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SITE LINES

A SIXTH SENSE

While remotely sensed images may never replace crop scouting, they can aid in a variety of activities, including scouting, soil sampling, and application.

BY NICOLA MCINTOSH

IMAGINE a technology that could "look" at your customers' fields and tell you exactly what's wrong, what's causing it, and how to cure it.

If that's what you're looking for — a panacea, or a cure-all — you won't find it with remote sensing. However, remote sensing — the process by which airborne or equipment-mounted sensors detect variations in crop health and soils — can enhance your day-to-day operations, including geographic information systems (GIS) mapping, scouting, variable rate application, and soil sampling.

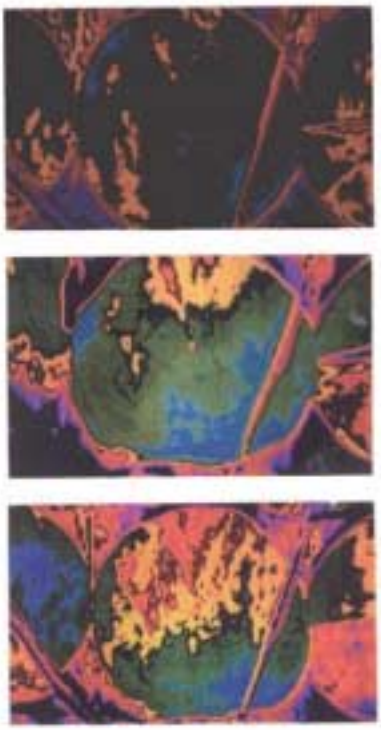
And, experts say down the road remotely sensed images may even tell you what exactly is causing the problem in a customer's field. But you'll still have to figure out the cure.

Out Of This World

Simply put, remote sensing "observes" something without being in contact with it, and is accomplished in one of three ways: with a sensor either ground-based or on board an aircraft, or attached to a satellite orbiting the earth. The sensors measure the amount of light reflected back from vegetation, which directly relates to the health of the crop.

The technique you choose depends on the application. A satellite "photographs" millions of acres at one time, while aircraft remote sensing works better on a field-by-field basis. But while the possibility of one-meter resolution from aerial imagery may appear superior to the 20-meter resolution offered by some satellites, remember this: The higher the resolution, the bigger the files, and the more cumbersome to store, says Lanny Faleide, president of Agri Imagis, Maddock, ND, a firm that provides image processing and analysis for dealerships.

Dealerships are putting remotely sensed images to work in a number of ways, from mapping field boundaries and identifying variation in a field to more experimental uses, such as assisting with soil sampling and variable rate application



Remotely sensed images from AMS of Oklahoma City capture the progression of black root rot disease through a field of seed potatoes. The photos, taken at one-week intervals, show the progression of the disease which starts as a small yellow patch at the top of the field (top), then builds until it encompasses most of the field (bottom). Increased severity of the disease is marked by the progression from yellow to orange to magenta in the upper portion of the field.

Identifying anomalies. Remotely sensed images can pick up crop stress — caused by

drought, weeds, disease, or insect infestations — as well as in-field variation due to soil type or problems with center pivot irrigation. "Remote sensing lets you know the plant is stressed, and then someone actually has to go in and say, why is this happening?" explains Dr. Kevin Price, associate director of the Kansas Applied Remote Sensing Program in Lawrence. "There's almost always field work that needs to be done with remote sensing, but it allows the groundwork to be done more effectively and can help cut the cost and the time required to monitor fields."

Mapping field boundaries. In the Red River Valley, dealerships are using satellite images of townships to map field boundaries. They request images from Agri Imagis, which obtains them from satellites controlled by SPOT Image Corp., Reston, VA. "We're able to see an ag supply retailer's entire trade area," Faleide says. "We can zoom into every field and draw a boundary to create a field map — we don't have to use a GPS receiver. The image is a backdrop registered to latitude and longitude coordinates."

Crop scouting. A quick turnaround time is the key to using remotely sensed images to assist with day-to-day monitoring of crop conditions. "The problems you're trying to solve are progressive," says Frank Lamb, a potato farmer and founder of an image processing company in Irrigon, OR. "The earlier you find them and treat them, the better the results."

The remote sensing service to be offered next year by Agricultural Management Systems (AMS), Oklahoma City, OK, returns images to the scout the morning after they are taken (see related article, p. 42), within 12 hours of the flight.

Assisting with soil sampling. One of the benefits of identifying in-field variability, Faleide says, is that it can be used to target soil sampling. Some of his customers pull samples from different zones of the field — the areas of greatest variation from good to bad. "With remote sensing, we can bring in precision ag a lot cheaper than with grid soil testing, and I believe we get a much more accurate map of the field," Faleide says.

Driving variable rate application. "This summer, we'll be experimenting with using the images to drive variable rate fungicide applications in wheat," Faleide says, adding that rates will be based on the amount of vegetative canopy the image detects — more fungicides sprayed in heavier areas that are prone to disease. That same theory also will be used to base variable rate applications of insecticides.

Dollars And Cents Of Sensing

Before you begin to offer remotely sensed images, consider your cost as well as the benefit to your customer. The price of remotely sensed imagery varies greatly, from less than $1 per acre on small plots to hundreds of dollars for an entire trade area. In addition, the price of satellite images is expected to drop as additional satellites are launched in the next few years.

Centrol of Cottonwood, a Minnesota consulting firm, charges its customers about $100 per field or $1 per acre for aerial images, which consultant Jim Ruhland says is break-even at best for the company.

AMS says costs for their images taken by aircraft will be less than the least expensive satellite imagery — below the 54¢ per acre range, according to the company's president, Dr. Stephen Paley.

Despite the numerous ways in which remote sensing is being used in agriculture, the technology has limitations. One of the biggest hazards related to remote sensing is cloud cover. "We don't have any instruments that can penetrate clouds and get through to the ground, so it's a fair weather game," explains Chris Johannsen, director of Purdue University's Laboratory for Applications of Remote Sensing.

However, a team of investigators plans to study the agricultural applications of Synthetic Aperture Radar, or SAR, which can acquire data through cloud cover. That ability could impact the delivery of real-time data in cloudy regions, says Dr. Philip Wolfson, part of the team that includes Dick Fox of ACC, Inc. and Dr. Jack Paris.

For now, to avoid the pitfall of cloud cover, Dr. Paley's company flies at night, when cloud cover is generally above 3000 feet, the altitude at which the plane flies.

Pushing The Envelope

Today, remote sensing only can tell you where there's something wrong in the field. But in the future, experts say hyperspectral imaging will reveal everything from varieties to plant species.

"Most of us have a very strong feeling that we'll be able to differentiate wider leaf plants from narrow leaf plants and between a plant that has hairy cover on it vs. one that doesn't," Johannsen says, referring to the ability of NASA's experimental Lewis satellite, which was scheduled for launch in May.

For 1998, RESOURCE21, Englewood, CO, will offer a service that will differentiate between weeds and crop, says Greg Knoblauch, director of ag marketing.

But while remote sensing is a very cost-effective method of surveying crops, "you can't sit in an office and look at a computer — you'll always have to spend time in the field," Lamb says. "The best fertilizer is still a farmer's tracks in the field." FC