Telemetry *Schedules* Irrigation

With The Latest Technology Farmers Keep Keener Eye On Crop Moisture

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Using telemetry to schedule irrigation can provide a big boost to yields, according to Dr. Joe Henggeler, irrigation specialist with the University of Missouri at the Delta Center in Portageville.

"Irrigators who schedule are making about 13 bushels more corn," he said. Most of these use the Woodroof method or the Arkansas Scheduler. At $4 corn that's $50 an acre, on soybeans with about an 8 bushel increase at $10, that's $80 an acre. Cotton is the same way, so scheduling is probably one of the biggest, best ways to make an improvement for an irrigator.

"One special type of scheduling actually uses soil moisture sensors," Henggeler added. "Instead of having a computer predict water needs, you actually look at what the sensors are showing you, schedule irrigation according to that; and, from our survey, the indications are that you will see an even greater yield bump."

Henggeler said the sample size of farmers using sensors was very small, so he doesn't want to mention the amount of yield increase, but it was much higher than the 13 bushels extra from just using computer scheduling. However, he's sold on the concept.

"All methods of scheduling are good, but this looks really good," he said. Some problems with normal methods in use is you have to go out and collect the data, then graph it which can be a problem especially in the middle of the season. Farmers have time earlier on to play with it and get it set, but after that point they've got to leave it to take care of itself.

"So what is a possibility now is using telemetry to schedule our irrigation," Henggeler said. "With sensors out in the field, instead of going out to collect the data, the data is sent to the farmer. Now you can use tensiometers or you can use a gypsum block type of equipment. There is a special probe with the capacitance method which will give you graphs of the water content in the soil. We recommend placing them at three depths, 6, 12, and 18 inches so you'll get a graph for each one."

The value of the 18-inch probe will stay fairly flat if you're irrigating correctly. If you're not putting enough water on, it starts to drop down; if you're over irrigating it starts to go up. It's a good indicator. The top one, the 6-inch, bounces up and down with the rains and the water use, gauging the current activity.

"What we actually like to do is average all three values at one site," he explained. He presented some charts showing some actual measurements. "Here is the average of the three different depths and it is presented as a curve. There are three things this curve can tell you and this is the most important one. After an irrigation you see the extraction rate over time is pretty linear. That is, each day you use the same amount of water as you did the day before; but at a certain point as you run that water it'll start to flatten out. That is when you know it's time to irrigate."

The sensor will incorporate everything, the soil condition, if there are hard pans, if there's disease problems, bugs. All will be incorporated because the sensor measures actual conditions.

"These sensors will also tell you if there's a problem of waterlogging after you irrigate," he noted, pointing to another curve. "Normally we get a nice rate of water use, but for the first three days after watering, or after a 1 1/2 inch rain, it was fairly flat meaning that it was not using much water. We actually get hurt as much during this period as we do during drought. We never could tell that before because when we collect the data by hand it is like two or three days before it's available anyway because you couldn't walk out into the field; so you never really saw what happened initially. But collecting it telemetrically you see it."

The sensors may also show big spikes after rains and that tells you that this water comes and rapidly evaporates. You begin to realize, whether it's rain or irrigation, there's always a certain amount of water that's lost to the atmosphere.

"You'll learn not to water too often because if this atmospheric loss is about one-tenth of an inch and you are applying 0.4 inches, you'll lose about a quarter of it sacrificially," Henggeler pointed out. "That's what the sensors will show you."

Recommendations on a pivot include using three locations. The reason for that is a typical pivot has distribution issues. If only one is in a location it might be placed in a wet or dry spot. With three there should be an average.

The placement at the three depths should be at three locations. They also should be on the outside part of the pivot because that actually covers more ground than the inside. Avoid the area wetted by the end gun because that's kind of uneven.

"Once the system is installed, there are basically two options to get that information telemetrically to the computer," he explained. "In one situation, the sensors' data is sent directly to your computer; and in the other it's sent to a medium level receiver, which acts as a data station which then sends it to the Internet. Sometimes you need repeaters because it will only transmit so many feet. The nice thing about the Internet option is that you can check up on it even if you are on the other side of the world, or you can have a crop consultant look at it. Both the home PC and the Internet options can be set up to make calls to your cell phone if certain trigger levels are ever reached."

Presently Henggeler is searching out systems that really work, studying the various methods of getting the information to the farmer.

"We're doing a test with three different systems and we're looking at how the whole communication system works and we are noting agronomically how it's telling us when to irrigate," he said. " With some systems, if your computer goes down you don't get any data because there's no extra data storage in any of these transmitters or repeaters; so if you're computer is out for a couple of days you've lost that data. Other types of transmission devices are better. Generally there are two frequencies that the government allows people to use; one is at 900 megahertz and the other is at 2.4 gigahertz. The 900 megahertz has a much longer, about two or three times the range as the other, so those are probably the better ones to use."

The cost of the systems are going to vary. It will be a little bit cheaper if the information is sent directly to the PC than to have it on the web.

"You can have systems that would be $6 or $7 an acre and this would actually go lower, for example if there were more acres," he explained. "This was used on 100-acre estimates, but a typical pivot is 135 acres and this goes lower. If you have two pivots right next to each other, then the cost is almost half of that. So basically for $4-$5 in a lot of situations you can schedule by telemetry.

"If you go back and look at the yield increase that soil moisture sensors have versus present scheduling methods you see a really fantastic return on investment," Henggeler noted. "That's why I am so excited about this as just common sense. You have the science, but you also have the human side where you need to find out the pitfalls that will show up, and things like connectivity, connectability and all that; we've got to get rid of all those.

"If you go with the Internet option to store your data there are some real pluses," Henggeler said. "If you have an ipod you can look at it, if you have a consultant he can look at it. We've heard stories where a consultant will call and say 'what is going on with pivot number 4, is something wrong?' The farmer will take a look and be able to correct the problem. So you have more than one set of eyes keeping track of it.

"What we are interested in is linking telemetry and irrigation at the University of Missouri, and we're going to explore this, using the University of Missouri ag website," he continued. "So the data can be combined with information from weather stations. A farmer can then check his soil moisture, the temperature, real time wind, and all this other information. He can pull future forecasts of rain, or various other things to help determine the need for irrigation. The university would send that information in e-mail form to farmers.

"That's what we're shooting for, and we're going to be talking this winter with the IT people to see basically the best way to do that," he said.

"There are a couple of large farms in this area using the telemetry system. They are top producers, one focuses on cotton and the other on corn/soybeans. Both report excellent results and increased profits; and both also agree that, as large as they are, it is best to turn the job of monitoring and interpreting the soil moisture data over to just one person who then calls the shots of when to irrigate."

The graphs generally speak for themselves, but the moisture level lines can be confusing. Henggeler says it's like a sonogram; everyone can see that there's a baby there, but only the specialist can tell you if it's a boy or girl. This same equipment has been used by several seed companies to learn more about soil water uptake of their varieties.

"Basically, in conclusion, this telemetric irrigation scheduling is very reasonable and, easily, for $7 to $10 an acre – or about double that for the Cadillac system – you can do it," he summed. "It would be a lot less if there are pivots nearby and, with the expected yield increase, especially if you're not scheduling already, it would almost undoubtedly pay for itself in terms of months rather than years."

The cost to send the information to your PC will be less, but there's more headaches in connecting it; however, you can instantaniously see the information, but only if you're at your computer's location. If you go to the website the data won't be instantaneous because most sites will only collect the data about twice a day; so you'd see data that is 12 hours old, but you would have a second set of eyes looking at it. However, no matter where you are in the world you can check the soil moisture of your crop.

"This looks good. I really think we'll see a lot more of this in Missouri. Missouri will be the first state to develop a statewide concept. We're focusing specifically on pivots because they can also respond with the small water amounts and we're developing a holistic plan for doing this. We are talking with the companies that make this, and they like to see a lot of applications for their systems but they don't have the specific information of how to make one specific system work. So they're very excited in what we're doing here and I think when it's all said and done we're going to present, basically, a turn-key package; so for about $3,000-$4,000 total a person will be able to put in a 135-acre pivot and have it telemetrically tell them exactly what the moisture situation is." Δ

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