RFID JOURNAL
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Syngenta Looks to Sensors to Boost Food and Biofuel Production

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The global agriscience company is working with the University of Manchester to develop ways to use RFID and wireless sensors to improve crops, reduce fertilizer and water usage, and minimize waste.

By Claire Swedberg

Sept. 24, 2009—Global agriscience firm Syngenta is partnering with the University of Manchester on a British project with global objectives to develop a series of four platforms on which to build wireless sensor technology, in order to improve the way food and biofuel crops are grown, stored and transported. For one of those platforms—the supply chain—the project's participants are currently in the initial stages of developing a system combining sensors and passive RFID tags. It's all part of an effort to reduce food waste and improve crop production in a variety of climates, the partners report.

With funding from a multitude of companies and government agencies, the group—under the umbrella of the Syngenta Sensors University Innovation Centre (UIC)—is completing the proof-of-concept phase for the use of technology to improve the way the food supply chain is managed.

According to Bruce Grieve, director of the Syngenta Sensors UIC, the research is the result of efforts by Syngenta to employ technology to boost crop production and reduce waste in a changing world in which water scarcity, climate change, population growth and the high-protein diet of many people worldwide is affecting what farmers plant, and how effectively they grow it. "We've created a group to generate technologies," he says, with plans to make them marketable within two to five years.

Early conceptual thinking for the project was undertaken when Grieve was employed at Syngenta, in 2005 and 2006. At that time, he says, Grieve worked with the company's business managers to generate ideas for utilizing sensors and diagnostic systems within agribusiness. He took a position as director of the UIC in January 2007, he notes, and the group "managed to start recruiting Ph.D.s as research associates in the third quarter of that year."

For the supply chain platform, the group is studying a sensor-based system that would employ passive 13.56 MHz RFID tags to transmit sensor data to a reader. In this way, the food industry could track the conditions of perishable goods from the field to the retail store, as well as better manage expiration dates and reduce the spoilage of produce that spent too much time in the supply chain, or was stored or transported under improper conditions. The aim is not just to tag, Grieve says, but also to record and then study the time-versus-temperature "stress profiles." In other words, he explains, the goal is to gain visibility into which kinds of conditions lead to shorter expiration dates, and when expiration dates are being inappropriately assigned (such as setting the expiration point sooner than it should be, thereby leading to the goods' premature disposal).

The group is presently focused on studying sensor technology only, and will later select an RFID vendor to assist with the project's transmission component. "Initially," Grieve states, "the platform is a 13.56 MHz tag, but this could be an alternate frequency, depending upon the choice of the RFID partner." The

group expects the sensor network it is developing to use RFID to transmit data regarding temperature, humidity and the presence of ethylene gas (an indicator of ripeness) from the field to a store's stock room.

While the research is initially being conducted in laboratories, the team eventually hopes to set up RFID interrogators along an actual supply chain route—capturing data in the agricultural field and at hand-off points, such as warehouse docks, as well as at retail stores—to better understand the conditions to which the produce has been exposed, as well as how those conditions affect that product's quality. The data from the RFID reads will be downloaded for use by researchers in real-time predictive models of eventual produce quality.

The second platform is designed to track fungi in plants as they grow, thus catching a disease early in its inception, when growers can still eradicate that pathogen before it destroys all of the plants. The research is initially being conducted in a UIC laboratory. Researchers are considering using mobile phones to receive that information from sensors and forward it to an application running on a server. The third platform is a system for monitoring what happens underground while a plant is growing, such as using imaging technology known as electrical impedance tomography to display the ways in which roots absorb nutrients, thereby allowing growers to then adjust soil nutrients accordingly. Finally, the fourth platform focuses on biofuels.

For instance, sugar cane requires enzymes to break the crop down to produce the biofuel, and wireless sensors can be used to measure the presence of enzymes and then transmit that data to be stored by researchers. "Once [the technology is] proven, we will move on to the biofuels pilot plant in Queensland [Australia]," Grieves says. All four platforms would use wireless sensors, though RFID is not yet being planned for any of these three projects.

The four platforms are now being researched at the Innovation Centre, Grieve says. For the supply chain platform, he notes, "We will partner with the passive RFID manufacturers in the future." According to Grieve, the group hopes to identify the best, most inexpensive tag for the application.

Funding for the projects comes from Syngenta, the UK Technology Strategy Board, the Engineering and Physical Sciences Research Council (EPSRC) and Biotechnology and Biological Sciences Research (BBSRC).