CAN DRIP IRRIGATION KEEP THE PRAIRIE PROFITABLE?

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The use of flood and center pivot irrigation of crops via the waters of the Ogallala Aquifer is as hot a discussion topic as the current drought.

To many who mine the aquifer to make a living, trying to keep a profitable way of life sustainable in a time when the broader public is seeking more conservation of resources yet wanting inexpensive, plentiful and safe food is problematic.

Perhaps it's wise to keep in mind the words of 2012 World Food Prize Laureate Daniel Hillel. "What undermines civilizations very often is mismanagement of land, water, crops and agriculture; the very basis of subsistence, the very basis of life," Hillel said at his laureate lecture. "Infrequent, periodic flood irrigation over the centuries has proven not to be sustainable."

Perhaps his most telling words were these: "We have been sinful in our use of the soil and of life. We can either play a negative role or a positive one in the use of our resources depending on how we manage them."

Hillel became considered the father of drip irrigation, bringing life to the Negev Desert.

"The theory of infrequent irrigation - that is, come back every two or three weeks when moisture is depleted - was at one time the standard theory," Hillel said. "Equal availability of wilting point and field capacity."

Though born and educated in the U.S., Hillel brought his agricultural education to a kibbutz in the nascent state of Israel in the early 1950s. Hillel saw the people of Israel kibbutzim were mostly new to farming and would be willing to try new technologies.

"It occurred to them that maybe if we applied water a few drops at a time in a continuous frequency rather than flooding the land with high volume and low frequency using perforated PVC tubing - something new that had emerged out of the post-war era - and then fine-tune the amount of water as the plant matured, you could have success in response to rainfall and the needs of the plant," Hillel said.

Through the pioneering efforts of Hillel, the benefits of drip irrigation - yield increases, crop quality improvement and better resource use efficiency - are being seen and more widely adapted, to the point where many universities have researchers examining the successful efficacy of drip irrigation in ever more complex field uses.

Subsurface Drip Irrigation is a specialized subset of drip irrigation where dripline or drip tape "lateral lines" (tubes buried beneath the crop rows) and supply and flushing "submains" (pipes supplying water to the lateral lines) are buried beneath the soil surface for multi-year use.

The SDI lateral line tubes are buried beneath the crop and deliver water and nutrients directly to the soil and plant roots to support crop growth. In addition to drip tape, thin wall integral driplines are commonly used as well.

The technique of burying less expensive bi-wall drip tape laterals beneath field crops was pioneered in fruit and vegetable fields in the Southwest U.S. decades ago. Fast forward a half-century to discover SDI has become the fastest growing irrigation technology in the world.

The SDI technique is now being used throughout the world on a wide range of grain, forage and fiber crops including alfalfa, corn, cotton, soybeans and sugarcane. In Kansas alone, about 30,000 according to Freddie Lamm, Ph.D., research agricultural engineer at the Kansas State University Northwest Research-Extension Center at Colby.

"Drip irrigation will definitely have a play in our deficit water situation, where water is very marginal," Lamm said. "We will likely be able to end up stabilizing yields at a higher level under drip irrigation than we are now using other alternative watering systems like flood and pivot. There's very little evaporation from the soil surface in drip irrigation compared with pivots and flood irrigation."

"There's also no runoff. It leaves the soil drier so you can capture rainfall events when they occur. By applying smaller amounts of water, you also decrease the potential of the amount of depercolation below the root zone and you can better time the watering as needed especially late in the season."

Still, for all the platitudes that can be handed toward drip irrigation, agriculture is still a business, and long-term investments such as a move to drip irrigation must be made with care.

"We are constantly narrowing the cost-benefit gap in drip irrigation as the overall costs have decreased over time," Lamm said. "You have an opportunity to narrow the gap by irrigating a few more acres than you would with a center pivot. With the same amount of water, you can irrigate a few more acres."

DRIP IRRIGATION ON THE PRAIRIE

"Overall, we can see about a 25 percent water savings over pivot is possible from drip irrigation."

Advocates for SDI say there are benefits such as decreased long-term costs with increased crop flexibility along with the reduced water use. They also tout benefits like being able to irrigate odd-shaped fields or fields with obstacles, permitting access to fields around the clock since there are no pipes in the way, easier fertilizer application, either to the whole system or to trial blocks that are square shaped instead of pie shaped.

SDI systems must be designed, installed, operated and maintained properly in order to be long lasting and cost-effective. Common challenges include emitter clogging, root intrusion, vacuum suction and insect, rodent and mechanical damage - all of which may be successfully addressed with proper planning and management. It all starts with quality water, Lamm said.

"Clogging prevention is crucial to SDI system longevity and requires understanding of the potential hazards associated with a particular water source," Lamm said. "There have been some water chemistry problems, particularly in central Kansas - primarily from about Wichita north into Nebraska - and when they do flair up they create problems."

"Although nearly all water is potentially usable for SDI, the added cost of complex water filtration and chemical treatment of marginal-quality water might further reduce the feasibility of SDI use on lesser-value crops."

That means no SDI system should be designed and installed without first assessing the quality of the proposed irrigation water supply, Lamm said.

"In some cases, poor water quality can also cause crop growth and long-term soil problems. However, with proper treatment and management, many waters that are high in minerals, nutrient enrichment, or salinity can be used successfully in SDI systems," Lamm said.

Then comes the selection of a dripline, which involves consideration of dripline diameter and wall thickness, emitter type, discharge rate and emitter spacing. The way Lamm describes the process of system design, it sounds complex but not daunting.

"The design process may require several tries to select the correct emitter discharge, emitter spacing, dripline spacing - which is usually fixed at twice the row spacing - with zone size, field size and system flow rate given the producers desired level of irrigation system reliability," the ag engineer said.

Perhaps the biggest of the challenges Lamm has seen is rodent damage. "It doesn't happen for everybody," Lamm said. "When it does happen, it's a major problem since it's difficult to fix. The water may be coming up in a place other than where the damage actually is."

As with nearly all investments, the decision of whether an SDI investment is sound lies with the farmer/investor, Lamm said.

"It really requires a thorough understanding of the fundamentals and the recommendations from a trusted and proven expert," Lamm said. "People should spend a good amount of time to determine if drip is a good option for their situation at this time. Lamm and a host of other colleagues at K-State Research and Extension who are experts in irrigation system design offer a few ideas on what to consider before purchasing an SDI system:

1. Educate yourself before contacting a service provider or salesperson. Seek out university and other educational resources. A good place to start is the K-State SDI website at www.ksre.ksu.edu/sdi. Also, read the literature or websites of micro-irrigation companies as well. Review SDI minimum design components as recommended by K-State. Visit www.ksre/ksu.edu/sdi/Reports/2003/mf2576.pdf to learn more. Visit other producer sites that have installed and are using SDI. Most current producers are willing to show their SDI systems to others.
2. Interview at least two companies. Ask them for references, credentials (training and experience) and completed sites (including the names of contacts or references). Ask questions about design and operation details. Pay particular attention if the minimum SDI system components are not met. If not, ask why. System longevity is a critical factor for economical use of SDI. Also, ask companies to clearly define their role and responsibility in designing, installing, and servicing the system. Determine what guarantees are provided.
3. Obtain an independent review of the design by an individual not associated with the sale. This adds costs but is relatively minor in comparison to the total cost of a large SDI system.

"Eventually, there will be fewer irrigated acres in Kansas," Lamm said. "This will lessen the blow and has the potential to extend the transition period to fewer acres. In that transition, we may see the introduction of a broad array of new drought-tolerant crop varieties."

"We can combine all these technologies as we move forward rather than wait until the water is gone. Once it's gone, it's gone."