They say you can’t teach an old dog new tricks, but Robert Cubbage certainly hasn’t had any trouble implementing new technology in the name of conservation — thanks in part to tech-savvy farming partners Justin Ogle and Brad Majors. Besides farming nearly 3,000 acres near the city of Nevada, the three are involved with Record Harvest, a technology company owned and managed by Cubbage’s son, Steve.

Based in an office on the Cubbage farm, Record Harvest markets a wide variety of precision farming tools and services offered by such companies as Trimble, Ag Leader, Outback and Mid-Tech. Ogle also manages a separate division, called Prime Meridian, which stores and manages precision farming data for Midwest farmers.

Consequently, Ogle, Majors and Cubbage have been among the first to adopt new technology that promises to increase productivity, lower input costs, and conserve soil and resources. Many of the new programs have accomplished all three. It’s kind of like a farmer’s version of, “We try it before you buy it.”

**TESTING ON THE FARM**

One example is the use of color sensor technology to control variable-rate, sidedress nitrogen applications. Ogle says they have used systems marketed by two different companies. Both use an optical sensing system that measures crop status and variably applies the crop’s nitrogen requirements. Yield potential for a crop is identified using a vegetative index known as NDVI, for normalized difference vegetative index, and an environmental factor. Nitrogen is then recommended based on yield potential and the responsiveness of the crop to additional nitrogen.

“In effect, we’re not wasting nitrogen by putting on more than the plant needs,” Ogle says. “We put about 50 to 60 units down prior to planting and then come back with the rest as a sidedress application in the spring.”

One system recommends putting down an N-rich strip in every field as a gauge in which nitrogen is not the limiting factor, he says. “During the first couple years we used the color sensor technology, we were putting an N-rich strip in each field and with each hybrid within a field. The next step is to drive a pass next to the strip, which allows the system to collect NDVI readings from the nitrogen-rich strip and determine the benefit of additional N in each area of the field.”

While his young partners use technology to reduce waste and conserve resources, Cubbage concentrates on the agronomic issues and new seeding practices that help reduce erosion. One of those is a strip-till program for corn, which he has been fine-tuning since 2004.

“We have kind of an unusual arrangement, but it works well for us,” says Ogle, who has been part of the operation since 1999. “Brad and I each
Turning to Color Sensors to Control N Losses

According to Peter Scharf, professor of agronomy at the University of Missouri and MU Extension specialist, producers who sidedressed corn during the past three years, regardless of how the nitrogen was applied, not only saved fertilizer, but also gained a huge benefit financially.

“As from 1995 through 2007, there were certainly areas within Missouri every year where 100% preplant nitrogen wasn’t going to get it done,” he says. “But it was never massive and year after year, like it has been the last few years.”

Yet, Scharf believes Missouri farmers have the potential to benefit even more from sidedress nitrogen applied with the aid of color sensor technology. In fact, he has been conducting research on the practice since 2004, when the industry was still in its infancy.

“We did 55 replicated field-scale, on-farm demonstrations where we compared sidedressed nitrogen applied with the aid of crop sensors with the rate that the producer chose,” he says. “On average, over the 55 trials, we made about 2 extra bushels per acre and saved 14 pounds of nitrogen per acre. That comes out to about $17 more profit per acre by using crop sensors.”

As Scharf explains, much of the preplant fertilizer applied for the corn crop over the past few years was lost due to heavy rainfall before the crop could take it up. This led to widespread nitrogen deficiency and yield losses that have totaled in the millions of bushels.

Timing nitrogen in season

With variable-rate nitrogen sidedressing guided by color sensors, the biggest nitrogen application is made during the growing crop. Sensors detect the crop color with the aid of light-emitting diodes to generate red and near-infrared light. The light generated is then reflected off of the crop and measured by a photodiode on the sensor head. When the crop is dark green, a low rate of nitrogen is applied, and when the crop is light green or yellow green, a high rate is applied. Sensors detect crop color around 10 times per second, and a new N rate command is given once per second.

Research on farms and experiment stations has shown that the economically optimal nitrogen fertilizer rate varies widely from field to field and from place to place within a field,” Scharf says. “Variability in how much nitrogen the soil is supplying to the crop appears to be the dominant factor controlling how much N fertilizer is needed.

“Crop sensors are the most logistically practical way to take advantage of the plant’s ability to indicate soil nitrogen supply,” he adds. “In effect, sensors take advantage of what all crop producers know from experience and common sense — crops with enough N are darker and taller crops” than N-deficient crops.

The use of crop sensors to variable-rate sidedress nitrogen will require some adjustment in management, though, as Scharf says he is uncomfortable with using sensors to make decisions on corn that is less than a foot tall.

“None of the three demonstrations that we did on corn less than a foot tall were economically successful,” he relates. “However, the Missouri producers who sidedress corn normally start when plants are 4 to 8 inches tall and finish in corn that is 12 to 20 inches tall. Hence, starting to sidedress when corn is 12, as opposed to 6 inches tall, means a higher risk that the job won’t be finished by the time the corn is too tall for tractor clearance.”

Expanding crop info

In the meantime, Scharf and his co-workers have already developed equations for translating sensor measurements to N rates for corn and cotton, and are working on developing equations for wheat. As for cost, Scharf notes that if a farmer already owns the GPS system and variable-rate controller, the cost to add a color sensor system will run between $10,000 and $17,000. However, at current corn prices and savings of $17 per acre on 500 acres of corn, the system would pay for itself in as little as two years.

“Unfortunately, we didn’t get them planted until after we had done the strip tilling. As a result, we didn’t see as much growth and benefit as we would have liked. So this year, we had a mix of red, yellow, and tillage radishes on the standing soybeans in mid-September.”

Ogle, Majors and Cubbage aren’t ones to adopt a program without testing the benefits, though. It has to pay dividends in the form of either lower costs or increased yields.

“We like to validate every decision we make,” Brad says. “Our variable-rate fertilizer applications, for example, haven’t necessarily improved yields, but we have reduced our fertilizer expenses by about a third.”

Fortunately, the trio has the technology needed not only to implement change, but also to measure the results of those changes at harvest.

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