Irrigation Extra

Sensors that talk

By DON McCABE

As the pivot slowly circles the cornfield, an antenna on an outer span periodically captures a signal sent by an underground soil moisture sensor. Using that information, the pivot will either stop applying water or change the overall system application rate. If the pivot is equipped with specially designed nozzles, it even could variably apply water to the field.

Far-fetched? Not as much as you might think.

Mehmet Can Vuran, a University of Nebraska-Lincoln computer engineer, has received a $418,000 National Science Foundation grant to continue research in developing and expanding wireless underground soil sensor networks for irrigation.

“Integrating wireless sensor network solutions with agriculture has the potential to improve crop yields, as well as decrease irrigation costs significantly,” Vuran says. “It could reduce irrigation as much as 25%.”

Soil moisture sensors for irrigation are not new. And neither is wireless delivery of that data to home computers or smart phones, which farmers can use to make management decisions without leaving the house or farm shop. Wireless monitoring technology is rapidly evolving in the irrigation industry.

Nebraska has a large irrigation network in which several hundred participants use Watermark sensors to measure soil moisture levels in center-pivot-irrigated fields. They are installed in one to two locations per quarter-section and provide accurate readings, but the user must go to the site with a hand-held meter to pull off the data or string a wire to a field-edge data logger to check the numbers. Other moisture sensors use wireless capability to send soil moisture readings to home computers or smart phones.

What’s different about Vuran’s approach, however, is how and where soil moisture measurements are relayed. A key component in his work in small-scale experiments is a 2-inch-long box, the size of a 9-volt battery, with an antenna. The “computer node,” as Vuran calls it, is placed underground and wired to a nearby Watermark soil sensor. It collects data from the soil sensor either on an hourly or daily basis, depending on how it’s programmed.

Data transfer

As it approaches the sensor and computer node, the pivot captures the data and automatically changes its water application. The same information also could be relayed to a home computer or cell phone.

The computer node has built-in memory and a radio to communicate with the pivot. The device’s sensor board is configured so it can be attached to other sensors as well, such as those that record temperature and humidity.

The five-year grant will enable Vuran and colleagues to study the challenges inherent in belowground sensor communication. Wet soils, for instance, limit the sensor’s transmission power. “The ability to harmonize farming operations with actual soil conditions would give wireless underground sensor networks a major advantage over aboveground weather stations that only monitor atmospheric conditions,” he says.

Vuran hopes to increase the communication range of the buried computer nodes and to create improved network protocols and communication devices smart enough to adjust to the changing conditions of soil and water.

Key Points

- Underground sensors measure soil moisture conditions.
- Research project evaluates small computer that relays data.
- Wireless networks could be the future for the irrigation industry.

WISER WATER: Mehmet Can Vuran, a University of Nebraska-Lincoln computer engineer, believes wireless underground sensors can lower irrigation costs by transmitting data to the pivot.

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