Story by Leslie Lee

ON THE FAST TRACK

Collaboration expedites adoption of efficient irrigation technologies in the High Plains

The High Plains of Texas have been nagged by severe drought for two years straight, with very little rainfall or relief from harsh weather. As agriculture producers in the region use every tool they can to make the most of their available resources, Texas A&M AgriLife Research scientists and Texas A&M AgriLife Extension Service professionals are getting new irrigation technologies into growers' hands in record time.

Irrigation is incredibly valuable in the High Plains — not only to individual producers but to the region as a whole. Without available irrigation water, converting all of the region's irrigated acres to non-irrigated dryland farming would cause an annual net loss of over $1.6 billion.[1] As drought and supply limitations stress the region and increase pressure on producers, Texas A&M AgriLife experts are upping their efforts.

"If you have limited water, like we have here, then you just have to make the best use of it when you apply it," said Dr. Dana Porter, an AgriLife Extension agricultural engineering specialist for irrigation and water management, who is stationed in Lubbock.

Better tools and timing

There is an abundance of efficient irrigation technologies, including low-pressure center pivot systems such as low-energy precision application (LEPA) and low-elevation spray application (LESA), as well as microirrigation systems such as microspray, surface drip and subsurface drip irrigation, Porter said.

"LEPA is a type of center pivot irrigation, and the identifying characteristic of that system is that water is deposited directly on the ground, typically in alternate furrows," said Jim Bordovsky, senior research scientist and agricultural engineer with AgriLife Research at Halfway. "LEPA eliminates spray evaporation losses that would come from an applicator that was higher off the ground and typically would wet the entire surface area. So we're reducing evaporation from spray losses as well as soil surface evaporation losses."

It's not just the irrigation system that is important. The timing of the application is also key.

Bordovsky is leading a four-year study to optimize water efficiency, yield and fiber quality of cotton under limited water conditions by evaluating a combination of irrigation amounts during different growth periods using LEPA irrigation. After three years of research, Bordovsky has found that the conventional wisdom of filling the soil profile with water at the beginning of the growing season may not be the most economical use of water.

"One of the things we saw was that the water that was applied during that first period of the growing season was not utilized as efficiently as water applied during the second and third periods," Bordovsky said. "Part of that is due to the fact that we've got very harsh environmental ⇨

[1] *Texas Water Resources Institute EM-115, 2012.*

Low-energy precision application, or LEPA, irrigation eliminates spray evaporation losses that would come from an applicator that was higher off the ground and typically would wet the entire surface area. An experimental type of LEPA system is pictured. Photo by Jim Bordovsky, Texas A&M AgriLife Extension Service.

conditions — high wind speeds, high temperatures, low relative humidity — during that time period."

The study began in 2010, which was a relatively wet year, Bordovsky said, followed by two very dry years.

"We've also seen that we are enabling that cotton plant to grow too large early with insufficient irrigation capacity to meet the water needs of that plant later in the growing season," Bordovsky said. "We are seeing that our water value, or our water efficiency, is higher toward the end of the growing season."

This research is supported in part by the Texas State Support Committee of Cotton Incorporated and the U.S. Department of Agriculture (USDA) – Agricultural Research Service Ogallala Aquifer Program. Many of the research projects in the High Plains have been funded by the Ogallala program, which was created by Congress in 2003 to find solutions to problems arising from declining water levels in the aquifer. Approximately 80 state and federal scientists from the Agricultural Research Service, Kansas State University, AgriLife Research, AgriLife Extension, Texas Tech University and West Texas A&M University participate in the Ogallala Aquifer Program, and the Texas Water Resources Institute helps facilitate it in Texas.

Not one size fits all

Extension professionals such as Porter help producers decide which irrigation system will be ideal for their individual operation.

"We have all of those great technologies — LEPA, microirrigation, including subsurface drip — and they are great tools, but they are not one-size-fits-all," Porter said. "They've got to be managed well to get the good results."

When producers are choosing irrigation systems, there are many factors to consider: available irrigation supplies, field topography and size, weather conditions, management style, labor force and economics.

"We can't take all the pivots in the High Plains and turn them into LEPA systems, because the typography of many fields is such that you would have too much runoff with a LEPA system," said Bordovsky, who has extensively researched LEPA systems. "We cannot say, across the board, convert everything to LEPA and save all this water; there are areas where it is not a good fit."

Porter and Bordovsky said that each technology has its limitations, and producers should seek the best solution for their operation.

"For instance, subsurface drip is a really good tool, but it's not going to work for everybody," Porter said. "There's an economy of scale to consider. If

Low-energy precision application, or LEPA, irrigation is being used to irrigate approximately 20 to 30 percent of High Plains cotton for at least a portion of the growing season. An experimental type of LEPA system is pictured. Photo by Jim Bordovsky, Texas A&M AgriLife Extension Service..

you have more water and a bigger field, it is cheaper per acre to put in a low-pressure center pivot than it is a subsurface drip system. With LEPA, if I've got too much field slope, then I run too much risk of losing water to runoff. So, none of these work everywhere."

She said that it's also important for her and her peers to be realistic about new technologies.

"When we talk about new research, it's so important to spell-out clearly the details, the specific conditions under which the results were achieved," Porter said. "A new technology isn't a magic fix."

Working together

In the High Plains, AgriLife Extension focuses on helping producers maximize the benefits from those new technologies, Porter said.

"We help producers by applying soil physics knowledge, soil moisture characteristics, soil storage, and helping folks understand the root zone and how to manage that for maximum efficiency," Porter said.

She said that with all of the different factors to consider — weather conditions, soil moisture data and plant stress indicators — AgriLife Extension can help producers interpret data to choose their best irrigation system option.

At the same time, the research team Bordovsky leads is working to give producers better tools for efficient irrigation.

"The high rate of adoption of advanced irrigation technologies — including low-pressure center pivot and subsurface drip — I will accredit much of it to his work," Porter said, on Bordovsky's research. "He's done so much, just leading the way in developing, first of all, and then refining LEPA and subsurface drip. Because of his research program and research programs like it, such as the USDA's Conservation and Production Research Laboratory at Bushland, and because these technologies are really well-suited to growing conditions and the climate conditions in the Texas High Plains, [the technologies] just fit here. They are working here."

LEPA has been around for a number of years, said Bordovsky, and approximately 20 to 30 percent of High Plains cotton is grown using LEPA for at least a portion of the growing season.

"The producers out here are very proactive in adopting new technology, and they will do that as quickly as they can, of course as a function of economics," Bordovsky said. "So if they can convert from furrow to drip irrigation, and they can see that they can produce as much or more, and get as much production to result in payback for that investment, they will do that. They will jump through hoops to learn that technology."

Porter also credits the Ogallala Aquifer Program for helping facilitate improvements in the High Plains.

"The fact that research and extension folks here have a good collaborative relationship is so important, and the Ogallala Aquifer Program has made it even easier for us to work with other states and agencies, too," Porter said. "We share information so much better, and it's easy for me to get the information into producers' hands faster."

The past two years of drought have also increased producers' receptiveness to "anything that can help them save water and prolong the life of the water they've got available," Bordovsky said. Although Bordovsky is mainly a research scientist, he also participates in field days and producer meetings, he said.

"The growers trust the research that comes from here, and it works for the growers," Porter said. "We have some really progressive producers here in the High Plains who are willing to grab onto these new technologies and incorporate them into their operations."

The combination of well-researched and thoroughly developed technologies, open-minded producers, and the adaptability and applicability of the technologies to High Plains conditions has made the region an example of the land grant mission in action: high quality research and experimentation resulting in relevant knowledge that is disseminated to the public through extension education.

"We've got the education, the research, the industry involvement and the technology development in a kind of critical mass, all in one location — so we just have this huge rate of adoption of efficient technologies such as LEPA and subsurface drip," Porter said. "In other places where any of those pieces are missing, adoption may lag because it's more of a struggle for the producers to get the information, expertise and equipment that they need. But here, they have relatively good access to these resources."

The researchers' ultimate goal is increasing the economic value of the irrigation water applied, Bordovsky said. As limited supplies and the possibility of continued drought looms, innovative research and relevant extension education will continue to help make High Plains agriculture increasingly efficient.

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