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Agriculture: It’s a wonderful life. Plus, certification update, meet the professional, and more.
Precision agriculture these days is often defined by the five “R’s”: applying the right input in the right amount at the right time in the right place and in the right manner. But if you ask Dr. Simon Blackmore, managing director of Unibots Ltd., he might add another “R”—using the right robots.

Blackmore’s company is commercializing academic research in mobile outdoor robots for use in agriculture. He described his vision of the farm of tomorrow during the opening session of the 9th International Conference on Precision Agriculture (ICPA) in Denver, CO this past July. More than 450 agricultural scientists, industry professionals, producers, extension agents, and certification holders (CCA, CPAg, and CPSS/C) from 43 countries around the world attended this year’s conference. Blackmore sees autonomous robots, with names like RoboCrop and Hortibot, performing many tasks that currently require humans—from seeding to weeding to spraying to harvesting. He’s been working with groups around the world on various prototypes.

“The purpose of all of this work is to figure out how we can get an autonomous machine to interact with a growing crop plant within a couple of centimeters without damaging it,” Blackmore explained.

He described a machine in Japan that identifies and sprays broadleaf weeds. It uses active-shape recognition to identify 26 different species of weeds, and the spray boom switches on and off so that it only hits the intended target. According to Blackmore, the application rate of glyphosate was reduced from 720 to 1 g/ha (about 10 to 0.01 oz/acre) when intelligent placement was used compared with when it was done by a person.

“With more intelligent placement, perhaps we can reduce the amount of energy coming into the farms from the fossil fuels and therefore try to reduce or even eliminate wastes or off-farm pollution. I think we’ve now got an opportunity of looking at these closed-loop systems on the farm to see if we can grow energy crops on the farm specifically to give us the energy that we require on the farm. And with the increasing costs of energy going up all the time, I think this is something that we should be looking at in more detail.”

In Japan, researchers are also working on a manure spreader that can apply manure by itself according to a treatment map. In the UK, an autonomous weeder is being developed that uses machine vision and a notched disc to control weeds while avoiding the crop plant. In the United States, John Deere will be coming out with an autonomous tractor in the future.

Blackmore said the best approach is to develop small, lightweight ro-
bots so as to mitigate soil compaction, which is a big problem with a lot of the heavy machinery currently in use. It’s estimated that up to 90% of the energy going into cultivation is used to repair the damage caused by the machinery in the first place. Another advantage of small robots is that they can be developed with a cost-effective, incremental investment, and if a larger work rate is needed, they can be scaled up.

“I think it’s obvious that equipment is going to get smarter, we’re going to see improved automatic control for well-defined tasks, more automated data gathering, and better processing into real information, with the possibility of fully autonomous vehicles in the near future,” Blackmore predicted. “I believe we have the chance to design and build a complete new, small, smart mechanization system based on these precepts.”

Safety, cultural considerations

But there are safety issues to consider when removing the human ability to react to unexpected situations.

“I think the aspect of safety for autonomous machines is a paramount issue,” Blackmore said. “We are addressing this in a number of different ways. Firstly, if the machine is small, it is less likely to do any damage. Secondly, if it’s going slow, it’s less likely to do any damage. Thirdly, if we put redundant system architecture within it so that if parts of the system break down, it knows what’s happening to itself so that we don’t get catastrophic failure, that will address some of the safety issues.”

There are also cultural implications of robotic agriculture that would need to be considered. Many farmers take great pleasure in getting into the tractor, tilling the soil, and performing many of the other operations on the farm. How might they react to spending more time in the office while R2-D2 is out in the field?

“I’m not saying that robotics are a panacea and will apply to every area in every situation,” Blackmore admitted. “Some of the social aspects have not been resolved yet. We need to discuss them and work our way through them a little more. But we can see that the economics are there. The most expensive part of most operations is the person sitting on the tractor. Therefore, if we can remove that person and the cost of the cab and all the rest of it, I think we get a stronger case from the economic point of view.”

Blackmore said the first robots that we’ll actually see on the market will initially perform relatively simple tasks.

“When we start seeing robots actually breaking through the barrier and being sold, I think that first area is going to be in cutting grass. It’s a semi-skilled task that’s repeated every week or every couple of weeks. When we start seeing these types of machines being introduced, I think it’s going to mushroom once we realize these things can be made and are safe, reliable, and cost effective.”

But Blackmore admits in some ways we’ve already made agriculture too complex for some farmers—even without the robots. Keeping up with all of the different precision ag technologies on the market can certainly be daunting.

Larkin Martin, a farmer in Courtland, AL, has experienced her share of frustration in incorporating precision ag technologies into her operations. During the “A to Z sessions” specifically held for practicing professionals at the ICPA conference, she explained how she often has had trouble getting things to work right.

“Over time, we have put gadgets on all sorts of machines, and it can be a mess,” Martin said. “One of the nightmares of precision farming for a farmer is figuring out how all of this stuff works. Lots of this stuff works well, but [the different components] don’t talk to each other. The data you get for your implement doesn’t talk with the software somebody else sold you for your office. That’s the part I hate. I had bought all this stuff, and I couldn’t get simple information back into my system. I spent the money with everybody, but they wouldn’t talk to each other, and the farm is the victim of this race to dominate [the market].”

Martin said she often had trouble getting good support from her equipment dealers when things went wrong, and sometimes just articulating the problem was an obstacle.

“We’re good at farming. We’re not in the field used to using computers. This brave new world of ports and cabling is not something that comes easily or naturally. It’s not even something that we can get on the cell phone and explain to somebody who sold us the equipment. We don’t even have the words to ask the questions. It’s a big problem with precision ag—it’s one of the big hurdles.”

Variable-rate fertilizing, planting

Despite the headaches, Martin has had success with variable-rate fertilizer applications, reducing her nitrogen sidedress to corn and wheat from this past year using GreenSeeker sensors. She has created management zones generated by yield maps and collects multiple soil samples within those zones. The samples are shipped off to the laboratory, which sends the soil test results back to her in a data file.
that she downloads to her computer. Then she uses soil test management software to read the file and write fertilizer prescriptions for the field. Those are placed on a data card that is inserted into the spreader, and the nutrients are applied to each zone at different rates.

Soil sampling in zones is cheaper than grid sampling, according to David Franzen, an extension soil specialist at North Dakota State University in Fargo. Franzen also spoke during an A to Z session in Denver and talked about some of the different tools that can be used to create these zones in the field—aerial or satellite images, topography, or soil electrical conductivity (EC) to name a few. Yield maps generated from yield monitors and GPS equipment also work, but Franzen prefers yield frequency maps. He explained that a lot of times an area will yield very well with one crop one year and not so well with another crop another year, creating confusion for the farmer. With yield frequency maps, it doesn’t matter what crop you grow from year to year because the yields are normalized, so you’re using the relative yield instead of the actual yield. However you create your map, Franzen recommends using more than one factor.

“What we’ve seen is that using multiple layers is a lot better than using just a single one. If you’re going to use topography and you add EC to it, your correlation value goes way up. I really recommend that you use at least two tools to delineate those maps.”

Ron Heiniger, a professor of crop science and cropping systems specialist at North Carolina State University, has been using these tools to increase seeding rate efficiency in corn. He estimated that we’re only using about 80% of the available incident sunlight in corn fields today, and if we could capture the rest of it by placing more leaf area in the field, we could significantly increase yields.

“The challenge for precision agriculture is to try to find ways to fit a higher population in the good soils and to pull back population to avoid stress in the poorer soils,” he said. “By using variable seeding rates, we can achieve optimum populations in each part of the field. I think this is the most exciting possibility for increasing yields and putting money in our pockets out there today.”

Kyle Freeman, a technology development representative for Monsanto Corporation, predicted better integration of biotechnology with precision ag will lead to even greater yields and profitability in the future.

“Genomics and biotechnology will continue to increase grower productivity, but there are a lot of interesting challenges that precision ag can help solve,” he said. “We’re looking at utilizing the two together to advance products faster and make them more profitable for the farmer.”

Monsanto is primarily using precision ag technologies as an evaluation tool for new traits in the pipeline and for planting recommendations to its customers.

“As we look to the future, we see a lot of possibility in the precision ag community for the different tools that are available,” Freeman said. “We want to do a good job of not only evaluating products but also placing products on the right acre. We want to make the best recommendation to the farmer that we can.”

Freeman sees the potential for not only variable-rate planting, but planting variable hybrids across a field based on site-specific conditions and a trait’s suitability to those conditions. Back in Alabama, Larkin Martin plants at variable rates using a relatively
new technology—new to agriculture at least—called CORS (Continuously Operating Reference Station). Traditionally used by the survey, transportation, and oceanographic industries, Martin and eight other Lawrence County, AL farmers pooled their resources together, in addition to some other funding sources, to establish a CORS in Courtland, AL this past May. Agricultural machinery equipped with an internet accessible cellular phone and an RTK (real-time kinematic) GPS device can utilize the round-the-clock continuous data output by CORS for a GPS correction signal. This data provides centimeter-level accurate, on-the-go GPS for farming applications such as planting, spraying, and harvesting.

Choosing the right guidance system

Traditionally, base stations have been required for growers to implement RTK-level accuracy for auto-steer systems in their farming operations. These base stations only provide up to a 6-mile coverage radius and require direct line of sight to the station, which can be a problem in hilly areas or where there are a lot of trees. CORS offers extended coverage (typically 20 miles) without the line-of-sight requirements. However, not all brands of autoguidance equipment accept the correction signal and not everybody gets a CORS signal or wants to invest in a $12,000 base station. Sid Siefken, business sales manager for Trimble Navigation, assured the audience that there are still plenty of options out there such as assisted steering.

“I think assisted steering has a great fit in the marketplace, especially for some of those broad-acre crops and some of those markets where we really haven’t figured out how to implement a complete autoguidance system,” Siefken said. “If you haven’t got started yet with GPS guidance, this is an easy way to do it with very low risk to the farming operation.”

Siefken said assisted steering costs less than a full hydraulic autopilot system and doesn’t require commitment to a base network. But he said that the guidance systems and GPS receiver you buy should be based on the operations they’re being used for.

“Keep in mind, no matter the guidance system you’re using—whether it’s manual, assisted steering, or autopilot—ultimately your positioning and your controls are as good as your GPS. So you want to make sure that your GPS tolerances and your accuracies are meeting the application that you’re trying to accomplish. You don’t want to try to do RTK-level work—strip till, planting repeatability, and harvesting—if you’re playing with a WASS (6- to 8-inch) level of accuracy. You just won’t get the repeatability even though it may be attractive because it’s a little less money.”

Whichever tools you’re using, most conference participants agreed that precision agriculture will play a big role in helping solve some of the world’s biggest problems in the future.

“There’s never been a better time than now to take advantage of precision agricultural technologies when the world is witnessing the largest rise in food prices, energy prices, and input prices, and demand for a supply of food to feed the hungry,” said ASA–CSSA–SSSA member and CPSS Raj Khosla, who chaired this year’s conference. Dr. Khosla will also chair the 10th ICPA in Colorado in July 2010. For more information, contact him at Raj.Khosla@Colostate.Edu or visit www.icpaoonline.org.
Farmers hold their own during economic crisis, but credit markets tighter

From farm to market, agriculture is holding its own during the current economic crisis, even though a credit crunch is sending ripples of stress throughout the industry, say agricultural economists.

Bruce Ahrendsen, professor of agricultural economics and agribusiness with the University of Arkansas System’s Division of Agriculture, says that most agricultural businesses, especially farmers, are generally in good shape because they have solid assets—meaning land.

“The balance sheet has been strong for farms, particularly those owning farmland,” Ahrendsen says.

Farm business equity was expected to continue rising in 2008 as the increase in farm asset values exceeds the rise in farm debt. According to the USDA, the net worth of U.S. farms is expected to reach over $2.1 trillion in 2008, up about $133 billion from 2007. This growing stock of equity capital can help finance investments in farm and nonfarm capital or may be used to restructure outstanding debt.

This past year, most current farm borrowers had little difficulty servicing their production loans, given the high commodity prices. With falling commodity prices, the loan environment may be more challenging. Still farm sector debt-to-asset ratios are strong; currently, the debt-to-assets ratio of the farm sector is just 9%, down from 22% at its peak in 1985 (Table 1).

Greater requirements from borrowers

A global economic slowdown isn’t likely to hit agriculture as hard as other industry sectors, but that doesn’t mean farmers and their lenders won’t see changes ahead, says Michael Boehlje, a Purdue University agricultural economist.

While Boehlje says he believes credit will be available for crop and livestock producers, farmers and ranchers might have to jump through more hoops to borrow money. Banks, on the other hand, could require more information and documentation from borrowers.

“At a minimum, producers are going to have to do a better job of showing their lender what kind of profitability they’ve had and what kind of income they’re generating,” Boehlje says. “Secondly, it’s quite possible that the lender is going to be asking for more detail on the inventory side of a producer’s balance sheet.

“Producers might end up with more projection work. Whether they’ll have to do a full-blown cash flow projection is isn’t certain. But they certainly are going to at least have to give some additional evidence than they’ve given in the past of the cash that’s going to be generated by their operation next year.”

Lenders also could increase their oversight of borrowers, Boehlje says. That might come in the form of more frequent farm visits and monitoring of checking and deposit account balances and spending.

Producers could discover lenders aren’t willing to loan them as much money as they ask for, especially if the loan is for purchasing machinery or land.

“We’re probably going to see capital expenditure loans are a little more difficult to obtain this next year than they might have been otherwise,” Boehlje says. “I suspect lenders are going to be asking more questions about land purchases. Particularly, what kinds of financing will be needed to buy land.”

Farmers could also feel the impact of tightened credit in 2009 when they apply for operating loans to buy fertilizer, fuel, and other production inputs. Production costs have risen with the

| Table 1. Balance sheet of the U.S. farming sector, 2004–2008 (forecast).† |
|--------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                         | $ million       | $ million       | $ million       | $ million       | $ million       | %               |
| Farm assets              | 1,617,582       | 1,835,464       | 2,047,439       | 2,209,924       | 2,359,034       | 6.7             |
| Total farm debt          | 182,965         | 193,230         | 196,392         | 211,520         | 211,742         | 0.1             |
| Debt-to-equity           | 12.8            | 11.8            | 10.6            | 10.6            | 9.9             |                 |
| Debt-to-asset            | 11.3            | 10.5            | 9.6             | 9.6             | 9.0             |                 |

† Source: USDA Economic Research Service (data current as of August 28, 2008).
Grain elevators feel the crunch

Over the last two years, grain elevators have experienced increased credit costs because of higher and more volatile commodity prices, University of Arkansas economists say.

Elevators serve as “middlemen” in the agricultural market system, says Andrew McKenzie, University of Arkansas associate professor of agricultural economics and agribusiness. They buy grain crops from farmers and hold them in storage until selling them for livestock feed or to food processors.

When crop prices are favorable, farmers enter into contracts with elevators as much as two or three years in advance so they can sell their crops at those higher values even if current prices fall, McKenzie explains.

If crop prices fall, farmers benefit from having locked in higher prices, but the elevators face losses. To protect against such losses, elevators hedge in the futures markets at values equal to their contracts with farmers, McKenzie says.

The idea is that losses from lower crop prices will be offset by higher profits from futures holdings, McKenzie says. Conversely, losses from changes in futures will be offset when crop prices rise higher than contract prices with farmers.

Credit is essential in futures trading, according to McKenzie. Investors are required to pay a percentage of the current futures prices for their holdings, or positions, usually 5% or less. This up-front payment is known as margin money. Although it is a small fraction of the actual value of a futures contract, this can still represent a large dollar commitment because elevators deal in large volumes of grain.

“You have to have a lot of cash on hand to get into the futures market,” McKenzie says. Elevators usually borrow that cash from banks.

When futures prices go up, McKenzie says, futures brokers issue margin calls—demands that futures investors pay the difference to maintain the same percentage of the going prices. Those margin calls are often in the millions of dollars, and that means going back to the bank.

“Elevators don’t usually have that cash on hand, so they need a good line of credit,” McKenzie says. “This makes elevators reluctant to offer farmers long-range contracts. At some point, elevators don’t want to book crops one or two years out.”

In many cases, elevators will only offer contracts for six months in advance, McKenzie says. Some will not offer advance contracts at all or will charge fees to offset risks. The problem backs up all the way to the farmer, who is squeezed between rising production costs and the inability to lock in high crop prices.

“Elevators play a crucial role in getting food from the farm to the grocery store,” McKenzie says. “That role has been compromised.”

But most elevators are hanging in there, operating in the traditional manner, according to McKenzie. And with commodity prices falling dramatically from their summer highs, margin credit financing should be less of a critical issue. He says elevators across the

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Crawler tractor for vineyard work

A new crawler tractor, the M8540 Power Krawler, for vineyards, orchards, and other specialty applications has been introduced by Kubota Tractor Corp. The company claims that the narrow-cab tractor brings the benefits of a rear crawler track to narrow-cab chassis, increasing traction and stability while providing better flotation and less soil compaction. The tractor is said to offer increased performance in rolling terrain and maneuverability in narrow rows of vineyards and orchards.

“Unlike full crawler vehicles, the Power Krawler’s basic maneuverability and speed is nearly identical to that of a standard four-wheel tractor, so there is no need for special operator training,” says Paul Williams, Kubota Tractor product manager. “The longer wheelbase, lower center of gravity, and independently oscillating rear tracks improves stability and keeps operators from bouncing through uneven terrain.”

A larger track footprint offers increased traction, especially in wet and hilly conditions. The tractor’s rear weight is distributed over the larger surface area of the rear tracks, which decreases the level of ground compaction by an estimated 60% compared with a standard wheel tractor of comparable size; this results in better flotation with less damage to soil, according to the company.

The rear crawler design features a synthetic rubber track with hard rubber lugs that are said to provide a smoother ride at higher speeds than typical steel lugs. Both sides of the tractor are kept in contact with the ground via independently oscillating crawlers. The maintenance and process for changing crawler tracks is aided by a split-type drive sprocket design with rotating pins.

The tractor comes standard with a turbocharged 76 PTO horsepower four-cylinder engine, and it features hydrostatic power steering and a hydraulic shuttle transmission with wet main clutch.

The narrow cab features a standard air conditioner and heater, two front/rear halogen work lights, and a monitor coupler. Optional equipment includes a CD or cassette player radio with weather band and rear wiper.

For more information, visit www.kubota.com.

Handheld computer for field agricultural applications

Juniper Systems, Inc., a provider of field computer systems for agriculture applications, announced the release of its new Allegro MX Field PC. The system features a Windows Mobile 6.1 operating system, an IP67 rating, a full keyboard, integrated Bluetooth wireless technology and Wi-Fi 802.11b/g options, a Marvell XScale core 624MHz processor, long-term battery life, and a highly outdoor-visible display. The company claims that the unit is durable in extreme environments.

The operating system runs standard agriculture programs for mobile applications, including the company’s Field Research Software Note Taking and Harvest options. A total of 2GB of internal data storage may be used for storing field maps, reference information, and notes. Wireless connectivity lets users sync the unit with sensors and networks.

The full alphanumeric keyboard is designed for note taking in the field. The keyboard features large keys that are color-coordinated by function. There are 12 function keys available as hot keys for application programs with a unique ability to also serve as Windows Mobile hot keys.

The system meets IP67 and Mil-Std-810 F standards for drop, vibration, immersion, humidity, and operating temperatures. The company claims that it works in harsh environments, with dust, heat, rain, snow, and ice. The unit’s expansion pods provide customers or original equipment manufacturers the ability to customize the product for specific market needs. For example, expansion pods allow PCMCIA or other sensor modules to be integrated with the product while still maintaining the IP67 rating. Standard expansion pods include a bar code scanner and a GPS receiver.

The Windows Mobile operating system, according to the company, has more than 18,000 applications. The unit includes Microsoft Excel Mobile, PowerPoint Mobile, Word Mobile, Outlook Mobile, Internet Explorer Mobile, and ActiveSync for the desktop PC. These programs allow for synchronization of files, tasks, and appointments with an office PC. The unit is available in multiple languages. For more information, see www.junipersys.com.

Longer-term hedge program for grain producers

Cargill AgHorizons and Wells Fargo have announced that they are collaborating on a new contracting program to assist farm families in capitalizing on grain-contracting opportunities. The program, called EliteHEDGE, will be available in all markets jointly served by Wells Fargo and Cargill AgHorizons.

The companies claim that the program enables growers to leverage the value of their deferred-delivery grain sale commitments to Cargill via a Wells Fargo line of credit, which is
used to offset the hedging costs of the contract until final delivery of grain to a Cargill-approved delivery point. The arrangement provides eligible producers greater access to credit in contracting for the sale and delivery of their grain.

“In times of unprecedented volatility and skyrocketing input costs, many producers have cited the growing inability to forward-contract grain more than 12 months out as their biggest concern,” says Cargill AgHorizons President Dan Dye.

The program enables eligible farm customers to forward-contract a portion of their expected future production as much as three years out. According to the companies, this provides a significant competitive advantage, as most programs available in today’s market do not exceed 12 months or, if available, come with very high fixed fees.

The program does not require customers to establish a futures brokerage account nor pay the up-front fees normally associated with hedging contracts. It also does not expose them to margin calls. Instead, qualifying farm customers can leverage the value of their deferred-delivery grain sale commitments to Cargill via a Wells Fargo line of credit. The line is used exclusively to cover the hedging costs associated with the contracts.

Eligibility is a function of positive contract history with Cargill, land ownership or rental arrangements, and other conditions. Wells Fargo says it will work directly with eligible customers to complete a line of credit application and, if approved, establish such line of credit. Cargill says it will hedge the grain as normal but will be able to use the pre-established line of credit to offset associated hedging costs during the life of the contract.

Cargill plans to continually mark the program’s contracts to market and make appropriate withdrawals from or deposits to the line of credit. At settlement, Cargill says it will pay off the line of credit as appropriate and adjust the farmer’s contract price to reflect any interest expense (or credit, as the case may be) incurred by the farmer and paid by Cargill. The structure makes the costs transparent—farm customers can see exactly the hedging costs needed to carry their forward contract to delivery. As always, physical delivery of the forward-contracted grain is required.

Beginning with the 2009 crop season, the program is being offered in market areas jointly served by Cargill AgHorizons and Wells Fargo. This covers most of the Grain Belt from Ohio to Colorado and Minnesota to the Texas Panhandle. Some AgHorizons areas not served currently by Wells Fargo should become covered after Wells Fargo’s agreed purchase of Wachovia.

Cargill AgHorizons still offers other forward-contracting alternatives, though many of these products have a more limited contracting time frame or a higher fixed fee structure.

For more information, see www.CargillAg.com.

Low-linolenic soybean varieties

Pioneer Hi-Bred is adding three new low-linolenic soybeans, called the Y Series, to its soybean seed product lineup for 2009. According to the company, this expansion of low-linolenic soybean offerings provides additional choices to growers who can reap cash premiums for this healthy end-use product.

The new series, announced earlier this year, represents a step change in soybean productivity and is the result of a proprietary matrix of traits and technologies researchers have developed. The company says that the new low-linolenic soybeans have shown yield advantages over previous low-linolenic products.

“The market for low-linolenic soybeans continues to expand, increasing contracting opportunities for growers, and Pioneer is meeting that demand by expanding its product offerings,” says John Muenzenberger, Pioneer senior business manager of soybean output traits.

The 92Y90 variety is said to offer good tolerance to brown stem rot and has good emergence and stability scores. It is a late Group II variety that is early maturing and suited for areas like eastern Iowa and northern growing areas such as Ohio.

The 93Y01 variety is an early Group III type featuring good field emergence and harvest standability.

The 93Y50 is said to be a high-yielding new variety that displays strong field emergence and harvest standability, plus resistance to Phytophthora root rot. “This is our ‘ultra low lin’ variety, which means it is around 1% linolenic acid,” Muenzenberger explains.

Soybean producers growing Pioneer low-linolenic soybeans again will be able to receive an attractive premium for their crop at numerous locations across the heart of the Corn Belt. Pioneer works with various processors, including Bunge, to offer low-linolenic premiums to growers.

Low-linolenic soybean growers will earn a premium of $0.60/bu for on-farm storage of low-linolenic soybeans and a premium of $0.55/bu for harvest delivery.

“We continue to see a rising demand from food companies for low-linolenic soybean oil and are excited to offer value-contracting opportunities with flexible marketing alternatives to soybean growers,” Muenzenberger says. “By participating in our low-linolenic soybean program, growers help position themselves as leaders and innovators in the global marketplace while helping meet the increasing consumer demand for foods with improved nutritional profiles.”

In its fifth year, this low-linolenic soybean contracting program has grown from a targeted base in Iowa to an expanded geography currently reaching multiple locations in at least seven states for the 2009 growing season: Iowa, Illinois, Indiana, Ohio, Michigan, Pennsylvania, and Missouri.

Pioneer research activities for soybean output traits have also
expanded to seven research centers throughout the Corn Belt. In addition to extending the lineup of low-linolenic soybean varieties, the company is also developing high-oleic soybean varieties, which will be commercially available in 2009, pending regulatory approval. Pioneer says these products offer healthier oil alternatives and can also be used in a wide range of industrial applications including lubricants, coolants, and hydraulic fluids.

For more information about low-linolenic soybean varieties, signing details and options, and participating elevators in a particular area, see www.pioneer.com/LLSoy.

Real-time mapping of soil pH

Veris Technologies has announced two new developments for soil mapping: first, a new metal pH electrode that is said to reduce per-acre pH mapping costs and improve data quality, and second, new electronics packages and software for soil electrical conductivity and pH mapping, including real-time map display of soil measurements.

The company’s soil pH system produces between 5 and 10 pH samples per acre. Veris Technologies says that number of samples is up to 25 times as many sample points as a 2.5-acre grid map. Soil pH can vary more than what 2.5-acre grids can capture—in fact, the variability within a grid cell can be as much as within the entire field. The company says that with the introduction of the new metal pH electrode, fields can be mapped more economically and with improved accuracy.

Also new for 2009 are electronics packages and software for soil electrical conductivity (EC) and pH mapping, including real-time map display of soil measurements. The company says that the operator can view the soil EC or pH map as measurements are being collected.

For more information, see www.veristech.com.

Spray nozzles

This year, Lechler, Inc. introduced the IDK-T ceramic twin flat spray nozzle, an addition to its lineup of IDK air induction nozzles. This drift reduction nozzle is designed to be used alone to provide excellent coverage in dense foliage.

The 120° pattern nozzle features two angled spray fans that are positioned to spray 30° forward and backward of the boom. The IDK-T’s working pressure range of 15–90 psi yields very coarse to medium droplet sizes with very low drift potential.

The nozzles are ISO color coded with high wearing ceramic cores that are removable for easy maintenance. They will fit most bayonet cap and nozzle body systems and will be introduced in 03, 04, and 05 sizes.

For more information, visit www.lechlerag.com.

Wireless crop monitoring

A new wireless crop monitoring system enabling precision agriculture, called the eKo Pro Series, is being offered by Crossbow Technology, Inc. According to the company, the new system represents the next generation in crop monitoring and precision agriculture techniques, employing a mesh network of wireless sensors and providing vital live data about crop health, vigor, and growth progress via a simple internet browser.

The system features solar-powered, field-deployed wireless sensor nodes, which don’t require electrical power so that sensors can be placed where needed; web-based data viewing that allows remote access to live sensor data, critical trend charts, and alarm settings; and a wireless mesh network technology that is “self-configuring and self-healing,” thus providing easier setup and scalability where additional wireless nodes and sensors can be added.

“eKo Pro Series enables growers to consistently improve yield and quality regardless of the variability in the terrain, soil, or micro-climates,” says Robert Robinson, vice president of sales and marketing at Crossbow. “Growers can now overcome the traditional tradeoff between higher yields vs. higher quality and can achieve a higher average price on larger harvests consistently by executing precision agriculture techniques with eKo Pro Series data.”

The mesh-based wireless architecture integrates features such as data rerouting, self-configuring and self-healing wireless network, auto-detection of new nodes, and scalability. The sensor interface allows for the addition of other sensors from third-party vendors.

The system starter kit includes a network gateway, three wireless nodes, six soil moisture/temperature sensors, one ambient temperature sensor, and a built-in web-based monitoring application. Additional wireless nodes and sensors may be added.

For more information, see www.xbow.com/eKo.
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Finding best practices for growing alfalfa in the Northern Plains

The debate between proponents of field burning in alfalfa acreage, meant to eliminate pests, has been evaluated many times. However, long-range effects have not been tested. In a recent study published in Agronomy Journal, two experiments were conducted over a 13-year period (1989–2002) in Lethbridge, Alberta, Canada with five alfalfa cultivars. In the first experiment, Barrier and Pacer were subjected to three different burn treatments (no burn, burn every year, and burn in alternate years) while in the second experiment, four cultivars (Barrier, Heinrichs, Trumpetor, and Legend) were given burn or no burn treatments to evaluate the impact of burning of crop residues on forage yield, incidence of verticillium wilt, and insect pest abundance.

Because alfalfa is an important forage crop in Canada and elsewhere, the questionable effectiveness of burning on forage yield and the environmental effects of burning such as air pollution, hazardous loss of visibility during burning operations, and loss of crop cover suggest that burning should not be used as a production strategy for this widely grown crop.

Alfalfa is grown for seed, long-stem hay, processed hay (cubes and pellets), health food (sprouts), and as a healthy food crop. It may be grown as a dryland crop or irrigated (cubes and pellets), health food (sprouts), and as a healthy food crop. It may be grown as a dryland crop or irrigated in the Northern Plains. Diseases of alfalfa include verticillium wilt in North America, Europe, and Japan— a disease that can lead to serious reduction in yield. Verticillium wilt is often controlled by using wilt-resistant cultivars such as Barrier, AC Blue J, or AC Longview. A number of previous studies have shown that burning of crop stubble and debris infected by verticillium wilt can reduce populations and inoculum potential of the fungus, preventing the buildup and spread of the disease in fields.

Wilt isn't the only pest associated with alfalfa in the northern tier. While most pests are not major problems in Canada, some cause considerable damage. Common insect pests in southern Alberta alfalfa fields are alfalfa plant bugs, pea aphids, alfalfa weevils, and lygus bugs. A number of cultural methods for insect control have been proposed, including flaming, flooding and harrowing, early harvest, swathing and clear cutting, and burning. Postburned stands can benefit from alfalfa pollination by leaf-cutter bees, improved weed control, and nutrient enrichment of the soil, which improves alfalfa seed production.

Most reported studies that measured the effects of burning covered a short to medium time range (two to six years) and showed promise in increasing alfalfa forage yield while reducing insect pest populations. A few longer-term studies (>eight years) indicated that burning reduced the pest populations and improved the yield potential but did not assess interactions with cultivars. Most of the earlier studies included the application of insecticides and their interactions with burning treatments. The objectives of the long-term study reported here were to determine the effect of burning regimes on forage yield of alfalfa cultivars under prairie conditions and to observe their effect on verticillium wilt of alfalfa and insect pest abundance in the absence of pesticides.

Location and methods

The study sites were located near the Agriculture and Agri-Food Canada Research Centre in Lethbridge, Alberta, in the semiarid zone with an annual average snowfall of about 6.3 inches and average annual precipitation of about 10.3 inches. This part of the Canadian prairie is about 2,952 ft above sea level and has Orthic Dark Brown Chernozem soil. The Canadian taxonomic classification for this soil is Mollisol (U_Order); Ustolls (U_Suborder); Haplustolls (U_Great Group); and Typic Haplustolls (U_Subgroup).

The study was conducted in two phases. In the first phase (1989 to 1993), the researchers studied the effect of burning regime and alfalfa cultivar on the appearance of verticillium wilt of alfalfa. Barrier and Pacer were planted using a randomized complete block design (RCBD) with six replicates and three burning treatments (no burn, burn every year, and burn in alternate years). The burning treatments were applied between the last week of April and the first week of May before extensive new growth was visible. Each year, the number of plants infected with wilt was counted. Wilt was identified by symptom (stunting, wilting, and v-shaped lesions on leaflets) in late June (early bloom stage, immediately before first cut). Diseased portions were plated and examined microscopically to confirm that the plants were infected by wilt.

Phase 2 consisted of a long-term experiment established in 1992 to quantify the effect of burning on the dry matter yield of different alfalfa cultivars and to assess the abundance of insect pests in the plots. A two-factor factorial experiment was replicated four times: the factors were alfalfa cultivar (Barrier, Trumpetor, Legend [cultivars adapted to irrigation], and Heinrichs [cultivar adapted to dryland]) and burn treatment (control and annual burn). Barrier was described as a high-yielding cultivar with a high level of resistance to verticillium wilt, Trumpetor and Legend were considered moderately resistant to the disease, and Pacer and Heinrichs were considered to be susceptible to verticillium wilt.

The Phase 1 study used plots of 20 rows, while the second experiment contained 10 rows, separated by alleys and similar planting patterns. Seeds were inoculated with Rhizobium spp. strain NRG-185-1/A culture (Nitragin, Brookfield, WI) at
a recommended rate during seeding. Irrigation was applied four times during the growing season. Burning was done before the initiation of new growth (late April to early May) by placing clean, dry straw and lighting it with a propane torch. No fertilizers or pesticides were used. The number of cuts and their corresponding harvest dates for each year during the study (second phase) are presented in Table 1.

For the second phase, a subsample was taken from each plot, dried for two weeks, and weighed. Forage yield (dry matter) was calculated. Insects were sampled four times (June 8, 2000; May 31, 2001; and June 25 and July 30, 2002) by taking five sweeps (90° arc) per plot using an insect sweep net, transferring the contents into plastic bags, and holding at freezing temperatures. Alfalfa weevils, alfalfa plant bugs, lygus bugs, cabbage seedpod weevils, aphids, and leafhoppers were counted in these samples. Predatory insects including ladybird beetles (Coccinellidae), spiders, syrphid flies (Syrphidae), damsel bugs (Nabidae), lacewings (Neuroptera), and minute pirate bugs (Anthocoridae) were found in low numbers and were grouped under beneficial insects (not identified beyond order or family).

For the verticillium wilt assessment, an analysis of variance at the $P = 0.05$ level was used to determine significant differences between treatments for the number of infection loci. Since the interaction among cultivar, burn treatment, and year was significant, the data for each year were analyzed separately and with rigor.

### Yield results

Burning had no effect on yield, and its interaction with cultivar was not significant. Cultivars had similar yields in 1993, 1994, and 1996, but in the other seven years, Heinrich had significantly lower yields than the other three cultivars. Barrier and Legend had numerically higher yields than the other two cultivars in most years and Trumpetor had intermediate yields, but the differences were not always significant.

The yield trend for all the cultivars followed three distinct patterns. From 1993 to 1995, yield increased and then decreased steadily with year-to-year fluctuations between 1996 and 2000. After 2000, the yield of all cultivars decreased sharply and reached the lowest level in 2001 to 2002. Barrier, Legend, and Trumpetor showed similar trends having four phases in their yield pattern during the 10 production years. For these cultivars, yearly fluctuations were significantly different in all years except 1993. Heinrichs (lowest yielder), on the other hand, had two statistically different phases in its yield pattern from 1993 to 1995 and from 1996 to 2002. The yield of Heinrichs declined sharply toward the end of the trial with minor fluctuations in between. Barrier was the highest yielder over the entire duration as well as at the end of the study, but was the lowest-yielding cultivar at the beginning of the trial.

### Verticillium wilt incidence, insect abundance

Verticillium wilt symptoms of stunting, wilting, and $V$. albo-atrum shaped lesions on leaflets were observed on alfalfa plants in all plots during the entire study period (1989–1993). The number of infection loci was significantly higher for the susceptible alfalfa cultivar Pacer compared with the resistant alfalfa cultivar Barrier. For example, the number of infection loci per plot in the unburned Pacer treatment in 1993 was 883.1 compared with 63.2 for the unburned Barrier treatment. However, the differences among the burning regimes were not significant. The trends were consistent throughout all years of the experiment. All of the stem samples plated tested positive for $V$. albo-atrum (see Table 2 next page).

Burning had a significant but variable impact on insect abundance. Numbers of alfalfa plant bugs were consistently higher in control plots than in burned plots in all years. On the other hand, numbers of lygus bug adults were higher in the control plots than in the burn plots in 2001 only. Similarly, numbers of lygus bug juveniles were higher in the control plots compared with the burn plots in 2000. The abundance of lygus adults was different among cultivar means in 2000 and in July 2002. In 2000, adult lygus bug numbers were highest in Legend plots, followed by plots of Trumpetor, Barrier, and Heinrichs. Again in July 2002, adult lygus bug numbers were highest on Legend plots, followed by Barrier, Trumpetor, and Heinrichs.

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**Table 1. Number and dates of irrigated alfalfa forage harvest and corresponding precipitation in each year of the study at Agriculture and Agri-Food Canada Research Centre, Lethbridge, AB, Canada (field experiments, 1993–2002).**

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of cuts</th>
<th>Corresponding dates</th>
<th>Precipitation†</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>1</td>
<td>July 16</td>
<td>16.7/25.6</td>
</tr>
<tr>
<td>2001</td>
<td>3</td>
<td>June 19, Aug. 9, and Oct. 3</td>
<td>2.5/7.2</td>
</tr>
<tr>
<td>2000</td>
<td>3</td>
<td>June 19, July 26, and Sept. 26</td>
<td>3.5/11.4</td>
</tr>
<tr>
<td>1999</td>
<td>3</td>
<td>June 23, Aug. 20, and Oct. 4</td>
<td>9.0/13.5</td>
</tr>
<tr>
<td>1998</td>
<td>3</td>
<td>June 22, July 28, and Sept. 23</td>
<td>11.7/19.0</td>
</tr>
<tr>
<td>1997</td>
<td>3</td>
<td>July 4, Aug. 11, and Sept. 29</td>
<td>10.3/14.5</td>
</tr>
<tr>
<td>1996</td>
<td>2</td>
<td>July 12 and Aug. 20</td>
<td>3.9/13.0</td>
</tr>
<tr>
<td>1995</td>
<td>3</td>
<td>June 22, Aug. 16, and Sept. 29</td>
<td>14.1/19.5</td>
</tr>
<tr>
<td>1994</td>
<td>3</td>
<td>June 24, Aug. 12, and Oct. 20</td>
<td>8.3/14.6</td>
</tr>
<tr>
<td>1993</td>
<td>2</td>
<td>June 21 and Sept. 2</td>
<td>13.9/21.0</td>
</tr>
<tr>
<td>1992</td>
<td>0‡</td>
<td>–</td>
<td></td>
</tr>
</tbody>
</table>

† Total precipitation for four months (May–Aug.) at Lethbridge/annual precipitation. Precipitation during May to August normally comes as rain in Lethbridge area.

‡ Seeding year.
For other insects, numbers of aphids were greater in control plots compared with burned plots in June 2002, as were leafhopper numbers in 2000. The highest number of aphids (July 2002) was recorded in Barrier, followed by Trumpetor, Legend, and Heinrichs. The highest number of leafhoppers (June 2002) was recorded on Heinrichs, followed by Trumpetor and Barrier (not different among them) and Legend (lowest number). Barrier was again significantly different from the other cultivars. Beneficial insects, lumped across taxa, and cabbage seedpod weevil were not affected by any of the factors.

A common practice among prairie alfalfa producers is to maintain hay stands for a three- to four-year period after establishment. This study indicates that the choice of alfalfa cultivar is important to maximize forage yield and to manage verticillium wilt but is not as important for insect pest management. Burning did not increase forage yield of alfalfa or lower incidence of verticillium wilt in the long-term study, and therefore it should not be encouraged as a cultural practice for alfalfa forage production. This long-term study shows that alfalfa stands follow three distinct patterns of growth with or without burning. During the first two production years, forage yield increases, after which the stands decline slowly but steadily for about four years for all cultivars. Although stands of some cultivars decline faster than others, it is easy to understand why producers keep their stands for only three to four years. Most alfalfa breeders select for maximum productivity during the first three to four years.

It is interesting to note that precipitation during the growing season or total annual precipitation during the study period did not influence annual growth patterns of these alfalfa cultivars. Breeders realize the need to sacrifice yield during the initial years to develop cultivars with long-term yield stability, making them economically less appealing to seed companies as well as producers. Although disease-resistant cultivars such as Barrier can produce over 2.68 ton/acre dry matter on the 10th year, the stands are normally replaced after four production years. Forage yield of the four cultivars tested in the current study fluctuated from year to year, but the trends were similar, indicating little genotype $\times$ environment interaction.

This was expected as all four cultivars were tested and registered for commercial production in western Canada.

Under irrigation, Barrier alfalfa developed by Agriculture and Agri-Food Canada at Lethbridge was the highest yielder, outyielding the relatively new cultivar Legend and a slightly older cultivar Trumpetor. Heinrichs, a dryland cultivar used in the trial, was the lowest yielder, suggesting that a choice of cultivar with appropriate adaptation is important for maximizing forage yield. The higher level of resistance to bacterial wilt and verticillium wilt in Barrier compared with Legend or Trumpetor may have contributed to slower stand decline for Barrier in southern Alberta, where verticillium wilt is a production concern. Differences in insect abundance among cultivars are difficult to explain as the cultivars were not selected for resistance against the insect pests studied. It is possible that differences in canopy structure among varieties influence the populations of insects, but this requires more detailed study.

This study demonstrates that burning alfalfa crop stubbles and residues did not show reduction in number of infection loci, unlike earlier studies that indicated burning can kill Verticillium spp. in crop stubbles and debris. This suggests that the infection loci observed in this study may originate from soil-borne inoculum of V. albo-atrum that escaped the high temperatures of the burning treatments or from spores dispersed to the plots from other locations, perhaps by insects. Furthermore, availability of resistant cultivars makes the ineffective burning method a superfluous strategy to manage verticillium wilt.

Effects of burning alfalfa on insect pests vary with the life history of the species. Only those that overwinter in situ on the stems or at surface level are likely to be impacted. Earlier studies on spring and autumn burning of alfalfa stubble found significant but inconsistent reduction of insect pests such as alfalfa plant bugs, alfalfa weevil, lygus bugs, and pea aphids.

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Winter 2009 Self-Study Quiz
Finding best practices for growing alfalfa in the Northern Plains (no. SS 03841)

1. Common pests that reduce alfalfa yield include
   a. collectricum mold, cabbage worms, corn root worm, and late blight.
   b. black mold, alfalfa plant bugs, and potato beetles.
   c. verticillium wilt, alfalfa plant bugs, pea aphids, alfalfa weevils, and lygus bugs.
   d. early blight, cabbage moth, cucumber beetles, and corn aphids.

2. Most reported studies that measured the effects of burning covered a short to medium time range (two to six years) and
   a. showed promise in increasing alfalfa forage yield while reducing insect pest populations.
   b. showed promise in increasing seed yield with no change in insect population.
   c. showed increases in helpful insects with no yield advantage.
   d. increased pollution and also yield.

3. The objectives of this long-term study were to determine the effect of burning regimes on forage yield of alfalfa cultivars
   a. on saline soil with pesticides.
   b. under prairie conditions and to observe its effect on verticillium wilt of alfalfa and insect pest abundance in the absence of pesticides.
   c. when the fields were overfertilized.
   d. when irrigation was heavy.

4. Various cultivars of alfalfa are known for their characteristics. Which cultivars are susceptible to verticillium wilt, according to the current wisdom?
   a. Barrier, which is high yielding.
   b. Legend, which yields large amounts of seed.
   c. Trumpetor, an average-yielding cultivar.
   d. Pacer and Heinrichs.

5. Burning is considered a method to reduce insect pressure. Which statement is not true?
   a. Burning had a significant but variable impact on insect abundance.
   b. Numbers of alfalfa plant bugs were consistently higher in control plots than in burned plots in all years.
   c. Numbers of lygus bug adults were higher in the control plots than in the burn plots in 2001 only; similarly, numbers of lygus bug juveniles were higher in the control plots compared with the burn plots in 2000.
   d. The abundance of lygus adults was the same among cultivar means in 2000 and in July 2002.

6. The long-term study described in this article shows that alfalfa stands follow three distinct patterns of growth with or without burning. Which statement is true?
   a. During the first two production years, forage yield increases, after which the stands decline slowly but steadily for about four years for all cultivars.
   b. During the first three years, forage yield stays steady but then increases in the fourth year.
   c. Yield is highest for the first year and then drops quickly.
   d. Yield peaks during the third year and remains high during the fourth and fifth year.

7. Under irrigation, Barrier alfalfa developed by Agriculture and Agri-Food Canada at Lethbridge was a good performer, outyielding
   a. the standard Legend cultivar but not Trumpetor.
   b. all except the relatively new cultivar Legend and a slightly older cultivar Trumpetor.
   c. Heinrichs, which requires low water.
   d. all varieties except Pacer.

Quiz Continues
Next Page
8. The higher level of resistance to bacterial wilt and **verticillium** wilt in Barrier compared with Legend or Trum-petor may have contributed to slower stand decline for Barrier in southern Alberta

- a. although verticillium wilt is not a production concern.
- b. where verticillium wilt is a production concern.
- c. although insect pressure was affected by wilt as well.
- d. although wilt is not a factor in stand characteristics.

9. This study demonstrates that burning alfalfa crop stubbles and residues did not show reduction in number of infection loci, unlike earlier studies that indicated burning can kill **Verticillium** spp. in crop stubble and debris. This suggests

- a. that burning fields is a good stratagem to use.
- b. that the infection loci observed in this study did not originate from soil-borne inoculum of *V. albo-atrum*
- c. that burning fields causes more problems related to wilt.
- d. that availability of resistant cultivars makes the ineffective burning method a superfluous strategy to manage verticillium wilt.

10. Burning did not increase forage yield of alfalfa or lower incidence of verticillium wilt in the long-term study

- a. and therefore it should not be encouraged as a cultural practice for alfalfa forage production.
- b. and should be used to control insects.
- c. but may serve as a herbicide method.
- d. but may improve other aspects of alfalfa growth.

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**SELF-STUDY QUIZ REGISTRATION FORM**

Name: __________________________________________

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☐ $20 check payable to the American Society of Agronomy enclosed. ☐ Please charge my credit card (see below)

Credit card no.: ________________________________

Name on card: ________________________________

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Signature as it appears on the Code of Ethics: ________________________________

*I certify that I alone completed this CEU quiz and recognize that an ethics violation may revoke my CCA status.*

*This quiz issued December 2008 expires December 2011*

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**SELF-STUDY QUIZ EVALUATION FORM**

Rating Scale: 1 = Poor  5 = Excellent

Information presented will be useful in my daily crop-advising activities: 1 2 3 4 5

Information was organized and logical: 1 2 3 4 5

Graphics/tables (if applicable) were appropriate and enhanced my learning: 1 2 3 4 5

I was stimulated to think how to use and apply the information presented: 1 2 3 4 5

This article addressed the stated competency area and performance objective(s): 1 2 3 4 5

Briefly explain any “1” ratings: ________________________________

Topics you would like to see addressed in future self-study materials: ________________________________
Managing the phosphorus–nitrogen balance in corn and spring wheat

Tools to diagnose P crop status are becoming increasingly important to the process of minimizing the risk of surface and groundwater contamination from excessive fertilization while still applying sufficient P to optimize crop yield. Efficient management of P in crop production requires the development of tools to quantify the P status of plants. Diagnosing P deficiency during the growing season and pinpointing the critical P concentration that defines deficiency is critical to water protection.

A diagnosis of P nutrition, based on the relationship between P and N concentrations during growth, was first proposed in France for perennial grasses and for timothy in eastern Canada. Studies on corn and spring wheat are compared in this article. The objectives were to establish the relationship between P and N concentrations in grain corn and spring milling wheat during the growing seasons and, in particular, to determine the critical P concentration required to diagnose P deficiencies in both crops.

Applications of P fertilizers in areas like eastern Canada are common, and the rates used are principally based on soil test analyses. This soil testing, however, has not always been reliable when applied to diverse soil types and climatic conditions. Plant tissue analyses could be used to complement soil test analyses by diagnosing P deficiency in growing crops. Plant tissue analyses measure nutrients that have been absorbed by plants and can be considered a reliable indicator of the soil nutrient fraction available to plants. The physiological basis for assessing the P status by plant analysis is that a predictable relationship exists between the concentration of a nutrient measured in whole plants or a specific part of the plant and a yield parameter.

Site description and treatments

The relationships between P and N concentrations in corn and spring wheat shoots were studied using data from an experiment that was conducted during 2004 and 2005 at three sites in Quebec, Canada. The sites were selected to represent diverse soil textures and different previous crops within the area of corn (Table 1a—next page) and spring wheat (Table 1b—next page) cultivation in Quebec. Appropriate corn hybrids and planting and fertilization dates were adapted to each site. AC Barrie, a recommended spring milling wheat cultivar in Quebec, was used at all sites. A randomized complete block design with four replicates was used at each experimental site for each crop.

Within the area of corn (Table 1a—next page) and spring wheat grown without N fertilization at six sites, no N applied ranged from 0.45 to 1.0, indicating a wide range of levels of N nutrition among sites. In Atlantic Canada, a range of 0.33 to 0.76 was reported for the relative yield of spring wheat grown without N fertilization at six sites.

Effect of nitrogen fertilizer on corn and wheat grain yields

Corn grain yield increased with increasing N fertilization rates. The increase of corn grain yield with fertilizer N application is consistent with other studies conducted in eastern Canada and in the USA. Nitrogen fertilization increased shoot N and P concentrations on most sampling dates. This positive effect of N fertilizer on N tissue concentration has often been reported; however, the effect of N fertilization on P concentration has not been studied as much and has been attributed to the increasing capacity of roots to exploit more volume of soil and therefore absorb more nutrients.

In spring wheat, N fertilization significantly increased grain yield during four of the six site-years but did not affect grain yield at the other two sites. The increase in grain yield with fertilizer N application is consistent with other studies conducted in eastern Canada. The relative grain yield with no N applied ranged from 0.45 to 1.0, indicating a wide range of levels of N nutrition among sites. In Atlantic Canada, a range of 0.33 to 0.76 was reported for the relative yield of spring wheat grown without N fertilization at six sites.

Decrease in phosphorus and nitrogen concentrations over time

Phosphorus and N concentrations in the shoot biomass generally decreased with time. A decrease in N concentration with time or advancing maturity has been reported for potato and timothy. On average, N concentration varied from a maximum of 3.63% dry matter (DM) to a minimum of 0.6%. Phosphorus concentration, however, varied between 0.52 and 0.13% DM. Similar concentrations were reported for Australian wheat and French corn.
In corn production, P concentrations were particularly low at one site (St-Basile in 2004), where P concentrations varied by about 100% during the growing season. This may have been caused by the amount of precipitation in May and June of 2004, which was less than the 30-year average at that location. It is well known that water stress, especially early in a season, decreases root growth and consequently the capacity to absorb P. Shoot P decreased as shoot biomass increased at all six sites. For a given shoot biomass, P concentration tended to decrease with decreasing N rates, particularly at St-Louis in 2005.

### Relationship between phosphorus and nitrogen concentrations

The shoot P concentration increased with increasing N concentration at all six sites in both crops. For a given N concentration, the P concentration generally decreased with increasing N fertilization rates. The relationship between P and N concentrations is reportedly different for limiting and nonlimiting N conditions. To determine these two contrasting conditions, the N nutrition index (NNI) was used.
for corn and the relative yield was used for wheat. Therefore, the researchers considered that N was not limiting corn grain yield when NNI was $\geq 0.90$. Based on this assumption, they selected N fertilization treatments with a NNI $\geq 0.90$ to determine the relationship between P and N concentrations under nonlimiting N conditions. To determine limiting N conditions, the researchers used treatments with a NNI $< 0.80$. For wheat, the researchers considered that N was not limiting wheat grain yield when the relative yield was $\geq 0.90$. Based on this assumption, they selected N fertilization treatments with relative yield $\geq 0.90$ to determine the relationship between P and N concentrations under nonlimiting N conditions. For limiting N conditions, the researchers used treatments with a relative grain yield $< 0.80$ for which grain yield was significantly different from N fertilization treatments used in the nonlimiting N condition relationship. Therefore, the following relationships were obtained:

Under nonlimiting conditions:

- \[ P = 1.00 + 0.094N \ (R^2 = 0.76; P < 0.001; \text{Ziadi et al., 2007}) \] for corn (Fig. 1—next page) and

- \[ P = 0.94 + 0.107N \ (R^2 = 0.59, P < 0.001; \text{Ziadi et al., 2008}) \] for wheat (Fig. 2—next page).

Under limiting conditions, obtained relationships were different from those under nonlimiting conditions and were:

- \[ P = 1.25 + 0.104N \ (R^2 = 0.95; P < 0.001; \text{Ziadi et al., 2007}) \] for corn (Fig. 1) and

- \[ P = 1.70 + 0.092N \ (R^2 = 0.48, P < 0.001; \text{Ziadi et al., 2008}) \] for wheat (Fig. 2).

### Table 1b. Site characteristics and cropping practices for spring wheat.

<table>
<thead>
<tr>
<th>Site characteristics</th>
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† P saturation = (ppm P /ppm Al) $\times 100$; P and Al extracted with Mehlich-3.
‡ Soil Survey Staff (2006).
§ Calculated from the planting date to the harvesting date.
¶ Average temperature calculated from the planting date to the harvesting date.
# Second N application following the application of 26.8 lb/acre at planting.
†† Defined by Zadoks et al. (1974).
Implications for phosphorus diagnostic

In corn, the N status has proved necessary in understanding the role of P. Results indicate that the P/N ratio differs between nonlimiting and limiting N conditions—it is higher when N is limited. Consequently, in using the P/N ratio as a diagnostic tool, the level of N nutrition should also be considered. The relationship between P and N concentrations for both N conditions indicates that the P/N ratio changes during the growth cycle, although the concentration of both elements can decrease. The optimal P/N ratio depends on the stage of development and on the level of N nutrition.

The importance of adequate tissue P concentration for early corn growth and crop yield is well documented. Present studies provide a relationship to estimate the critical P concentration that is essential for quantifying the degree of P deficiency. When it is combined with an index of N nutrition, it provides a diagnostic tool for N and P deficiencies and imbalances in corn.

Since early P deficiency in corn cannot be remedied with later applications, producers can use this tool to adjust P fertilization in the following growing seasons.

References


Winter 2009 Self-Study Quiz
Managing the phosphorus–nitrogen balance in corn and spring wheat (no. SS 03842)

1. Plant tissue analyses measure nutrients that have been absorbed by plants. The measure is considered
   a. a reliable indicator of the soil nutrient fraction available to plants, especially wheat.
   b. an unreliable indicator of soil nutrient fractions available to plants, especially wheat.
   c. a reliable indicator of soil nutrient fractions in plants, except for wheat.
   d. an unreliable indicator of nutrient fractions in plants, except for wheat.

2. In corn, N fertilization generally causes the following change:
   a. Nitrogen fertilization increases both corn grain and shoot N and P concentration.
   b. Nitrogen fertilization increases corn grain and reduces P concentration in shoot tissues.
   c. Nitrogen fertilization reduces corn grain and increases P concentration.
   d. Nitrogen fertilization decreases P and N shoot concentration.

3. Early P deficiency in corn cannot be remedied with later applications, however
   a. P content is very important and cannot be reversed in the growing year.
   b. producers can use this tool to adjust P fertilization in the following growing seasons.
   c. P deficiency is usually not reversible in later years.
   d. P and N content are not related.

4. Nutrition N index can be limiting or nonlimiting. Which of the following statements is true?
   a. If the NNI does not limit corn grain yield, it is limiting.
   b. If the NNI limits corn grain, and is above 0.90, it is considered nonlimiting.
   c. The relationship between NNI and P in corn grain is not predictable.
   d. NNI at 0.70 would be predictive for P.

5. In estimating phosphorus concentration, wheat producers who apply
   a. adequate rates of N to optimize wheat yield could, in calculating P concentrations, assume that N conditions are nonlimiting.
   b. low rates of N to optimize wheat yield can assume no effect of N deficiency on the relationship between P and N and use the relationship proposed for nonlimiting N conditions.
   c. adequate rates of N to optimize wheat yield can assume an effect of N deficiency and use the relationship proposed for limiting N conditions.
   d. excess amounts of N to optimize wheat yield will eliminate N deficiency and keep the N concentration in the field for future years.

6. In corn, studies show that P and N concentrations decrease during growth. Which of the following statements is true?
   a. Critical P concentration is a function of the N concentration and the degree of N deficiency.
   b. Critical P concentration is a function of the amount of rainfall.
   c. Critical P concentration is independent of N concentration.
   d. Critical P concentration is dependent on timing of N addition.
7. In wheat, the critical phosphorus concentration combined with an index of nitrogen nutrition
- a. provides the tools required to diagnose nitrogen and phosphorus deficiencies and imbalances in spring wheat.
- b. suggests that N index is independent of P concentration.
- c. is not predictive.
- d. can lead to overfertilizing.

8. In corn, the N status has proved necessary in understanding the role of P. Results indicate that the critical P/N ratio differs between nonlimiting and limiting N conditions—it is higher when N is limited. Which of the following statements is true?
- a. Limiting N results are described by an NNI of >0.80.
- b. A NNI of <0.80 is generally limiting and can contribute to lower grain yields.
- c. Careful balance between NNI and critical P produces good grain yields but doesn’t affect water runoff.
- d. NNI of unlimited concentration increases needed K/P.

9. In wheat, limiting N conditions, chosen with a relative grain yield about 0.80, produced grain yield that was significantly different from using N fertilization treatments in the
- a. limited N condition relationship.
- b. nonlimiting N condition relationship.
- c. general production method without additional N fertilizer.
- d. organic field method.

10. In both corn and wheat, grain yield is best when
- a. P levels are corrected for.
- b. N levels are corrected for.
- c. P and N are in balance.
- d. soil is rich and no correction is used.
Canada East

Spring canola BMP trial—raising the yield bar

By Brian Hall, canola and edible beans specialist, Ontario Ministry of Agriculture, Food, and Rural Affairs; brian.hall@ontario.ca

In the face of sharp increases in production costs, farmers are looking for ways to squeeze every bushel they can out of their crops. To that end, the Ontario Canola Growers Association has organized a yield challenge for growers the past few years. Several winners of the contest have used various foliar treatments of fungicide, boron, and insecticide applications. In 2008, a canola best management practice (BMP) trial was conducted to quantify the impact of foliar fungicide alone and in combination with boron and insecticide on yield and seed quality of spring canola.

Boron has been one of the least studied nutrients in Ontario, and yet canola has been reported to be responsive to boron application. Research in Western Canada resulted in no significant yield response with soil- or foliar-applied boron (Karamanos et al., 2003). The University of Guelph reported a significant response to boron in a 2007 BMP canola research trial (Earl, 2007). Insecticide application at flowering improved yields when moderate to high populations of seedpod weevil and/or tarnished plant bugs have occurred. In addition, controlling these insect pests improved seed quality by reducing brown seed count.

Trials were conducted at nine locations in 2008 as two replicate randomized field length trials. Foliar treatments of fungicide, fungicide + boron, and fungicide + boron + insecticide were applied at the 10 to 30% flower stage. Fungicide and insecticide were applied at the recommended labeled rate. Boron was applied with the other products at a rate of 0.3 lb/acre (actual).

Results

Growing conditions were excellent with moderate temperatures and adequate (or excessive) rainfall, resulting in average to phenomenal canola yields. The average yield achieved by co-operators was 2,583 lb/acre compared with the long-term provincial average of 1,800 lb/acre. Canola yields improved only slightly with increasing inputs (Table 1—next page). None of the treatments increased dollar returns over the check treatment (no foliar application). Canola canopies were thick and lush with cool, wet conditions at flowering, ideal for Sclerotinia (white mould), which was present in all plots at moderate levels.

Visual differences were evident between the check (no foliar application) versus those that received a fungicide application. Surprisingly though, plots were monitored for growth, insect, and disease levels. Seed samples were collected at harvest for quality analysis.

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![PR2 Profile Probe](image)

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Southern

Snively wins Florida crop advising award

Jim Snively, vice president of Grove Operations for Southern Garden Citrus, received the Florida Farm Bureau Excellence in Crop Advising Award this fall. He received a plaque from John Hoblick, president and CEO of the Florida Farm Bureau Federation (FFBF), during FFBF’s annual meeting in Orlando. He also received a $500 check from FFBF and the Florida CCA program.

Snively, a CCA for the past five years, coordinates all citrus production for Southern Garden Citrus, one of Florida’s largest citrus operations. He won the award in recognition of his statewide leadership role in the fight against citrus greening, a disease ravaging the Florida citrus industry. Snively’s company manages the disease using polymerase chain reaction (PCR) techniques to screen vector psyllids as carriers of greening. In addition, Snively advocates more traditional cultural practices such as eliminating host plants for the vector to limit pest populations.

In recognition of his efforts on behalf of Florida citrus growers, Snively was also honored with the 2008 Citrus Achievement Award earlier this year.

The combination of fungicide and boron was the only treatment to provide a significant but small increase over the check. The boron + fungicide treatment improved yield slightly at six of nine sites over fungicide alone. However, it is not clear if the increase was due to the boron or the combination of boron + fungicide. The treatment with insecticide did not increase yield, which may have been because of low populations of seedpod weevil and plant bug. This finding highlights the value of IPM scouting prior to decisions on insecticide application.

Results are only for one year and should be interpreted with caution. Complimentary Ontario canola research trials are ongoing to investigate various combinations of boron, fungicide, and insecticide.

References


Western
Slow-release nitrogen in Pacific Northwest wheat production systems

By Brad Brown, extension crop management specialist, Southwest Idaho Research & Extension Center, University of Idaho, Parma; Rich Koenig, soil fertility specialist, Department of Crop & Soil Sciences, Washington State University, Pullman; and Don Horneck, extension agronomist, Oregon State University, Hermiston, OR

Wheat production systems in the western U.S. are extremely diverse. They include annual cropped and wheat–fallow, low-rainfall, high-rainfall, and irrigated systems. In all systems, nitrogen (N) is typically the most limiting nutrient and is a significant production cost. Optimal N management differs depending on the cultural practices, soil conditions, rainfall, and other factors unique to each system.

Preplant-applied N in all production systems does not supply N in tune with the dynamics of N uptake, particularly for fall-planted wheat. Fertilizer N release that more closely matches plant needs has the potential to improve N effectiveness. An additional challenge for hard wheat production is providing sufficient N later in the season for acceptable grain protein.

Production systems change with the introduction of new technology—new cultural practices such as conservation tillage or new fertilizer technology. New fertilizer technologies include stabilized N formulations to slow N release or inhibit the enzymatic (urease) or microbial conversion (nitrification) of ammonium to nitrate.

While N stabilizers such as nitrification inhibitors are not new, they were not always convenient or appropriate to use with dry N fertilizers. More recently, several coated or treated dry urea products were developed to slow N conversions or N release. Not all products have been evaluated in all production systems, but land grant institutions are gaining experience as resources allow. More information is available for polymer-coated urea (PCU) in the Pacific Northwest (PNW) than with other specialty products and is summarized in this article.

Irrigated wheat
Irrigated wheat production in the PNW is some of the most productive in the country. The total N requirements are also high. Challenges in optimizing N effectiveness that are unique to surface-irrigated systems include limited control of the wetting front in long irrigation furrows or basins. Also, high rates of readily available fertilizer N may overwhelm the capacity of wheat to effectively assimilate the N or cause excessive vegetative growth and lodging.

Preplant-incorporated PCU for furrow-irrigated hard red spring wheat

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approximately 70% of precipitation occurs in September–April with annual totals ranging from less than 10 to more than 30 inches. Understandably, N management practices such as rate and timing vary considerably with precipitation zone. In low precipitation (<12 inches) crop–fallow areas, wheat is fertilized mainly in the summer of the fallow year. In areas of moderate precipitation (14 to 18 inches), fertilizer is applied at planting while in high precipitation areas, fertilizer may be split between fall and spring.

In a recent study on hard red winter wheat, grain yield and protein responses to N rate (0 to 250 lb N/acre) were identical for fall-applied PCU and conventional urea in an 18-inch annual rainfall environment on a gently sloping hillside. More N was retained in the profile with PCU compared with conventional urea, suggesting that PCU may be advantageous in environments with higher annual rainfall totals where the potential for N loss is greater.

Polymer-coated urea and possibly other slow-release methodologies can improve N effectiveness in irrigated systems when used appropriately. The new treated or coated fertilizers are more costly. Where they provide a yield advantage for preplant N, their cost effectiveness depends largely on their price relative to the cost of split applications. In none of the furrow-irrigated evaluations was preplant-applied PCU more effective than split-applied (preplant and late vegetative) urea. In dryland/rainfed environments, PCU may offer advantages in situations where annual rainfall exceeds 20 inches though additional research is required to verify this.

For sprinkler-irrigated hard red winter wheat, late-winter topdressed PCU in limited testing was more effective than topdressed urea (145 vs. 132 lb/acre), and protein did not differ. Surprisingly, split urea applications were not as productive as topdressed PCU (138 vs. 146 lb/acre).

In several trials, high rates of urea N have been detrimental to production. Where irrigated hard wheat classes require more N for acceptable protein than is required for yield, PCU may be better suited.

### Dryland/rainfed wheat

In the inland PNW, winter wheat is grown in environments where approximately 70% of precipitation occurs in September–April with annual totals ranging from less than 10 to more than 30 inches. Understandably, N management practices such as rate and timing vary considerably with precipitation zone. In low precipitation (<12 inches) crop–fallow areas, wheat is fertilized mainly in the summer of the fallow year. In areas of moderate precipitation (14 to 18 inches), fertilizer is applied at planting while in high precipitation areas, fertilizer may be split between fall and spring.

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Software provides comprehensive nutrient management planning

A December webcast that is co-sponsored by the American Society of Agronomy and the Livestock and Poultry Environmental Learning Center will feature a Windows-based computer program called the Manure Management Planner. Developed at Purdue University, the software is used to create manure management plans for crop and animal feeding operations. The workshop will be broadcast on December 19, 2008 at 2:30 pm (Eastern). An archived version may be accessed at www.extension.org/pages/December_Webcast_Is_About_the_Manure_Management_Planner_Software. Webcast speakers are Brad Joern and Phil Hess of Purdue University’s Agronomy Department and Rick Swenson with USDA-NRCS.

Users of Manure Management Planner enter information about the operation’s fields, crops, storage, animals, and application equipment. Although created to address manure management planning, the software encompasses nutrient management plans for crop production. The program can be downloaded from the CCA, CPAg, or CPSS websites (www.agronomy.org/certifications). You will need to log in first with your email address and your password (certification number plus the first initial of your first name).

The workshop provides an introduction to the software program, which is designed to assist an animal producer or adviser in assembling a comprehensive nutrient management plan (CNMP). The software currently supports the nutrient recommendations for 34 states and phosphorus risk assessments for 25 states. The tool will generate plans for field-specific manure and fertilizer recommendations and assess the sufficiency of available crop acreage, seasonal land availability, manure storage capacity, and application equipment to manage the manure.

The planner is being recommended by USDA-NRCS as the software tool of preference for technical service providers developing CNMPs. The USEPA is also endorsing the planner as one option that will address the nutrient planning requirements of the new regulations for concentrated animal feeding operations (CAFOs).

The planner helps the user allocate manure (where, when, and how much) on a monthly basis for the length of the plan (1–10 years). This allocation process helps determine if the current operation has sufficient crop acreage, seasonal land availability, manure storage capacity, and application equipment to manage the manure produced in an environmentally responsible manner.

The tool is also useful for identifying changes that may be needed for a nonsustainable operation to become sustainable and determining what changes may be needed to keep an operation sustainable if the operation expands.

The software also has a set of document generators. These are planning tools that work with the planner in development of either:

- a CNMP as required in an application for approval of construction or major modification of a livestock waste control facility or
- an annual manure use plan (AMUP) or an annual nutrient management plan (Title 130: Chapter 4 005.04; Chapter 14).

The generated plans also provide guidelines and forms for CAFO record-keeping. Microsoft Word files are created and easily edited by the planner.

Credit Markets | FROM PAGE 9

board have done a “heroic job” of maintaining the market system.

“Consumers may be seeing higher food prices, but there have been no food shortage scares. Food is still getting to the stores,” McKenzie says. “That’s at least in part because of the remarkable job the elevators have been doing.”

Investment in research needed

Overall most economists would agree that if stability is going to be restored in world food supplies, then investment is needed in research to enhance productivity. It is still unclear how the financial problems will play out.

“There are different views at the moment on the extent to which developed countries will go into recession—how long such recessions might continue,” says David Hallam, head of the trade policy service of the United Nation’s Food and Agriculture Organization (FAO).

Relating the financial crisis to the food crisis, Hallam indicates that one of the fundamental, underlying causes is a long-term decline in investment in agriculture and poor productivity. These problems have not been solved, and grain stocks remain low. If there is a downturn in activity and there’s a cutback in production, most markets would be back into the kind of emergency situation that prevailed earlier this year.

For more information about agricultural borrowing and lending in today’s economy, see www.agecon.purdue.edu/news/financial_crisis.asp.

—Source: The Agricultural Communication Services of the Arkansas Agricultural Experiment Station (http://arkansasagnews.uark.edu), the Purdue Agriculture Report (www.agriculture.purdue.edu/agcomm/news/agresearch), and staff reporting.
Virginia farmers hit high yields with no-till

Wheat farmers in Virginia are dispelling the myth that environmentally sound best management practices are incompatible with high yields. According to the Virginia Grain Producers Association and Virginia Cooperative Extension, all three winners of an annual statewide small-grain contest this year produced very high yields using nutrient management plans and continuous no-till.

Nutrient management planning assists farmers in applying fertilizer according to crop requirements, avoiding excess application that can lead to surface and ground water pollution. Continuous no-till leaves the surface of the soil undisturbed, reducing soil erosion by as much as 90%. Soil erosion and runoff cloud water, bury underwater plants and animals in silt, and can carry nitrogen, phosphorus, and other agricultural chemicals that harm aquatic ecosystems. Excess nitrogen and phosphorus contribute to noxious algal blooms and dead zones. Using best management practices that mitigate erosion and runoff is particularly important in Virginia.

“We’re very close to the water,” explains David Moore, a certified crop adviser (CCA) with the Virginia Cooperative Extension. “We’re farming on the Chesapeake Bay watershed, and I think that’s one reason why no-till has taken off here. We’ve all got to be mindful of where we are and cut down on runoff and erosion, and no-till is a really good way of reducing all those things.”

Environmental groups like the Chesapeake Bay Foundation (CBF) are taking notice. Ann F. Jennings, CBF Virginia executive director, praised the state’s wheat farmers earlier this year “for their leadership in production and for their leadership in using conservation practices that assist Virginia in meeting its goal of improving wa-
Overcoming early challenges

Moore says most farmers in Virginia are going no-till wheat these days, but making the switch from conventional till several years ago presented some challenges.

“Trying to get a stand of wheat into corn stalks was a challenge,” he says. “When we first started [using no-till] we had things planted too deep the first year and probably not deep enough the next year. It took a while to realize that we can plant at about an inch to an inch and a half consistently with no-till, whereas with conventional, if you plant much over an inch, everybody starts thinking you’ve lost your mind. After doing no-till for a while, the seedbed becomes much better to plant into, and I think you can plant a little deeper than a lot of people think.”

Moore says they also had some challenges with weeds initially.

“The first few years, we didn’t do a burndown before we planted wheat, and I think that’s an absolute must. You need to burndown with either Gramoxone or a glyphosate product. A lot of farmers will look at a field and say, ‘Well this field is clean—I don’t need it.’ But you don’t see everything, so I think it’s best for you to try to burndown before you plant.”

Paul Bodenstine, a certified professional agronomist (CPAg) with Ag Systems in Mechanicsville, VA, also recommends burning down with Gramoxone and 2,4-D. He worked with the first-place winner of the statewide yield contest, Chuck McGhee of Grainfield Farms. McGhee raised 131 bu/acre wheat—more than double the 2007 state yield average of 64 bu/acre and well above this year’s average of 71 bu/acre, which itself was a state record. Bodenstine says one benefit of no-till is that it creates a firm seedbed, which is important for even wheat emergence.

“Our data shows that if you get wheat emerging more than seven days after the first wheat emerges, you go from 105-bu wheat down to 35-bu wheat. Even emergence is so critical with wheat.”

Savings add up

Efficient use of nutrients is also critical for both water quality as well as the farmer’s bottom line, particularly with today’s high input costs. Bodenstine says that they’re actually using less nitrogen with no-till.

“We used to use about 2 lb of nitrogen per bushel, and we’re down now to right around 1.2 lb of nitrogen per bushel. So by no-tilling, we’re building up the organic matter, and it’s releasing nitrogen. We’re not as efficient as we think we can be, but we’re getting pretty darn efficient. Obviously with the stalks in the ground, there’s very little erosion and runoff, and that means a lot to us. We don’t want to lose [these nutrients]—it’s too expensive.”

When the crop gets to the two- to four-leaf stage, McGhee applies his nutrients and pesticides in one trip. This saves on fuel and wear and tear on the equipment compared with a conventional operation where you make at least three different trips between corn harvest and wheat planting to plow, disk, and drill. And there’s another important non-renewable resource to consider—time.

“It’s all about time,” Bodenstine says. “The wheat has a relatively narrow [planting] window, and we’ve got to get it in right after the corn crop, so the biggest reason why we’ve gone to no-till is to be timely.”

It’s not just fewer trips across a field that makes no-till a better option for timely wheat planting, it’s the soil conditions too, says Charles Hubbard, a CCA with Southern States Cooperative.

“You can also get on the ground when it’s a little wetter when it’s no-till,” says Hubbard, who worked closely with a top-yielding grower in the regional portion of the contest. “You don’t have to have perfect moisture conditions, and that’s a huge benefit to being more timely in planting.

“Most of the farmers in this area are now [employing] no-till on wheat. I would have a hard time going out and finding a conventional till field to show you. I think it’s a very good thing. When you can grow the kind of wheat that these fellows grew in an environmentally friendly way, it’s a win for everybody.”
Certification update

By Luther Smith, Director of Certification Programs; lsmith@agronomy.org or 608-268-4977

All three certifying boards met in October to hold their annual business meetings. The International Certified Crop Adviser (ICCA) board met in Indianapolis, IN while the Certified Professional Agronomist (CPAg) and Certified Professional Soil Scientist/Classifier (CPSS/C) national boards met in Houston, TX during the Joint Annual Meeting of the American Society of Agronomy (ASA), Crop Science Society of America (CSSA), and Soil Science Society of America (SSSA).

The CPGA and CPSS/C boards are made up of six members, each representing different U.S. regions and having diverse backgrounds from within the professions. They review applicant credentials throughout the year, deal with any continuing education abnormalities as well as ethics complaints, and set the policies for the programs.

The ICCA board has a representative from each of the 37 local boards along with committee chairs and agency representatives. It sets the overall policies and procedures for the ICCA program while the local boards (state/province/regional) review applicant credentials, continuing education approvals, and ethics complaints and promote the program at the local level. You can view members of each of the certifying boards on the respective websites (www.agronomy.org/certifications).

CPAg

There are 652 CPGA’s, and of these, 558 also have a CCA certification. CPAg’s and CCAs both have to pass the same international CCA exam, but CPAg’s also have to have at least a B.S. degree in agronomy while CCAs have to pass the local board exam.

The focus of the CPGA meeting was on promotional efforts that would help grow the program. One idea was to ask each CPGA to recruit one other person to become a CPGA during 2009.

The ASA office will provide each CPGA with a packet including the credential booklet and background on the program. All the CPAg has to do is give that to someone he/she believes is qualified to become certified and also offer to be a reference for the person. The group agreed that most people would feel honored if they were asked by a peer to become part of a profession, especially when that person is willing to help them through the process and be a reference. More information will be provided early next year.

Members of the CPGA board also met with members of the ICCA and ASA executive committees to discuss how CPGA and ICCA could work together. This was not a discussion about changing the requirements for becoming certified, but rather how the support and board structures could work together to gain efficiencies. Each program today is distinct and separate but pretty much applies to a very similar audience. There are some real advantages to be gained if the infrastructure of both programs—e.g., marketing, finance, and reviews—could be pulled together to promote one seamless process and represent the ASA vision of “field through plate.”

There are 12,950 CCAs, and of those, more than 75% have at least a B.S. degree with about 50% of those having agronomy degrees. The potential is very large to grow the CPGA program through this effort. Nothing has been changed or decided other than to form a task force of CCAs and CPAg’s to evaluate what could be done, the potential benefits of a closer working relationship, and if anything should change in the future. We’ll keep you posted as talks continue.

CPSS/C

There are 984 CPSS and 185 CPSC certification holders, for a total of 1,169 in the soils programs. CPSS board members discussed promoting the program in 2009 and putting in place a similar program to what the CPGA board talked about in terms of recruiting fellow professionals to become certified. They also updated the reference requirement for associate status from five to three references, but when a person applies for certified status, he/she will need to provide five new references.

CPSS/C utilizes one national certifying board, but in 2007 it initiated a pilot program in Florida and Ohio to establish state-based certifying boards. The effort is designed to strengthen the certification process by establishing a stronger presence at the state level where state licensing does not exist. The two state boards are now organized and will be reviewing applications as they receive them.

The soils programs are also supporting state licensing. Washington and Tennessee will have proposed legislation before their respective state legislatures in early 2009. It will take a combined effort of all soils professionals in those states if the legislation is going to pass. I’d like to encourage your involvement in the process.

ICCA

The ICCA program has a state/province-based structure with 37 local boards (states/provinces/regions) representing 12,950 CCAs throughout the United States and Canada. The ICCA board meets annually to review policy-related issues and promotional efforts. The primary focus of the promotional efforts has been to educate farmers on why they should work with CCAs. A major advertising campaign was undertaken in 2008 with Successful Farming magazine in the United States, Top Crop Manager magazine in Canada, and some regional efforts in California around the recently passed manure management legislation. The board is evaluating a similar plan for 2009.

A major effort is underway to work with university departments to use the ICCA and/or soils exams as an assessment tool along with getting students started in their professional certifica-
Certification

The department gets statistical data that can be used in evaluating its curriculum while the student begins preparing for the transition to the work world where recruiters look for professional certifications as an added bonus to hiring that individual. It’s a “win–win” approach.

ICCA has always had strong leadership, and 2009 will be no different. Howard Brown, CCA-IL and CPAg, will be chair; Kim Polizotto, CCA-IN, will be past chair; and Jim Smith, CCA-NW, will be vice chair. Tom Kemp, CCA-SC and past chair this year, will rotate off of the executive committee. I have often said that we have had the right chairperson for the right time. Each one brings their own style of leadership and priorities, but all are committed to seeing the program thrive.

Tom Kemp led the program through some very difficult structural discussions, and his attitude that anything can be fixed while standing in a creek fishing helped build lasting relationships and keep the “family” together. Howard Brown will help guide the program into international expansion started by Kim Polizotto. Jim Smith joins the executive committee from the Pacific Northwest with a desire to increase the value of being certified. You will hear more about and from your CCA board members in the coming issues of Crops & Soils.

ASA educational offerings, end-of-year CEU reminder

The first online course, Basics in Applied Agronomy, was offered by ASA this fall. The interest and participation was overwhelming to the point that another class is being considered for this spring. We are also launching webinars in January 2009 featuring timely agronomic topics. More details will be sent to you via email, so if you don’t have your email address up to date with us, you might want to do that soon so that you don’t miss out.

As 2008 comes to a close, make sure your CEUs are also up to date. If your two-year cycle ends this year, you will need at least 40 total CEUs. Check out the ICCA website (www.certifiedcropadviser.org/certified/education/self-study) for self-study CEUs if you are short. Now is not the time to let your certification expire. Demand for certified agronomists is at an all-time high, regulations are increasing and many require certified professionals to do the work, and opportunities continue to grow.

You will be getting a CEU statement in January showing all that has been reported. Those not meeting the requirements will have time to report any missing information or appeal to the board if they have had extenuating circumstances. You can access your CEU records 24/7 via the website (www.agronomy.org/certifications). You also have the ability to take online self-study CEUs and self-report professional meeting events that may not have been CCA board approved by completing the online form.

Top: Kim Polizotto (right), CCA-IN and chair of the ICCA board, passes the gavel to incoming ICCA board chair Howard Brown, IL-CCA and CPAg, during the annual ICCA board meetings held in Indianapolis, IN in October. Right: Members of the CPAg board and the ICCA and ASA executive committees met at the ASA Annual Meeting in Houston, TX to discuss the potential of having the CPAg and ICCA programs work closer together.

As 2008 comes to a close, make sure your CEUs are up to date. If your two-year cycle ends this year, you will need at least 40 total CEUs. You can earn CEUs at www.certifiedcropadviser.org/certified/education/self-study

www.agronomy.org
Illan Romander, chairman of the California Certified Crop Adviser (CCA) board, has been selected to receive the International Certified Crop Adviser (ICCA) of the Year Award by the American Society of Agronomy (ASA). This award recognizes CCAs who deliver exceptional customer service, show that they are leaders in their field, and contribute substantially to the exchange of ideas and the transfer of agronomic knowledge within the industry.

Romander was nominated for the award by the California CCA board. The award was presented to Romander at the Joint Annual Meeting of ASA, CSSA, SSSA, and the Geological Society of America in Houston, TX in October. He received hotel and travel expenses for two to the meeting, $500 cash, a commemorative plaque, and a one-year membership in ASA.

Romander is a pest control adviser (PCA) and CCA with Western Farm Service in Vernalis, CA. He officially retired from Western in 2007 after 20 years of service but continues working with the firm as an irrigation consultant and assisting in field personnel training.

The California Association of Pest Control Advisers (CAPCA) represents more than 75% of the nearly 4,200 California EPA–licensed PCAs that provide pest management consultation for the production of food, fiber, and ornamental industries of the state. Romander has been a member of CAPCA for the last 21 years.

A 1968 graduate of Cal Poly Pomona, Romander resides in Modesto, CA with his wife, Mary. He has four children and six grandchildren.

On-the-job training

Romander has more than 40 years of crop-advising experience. His interest in agriculture goes back to when he was a teenager and had a chance to work on a ranch in southeastern Oregon. Inspired by the experience, he studied animal science in college. Upon graduation, there were few opportunities in ranching, so he started a career with H. J. Heinz Company as a field buyer. He worked with Heinz in California and Michigan, developing management practices for mechanical harvesting of pickling cucumbers. Since he had formal education in animal science, much of his agronomic knowledge was acquired “on the job.” This instilled the value of lifelong continuing education in Romander.

Upon returning to California, he worked as a crop adviser, and in 1979, he earned his PCA license. He worked for Schmied Soil Service in Manteca from 1979 to 1987.

Romander has been on the forefront of water management issues in Western Stanislaus County, where the Vernalis branch is located, working with growers on reducing sediment loss during irrigation and helping them increase water efficiency using soil moisture technology for improved irrigation management. He has developed irrigation-scheduling techniques for tree, row, and vine crops using probes.

“I learned the value of irrigation management while working with tomato growers during my employment with H.J. Heinz,” Romander recalls.

Over the years, he has seen many changes in how agricultural water management is handled. Romander says that for growers in the Western United States, water issues will become even more critical in the years to come with increasing urbanization, costs, and additional focus on environmental issues.

Since retirement, Romander has also been working with a company on a soil water monitoring, measuring the moisture content of the soil at different depths using capacitance technology. The information provided ensures better and more profitable irrigation management. Known commercially as the C-Probe, the data obtained by the system’s sensors is collected by a central logger and then downloaded by the user through a variety of manual and telemetry methods. Data analysis software helps track water movement through the soil and allows visualization of actual plant water use, enabling irrigations to be tailored for maximum benefit. Romander consults and installs the monitoring systems for growers.

Romander has a keen interest in helping people understand the positive contributions of agriculture. He was active in the “Plant Doctor” program, making numerous presentations to young students throughout central California.
to help them appreciate where food comes from and the role of the crop advisers in producing healthy and safe food.

The Plant Doctor program was created by the California Agriculture Production Consultants Association in 1990 after research showed not much time was being devoted to agriculture in academic curriculums. In 1991, the first Plant Doctor presentation was made in a classroom, and by 1993, the program had gained vast popularity. The program is an information kit that is mailed out free to California teachers upon request. The target group is third, fourth, and fifth graders. Since 1991, the program has reached more than 350,000 individuals.

Improving the CCA program’s relevance

Romander became a CCA in 1994 and joined the California CCA board in 2004. He was selected as the chair of its Marketing and Communications Committee in 2005 and then became vice-chair of the board in 2007. In 2008, he was elected chairman of the board and the California representative on the ICCA board.

Romander has helped to revitalize the California CCA program, providing a vision of an active, growing, and relevant CCA organization. He has worked to improve the relevance and importance of the CCA program by making presentations throughout the state at meetings and to professional organizations that serve the agricultural production industry. He has taken the CCA exhibit to many meetings to pitch the program and answer questions.

He sees the increasing importance of the CCA program in California where nutrient management on farms is becoming more regulated.

“In order to be a field consultant to a grower, you have to be a licensed pest control adviser, but there is no such related minimum requirement for a certified crop adviser in California,” Romander notes. He believes that it is critical for such standards to be in place.

Dr. Rob Mikkelsen, western director of the International Plant Nutrition Institute, sums up Romander by saying, “Allan’s experience with the Plant Doctor program reflects his approach to many activities. He first finds programs that he believes in, learns the ropes, and then dives in with effective leadership to bring excellence to his activities. This is true when introducing new technology to his clients, overseeing complex production and environmental issues, or providing outstanding leadership to a renewed CCA program in California. His grasp of complicated multidisciplinary production issues has earned the high respect of his peers.”

As the incoming chair of the International Certified Crop Adviser (ICCA) program for 2008–2009, I welcome the opportunity to serve the more than 12,000 CCAs in the United States and Canada. The program has been nurtured and supported by the hard work and creativity of local board members. It is the toil and vision of this group of people that made the ICCA program what it is today. It is the unselfish contribution of time and effort of this group that makes us the strongest and most active agricultural certification organization in North America. It is the work of people locally involved that provides the energy to grow the ICCA program in value and recognition.

With that said, we have much work ahead of us to continue our quest of adding even more value to the ICCA program. Here are just a few of the ideas under consideration to better serve you as a professional in the field.

1. In conjunction with the American Society of Agronomy (ASA), deliver timely, valuable information to CCAs in the field by using internet meeting platforms and offering CEUs for qualifying presentations. One such web-based presentation was offered on November 6 and featured the Plant Management Network. More than 245 CCAs registered for the online presentation.

2. Work with ASA to focus more attention on the needs of CCAs and other in-field professionals. Find ways to better deliver current applied research that adds value to the effort of those working on the “front line” with producers.

3. Continue to emphasize the value of the ICCA program through marketing to make more clients, agricultural industries, and governmental agencies aware of it and the value it brings to local and international agriculture.

4. Work with ASA to offer online continuing education courses that fit the schedule of practicing CCAs and other professionals. Develop online courses and/or programs that meet the needs of CCAs with the desire to continue their education, whether it be pursuit of an online master of science degree, completion of an associates or bachelor of science degree, or just to learn or review a specific area of applied agronomy.

Does the ICCA program have value to you as a CCA? Are you getting a return on your investment? Many of us have, or still do, ask these same questions. I have no problem with my answer. It is my goal over the next year to work with the local boards and focus the effort of the ICCA board to add value to the ICCA program. By the end of my tenure, I hope you can answer those same questions the way I do—with a resounding “Yes.” Stay tuned...
When it comes to choosing a lab to analyze your soil or plant samples, turnaround time and price are certainly important considerations, but the quality of the analyses should be just as important. After all, the credibility of your business depends on giving good advice, and it is tough to give good advice with bad data.

But how do you know that the lab is providing “good results” that are both accurate and precise? For this, you need to ask some questions about the quality assurance and quality control programs (QA/QC) that the lab has in place.

Figure 1 shows the worst-case scenario for a lab with no quality control program. Analytical results are scattered, with no assurance that the result you receive on any particular sample is correct, or even close to correct. Fortunately, this pattern is rare among analytical labs, but it is not impossible.

Much more common is the situation shown in Fig. 2, where the lab has a good internal quality control program in place but lacks external quality assurance. The results are tightly clustered, indicating a high level of precision, but they are not centered on the “correct” value. Frequent check samples within the lab will show consistent results, but they cannot uncover the hidden bias. This type of error can occur if there is a calibration problem with the equipment in the lab, if standards are contaminated, or if the specific test being used is inappropriate for the sample.

Figure 3 shows the opposite situation, where a lab is depending on an external quality assurance program only. The results are clustered around the “correct” value, but the spread in the values is large enough that there can be significant doubt about the accuracy of any particular result.

It should be obvious from these examples that good results from the lab depend on both internal quality control and external quality assurance programs. You, and your clients, are looking for the kind of results shown in Fig. 4, where the results are tightly clustered around the “correct” value.

Ask your lab about its QA/QC program, both what it is doing internally, as well as what external programs it is enrolled in. Labs that are participating in the North American Proficiency Testing Program (NAPT) have access to the most comprehensive comparison of lab performance on the continent. Many states and provinces are using quarterly NAPT results to certify/accredit labs working in their state/province, adding a level of assurance to laboratory results. Moreover, some mandate that labs meet the requirements of the Proficiency Assessment Program (PAP), a USDA-NRCS requirement in some states to analyze soils for the development of nutrient management plans.

If you would like more information about lab QA/QC, or about the NAPT or PAP programs, check out the website at www.naptprogram.org, or contact any of the NAPT Oversight Committee members. ■
Newly certified

The following list includes newly certified individuals and those that have added additional certifications since the last issue of Crops & Soils. The list is alphabetized by state/province and by surname within each state/province.

Canada

Jarvis, Chad, Camrose, AB (CCA-PP)
Baete, Amanda, Swan Lake, MB (CCA-PP)
Chevalier, Randy, Tilbury, ON (CCA-ON)
Gagnier, Jerome, Rockland, ON (CCA-ON)
Gowan, Brian, Waterford, ON (CCA-ON)
Gowan, Susan, Waterford, ON (CCA-ON)
Green, Tina, Monkton, ON (CCA-ON)
Pearson, Andrew, Thamesford, ON (CCA-ON)
Schneider, Christina, Palmerston, ON (CCA-ON)
Vos, Robert, Alvinson, ON (CCA-ON)
Wise, Gregory, Mitchell, ON (CCA-ON)
Wright, W. Timothy, Guelph, ON (CCA-ON)
Zettler, Jonathan, Alliston, ON (CCA-ON)

United States

Adams, Zachry, Newton, AL (CCA-AL)
Roberts, Justin, Auburn, AL (CCA-AL)
Everett, Scott, McCrory, AR (CCA-AR)
Stratton, Mark, Stuttgart, AR (CCA-AR)
Baird, Joe, Merced, CA (CCA-CA)
Battig, Nathaniel, Modesto, CA (CCA-CA)
Battig, Gabriel, Corcoran, CA (CCA-CA)
Davis, Nicholas, Madera, CA (CCA-CA)
Falcon, Mathew, Turlock, CA (CCA-CA)
Freitas, Justin, Madera, CA (CCA-CA)
Heinrich, Aaron, Modesto, CA (CCA-CA)
Hornor, David, Reedley, CA (CCA-CA)
Huerta, Pedro, Tulare, CA (CCA-CA)
Huffman, Michael, Galt, CA (CCA-CA)
Jacobsen, David, Madera, CA (CCA-CA)
Johnson, Jerry, Vero Beach, FL (CCA-FL)
Johnson, Larry, Orlando, FL (CCA-FL)
K_PREDIction
McDonald, Charles, Flat Rock, IL (CCA-IL)
McInnes, Brian, Monticello, IL (CCA-IL)
Nettleton, Jason, Lawrenceville, IL (CCA-IL)
Reep, Benjamin, Paxton, IL (CCA-IL)
Rincker, Rusty, Vincennes, IN (CCA-IN)
Ruppel, Richard, Tallula, IL (CCA-IN)
Sneed, Chris, Wapella, IL (CCA-IN)
Taylor, Lance, Morton, IL (CCA-IN)
Goebel, Darren, Evansville, IN (CCA-IN)
Misch, Andrew, Monticello, IN (CCA-IN)
Roberts, Marc, Crawfordsville, IN (CCA-IN)
Westhoffen, Andrew, West Lafayette, IN (CCA-IN)
Hendrickx, Joel, Auburn, KY (CCA-KY)
Ritchey, Edwin, Lexington, KY (CPSS)
Ahrenholz, Aaron, Clara City, MN (CCA-MN)
Anderson, Kristopher, Wheaton, MN (CCA-MN)
Carlson, Kevin, Pine City, MN (CCA-MN, CPag)
Demars, Christopher, Maple Lake, MN (CCA-MN)
Erthum, Bradley, St Charles, MN (CCA-MN)
Krohn, Benjamin, Worthington, MN (CCA-MN)
Linder, Kate, Easton, MN (CCA-MN)
Moldenhauer, Raymond, Long Prairie, MN (CCA-MN)
O’Malley, Jared, Kensington, MN (CCA-SD)
Paradis, Curtis, Balaton, MN (CCA-MN)
Peeters, Michael, New York Mills, MN (CCA-MN)
Rygge, Matthew, Byron, MN (CCA-MN)
Samyn, Michael, Wabasso, MN (CCA-MN)
Swenson, Rick, Fergus Falls, MN (CCA-MN)
Toothaker, Cody, Fairmont, MN (CCA-MN)
Wisecres, Tracey, Fairmont, MN (CCA-MN)
Further, Michael, Westboro, MO (CCA-IA)
Meyer, Christopher, Marshall, MO (CCA-IA)
Schmitt, Ryan, Kansas City, MO (CCA-MO)
Poiritz, Nicholas, Sheridan, MT (CCA-RM)
Wills, James, Buffalo, MT (CCA-RM)
Cherry, Henry, Washington, NC (CCA-NC)
Fowler, Daniel, Weldon, NC (CCA-NC)
Mitchell, Charles, Youngsville, NC (CCA-NC)
Parker, Jacob, Columbia, NC (CCA-NC)
Tankard, William, Belhaven, NC (CCA-NC)
Tart, Kim, Clinton, NC (CCA-NC)
Brant, Joshua, Rugby, ND (CCA-ND)
Brekhus, Michael, Fargo, ND (CCA-ND)
Faul, Kendon, McClusky, ND (CCA-ND)
Hart, Charles, Pembina, ND (CCA-ND)
Iverson, David, Fortville, ND (CCA-ND)
Knutson, Larry, Oakes, ND (CCA-ND)
Zahradka, Nicole, Lankin, ND (CCA-ND)
Christensen, G. Ken, Grand Island, NE (CCA-NE)
Franzen, David, Axtell, NE (CCA-NE)
Holsing, Kristopher, DeWitt, NE (CCA-NE)
Holsten, Jason, Upland, NE (CCA-NE)
Holmeister, Michael, Dorchester, NE (CCA-NE)
Karr, Brant, Oxford, NE (CCA-NE)
Romshack, Scott, Bellwood, NE (CCA-NE)
Schlaffer, Pamela, Kearney, NE (CCA-NE)
Swanson, Darrin, Holdrege, NE (CCA-NE)
Dixon, Lindsay, Yerington, NV (CCA-ND)
Barker, Jonathan, Branchport, NY (CCA-NR)
Holmes, Robert, Malone, NY (CCA-NR)
Mcfetridge, Crawford, Bellona, NY (CCA-NR)
Paige, Bret, Cohocton, NY (CCA-NR)
Wimmer, Timothy, Canastota, NY (CCA-NR)
Martin, Neil, Marietta, OH (CPSS)
Springer, Daniel, Mt. Vernon, OH (CCA-OH)
Walker, Ross, Dunkirk, OH (CCA-NW)
Williams, J. Joseph, Salem, OR (CCA-CA, CPag)
Pollock, Keith, Adrian, PA (CCA-PA)
Enerson, Eric, Watertown, SD (CCA-SD)
Eaton, Thomas, Williston, VT (CCA-ND)
Waterman, Roger, Middlebury, VT (CCA-ND)
Bair, Kyle, Moses Lake, WA (APSS)
Darling, Nancy, Olympia, WA (CPSS)
Calvert, Jeffery, Hazel Green, WI (CCA-WI)
Miller, Kevin, Elkhorn, WI (CPSC, CPSS)
Ruzich, Austin, Aurora, WI (CCA-WI)
Soley, Michael, Adams, WI (CCA-WI)
n Frank Capra’s *It’s a Wonderful Life* (1946), Clarence the angel was dispatched to show a distraught George Bailey how much worse things would have been had he not been born. Once Clarence’s good deeds put George on a renewed path to overcome the greedy Mr. Potter’s efforts to close his family’s savings and loan business, Clarence was given the ultimate reward: his wings.

Our hardworking industry faces a number of Potter-like characters miscasting agriculture’s good works, so it’s a good thing agriculture has its own “Clarence” in Mark Riehl, a CCA employed by Mycogen Seeds at Dow AgroSciences and volunteer for the CropLife Ambassador Network (CAN). As a CAN volunteer, Riehl knows the good that agriculture does for America today, and he’s willing to show others. Riehl says that with only 2% of the population having direct contact with food production, “CAN is our best opportunity to influence people about agriculture” before the Mr. Potter’s of our country “tell us how farming is and how they perceive it to be.”

CAN is a free program open to all in the agricultural industry, and it regularly places volunteers in the agricultural industry into elementary schools across the Midwest. Why does Riehl volunteer his time with CAN?

“It is important there be a voice for agriculture since farmers represent such a small part of our population,” Riehl explains. “It’s important that our children hear about it from those of us actually involved in agriculture.”

Our current methods and technology in agriculture do a great deal to avoid turning available farmland into the next “Potter’s Field of Bedford Falls.” Participating in CAN allows Riehl to talk about many different aspects of agriculture.

“We discuss interactions among agriculture, new home development, and new neighbors. [We explain] how important it is to be a good neighbor and adopt good cultural practices...[and] how no-till and filter strips work to prevent soil erosion and keep water clean.”

Riehl says participating in CAN has helped improve his public speaking skills and ability to talk confidently about the positive aspects of agriculture.

“My ability to speak in public has improved each and every time I do a program....I feel more comfortable talking to anyone about the benefits of agriculture. Like everything, the more you practice the better you get. I’m more confident in keeping consumers informed of what today’s farmers are providing for them and how efficient they have become without sacrificing food safety.”

Efforts such as Riehl’s show what vision is needed for agriculture and what can be done by all in the industry. Riehl knows first hand how to work his outreach efforts into a busy schedule.

“It can easily be part of your schedule if you want to be part of the solution. The rewards are well worth it. For me, it’s a matter of priority and principle since I feel like this education needs to be done. The only skills you need are a willingness to try and learn, along with a can-do attitude. Children look to us as authority figures. Our background and involvement in agriculture is greater than theirs, so we are bound to be successful. Children bring up misinformation they have heard, so in the farming context, ‘Every time you hear a pig squeal, an ambassador sets the record straight.’ ”

CAN is a network of agronomic professionals committed to generating public awareness and appreciation for American agriculture. For more information, email Janet Braun at janet@maca.org or call 800-625-2767.
SOIL! Get the Inside Scoop

Get kids excited about the living world of soil with this new publication from the Soil Science Society of America.

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