? Which topics needed more time on the program? Which topics should have been de-emphasized or omitted? What omitted or overlooked topics would the audience like to see on future programs? Did the program answer the questions or meet the needs of the target audience? If not, why not? By incorporating audience feedback into program development, educators can better serve the clientele with relevant and quality information. Linking survey instruments through common terminology and core knowledge goals allows for easier documentation of program effectiveness on local, regional and statewide scales.

Internet site counters recording the number of requests for information provide a valuable mechanism to measure relative usage of online resources (data, information, decision support tools). Increase in inquiries and usage of the websites, with expected cropping (irrigation) seasonal fluctuations, indicates increased interest and application of the resources. Positive feedback on the resources and requests for additional utilities for application with the data indicate that while the current tools are appreciated, additional utilities are desired, and are expected to further increase adoption and application.

Table 1. Summary of example educational events and evaluation survey results.

Event	Audience	Knowledge Assessment (% indicating increase in knowledge)		Technology/BMP Adoption or Intent to Adopt (% of respondents)	
Making the Most of Irrigation Workshop Lubbock, TX 02/01/2008	agricultural producers, crop consultants, irrigation professionals, extension educators (43 attending)	crop water requirements	100%	Low pressure center pivot or SDI	87%
		soil moisture management	100%	Equipment maintenance program	86 %
		irrigation efficiency and economics	100%	BMPs – irrigation scheduling	85%
		available information resources	100%		
Irrigation Training Program Series Workshop Chillicothe, TX 08/19/2008	agricultural producers, crop consultants, irrigation professionals, extension educators (43 attending)	crop water requirements	76%	Low pressure center pivot or SDI	73%
		soil moisture management	68%		
		center pivot irrigation	56%	Equipment maintenance program	86%
		subsurface drip irrigation	84%		
		irrigation scheduling	64%	BMPs – irrigation scheduling	86%
		available information resources	68%		
Subsurface Drip Irrigation Field Days Colby, KS 08/04/2009 & Halfway, TX 08/25/2009	agricultural producers, crop consultants, irrigation professionals, extension educators (100 attending Colby event; 118 attending Halfway event)	system components, layout, planning	40%*	Apply knowledge gained to irrigation decisions	89%
		SDI system maintenance and trouble-shooting	40%		
		applicability, advantages and disadvantages of SDI	49%	Change practices as a result of BMPs presented	50%
		BMPs to improve efficiency	46%		

** Note: Many participants in this event were experienced irrigation professionals who indicated a high initial level of knowledge and experience with the technologies and BMPs presented.*

Conclusion

Technology transfer to promote adoption and appropriate application of efficient irrigation technologies and best management practices is essential to maximizing their benefits. Traditional and emerging audiences present opportunities to deliver information and educational resources in a variety of formats and venues, and over a range of technical levels. Evaluation of educational program effectiveness provides important feedback for ongoing improvement of programs to ensure relevance and quality. These efforts will increase awareness of irrigation research and technology transfer programs and products, and ultimately will improve irrigation management.

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