Drip Irrigation Is A Workable Option for Rolling Plains Cotton

VERNON—After three years of testing cotton performance in the field, a Texas AgriLife Research agronomist says subsurface drip irrigation is a workable option for Rolling Plains crop producers.

"Drip is the preferred way to irrigate in many other crop-producing regions," said Dr. John Sij, AgriLife Research agronomist based at Vernon. "Research has proven it is the most efficient water delivery system available today.

"But is it feasible in the semi-arid climate we have here on the Rolling Plains? Answering that question is the rationale behind our research."

So far, the Rolling Plains project has focused on evaluating plant productivity and lint quality of irrigated cotton grown in conventional and conservation tillage systems. Results were then compared to cotton grown with traditional furrow irrigation.

The site for the first three years of this research was a 28-acre field in Munday, Texas. Subsurface drip-irrigation lines were installed 12 to 14 inches deep, using 40- and 80-inch spacings. This allowed the researchers to divide the field into 66 plots, each slightly smaller than one-half acre, which could be individually watered and monitored.

"We installed water meters to record actual crop water use in each plot," Sij said. "We planted our conservation-tillage study into a terminated rye cover crop. The planting dates for each study ranged from early May to early June.

"We used SureGrow 215 Bollgard/Roundup-ready cotton in all the plots, seeded at five plants per foot of row on 40-inch rows. We used a combination of hand-hoeing and herbicides to control weeds."

A well producing more than 200 gallons per minute provided irrigation. Wells of this caliber are common in the region, Sij said.

"We had some leaks in the system and a minor rodent problem right after the system was installed," Sij said. "Even with some labor involved to fix the leaks and take care of gophers, the subsurface-drip system has proven more labor-efficient than a traditional furrow-irrigation system.

"Installation cost is a factor when you compare drip systems to furrow or sprinkler irrigation," he said. "Drip is more labor-efficient, but it can cost from $700 to $1,200 per acre to install. The ability to intensively manage the crop and the land compensates for the higher installation cost."

In the 2003 study, there was no yield difference in cotton regardless of irrigation line spacing or tillage systems. The terminated rye cover crop used in the conservation-tillage study did not contribute additional soil moisture as Sij had hoped.

"There was very little precipitation in 2003, so we didn’t see any effect from using a cover crop," he said. "Our drip-irrigated cotton did, however, produce significantly more cotton than our furrow-irrigated plots. Our drip plots averaged 3.7 bales per acre, while the furrow-irrigated plots averaged about 2.5 bales per acre—a 48 percent yield advantage."

In 2004, Mother Nature turned the tables on the studies by adding abundant precipitation to the cotton equation.

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Cotton root rot, possibly encouraged by ample soil moisture, knocked yields of drip irrigated cotton back to 2.9 bales per acre. No yield difference was found between 40-inch and 80-inch drip line spacings with conventional tillage. But cotton grown in a terminated rye cover crop outperformed conventional-tillage cotton by six-tenths of a bale per acre.

"In a wetter year, the terminated rye cover crop boosted yields significantly," Sij said. He also conducted a study comparing deficit irrigation to full irrigation in 2003 and 2004 on 40-inch drip line spacings. Full irrigation was based on 100 percent evapotranspiration replacement. Reducing irrigation water by 50 percent, to 50 percent evapotranspiration replacement, reduced yields in conventional and conservation tillage studies but not as much as expected.

"We noted a 9 percent yield reduction in conventional tillage cotton and an 18 percent yield reduction in cotton grown in a terminated rye cover crop," Sij said. "That tells us that the cover crop extracted some subsoil moisture. At the same time, a cover crop protects young plants from weather-related damage and reduces erosion damage that can mean re-tilling or entirely replanting a field."

With two years of comparative data at hand and one year’s data still in review, Sij feels subsurface drip irrigation has proven its worth on the Rolling Plains.

"We achieved a labor savings, used our water more efficiently and brought in higher yields in two tillage systems, compared with traditional-furrow irrigation," he said. "In two years of our study, the loan value (lint quality) was the same for cotton grown with subsurface-drip lines on 40-inch spacings using 50 percent evapotranspiration replacement and 100 percent evapotranspiration replacement.

"That tells us that we can produce very respectable yields and lint quality using less water. We plan to continue this study to see how far we can go with deficit irrigation in this region without significantly hurting yields. We also want to see if it is really necessary to pre-water cotton fields to ensure a stand when we use subsurface-drip irrigation."

In 2006, the research will move from Munday to a 15-acre site at Chillicothe, the agronomist said.

With a similar well and drip irrigation system installed at that site, Sij and other researchers at the Texas AgriLife Research and Extension Center at Vernon hope to expand the study.

"We would like to look at cotton rotations with grain sorghum and wheat using drip irrigation, and compare overall system costs to traditional furrow irrigation and sprinkler irrigation," Sij said. "We would also like to see how drip irrigation performs with high-value vegetable and melon crops, and intensively-managed forages."

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