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Switch to Drip Irrigation

Corn and Soybean Digest
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Fri, 2013-02-01 15:32

Subsurface drip irrigation systems reduce net irrigation needs by nearly 25% while maintaining yields.

Using subsurface drip irrigation, Nebraska farmer Don Anthony has maintained big corn and soybean yields while improving his watering efficiency by 35% or more. Like many western Corn Belt and southern High Plains growers with limited annual rainfall, Anthony has counted on irrigation as a staple for his corn, soybeans and other crops.

But with many areas seeing dwindling aquifers and/or government restrictions, subsurface drip irrigation (SDI) is replacing center pivots and furrow irrigation on some acres.

More than 300,000 acres are in drip irrigation across the Great Plains, says Freddie Lamm, Kansas State University agricultural engineer and irrigation researcher in Colby, noting that much success has been seen with cotton.

While initial costs are 40-50% higher than center pivot systems, growers can expect to see those costs paid back within two to five years, thanks to better water-use efficiency and lower irrigation energy bills.

Anthony's ground outside Lexington, Neb., is part of that shift to drip. It's paying off. With conservation in mind for years, Anthony's 50-50 corn-bean rotation is 100% no-till. Residue left over from harvested crops help hold precious precipitation that barely approaches 20 in. annually.

The land includes some odd-shaped fields that aren't practical for sprinkler systems. The gravity-fed furrow systems yield 200 bu./acre for corn and 65 bu. soybeans.

"But we wanted to be more efficient with our irrigation," Anthony says. "We were using too much water with the furrow system and a pivot wouldn't fit the field. So we looked at the drip system."

He installed his first drip system in the spring of 2006 using Toro Micro-Irrigation equipment. It relies on ¾-in. Toro Aqua-Traxxplastic drip tape, also called dripline, buried 15 in. underground. Water is fed to soil and root systems through small precise outlets, or emitters, spaced 24 in. apart.

The buried dripline is spaced 5 ft. apart on the 30-in. row cropping system, resulting in each corn row being about 15 in. from the nearest dripline. Water is funneled to the tape by a series of 6-in. submain lines. They are fed by 8-in. main lines, which flow from irrigation wells.

"We are able to keep our corn yields at about 200 bu./acre and our beans at 65 bu./acre," Anthony says.

Return on Investment

Apples and oranges may be the best way to describe Anthony's ROI of drip vs. center pivot. But his improved irrigation efficiency strongly contributes to the economic competitiveness of SDI.

"We're in an area where water regulations permanently remove any land not watered two out of the last 10 years from 'irrigated' status, so the tape is a defensive measure for our balance sheet," Anthony says. "Comparison with our (center pivot) circles is not apples-to-apples."

Pivots are more expensive to install on odd-shaped fields than large fields, he says.

"However, our irrigation efficiency is much better with drip. The drip system typically uses 65-75% of the water and energy needed to irrigate with a pivot. It often uses less than one-third of furrow watering."

Lamm notes that on similar smaller fields, the cost of a center pivot per acre may be about the same cost of SDI. "In addition, SDI will likely be able to irrigate more of the land area in these odd shaped parcels," he says.

Initial cost of Anthony's drip system was about $1,400/acre. Common SDI systems cost from $1,200 to $1,400/acre, compared to about $800-1,000/acre for a typical 132-acre circular pivot," says Inge Bisconer, technical marketing manager for Toro Micro Irrigation.

"Pivots can be even more if they're fitted with swing arms to irrigate the corners. On the other hand, SDI systems can easily accommodate both square fields or odd shaped fields, irrigating over 155 acres of a typical quarter section."

Lamm, who has led K-State SDI research more than 20 years, says yields from SDI can compete closely with pivot irrigation using much less water. "Careful management of SDI systems reduces net irrigation needs by nearly 25%, while still maintaining top yields of 200 bu./acres," he says.

"The 25% reduction in irrigation needs potentially translates into 35-55% savings when compared to sprinkler and furrow irrigation systems which typically operate at 65%-85% application efficiency."

A seven-year field study the past decade compared simulated low energy precision application (LEPA) sprinkler pivot irrigation to SDI for corn and soybean production on silt loam soils in northwest Kansas. LEPA corn averaged 235 bu./acre, while SDI averaged 233.

"There was little difference in average corn grain yields between system type across all comparable irrigation capacities," Lamm says. "However, LEPA had higher grain yields for four extreme drought years (about 15 bu./acre more) and SDI had higher yields in three normal to wetter years (about 15 bu./acre more)."

Lamm says there were no significant differences in soybean yield (73 bu./acre for SDI compared to 70 bu./acre for LEPA). Lamm says there was a trend toward SDI having greater yield at deficit irrigation levels and LEPA having greater yield at the full irrigation level.

Maintenance is Vital

SDI system costs include filtration equipment, since clogged emitters are a major enemy of water distribution.

The filter, usually an automated sand media, disk or screen type filter depending on water quality, helps prevent clogging of the drip tape emitters, Bisconer says. Maintenance chemicals such as acid and chlorine may be injected regularly to clean the system.

“We have switched from centrifuge and screens to sand media due to excessive plugging of the screen,” Anthony says. “Our maintenance includes daily flush of filters, an annual flush with N-Phuric acid and repair of main and submain leaks as needed.”

Lamm says valves, filters, flow meters, pressure gauges and other system components should also be inspected routinely for worn parts. Pipelines and components should be winterized in colder climates, he says.

Drip systems are often used to apply fertilizer and other chemicals to root zones. “Injecting small amounts of nitrogen solution into the irrigation water can spoon-feed the crop, while minimizing the pool of nitrogen in the soil available for percolation into the groundwater,” Lamm says.

Anthony says he will likely add more drip irrigation to his operation. “We need to improve our overall irrigation program even more,” he says. “This system helps us do that and helps get water more efficiently to various sizes of fields.”

Why go with SDI over LEPA?

Freddie Lamm, Kansas State University agricultural engineer and irrigation researcher in Colby, says the primary reason is probablybecause more acres can be irrigated when water supplies are sufficient. "For example, if you’re installing a pivot on a full 160 acres, it will cover about 125 acres," he says. "With SDI, you can irrigate about 155 acres.

“That's over 20% more acres. With today’s corn prices, that's quite a bit more in production and return per farmed acre."

In that case, an extra 30 acres at a yield of 200 bu./acre could generate an extra $42,000 in gross return based on $7 corn.

Lamm notes that if growers can control runoff, then a LEPA system, with its extended drop lines and more precise nozzles, can be virtually as efficient as SDI, other than watering fewer acres.

However, when slopes are too great, the use of both LEPA and SDI may be limited. And as with Anthony and his odd shaped fields, there could circular system issues.

Lamm notes that if a grower uses deep tillage that may interfere with

Drip line buried 12-18 in. deep, field operations also could be limited. "However, growers are likely using GPS, so if they need to rip between drip lines, they should be able to do without disturbing the drip line," he says.

Calculate your potential savings

Kansas State University offers growers an online calculator to help determine the efficiency of a drip irrigation system compared to center pivot or furrow watering. It can be accessed at http://bit.ly/RvkiiI.

Inge Bisconer, technical marketing manager for Toro Co. Micro Irrigation,says Toro offers an online calculator that enables growers to estimate how long it will take for a drip system to pay for itself.

The "payback wizard" atallows the user to enter his state, crop to be irrigated, current irrigation system (gravity, mechanized, etc.), number of acres watered and cost of water per acre-foot.

For example, a farm in Nebraska, irrigated corn with a gravity or furrow system on 100 acres at a cost of $20/acre/ft., could install a new SDI system and see its cost paid back in just over five years. In addition, an extra 31 acres could be irrigated with the amount of water saved.

The payback period will vary according to each individual situation, so each line item in the analysis may be customized, Bisconer says.

Additional drip irrigation information is available through www.toro.com/agriculture, and through Extension offices. The K-State site is http://www.ksre.ksu.edu/sdi/. Other SDI system companies, such as Netafim http://www.netafimusa.com/agriculture also offer information on switching to drip irrigation.

Source URL: http://cornandsoybeandigest.com/equipment/switch-drip-irrigation