Tweeting in the field
How social media is changing the way crop advisers communicate
Instruments Designed with Crop Scientists in Mind

CID Bio-Science
Portable Instruments for Precision Plant Measurement

Visit us at www.cid-inc.com
Feature

Are you using social media in your business? If you’re not using it, others are, including your clients. To understand better the changes in how social media and digital communications have affected the business of agriculture, Crops & Soils magazine spoke with six professionals in the industry.

12 Certification | Understanding changes to the CPAg program. Plus CEU opportunities in Cincinnati this fall.


28 New Research | First-year corn after alfalfa often requires no fertilizer N.

31 Continuing Education | Earn 2 CEUs in Nutrient Management with the following self-study CEU: Soil P and K following RTK-guided broadcast and deep-band placement in strip- and no-till.

Cover: iStockphoto/shotbydave.
Tweeting in the field

How social media is changing the way crop advisers communicate

Are you using social media in your business? If you’re not using it, others are, including your clients. To understand better the changes in how social media and digital communications have affected the business of agriculture, *Crops & Soils* magazine spoke with six professionals in the industry.

By John Morgan
*Crops & Soils* magazine contributing writer
The concept of social media for many is just that, a concept. It brings with it funny terminology like "tweeting" and "friending," and it can feel like another world with another language.

Add to this the fact that social media spread so fast and was adopted so quickly that it was easy to get left behind. What's also interesting is that it has been possible, for now anyway, to live one's life without social media. The question going forward is whether it will be possible to be successful professionally without it, particularly knowing that if you're not using it, others are, including your clients.

To understand better the changes in how social media and digital communications have affected the business of agriculture, *Crops & Soils* magazine spoke with six professionals in the industry. The six stories share similarities, but they are unique in how each professional has adapted social media to his or her own needs. If you're new to social media—Twitter, blogging, and Facebook, in particular, see the sidebar for a summary of each.

**Proactive, not reactive**

*Kelly Robertson*, farmer, adviser, blogger (Benton, IL)

*Business site and blog*: www.precisioncropservices.com

*Farm site and blog*: www.krfarm.net

On an average day you might find Kelly Robertson, a farmer and adviser, planting fields, fixing equipment, advising other farmers, or blogging and tweeting about all of...
this and more. In fact, he sets his tractor on auto-steer, pulls out his smartphone, and does a few of the above simultaneously. That’s right, plowing, blogging, tweeting, and texting.

“I got into it because I wanted to tell my story about what I was doing and what was going on in my part of agriculture,” he explains. “Not only to the people I work with or work for but also to the non-ag community that stop by and saw my site.”

Robertson stresses that it’s just like any other ag-related technology that comes out and makes life easier and business more effective. In fact, he has saved real money following blogs and tweets that alert him to buy fertilizer and seed at their lowest prices.

“Suppliers and dealers, plus farmers, put that information out all the time. And it’s free! And so the massive amount of information that’s coming out and is floating in cyberspace that allows me to be on top of the game is incredible,” he exclaims.

Robertson adds that as powerful as it is, these tools are actually pretty easy to learn, noting that if you use something like Microsoft Word and know how to cut and paste and such, then you can do social media.

“Anybody who says the technology is too hard to learn, I just laugh, because if you’re already typing an email, that’s basically a blog—you’re just doing it for one person. And if you’re doing text messaging, that’s already Twitter—you’re just doing it for one person.”

In Robertson’s mind, using social media is non-negotiable. He explains that the business is too dependent on getting critical information in a timely manner to not use social media, a perfect delivery system for information like warnings about weather and pests or advice on when to buy fertilizer or seed.

“And so any business—farm business or agribusiness—that thinks this is all about Britney Spears is just wrong because they’re so far behind the curve now on where they’re getting their information and how they get their information.”

A communication revolution

Owen Taylor, AgFax Media (Brandon, MS)

Website: http://agfax.com

“Farmers are like everybody else in terms of business, in terms of industry, they’ve got to have technology. And everything they do is going to pretty much parallel what society does,” explains Owen Taylor, who owns AgFax Media with his wife Deborah Ferguson.

AgFax is an agriculture news company that has been in the agriculture news business for decades and has adapted with technology, from sending out printed newsletters via fax, to pdf newsletters on web sites, to the use of blog-based web sites, Twitter, and Facebook.

It’s important to stress here, too, that you can go online, sign up for a blog or Twitter account, and be following blogs and tweets and even blogging and tweeting yourself in a matter of minutes. It’s also possible (and very easy in some cases) to set things up in a way that your Facebook page is updated and a tweet is sent every time you put a note on your blog. The benefit of this is that many folks will see this on their mobile devices instantly. And Taylor stresses that farmers are just like everyone else—soon a smartphone will be in pretty much every farmer’s pocket. So if you tweet about a possible frost issue or an article you just read about fertilizer prices, your clients and other “followers” will see this seconds after you post it.

“What we’re looking at right now is the fact that it’s not so much saying, ‘Well I know I’m reaching these specific people,’ Taylor continues. “It’s that you have as many channels going as you can possibly support. And so through those channels, you’re going to reach some
Social Media 101

Facebook is probably best misunderstood as the place people go to gossip and giggle amongst themselves. But it’s far more than that. It allows a person to create a community of “friends,” to post information, photos, videos, etc., and communicate about it all, posting notes and replying to posts. “Friends” can be relatives, colleagues, clients, and others and you approve them when they request to follow you. Businesses often use Facebook, too, sometimes in place of having a website. The application of Facebook to the crop adviser would be to connect with farmers, other crop adviser colleagues, supply companies, etc., to post notes on the fly while in field, including photos and video.

A blog is an online journal or column—usually focused around a specific topic—whose entries are posted publicly. And so a CCA might have a blog about growing fruit in the upper Midwest and he or she might post something on the blog each week of the year relevant to that topic—perhaps focusing more on general education in the off season. Others can subscribe and can attach comments to the blog post (which the blog author approves prior to posting). Popular free blog websites include Blogspot and Blogger, along with many others.

So you can very easily cover several bases at once, connecting with many more people in your network, depending on what form they favor. And this is the essence of social media. You’re connecting with lots of different people in the ways they prefer, which is different from using a website.

“There’s no such thing as, ‘I’m going to have a beautiful, well-managed website and a lot of content on it. And I’m going to send out an announcement, and people are going to find it, and they’re going to bookmark it and come back to it every couple of days to see what new and exciting information I have.’ It doesn’t work like that. You’ve got to keep pushing people to come to your content,” Taylor advises.

For the CCA, “pushing” means providing information on a regular basis about relevant topics. This pushing is via texts, tweets, emails, and Facebook posts.

“They’ve got to stay involved on an ongoing basis,” he suggests, “even if it’s nothing more than sending something out once a week that says here are three items that I found on the internet this week that I think relate to our soil types or our herbicide issues, things along those lines. You’re essentially saying to them, ‘I’m trying to find the best possible information, I’m out there all the time looking, here’s some things that you should pause and take a look at.’
Extension–consultant interaction

Angus Catchot, extension entomologist, Mississippi State University

Blog: www.mississippi-crops.com
Twitter: https://twitter.com/#!/acatchot

The idea is that social media enables you to more efficiently find information and take advantage of it, not simply to be a provider of it. For the consultant, this means staying in touch with what’s coming out of places like extension offices.

“Honestly, I think that we’re getting to the people who make the decisions better than we’re getting to the farmers,” notes Angus Catchot, an extension entomologist at Mississippi State. “So, for instance, if you’re a farmer and you farm 5,000 acres in the Mississippi delta, you may not necessarily be involved in Facebook and Twitter and all of this stuff, but I can almost bet you that somebody who’s responsible for helping you make management decisions—like your ag consultant or a retailer or your industry rep, whoever’s helping you—they are plugged in. So it’s somewhat misleading to just say there’s not a bunch of farmers that are plugged into this. They are indirectly, even whether they know it or not.”

Catchot and his colleagues worked with AgFax to design and launch their own blog-based version of the longstanding Mississippi Crop Situation, and he credits Owen Taylor for getting them moving. Catchot admits that there’s a bit of learning curve, but he stresses that if he can do it, anyone can. And the benefits of being able to get information out quickly and efficiently are too much to ignore.

“If you have a Twitter account, you get those headlines that are posted in our blog just as soon as they’re posted because it tweets them automatically once somebody posts them,” Catchot explains. “So you know instantly what’s going on. Plus, I’ve found that we’re more likely to post a 140-word or less quick fact almost daily on what we’re seeing here.”

Tuning into Twitter

Deb Campbell, CCA and owner of Agronomy Advantage (Dundalk, Ontario)

Twitter: http://twitter.com/#!/DCHighlander

CCA Deb Campbell works hard to find relevant information for her farmers and get it to them quickly.

“I use Twitter daily,” Campbell explains. “I’m not necessarily one communicating outwardly daily, but I follow quite a few farmers and also quite a few extension and university notes and tweets so that I’m staying connected to research articles and the news of the day.”

Campbell notes that it’s all about time and being the most efficient she can be, realizing that her clients are busy and it’s her job to keep them informed.

“Everybody’s busy and everybody’s going 20 different directions every day, and this is immediate. It’s right there in your pocket. You can stop for a coffee and suddenly you have the latest news in cropping and planting, etc. It’s all right there in your pocket brought right to you. My ability to bring them that information is the power of my business. That’s what drives my business.”

Campbell has found that she really has to be efficient with getting her clients what they need in a timely manner and filtering for them the information that she is monitoring on a daily basis.

“I do a lot of crop scouting, and I record everything on an iPad,” Campbell notes. “I have an app that I use that records everything that I’m seeing; I use Google Earth Maps within that document on weak patches or drainage issues. And by the time I leave the field, it’s all summarized and detailed and emailed directly to the farmer who...
Social Media 101

Why not a website? Well, it may sound hard to believe, but websites are already old hat. They are often simply online brochures and the information is static, so the content gets stale. It is possible to have a website that contains both a blog and a Twitter feed, making it much more dynamic.

The two main advantages of social media and the reason for its success are that it’s instantly updatable by anyone (don’t need to be tech savvy) and it allows for a discussion. You could open a Twitter account and send out a Tweet in two minutes—perhaps a few minutes more for a blog.

The CCA program and the Societies (ASA, CSSA, and SSSA) have a number of social media sites. Here are some that might be of interest to you:

- **CCA Facebook:**
  www.facebook.com/CCA.certifiedcropadviser
- **CCA Blog:**
  http://certifiedcropadviser.wordpress.com
- **Wired for Soils Blog:**
  http://wiredsoils.blogspot.com/
- **Twitter:**
  www.twitter.com/asa_cssa_sssa

For some eyes only

Howard Brown, CCA, CPAg, and manager of agronomic services, GROWMARK (Bloomington, IL)

Twitter: http://twitter.com/#!/HBrownGMK (Protected)

CCA and CPAg Howard Brown has been in the business a long time and is admittedly a late adopter when it comes to social media. But he has found the short and sweet nature of Twitter to be a perfect application for his work. He also values that he can protect his Twitter page so that only those he wants reading his tweets can do so.

“It’s a secured site,” Brown explains. And since I’m a regional cooperative, I try to minimize the number of competitive companies that read my tweets because that may give them the competitive edge to what we’re telling our people and our farmers.”

He notes that because he works in a competitive environment, he doesn’t necessarily want to share his information with competitors.

“That’s the other thing about social media. You can say too much to too many people. And actually instead of enhancing your position, it could diminish it because you’re just sharing with everybody if you’re not careful,” Brown cautions.
“I would say most of the tweets that I put out are utilized best by the salespeople who are working with farmers. So they’re the ones,” he explains.

Brown started using Twitter during the past year. What is particularly useful to him is how quickly and easily he can relay information to those following his tweets.

“Near term, it’s going to serve best by the quickness of the information distribution,” Brown suggests, adding that this is the crucial change from how he used to do things.

“So if I were excited about something I would normally wait until I got home late at night and then email everybody that I want about my topic. By the time I get home, and by the time I sit down, my enthusiasm level is starting to wane. I may be tired and I say, ‘Oh I’m not going to send that out tonight, I’ll wait until another day.’ But now I can stop along the road or I can be in a restaurant and just tweet away and capture that level of enthusiasm. And that also allows [my audience] to respond in real time—they don’t have to wait another day.”

Facebook on the farm

Orvin Bontrager, CCA, CPAg, and education director, Servi-Tech (Aurora, NE)


Facebook: To access Bontrager’s Facebook page, you would need to send a friend request

Globally, the major player in how people communicate and connect with each other is Facebook. And CCA and CPAg Orvin Bontrager, a 34-year veteran consulting agronomist, is enthusiastically on board.

“I got involved with it a couple years ago—I have grown kids away from home and they quit emailing me! I figured out that when I go to Facebook, I can find out what they’re doing and we communicate,” Bontrager explains, adding that he and his kids get along great; it’s just that they weren’t using compatible communication channels. They had moved on in that regard. Nowadays, it’s a rare day that he isn’t interacting with Facebook in some way.

“It was just interesting to get on Facebook and be able to post pictures and share pictures with them and communicate through Facebook. Then I started friending other people, my colleagues, some college friends I had lost track of. And I have a lot more farmers on it now, too, especially the younger ones,” Bontrager notes.

He does admit that while there are farmers on Facebook, he doesn’t necessarily interact with them a lot that way. He said it’s a great way to connect with other consultants, though, to compare notes and learn from others, particularly others in the profession.

“I probably get more comments from other colleagues that are crop consultants than I do the growers typically. Not only colleagues within our own company,” he explains.

Social media: staying ahead of the curve

These six agriculture professionals provide an interesting look at what social media is really all about—connecting with others. And not only does it allow for information to be exchanged instantly, it also fosters community, making it possible to compare notes and share information as part of an ongoing discussion.

As much as Kelly Robertson warns that if you’re not on board, you’re behind, he also encourages that it’s fairly each to implement and that it’s essentially free. The bottom line for him, however, is that it is the perfect tool for his business.

“Now you are educating in a proactive manner and not making decisions in a reactive manner after the fact. And the money to be made in agriculture is to be proactive, not reactive,” Robertson concludes. “And if I get the information three hours too late, I’m trying to keep from losing money, or from losing yield, instead of figuring out how to keep it or increase it.”
Currently, there are about 600+ Certified Professional Agronomists (CPAg). The CPAg program is actually older than the CCA program, but the CCA program grew to be much larger primarily due to the agriculture industry getting behind it 20 years ago. CPAg started in 1977 as part of the American Registry of Certified Professionals in Agronomy, Crops, and Soils (ARCPACS), which no longer exists, but CPAg has always been connected to the American Society of Agronomy (ASA) like CCA. CPAg targeted B.S. degree agronomists but did not provide the option for someone who had the experience but did not have the formal college level education to become certified; hence, CCA was born to serve both those with degrees and those without degrees.

In 2012, CPAg was moved into the ICCA program infrastructure as a specialty certification. There were no changes to the CCA program, and someone can still be a CCA without being a CPAg. But to become a CPAg, you first need to be a CCA. It is similar to someone earning a B.S. degree and then earning a M.S. You have to meet the requirements for CCA and then meet the additional requirements in experience, education, and references to become a CPAg.

Why was this done? Primarily, the changes were made to eliminate an unintended competitive situation between two programs that serve a very similar audience, to gain efficiencies, and be more effective in promoting the programs. The majority of CCAs (about 85%) have a B.S. degree in agronomy or closely related field, and in most cases, they could qualify for CPAg. However, it would have been unproductive to just shift people from one program to another and unwise since CCA has a much stronger brand. Connecting them in a step-wise process allows individuals to decide what is best for them—CCA only or CCA and CPAg. It also brought two programs together as a single agronomy certification process under ASA, combining resources to be more effective. We are still implementing some of the changes and updating the supporting systems, but that should all be completed in the coming months. Promotions and communications are catching up and will be increasing as we move forward.

The current CPAg application requirements were not changed except that someone now needs to be a CCA first. The total number of CEUs required to maintain the CPAg designation increased to 50 and the CCA CEU requirements were merged with the CPAg CEU requirements to create the new standards that are outlined below.

New CPAg CEU requirements

Content-based category requirements for CPAg CEUs now include:

- **Nutrient Management**—minimum 5 CEUs
- **Soil and Water Management**—minimum 5 CEUs
- **Integrated Pest Management**—minimum 5 CEUs
- **Crop Management**—minimum 5 CEUs
- **Professional Development**—minimum 5 CEUs (economics, computer skills, marketing skills, time/organizational management, business courses, presentation skills, relationship development, etc.)
- **Professional Service**—minimum 5 CEUs. This includes the old CPAg author/educational materials and community service categories. The “service” must be related to the agronomy profession including serving on professional boards and committees, city/town/county boards/committees. The “education” materials must be about agronomy and directed towards those aspiring to become agronomists or who are agronomists, including scientific papers, popular articles, and educational materials. By the way, writing articles for *Crops & Soils* magazine is a good way to earn Professional Service CEUs. If you’re interested, contact Matt Nilsson at mnilsson@sciencesocieties.org.
• **Professional Study**—no minimum. This includes the old CPAg self-directed study category [Scientific journals (reported by the article where 1 CEU = about 2,500 words), books, and videos (2 x the run time = total minutes for CEUs)].

The types of CEUs for CPAg’s include:

- **Board-approved CEUs:** Of the 50 total CEUs, a minimum of 20 must be CCA board approved. These are professional meetings, field days, seminars, workshops, etc., that are real-time events delivered face to face or online. How are board-approved CEUs generated? The vendor submits a CCA CEU application, which is then reviewed and, if approved, is assigned CEUs. You attend and sign your name to the roster or scan your card and the CEUs are entered into your record. You are probably already familiar with this type of CEU since it is in use for both CCA and CPAg.

- **Self-reported CEUs:** These are the same types of CEUs as board approved except they have not been reviewed by a CCA board and you can self-report them using the online form. The self-reported CEUs also include the new categories of Professional Development, Professional Service, and Professional Study and you use the same online-reporting form for those as self-reported professional meetings.

- **Board-approved self-study CEUs:** These are written articles, videos, and/or online programs that are not real time and include a quiz. There is a maximum of 20 board-approved self-study CEUs allowed during your two-year cycle. They are commonly found in *Crops & Soils* magazine or on the website and are not the same as self-directed study CEUs.

Many of you have already read about these changes since we have sent at least two letters via mail and/or email to every CPAg and have written about the changes over the last 18 months; however, we also realize that we need to continue to explain and communicate these important changes.

This article will also be posted to our blog at [http://certifiedcropadviser.wordpress.com](http://certifiedcropadviser.wordpress.com), so if you’d like to make a comment about the changes, please do so there. I realize some may not like or approve of the changes and may want to let us know. The ICCA and CPAg boards discussed potential changes for several years before coming to this decision, so it was not done in haste and was done to hopefully add more value to both programs. 

---

**Certification update**

**Mexico joins the International CCA Program**

The CCA Program now covers all of North America. The CCA–Mexico program held its pilot exam in May with 14 agronomists attending. We intentionally keep the pilot exam small in order to test the systems. Everything worked well and we are working with the Mexico CCA board to establish the supporting infrastructure.

Mexico is planning on having the first public offering of the exam in August with a goal of 100 examinees. For more details and to follow the Mexico program, visit [www.certifiedcropadviser.org/mexico](http://www.certifiedcropadviser.org/mexico).

Mexico becomes the fourth country to join the International CCA program (ICCA) with the United States, Canada, and India. Argentina is working on its performance objectives and hopes to offer the exam in the coming year.

**CCA blog**

Recently, we started a CCA Blog: [www.certifiedcropadviser.wordpress.com](http://www.certifiedcropadviser.wordpress.com). We hope to engage you in discussions about what is going on in production agriculture as well as provide information about the certification programs. Future posts will discuss herbicide-resistant weeds, drought, CPAg certification, U.S. farm bill, and the 20th anniversary of the CCA program.

**CCA promotions**

The ICCA program launched a promotions and communications campaign about a year ago. This resulted in the [ThatsSoundAdvice.com](http://www.thatssoundadvice.com) website along with marketing materials to support you in marketing yourself as a certified professional as well as to enhance the marketing efforts of the local CCA boards. ICCA hired a marketing firm to do the branding research, web page, and materials development. Originally ThatsSoundAdvice.com served three audiences—farmers, employers, and CCAs. The website will continue to serve the farmer and employer audiences and include the marketing materials for CCAs to use, but the program support items that CCAs use in being certified will remain on the CCA web site (things like checking and reporting your CEUs, agronomy information, self-study CEUs, etc.). The website will also be linked from the CCA home page, so you can now go directly to ThatsSoundAdvice.com or through the www.certifiedcropadviser.org website.
Newly certified

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

**Canada**

**Alberta**

Cowan, Marie, Oyen, AB (CCA-PP)
Farwell, Lance, Drumheller, AB (CCA-PP)
Hagen, Mark, Marwayne, AB (CCA-PP)
Hilhorst, Michael, Wetaskiwin, AB (CCA-PP)
Holt, Carol, Bashaw, AB (CCA-PP)
Markert, Danielle, Magrath, AB (CCA-PP)
Simpson, Elizabeth, Lamont, AB (CCA-PP)
Williamson, Jackie, Milo, AB (CCA-PP)

**British Columbia**

Martin, Bradley, Cranbrook, BC (CCA-PP)

**Manitoba**

Brown, Cody, Portage la Prairie, MB (CCA-PP)
Johnston, Garth, Virden, MB (CCA-PP)
Melnychenko, Jennifer, Grandview, MB (CCA-PP)

**Ontario**

Cruickshank, Travis, Ripley, ON (CCA-ON)
Migchels, Jason, Watford, ON (CCA-ON)
Moore, Todd, Blackstock, ON (CCA-ON)
Ribey, Margaret, Guelph, ON (CCA-ON)
Stephan, Burns Arthur, Simcoe, ON (CCA-RET)

**Saskatchewan**

Attema, Alysa, Moose Jaw, SK (CCA-PP)
Crawford, Allan, Tisdale, SK (CCA-PP)
Fornwald, Blaine, Lampman, SK (CCA-PP)
Hazlewood, Shayla, Tisdale, SK (CCA-PP)
Hiduk, Ashley, Jedburgh, SK (CCA-PP)
Hood, Jason, Carrot River, SK (CCA-PP)
Johnson, Eric, Lampman, SK (CCA-PP)
Mayerle, Ian, Tisdale, SK (CCA-PP)
Wiens, David, Kelfield, SK (CCA-PP)

**United States**

**Alaska**

Anderson, Jodie, Palmer, AK (APSS)
Fox, Scott, Yuma, AZ (CCA-CA)
Riley Jr., Patrick, Yuma, AZ (CCA-CA)

**California**

Baker, William, Temecula, CA (CCA-CA)
Bay, Darren, Springville, CA (CCA-CA)
Blake, Jeffrey, Glenn, CA (CCA-CA)
Chapin, James, Escalon, CA (CCA-CA)
Dingus, E. Patricia, Moorpark, CA (CCA-CA)
Garcia, Eduardo, Fillmore, CA (CCA-CA)
Gonzales, Nick, Woodland, CA (CCA-CA)
Grissom, Derrick, Salinas, CA (CCA-CA)
Herbert, Hans, Yuba City, CA (CCA-CA)
Iliff, Stephen, McArthur, CA (CCA-CA)
Johnson, Martin, Salinas, CA (CCA-CA)
Krause, Tom, Chico, CA (CCA-CA)
Lopez Jr., Elias, Santa Maria, CA (CCA-CA)
Lupien, Nick, Geyserville, CA (CCA-CA)
McClaskey, Kevin, Soledad, CA (CCA-CA)
McCcosker, Kevin, Walnut Grove, CA (CCA-CA)
Mohler, John, Salinas, CA (CCA-CA)
Morales, Ricardo, Guadalupe, CA (CCA-CA)
Nelson, Isaac, Bakersfield, CA (CCA-CA)
Panziera, Mathew, Salinas, CA (CCA-CA)
Penza, Paul, Oxnard, CA (CCA-CA)
Rossow, Silas, Merced, CA (CCA-CA)
Schroeder, Casey, Hughson, CA (CCA-CA)

**Colorado**

Rossman, Larry, Eaton, CO (CCA-CO)
Thompson, Joe, Walsh, CO (CCA-CO)

**Florida**

Atwood, Ryan, Tangerine, FL (CCA-FL)

**Georgia**

Heard, Jason, Camilla, GA (CCA-GA)

**Iowa**

Billerbeck, Kassie, Arlington, IA (CCA-IA)
Brennan, Ken, Terril, IA (CCA-IA)
Burns, Elizabeth, Union, IA (CCA-IA)
Loftus, Marshal, Algona, IA (CCA-IA)
Von Glan, Nicholas, Algona, IA (CCA-IA)

**Idaho**

Paul, Craig, Twin Falls, ID (CPSS)

**Illinois**

Kiefer, Robert, Mc Leansboro, IL (CCA-IL)
McKee, Eric, Macomb, IL (CCA-IL)
Merryman, Joshua, Champaign, IL (CCA-IL)
Walsh, Thomas, Tuscola, IL (CCA-IL)

**Indiana**
Moore, Alvin, Kendallville, IN (CCA-RET)
Porter, Timothy, Indianapolis, IN (CPSS)

**Kansas**
Andres, Joshua, Whitewater, KS (CCA-KS)
Bland, Greg, Lucas, KS (CCA-KS)
Olson, Jeremy, Everest, KS (CCA-KS)
Richard, Casey, Miltonvale, KS (CCA-KS)

**Kentucky**
Dublin Jr., Tommy, Mayfield, KY (CCA-KY)
Dumbacher, Joseph, Upton, KY (CCA-KY)

**Louisiana**
Bergeron, Paul, New Iberia, LA (CCA-LA)
Buller, Blake, Welsh, LA (CCA-LA)

**Michigan**
Brown, Scott, Hillsdale, MI (CCA-MI)
Gentner, Eric, Ruth, MI (CCA-MI)
Heck, Christopher, Blissfield, MI (CCA-MI)

**Minnesota**
Askegaard, Benjamin, Moorhead, MN (CCA-ND)
Bryson, Erik, Alden, MN (CCA-MN)
Dunn, Michael, Pielz, MN (CCA-MN)
Folland, Kris, Halma, MN (CCA-ND)
Kuehner, Kevin, Preston, MN (CCA-MN)
Miller, Adam, Dawson, MN (CCA-MN)
Pederson, Travis, East Grand Forks, MN (CCA-ND)
Schmidt, Ben, Cottonwood, MN (CCA-MN)

**Missouri**
Collier, Tyler, Charleston, MO (CCA-MO)
Schreiner, Matthew, Salisbury, MO (CCA-MO)
Shutt, Kelly, Natchez, MO (CCA-LA)
Whitacre, Robert, Lucerne, MO (CCA-MO)
Wilhelm, Kurt, St. Louis, MO (CCA-MO)
Young, Todd, Bernie, MO (CCA-MO)

**Montana**
Lang, Mike, Malta, MT (CCA-RET)

**North Carolina**
McGee, Christopher, Raleigh, NC (CPSS)
Prince, Cameron, Maxton, NC (CCA-SC)

**North Dakota**
Beckley, Brian, Fessenden, ND (CCA-ND)
Bratvold, Jacob, Sherwood, ND (CCA-ND)
Kemnitz, Sheri, Davenport, ND (CCA-ND)
Kramer, Toby, McClusky, ND (CCA-ND)
Okke, Kyle, Leeds, ND (CCA-ND)
Pederson, Jeremy, Minot, ND (CCA-ND)
Peterson, Ross, Bismarck, ND (CCA-ND)
Schmaltz, Gregory, Velva, ND (CCA-ND)
Sickner, William, Williston, ND (CCA-ND)
Vetter, Michelle, Harvey, ND (CCA-ND)

**New Mexico**
Ganta, Reddy, Santa Fe, NM (CCA-TX)

**New York**
Barry, Patrick, Ithaca, NY (CCA-NR)
O’Brien, Megan, Greenwood, NY (CCA-NR)
Saeli, Christine, Fultonville, NY (CCA-NR)

**Ohio**
Rethmel, Wade, Sherwood, OH (CCA-OH)
Undercoffer, Jason, Edison, OH (CCA-OH)

**Oklahoma**
Rieckhoff, Matthew, Coweta, OK (CCA-OK)

**Oregon**
Hartmann, Justin, Portland, OR (CPSS)

**Tennessee**
Trail, Adam, Beechgrove, TN (CCA-TN)

**Texas**
Davis Jr., James, East Bernard, TX (CCA-TX)

**Wisconsin**
Kampen, David, Rio, WI (CCA-RET)
Miller, Cody, Fremont, WI (CCA-WI)
Rankin, Nicholas, Beloit, WI (CCA-WI)
Wilkens, Steve, Random Lake, WI (CCA-IL)

**Wyoming**
Lilly, Kyle, Laramie, WY (APSS)
Career, CEU opportunities at the Cincinnati Annual Meetings

This fall, join the American Society of Agronomy (ASA), Crop Science Society of America (CSSA), and Soil Science Society of America (SSSA) at the 2012 International Annual Meetings, October 21–24, in Cincinnati, OH, under the theme, “Visions for a Sustainable Planet.” View the program, search the schedule, or browse by CEUs, dates, and Section/Division at: www.acsmeetings.org/program.

Earn CEUs

Approximately 3,000 poster and oral papers will be presented in sessions throughout the week, covering such topics as nutrient management, soil and water management, integrated pest management, crop management, and professional development. New this year: Papers that feature board-approved CEUs will be posted to the Annual Meetings website and will be incorporated into the abstract search.

Certified professionals can attend paper sessions and self-report their CEUs following the meeting. CCAs may only receive CEUs for structured oral presentations; open poster sessions do not qualify for CCA CEUs. Self-reporting forms are available online at www.certifiedcropadviser.org and www.soils.org/certifications.

Meeting highlights

Certified professionals working in the agronomic, crop, soil, and related sciences can learn about the latest advances in production agriculture, network with colleagues, view products and services in the exhibit hall, and attend professional development programs. They’re also encouraged to attend the business meetings of ASA Sections and Communities and CSSA and SSSA Divisions, held throughout the week. View the program for more information.

Education & Extension Section Sessions

CCAs and other professionals are encouraged to attend sessions throughout the week sponsored by the ASA Education and Extension Section: http://scisoc.confex.com/scisoc/2012am/webprogram/A01.html, including the Applied Agronomic Research and Extension Session on Wednesday, October 24. This topical session features numerous oral papers on applied research and extension education programs and approaches in crop and forage production, soil management, pest management, and resource conservation.

Consulting Soil Scientists Division Sessions

Professional soil scientists and other professionals are encouraged to attend sessions sponsored by the Consulting Soil Scientists Division on Sunday, October 21:

- **Ethics Oral Session.** This presentation will count for your one CEU for ethics in certification.
- **Symposium—Urban Soils.** This symposium will highlight urban soils restoration and management including applications for landscape, stormwater management, and environmental remediation. Presentations will include case studies and research relating to challenges of working with drastically disturbed and anthropogenically created soils for urban and suburban uses.
Career opportunities

If you are looking for an employee or a job, tap into the services of the Annual Meetings on-site Career Center. Open Sunday through Wednesday in the exhibit hall, the Career Center assists employers and employees with job opportunities and facilitates interviews. In addition, this year the Societies will host a Career Fair on Monday, October 22 from 4 to 6 pm. Visit the Career Fair to meet prospective employers and industry leaders in the Career Center. For information, visit www.careerplacement.org or contact Teri Barthelmes at 608-268-3972 or tbarthelmes@sciencesocieties.org.

Meeting registration

Registration for the Annual Meetings is available online or by fax or mail. Register by September 11 to receive the early registration discount or by September 25 to receive the pre-registration discount. Early registration by September 11 is $470 for members of ASA, CSSA, or SSSA and $670 for non-members. After September 25, the registration fee increases to $530 for members and $730 for non-members. Both one- and two-day rates are available. Members receive substantial registration discounts. In most cases, it costs less to join or renew and register for the Annual Meetings than it does to attend at the non-member fee. For more information, visit the website at www.acsmeetings.org/register.

Looking for in-season options that can improve yield potential?

Research is the backbone of Agro-Culture Liquid Fertilizer’s long history of success. Because of our strong commitment to Responsible Nutrient Management, growers across North America can rely on the products and recommendations we make.

RESEARCH PROVEN, GROWER TRUSTED CROP NUTRITION

Whether strip-tilled, broadcast, applied with your planter, side-dressed, or foliar fed, Agro-Culture Liquid Fertilizers provide unsurpassed performance and exceptional compatibility. Giving you the options you are looking for to improve your yield potential. Visit us on the web to contact your local sales representative.

www.agroliquid.com/Options 1-800-678-9029
Research has shown that when it comes to sunflower fertility, it is extremely important to have the N:P:K ratio correct (2:1:2 is recommended). If you have too much nitrogen and not enough phosphorus, the sunflower produces more stalk than it needs (longer green growth and no extra oil produced) and the nitrogen is not being used where it is needed. That being said, are producers doing the right thing when it comes to the phosphorus needs of their sunflower crops?

Monoammonium phosphate (MAP, 11–52–0), diammonium phosphate (DAP, 18–46–0), and ammonium polyphosphate (10–34–0) are equally effective per unit of P if properly applied. The choice of which to use should be based on availability, equipment, and price per unit of P. There are various methods to putting down starter fertilizer. Air seeders and planters that have the capabilities of putting the fertilizer away from the seed allow for the proper fertilization. Banding P near the seed as a starter frequently results in more efficient use of the fertilizer, as P is not mobile in the soil. The recommended placement for a fertilizer band is 2 inches beside and 2 inches below the seed as sunflower is extremely sensitive to fertilizer salts and great care must be taken to avoid germination damage. The sensitivity to salts increases in dry soils, so in drier years, you have to be even more careful.

A lot of planters and air seeders don’t have the capabilities of a 2-inch by 2-inch band, and it is because of the reasons previously stated that I believe that growers do not take the risks of using a starter fertilizer with their sunflowers. Because phosphorus is the second most limiting nutrient (nitrogen being the first), we need to find a way to get it down where the seed can use it. Broadcasting it is one possibility, but that requires working it into the ground and in an area where no-till is becoming increasingly popular, that is not a realistic application. Is it possible to put some fertilizer down directly with the seed? Research from Manitoba Agriculture, Food, and Rural Initiatives states “If all phosphate must be placed with seed, the amount of phosphate should not exceed 15 lb per acre P₂O₅ for 12-inch row spacing, 10 lb per acre P₂O₅ for 18-inch row spacing, and 5 lb per acre P₂O₅ for 24-inch row spacing.”

2011 was a particularly wet spring, and sunflower planting was delayed in our area. We decided that this would be a great year to conduct some research on placing 10–34–0 with the seed. After looking at soil samples, and numerous discussions with other industry professionals, we decided to mix 2 gal of 10–34–0 with 2 gal of water and place it directly with the seed (in 30-inch rows). Planting was delayed numerous times due to moisture and was finished July 6.
I must note that some of what we observed could be partly due to the fact that we had more moisture in July and August than we have in typical years. At any rate, the sunflowers came up evenly with a great stand, more so than in years past. Even if there were no other benefits, even stand emergence is extremely valuable. Later in the season when you are scouting for weeds, insects, and diseases, it is much easier to apply pesticides at the proper time if the crop is all at the same stage.

Tissue samples were taken at R2, and the results from the fields that had P with the seed came back at 0.57% (normal ranges between 0.3–0.5%). The part of the field that did not get P down with the seed came back at a test range of 0.4%. While this level would typically not be a limiting factor, the results do show that under high-yield conditions, incremental phosphorus may be required to attain production goals. If we had ever had high-yielding conditions, last year was it.

When it was time for the combines to roll, the sunflowers were weighed with a scale on a grain cart. The sunflowers that had phosphorus down with the seed averaged 200 lb more than those receiving no phosphorus as starter fertilizer. We also saw a 0.5 lb difference in test weight but no change in oil content.

This is only one year of testing, and although I can’t say that these results would show up every year, I do believe that if the growing conditions are good and soil moisture is adequate or above normal while planting sunflowers, I would recommend growers trying small amounts of starter fertilizer with their sunflower seeds.

Kansas CCAs celebrate 15 years

The Kansas CCA board recently recognized nine members for their 15-year anniversaries: Amthauer, Verle—Junction City, KS; Benfer, Kurt—Guymon, OK; Coney, Stephen—Watonga, OK; Deckman, Gerald—Hugoton, KS; DiPippo, David—Mitchell, SD; Locke, Dwight—Atchison, KS; Peterson, Heath—St. George, KS; Peterson, Steven—Moundridge, KS; Ramey, Gary—Robinson, KS

The board also recognized CCAs celebrating their 10- and 5-year anniversaries, the names of which can be found at www.hpj.com/archives/2012/jun12/jun25/0611KSCertifiedCropAdvisorA.cfm. For more, go to www.ksagretailers.org and click on CCA.
Some fertilizer dealers suggest adding a little nitrogen fertilizer to a soybean crop in order to maximize yield. If you’ve heard this, you may have questioned the wisdom of this suggestion because you know that soybean is a legume and via its symbiotic relationship with *Bradyrhizobium japonicum*, a nitrogen-fixing bacteria, it obtains from 50–75% of its nitrogen requirements from the air. Additional nitrogen needed to maximize production is supplied from (1) soil residual nitrogen and (2) nitrogen supplied via mineralization of organic matter during the growing season. University of Maryland Extension currently recommends that no additional nitrogen fertilizer be supplied to soybean. But, this recommendation recently has been questioned by some Maryland fertilizer dealers who are suggesting to their customers that some starter N fertilizer (25–50 lb N/acre) is required for soybean to attain maximum yield. With funding support from the Maryland Soybean Board, a study to investigate the response of full-season soybean to nitrogen fertilizer was conducted during 2011.

The study was conducted at four University of Maryland Research and Education Center (REC) farms: (1) Lower Eastern Shore REC–Popham Hill, (2) Wye REC, (3) Central Maryland REC–Beltsville, and (4) Central Maryland REC–Upper Marlboro. Two Asgrow soybean varieties (3539RR2 and 4630RR2) were planted between the dates of May 6 and 21 in 30-inch rows, a spacing that would accommodate in-season nitrogen applications. Nitrogen treatments were rates of 25 and 50 lb N/acre supplied as UAN that was directed to the ground by drop nozzles at the time of application. Three application-time treatments were tested: (1) at planting, (2) at R1 (appearance of first flower), and (3) at R3 (appearance of first pod). And a treatment of no fertilizer nitrogen was used as the control. Root samples for the purpose of assessing soybean nodulation were collected between growth stages R1 and R2 from the control treatment and the two “at planting” nitrogen treatments at all locations except the Wye. The number of nodules on the roots of 5 plants/plot was counted.

Photo by Stephen Ausmus (USDA-ARS).
Different numbers of nodules were observed at the three locations. Approximately 11 nodules per plant were present for the soybeans collected at Poplar Hill and Beltsville while the plants from Upper Marlboro averaged 42 nodules/plant. The two varieties did not differ for nodule number at Poplar Hill and Beltsville while at Upper Marlboro, Asgrow 4630RR2 had nearly 48 nodules/plant compared with 36 for Asgrow 3539RR2. The primary reason for assessing nodules was to determine if the addition of nitrogen fertilizer to the system changed the soybean plant's ability to nodulate. At both Poplar Hill and Beltsville, the addition of either 25 or 50 lb N/ac had no influence on nodule formation. However, at Upper Marlboro, significantly more nodules (30%) were present for the two nitrogen fertilizer treatments compared with the control.

Soybean yield differed across the locations: 34.5 bu/ac at Poplar Hill and Beltsville, 55 bu/ac at Upper Marlboro, and nearly 73 bu/ac at Wye. However, there was no significant nitrogen response observed at any of the locations. The nitrogen treatments averaged 49.4 bu/ac across the four locations and were neither different from each other nor different compared with the control (no nitrogen), which averaged 48.7 bu/ac. The only difference of note was between varieties with Asgrow 4630RR2 producing 4 and 9 bu/ac better than Asgrow 3539RR2 at Wye and Beltsville, respectively.

Seed protein, oil content, and seed size were quality factors measured. And, nitrogen fertilizer application had no effect on any of these variables.

This study will be repeated at a number of Maryland locations during 2012. However, at this time, I do not see a different result and thus see no reason to alter University of Maryland Extension's current recommendation that nitrogen fertilizer application to soybean is not necessary to optimize yield. In order to ensure that soybean will be able to manufacture adequate nitrogen, University of Maryland Extension does recommend that a seed inoculant be used at planting whenever soybean has not been part of a field's crop rotation during the past two to three years.

A lot of folks flying over the area from Texas to Missouri will see mirror-like shimmering surfaces under their jet broken only by small green clumps and by what appear to be roughly sketched contour lines and wonder what they are. What they’re seeing is an extensive American rice production area that supports nearly three million acres of rice (USDA-NASS, 2011). Although rice is second only to corn in world-wide planted acreage (FAOSTAT, 2012), it is a cereal grain crop many have never seen growing in the field.

Other than agronomists, few people know the U.S. is a world center of rice production. Rice consumers rarely concern themselves about the crop’s seedbed preparation, soil and soil fertility management, or pest and disease control. In the U.S., most people probably consider rice as a food whose grains we throw at weddings or enjoy steamed in takeout meals.

However, some of our colleagues in the Southern Branch of the American Society of Agronomy (ASA) engage their best professional efforts around rice. Outside the U.S., more than half of the world’s population looks to this essential food staple for daily meals (Snyder and Slaton, 2001). Most of us are somewhat aware of that but may think of rice as a purely Asian interest.

Indeed, the importance of South Asian rice is both explored and emphasized in three recent self-study CEUs offered by ASA (2011; 2012a, 2012b). So, how important is rice within our country when we harbor but a miniscule part of the world population?

Simply put, the importance of the South region’s crop simply cannot be measured by CEUs, by the area used in its production, or by its market value. As world population increases and foodstuffs move globally, we also have to look at rice in relation to new concerns about American nutrition and food safety (Osborne et al., 2003). Further, water-intensive production systems demand that production occur while not depleting the “natural capital” (Robinson et al., 2009).

ASA Southern Branch agronomists are part of a small group acknowledged as world leaders in all aspects of rice production, research, and marketing. These colleagues in Texas, Louisiana, Arkansas, and Missouri are creating today’s links to a long economic/agronomic strand going back nearly 10,000 years (Xingcan, 1999). They have built on that long record while partnering with similar work in California in the race to raise foodstuffs to feed the growing world population while increasingly considering sustainability and soil natural capital.

Rice: essential to life

How critical is their work? FAO (2004) highlights rice as one of the few crops essential to life on this planet:

“Rice is the predominant staple food for 17 countries in Asia and the Pacific, nine countries in North and South America and eight countries in Africa. Rice provides 20 percent of the world’s dietary energy supply, while wheat supplies 19 percent and maize 5 percent.”

In the South, most of us know rice followed the earliest settlements at, for example, Wilmington, NC;
Charleston, SC; and Savannah, GA. Rice was paired with settlement for the same reason tobacco and cotton followed settlement: economic gain.

Following the U.S. Civil War, all Southern crop production systems were disrupted. As agriculturalists moved westward during and after Reconstruction, crops accompanied and supported this migration. People continued to grow crops with which they had cultivation and market experience. Production moved westward accompanied with new mechanical technologies.

As production began to move from a human labor base to a mechanical base, it began to concentrate into ever larger units. The contrasts between antebellum, today’s, and tomorrow’s production systems are extreme: extensive/intensive, hand labor/mechanical, and depleting/sustainable. In the case of rice, contrasts arose not so much out of a displacement from eastern to mid- and deep-south production as from the displacement to man-made microenvironments.

In many respects, Southern rice production adopted millennia-old Asian land manipulation techniques. In the grossest sense, if row crops and grain crops are viewed as using existing soil surfaces, Southern rice is usually grown on soil surfaces manipulated to effect water movement and facilitate flooding. These adaptations are reflected in today’s Southern rice research programs, which seek solutions to the following problems, among others:

First, rice production is literally rooted in both acid and high-base-status soils. Second, rice production occurs today in both dry and flooded soil environments. Third, today’s production often occurs in soils whose surfaces have been manipulated to create topographies conducive to slow movement of surface water over, across, and downslope. Such manipulation exposes infinitely variable root zone conditions as compared with the merely agonizingly complex ones that occurred naturally.

The exceptionally complex growing environments offer an exceptionally rich regional research literature. In this literature, we see a developing consensus as it emerges in journals of ASA as well as the Crop Science Society of America (CSSA) and the Soil Science Society of America (SSSA). Much as soil conservation literature moves from the general to the specific from the 1930s through today, rice production literature moves from empirical to relational in regards to nutrients, insects, disease, water management, etc.
Ecosystem services

Because a societal need (food) addressed by today’s Southern rice production is an increasing and increasingly nutritional world food staple, Southern rice research literature has direct application to today’s concerns about “ecosystem services” (Quin et al., 2012) delivered with N, P, and K management; runoff; wetlands; and in agricultural production without ecosystem destruction.

For instance, in the center of Southern rice production, one issue of an Arkansas rice journal (Norman and Johnston, 1997) applies a sequence of articles to explore N, P, and K relations in high-base soils. Here is the thinking and the relation to ecosystem services:

Research has shown that nitrogen is the key to high rice yields. We all know nitrate N denitrifies in flooded soil conditions. We also know N use efficiency is best in dry-seeded systems if N is applied just before flooding. Suppose we apply N just before a field is flooded. N is then below the oxygen rich soil–water interface; thus, nitrification cannot proceed and N remains in the root zone for plant uptake. Applying N at the rate used in crop growth reduces total N and keeps N from groundwater and runoff.

Another example? Plant disease resistance is directly affected by relative levels of major nutrients. Many diseases flourish in the absence of sufficient K. However, K relations vary dramatically as a function of soil texture, clay mineralogy, and the presence or absence of maintenance K. Maintenance K thus depends on intense soil testing and analysis with proper extractants. Soil testing can keep disease at bay.

A new agronomy

In conclusion, rice, a crop cultivated as long as any on earth and certainly cultivated as long as any in the U.S., is perhaps the ideal crop to serve as a world model of the natural capital concept. Few crops have been as intensively studied in microenvironments as has rice, and few crops are as actively managed as creatures of microenvironments as is rice. Because rice is one of the three grains that will have to feed the world food demand, a corollary demand for increased production is inevitable.

While we are far from measuring and applying ecosystem services in any crop production, we are perhaps most advanced in Southern rice production. As the U.S. focuses in crop production moves from nonrenewable to sustainable, that focus follows a century of rice research. While agronomists rarely speak in ecological or thermodynamic terms, ASA, CSSA, and SSSA and Southern rice are transitioning to a new ecological agronomy, which is in contrast to the one a recent thermodynamic analysis (Chena et al., 2009) of Chinese agriculture also found transitioning:

“…Chinese agriculture is shown under a transition from the self-supporting tradition dependent on renewable resources to the prevailing pattern of increasing nonrenewable input and heavy environmental impact.”

In the U.S., agronomic focus is in the opposite direction. We are decreasing non-renewable inputs and impacts and shifting from only short-term economic return concepts to inclusion of ecosystem-sensitive techniques. It may be that the Chinese model above will have to change too one day. If so, we could see another historic shift of production techniques…this time from West to East once again, one directed by rice.

References


Help your customers add an average of 9.9 bu./A. Tell them to add AVAIL® to their fall applied phosphorus.* Studies prove that AVAIL Phosphorus Fertilizer Enhancer promotes more efficient P uptake for stronger roots and better overall plant health. Supercharge their P this fall so they’ll see higher yields next spring—and have you to thank for it.

Ask your SFP rep for details today.
The response of crops to the application of fertilizers has been heavily researched since the widespread use of fertilizers began during the so-called “Green Revolution.” Early research on the rate response of crop yield to fertilizer application flourished in the 1950s and 1960s, was refined in the 1960s and 1970s to investigate the effects of fertilization on crop quality and the influence of antecedent soil nutrient test levels on crop response, and focused in the 1980s and 1990s on the response of crops to various fertilizer formulations and delivery technologies (e.g., fertigation, chelation, slow-release mechanisms, etc.).

This body of research forms the highly successful foundation for fertility management guidelines in both the public and private sectors. However, due to reductions in funding available to finance traditional fertilizer response research, more and more reliance is placed on a rapidly aging database. Improvements in fertilizer technology, crop genetics and yield capacity, and other agricultural technologies have occurred ahead of updates in fertilizer rate-response information, which is so vital to guiding ever-increasingly expensive fertilizer management.

The Utah case is an illustration. Much of the information used to formulate fertilizer management guidelines comes from the Utah Fertilizer Guide (James and Topper, 1989), which draws from historical research and Utah-specific information through the mid-1980s. Though as trusted and valid as the information has been for so long, there is a need to revisit and revalidate the information in light of current crop variety and fertilizer options available to growers.

This article is intended to encourage such updates generally and spur the involvement of agricultural practitioners (extensionists, crop consultants, government agencies, grower cooperatives, etc.) to contribute to state and regional updates by involving cooperator growers in non-traditional soil fertility research. Much can be done to draw cooperator grower information into powerful validation databases for updating fertility management guidelines.

Agricultural practitioners can gather large quantities of pertinent data with the assistance of cooperator growers to produce information similar to that presented in Fig. 1. Figure 1A contains soil phosphorus (P) and alfalfa hay production data from multiple sites across Utah over the late 1990s and early 2000s. The pertinent data gathered were soil test P (by the Olsen or bicarbonate method) and relative yield (normalized to local maximum yields for each location and year).

The data were gathered from cooperator grower fields from fertilizer rate trials subject to grower pest,
irrigation, and weed management practices. Soil test and yield information was gathered by Utah State University Extension researchers. The information produces a robust database from which to review and revalidate nutrient sufficiency levels. Figure 1A illustrates that the current Utah Olsen P sufficiency level of 15 ppm is still relevant and valid but may need to be revised slightly upward to ensure consistently optimum yields across a wide range of soil types and crop-growing conditions (the data presented covers the following ranges in noted soil and crop conditions: pH, 6.7 to 8.3; calcium carbonate content, 0 to 54%; clay content, 17 to 29%; and crop yield, 2.3 to 7.6 tons/ac).

Moreover, a large database over time, space, and soil and growing conditions allows a more detailed analysis. For instance, in Fig. 1B, the data from Fig. 1A were broken into categories of Olsen soil test P, comparing the rate of fertilizer application at each site to yield response (again relative to a local maximum for each year). For the sake of clarity, the regression curve for each category of soil test P is shown. This likelihood of response to added fertilizer is very important in helping a grower decide on the benefit of additional increments of application.

As funding for traditional soil fertility research wanes, nutrient sufficiency levels and crop response to fertilizer application must be revisited in new and adaptive ways. We encourage agricultural practitioners to adopt an approach similar to that illustrated and involve cooperator growers in ways that benefit them in the long run to make relevant and productive decisions in light of ever-changing and increasingly expensive inputs and management options.

References

This article was prepared by members of the Western Extension and Research Activities Committee on Nutrient Management and Water Quality (WERA-103). For more information about WERA-103, including upcoming meeting dates, see: https://community.ipni.net/site/wera.nsf/home.xsp.


Corn after alfalfa
[continued from p. 28]

is that the highest net return to grain production will frequently be obtained by avoiding fertilizer N application when first-year corn follows good stands of alfalfa on medium- to fine-textured soils. At the same time, corn silage yield responded to fertilizer N at 6 of 15 locations where it was measured, and the economically optimum N rate for silage yield across the responsive locations was 36 lb N/ac.

After corn harvest, the scientists measured residual soil nitrate-N at 7 of 10 locations where corn grain and silage yields failed to increase with fertilizer N. When compared with the unfertilized control, residual soil nitrate at these locations increased by 13 to 19 lb/ac when 40 lb fertilizer N per ac was applied; and by 66 to 251 lb nitrate per ac when 160 lb N/ac was applied. Confirming other reports, these results demonstrate that when N applications to corn following alfalfa exceed 40 lb N/ac, the risk of high residual soil nitrate levels increases greatly.

Results from this study support and extend previous research, most of which had lower grain yields than those achieved in these experiments. To prevent yield loss and reduce overapplication of fertilizer N in alfalfa–corn rotations, the authors suggest that the focus of future research should be to identify the conditions under which first-year corn does require additional fertilizer N.
First-year corn after alfalfa often requires no fertilizer N

Compared with fertilizer nitrogen (N) guidelines for corn following corn, guidelines for first-year corn following alfalfa in the U.S. Corn Belt suggest that N rates can be reduced by about 150 lb/ac (the alfalfa N credit) when more than 4 or 5 alfalfa plants/ft² are present at termination. These alfalfa N credit recommendations have been questioned by growers and their advisers, however, as corn grain yields have increased over time.

In the July–August 2012 issue of Agronomy Journal, researchers from the University of Minnesota and the USDA-ARS report on a study in which they set out to better understand the fertilizer N needs of first-year corn following good stands of alfalfa and how N needs are affected by carryover fertilizer K from the alfalfa and the amount and timing of alfalfa regrowth incorporation. Their research was conducted on 16 farms in southern and central Minnesota with soils ranging from loamy sand to clay loam.

Corn grain yield, silage yield, and fertilizer N uptake were not affected by carryover fertilizer K or the amount or timing of alfalfa regrowth incorporation, suggesting that alfalfa N credit guidelines do not need be changed to account for differences in how farmers manage alfalfa regrowth. Thus, growers should consider harvesting alfalfa regrowth in the fall before termination, and it appears they can also incorporate alfalfa in either the spring or fall, without reducing the alfalfa N credit to first-year corn.

The authors also found that maximum corn grain yield ranged from 5.4 to 7 tons/ac—with 11 locations exceeding 6.2 tons/ac—and yet, corn grain yield responded to fertilizer N at just 1 of 16 locations. At this responsive location, which had inadequate soil drainage, the economically optimum N rate for grain yield was 76 lb N/ac.

What these results (in addition to data collected under similar conditions from the literature) suggest
Root Observation
As an innovator in Minirhizotron cameras since 1984 this year sees us celebrating well over 25 years of use by the fields leaders & service to the research community.

In addition to our line of root-observation cameras, we design and build custom vision solutions for greenhouse applications, entomology, wildlife research, and industry.

Our Minirhizotron 100X cameras / accessories are the most durable field units available and have been proven in extremely harsh environments and the most challenging situations.

- Water Resistant
- Variable magnification
- Variable Lighting
- Extremely durable & robust for field use
- Non destructive.
- Repeatability
- Easily transportable
- Custom lighting configurations available

Image Capture
After years of perfecting our BTC ICAP software we are proud to release our completely redesigned Windows 7 / Vista compatible ICAP software BTC 7.2.

A much more intuitive and simple to use image capturing program that works in conjunction with the most popular root counting software for simple, efficient, robust image capturing that has been the field wide standard.

Please feel to contact us and the small family at Bartz Technology will be glad to discuss your needs.

Minirhizotron is what we do...
Fundamentals of Soil Science

A New Online Course
from the Soil Science Society of America
August through November 2012

Classes are on Wednesdays from August 22 - November 7, 2012

“Fundamentals in Soil Science” is an introductory soil science course designed for the practitioner hoping to build their knowledge and skills in the topics most needed for a fundamental understanding of Soil Science. The course is taught online, using distance education technologies. The next session begins on Wednesday, August 22, 2012

Cost: $495 plus the cost of additional resources

For Registration or more information go to:
https://www.soils.org/education/fundamentals-soils

Registration deadline is Tuesday, August 14, 2012

Questions?
Contact Michele Lovejoy: mlovejoy@science societies.org
No-till corn and soybean production has become more widely accepted over the last 20 years because, among other factors, it can represent savings in operation cost and may conserve soil and water resources to a greater extent than conventional tillage systems. However, new technologies that increase corn plant densities and reduce pest damage to plant materials have resulted in larger amounts of undecomposed crop residue remaining by springtime on the soil surface of no-till systems. Besides the mechanical interference with planting operations, soils covered with crop residue tend to stay wetter and cooler longer. These conditions can delay planting, germination, and early crop growth compared with conventional tillage systems. In recent years, strip-till has emerged as an alternative system as it incorporates the benefits of soil and water conservation of no-till and the improved seedbed conditions of conventional tillage. Improved seedbed conditions with strip-till have resulted in enhanced crop growth and yield.

Strip-till allows for simultaneous deep banding of fertilizers. While deep banding of slowly mobile nutrients, such as P and K, has been proposed as an alternative to improve nutrient availability, fertilizer use efficiency, and yield, there is no universal agreement since some studies have shown no or a small benefit to deep-banding relative to broadcast applications. Nonetheless, when repeated broadcast applications of P have caused high levels of this nutrient in the soil surface, deep banding may help reduce such levels and lower the potential for environmental degradation associated with P runoff from fields. Conversely, a potential drawback is that the soil disturbance created with strip-till during deep banding of P could actually increase the potential for P loss by soil erosion compared with no-till systems. Regardless of whether or not deep-banding P and K fertilizer is beneficial, there is consensus that deep banding creates a challenge when soil sampling to try to accurately represent soil P and K test levels of a field.

Since crops do not usually take up all of the P and K applied in a band, the residual fertilizer creates a zone of concentrated nutrients. While succeeding crop removal and chemical transformations that render P and K less available to plants can reduce the amount of residual fertilizer, soil P and K normally remain high for a prolonged period of time. Perpetuation of a horizontal pattern of high and low levels across the field is most likely to occur with strip-till because this system is designed to maintain...
strips in the same location and provide a controlled-traffic system. In recent years, the use of RTK satellite navigation technology makes it possible to plant and band fertilizers always in the same location, which can also intensify the formation of fertilizer patterns in the field. When nutrients are banded, representing the fertility of the field can be difficult even when the location of the fertilizer band is known. Despite the fact that the challenge of obtaining a sample that accurately represents the fertility of a field with banded fertilizer is generally recognized, the best way to collect such samples is poorly understood, especially for strip-till fields where the fertilizer band is typically maintained at a constant location.

In a recent study published in the *Soil Science Society of America Journal*, we set out to determine the distribution of soil P and K after repeated applications of various P and K rates and develop soil-sampling procedures to improve estimation of soil P and K for three systems: no-till broadcast (NTBC), strip-till broadcast (STBC), and strip-till deep band (STDB) where the fertilizer was applied 6 inches below the surface at the row position.

**Materials and methods**

**Site description**

The study was conducted in commercial fields during 2007 to 2010 at three locations near Pesotum, IL (east-central Illinois). Soils in all three sites were a combination of Drummer silty clay-loam soil (fine-silty, mixed, mesic Typic Endoaquoll) and Flanagan silt loam (fine, smectitic, mesic Aquic Argiudolls). Each of these sites had no prior history of banded fertilizer placement, and fields were chisel-plowed after corn and field-cultivated after soybean in years before the study. Soil analysis of composite samples collected from the top 7-inch layer showed organic matter ranged from 3.0 to 3.5% across sites, cation exchange capacity (CEC) ranged from 17 to 30 meq of charge/100 g, and pH ranged from 5.1 to 6.3. Except for tillage and P and K fertilization, the crops were managed as recommended for the region.

**Treatments**

The study was conducted on a corn–soybean rotation with 30-inch row spacing in all sites and for both crops. All three sites had soybeans during the 2007 growing season before the start of the study, and thus corn was the first crop planted after treatment establishment. Plot size was 20 by 500 ft, and treatments remained in the same plot for the duration of the study. The study was set up as a split-plot arrangement in a randomized complete-block design with two replications. The main (whole) plot included three tillage/fertilizer placement treatments: NTBC, STBC, and STDB. The split-plot treatments were blends of P$_2$O$_5$ and K$_2$O made to create seven P-K fertilizer treatments with a control receiving no P or K (0-0 or check). The six additional rates were established in 23 lb P$_2$O$_5$ and K$_2$O/ac increments starting with a blend of 46 lb P$_2$O$_5$/ac and 46 lb K$_2$O/ac. We established these rates to ensure a distribution of fertilizer rates above and below P and K removal levels. Three consecutive corn–soybean cropping years before our study

Strip tilling has emerged as an alternative system to no-till practices, combing the benefits of soil and water conservation of no-till and the improved seedbed conditions of conventional tillage. Photo courtesy of Collin Jenson.
(2002–2007; mean corn yield of 159 bu/ac and mean soybean yield of 49 bu/ac) and recommended removal rates were used to estimate P and K removal levels.

Strip-till operations were done always in the fall, and corn was planted on the location of the strips the following spring. The soybean crop was also planted on the same crop-row position as corn, but no tillage operations were performed for soybean. The location of the tillage and the banded fertilizer was maintained constant by using RTK satellite navigation technology (+/-1-inch accuracy; Trimble Field Manager Software) with two GPS receivers, one mounted on the tractor and the other mounted on the tillage bar. Strip-till was performed on 30-inch row spacing using a strip-till toolbar (DMI, Model 4300) that formed a residue-free berm approximately 2 to 3 inches tall and 10 inches wide and disturbed the soil approximately 7 to 7.5 inches deep. There was no soil disturbance before planting in the NTBC treatment.

Fertilizer treatments were also applied every two years in the fall before corn planting starting in fall 2007. Broadcast applications were done with a drop spreader (10T Series, Gandy, Owatonna, MN). For the STBC treatment, broadcast applications were performed after the strip-till operation. For the STDB treatment, the fertilizer was band-ed 6 inches below the soil surface during the tillage operation using a Gandy Orbit Air applicator (Model 6212C, Gandy, Owatonna, MN). Fertilizer sources were diammonium phosphate (DAP) (18–46–0) in 2007 and triple superphosphate (TSP) (0–45–0) in 2009 as the P source and KCl (0–0–60) as the K source. For the 2008 corn crop, corrective nitrogen (N) rates were applied to offset the N content of DAP fertilizer. All corn plots received a total of 180 lb N/ac. To minimize variability, the same equipment and operator were employed to perform strip-tillage and nutrient placement at all three locations.

Measurements

Soil samples for P and K analysis were collected from each plot every fall after crop harvest except in 2009 when soil samples were collected in the spring because wet soil conditions in the fall prevented access to the field before the soils froze. A composite of 12 soil cores (0.75-inch diameter each) was made for each of four sampling positions with respect to the crop row: in the crop row (IR) and in between the crop rows (BR) 7.5, 15, and 22.5
inches from IR. (From this point forward, these BR positions will be referred to as BR-7.5, BR-15, and BR-22.5, respectively.) Each sample was partitioned into 0- to 4-, 4- to 8-, and 8- to 12-inch depth increments. The composite 12 soil-core samples were collected three per each of the positions with respect to the crop row within a four-row geo-referenced 10- by 10-ft area in the center of each treatment. To ensure consistency in the sampling position, a board with pre-drilled holes at the designated distances was used. Soil samples were air dried, ground to pass through a 2-mm diameter sieve, and analyzed for P and K.

Most P and K fertilizer recommendations in the U.S. Midwest are based on no more than 8 inches of soil depth. Following this approach, we created a soil P and K test-weighed average for the top 8 inches of the soil for the different tillage/fertilizer placement and fertilizer rate treatments. In order to determine whole-field test levels, the top 8-inch soil P and K test levels were then used to calculate soil test levels for different sampling scenarios created by various ratios of IR to BR cores: 1:3, 1:2, 1:1, 1:0, and 0:3. The 1:2 and 1:1 ratios were calculated from the average of all possible combinations of IR, and the appropriate number of BR samples were drawn from a population of three BR samples. All of these calculated test levels were compared with the calculated “true” mean soil test levels for each fertilizer rate treatment. The “true” mean soil test level for the top 8 inches of soil was defined as the value obtained when averaging across the test values from one sample collected at IR and three samples collected at BR (1:3 ratio of IR/BR cores) for the NTBC system. This approach to calculate the “true” mean test level was deemed appropriate because pre-treatment (starting conditions) soil P and K test levels in 2007 were similar for the different treatments. Also, since the effect of broadcast P and K applications in no-till systems is already well documented, this system would represent an appropriate standard on which to compare other less-defined systems. The 1:3 sampling rate for the “true” mean represents the most complete set of cores collected. Since banding creates the same pattern across the field and one of the objectives of soil sampling is to use a sampling area to represent a larger area, it follows that using a systematic approach that accounts for one complete pattern or multiples of it should fulfill this objective. In our study, the sampling approach systematically divided the 30-inch banding pattern into four 7.5-inch-wide quarters.

Results and discussion

General background

While seed yield response to treatment was not the focus of this study, we briefly present this information as it relates to nutrient removal, which can influence changes in soil P and K levels. Corn seed yield (two-year mean) was 182 bu/ac for the NTBC treatment and lower than 191 bu/ac for STBC and 188 bu/ac for STDB. Mean soybean yield was 45 bu/ac, and there were no treatment differences. Similarly, there were no treatment effects on seed P and K concentrations, and mean nutrient concentrations in corn seed were 0.23% P and 0.35% K, while nutrient concentrations in soybean seed were 0.65% P and 2.00% K. Removal of P and K in seed over the three-year period of this study (two years of corn and one of soybean) was not affected by tillage/fertilizer placement treatment, but there was a linear increase in nutrient removal in seed with P and K fertilizer rate. We calculated mean annual removal rates of 43 lb P2O5/ac (range = 39 to 45 lb P2O5/ac) and 43 lb K2O/ac (range = 41 to 44 lb K2O/ac). Since these values were nearly equivalent to the biennial fertilizer rate of 92-92 lb P2O5-K2O, we selected this rate to represent the maintenance fertilizer rate for our study.

Averaged across location and treatments, starting soil test levels in 2007 were 60, 26, and 16 lb P/ac and 378,
246, and 232 lb K/ac for the 0- to 4-, 4- to 8-, and 8- to 12-inch depth increments, respectively. The degree of vertical stratification in soil test levels was greater for P than K. For P, the ratio of surface (0 to 4 inch) to subsurface test levels was 2.2:1 for the 4- to 8-inch depth increment and 4.0:1 for the 8- to 12-inch depth increment. For K, the ratio of surface (0 to 4 inch) to subsurface test levels was 1.5:1 for the 4- to 8-inch depth increment and 1.6:1 for the 8- to 12-inch depth increment. This large degree of vertical stratification was likely the result of broadcast applications with minimal disturbance of the soil by tillage before this study. Even with chisel-plow (the most aggressive soil-mixing tillage implement used before the study), it would be expected that broadcast P and K fertilizers would become stratified in the soil.

**Change in soil P and K test levels**

The statistical analysis of soil P and K as affected by treatment and treatment interactions can be more easily understood when presented as the change in soil P and K over time. For simplicity, we only show three fertility levels representing the check (0-0 P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O lb/ac), a maintenance rate (92-92 P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O lb/ac), and a buildup rate (highest fertility rate) (161-161 P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O lb/ac) following state recommendations. Similar decline in soil P and K at the top 4 inches of the soil occurred for the unfertilized check for all sampling positions and the different tillage/fertilizer placement treatments; but no change occurred in the 4- to 8- and 8- to 12-inch depth increments (Fig. 1A and 2A). The decline of P and K in the soil surface is likely related to crop removal of these nutrients.
At the maintenance P fertilizer rate (92 lb P₂O₅/ac), there was no change in soil P for the broadcast treatments (NTBC and STBC) across all sampling positions for the top 12 inches of the soil (Fig. 1B). These results agree with P removal rates measured in seed and illustrate that the current P maintenance rate recommendations, developed under conventional tillage systems, are adequate for broadcast applications under conservation tillage systems. For the STDB treatment, there was an increase of 160 lb P/ac at the IR position within the 4- to 8-inch depth increment. This increase was the result of localizing a maintenance rate on a small portion of the soil volume. Just as with the unfertilized check, soil P in STDB decreased at the surface layer for all BR positions and illustrates that despite placement technique, corn and soybean crops take most of their P from the surface layer. These data further indicate that continuous band application of P in the same location can result in a substantial localized increase in soil P and depletion in the rest of the root zone. We observed this increase even at the lowest P rate of 46 lb P₂O₅/ac where soil P at IR in the 4- to 8-inch layer of STDB increased 38 lb P/ac between the start of the study in fall 2007 and fall 2010.

At the highest P fertilizer rate (161 lb P₂O₅/ac), soil P increased at the soil surface of the broadcast treatments at most sampling positions (Fig. 1C). This increase was expected as fertilization exceeded the measured annual 43 lb P₂O₅/ac removal rate in seed. Averaged across sampling position, the highest fertilizer rate increased soil surface P for the NTBC treatment by 22 lb P/ac and for the STBC treatment by 30 lb P/ac, whereas soil surface P decreased by 22 lb P/ac for the STDB treatment. Similar to the maintenance rate, P levels increased by 146 lb P/ac in STDB at IR in the 10- to 20-cm depth increment as result of the band application of 161 lb P₂O₅/ac. However, with the highest P rate, we observed an increase in soil P below the application band in the 8- to 12-inch depth increment. It is likely that the increase in soil P in this location is the result of downward movement of P with the highest fertilization rate. Another possibility for the increase in test levels at the 8- to 12-inch depth at IR for STDB is deeper-than-expected fertilizer applications. However, this is unlikely because as with the maintenance rate (92 lb P₂O₅/ac), the 8- to 12-inch depth increment had no significant changes in P levels for the 46, 69, and 115 lb P₂O₅/ac rates (data not shown). On the other hand, as with the 161 lb P₂O₅/ac rate, there was a significant 44 lb P/ac increase in the 8- to 12-inch depth increment with the 138 lb P₂O₅/ac rate; further indicating that downward movement in STDB was the result of high P application rates.

Change in soil K at IR for STDB treatments receiving K fertilizer (Fig 2B and C) showed similar results to those of P. Application of K fertilizer in a concentrated band produced a large increase in soil K at the 8- to 12-inch depth increment. For the maintenance rate (92 lb K₂O/ac), the increase was 86 lb K/ac while for the highest rate (161 lb K₂O/ac), the increase was 170 lb K/ac. The highest fertilizer rate also increased soil K in the 8- to 12-inch depth increment below the location of the band, but no difference was observed for the maintenance rate. The increase in soil K at 8 to 12 inches for the highest K rate was likely the result of K leaching and may indicate that this rate was too high at the point of application to be retained by the soil. In contrast to P, soil surface K declined, or at least showed a declining trend, for the broadcast treatments at BR for the maintenance rate (Fig. 2B), and no buildup of soil K occurred for the highest K fertilizer rate (Fig. 2C). These results were surprising since the biennial maintenance fertilizer rate was nearly equivalent to the actual annual K removal rates in seed of 43 lb K₂O/ac and the highest fertilizer rate exceeded the amount of K removed in seed. On the other hand, the 0- to 4-inch soil layer at the IR position of broadcast treatments showed an increase in soil K for NTBC and an increasing trend for STBC at the maintenance rate (Fig. 2B) as well as an increase of 120 lb K/ac for NTBC and 146 lb K/ac for STBC at the highest K fertilizer rate (Fig. 2C). We speculate that greater K in the soil surface at IR than BR positions for the broadcast treatments is the result of K leaching out of mature plants before harvest. This leaching would not occur for P since this nutrient becomes part of the plant tissues and P is released to the soil after tissues are decomposed. Another possible explanation as to why soil K increased at the IR position of broadcast treatments is by mixing of soil and fertilizer during strip-till operation or by coulters during planting. However, this is not likely since it would be expected to influence soil P as well, and we did not observe such effect for P (Fig. 1B, 1C).

**Soil-sampling fields with banded fertilizer applications**

It is obvious from our study that the use of RTK satellite navigation technology, which allows for maintenance of crop rows and band applications of immobile nutrients always in the same location, can intensify the formation of patterns of varying fertility levels in the field. These patterns can have important implications for soil sampling. It is clear that within treatments, the three BR sampling positions were similar to each other but differed substantially relative to the IR position for soil P and K (Fig. 1 and 2). The effect of fertilizer placement and rate on soil P and K for the strip-till treatments (STBC and STDB) was calculated using different ratios of IR/BR sampling (Table 1, page 38). Those levels were compared with a “true” mean, defined as the value calculated from the average of test values from one sample collected at IR and three samples collected at BR (1:3 ratio of IR/BR cores) for the NTBC system. Because a shallow sample that does not
include the subsurface fertilizer band can result in inaccurate soil fertility estimates, these calculations were made on the top eight inches of soil to include the subsurface fertilizer band.

For STBC, soil P was not different than the “true” mean regardless of the sampling ratio used or the fertilizer rate (Table 1). This indicates that for soil P measurements when fertilizer is broadcast, the sampling strategy in strip-till can be the same as for no-till broadcast systems, and samples could be collected with no regard to the location of the crop row. On the other hand, always sampling in the location of the tilled strip (IR position) overestimated soil K. Averaged across all fertilizer rates, the 1:0 sampling ratio overestimated soil K by 56 lb K/ac relative to the “true” mean. However, for soil K, the comparison to the “true” mean needs to be considered with caution because K accumulation occurred at IR for the NTBC system as well (Fig. 2C). As previously discussed, K accumulation at IR for broadcast treatments is likely caused by K leaching out of standing plants during senescence. The fact that K accumulation occurs at IR when successive planting is done in the location of the previous crop row indicates that for broadcast applications in no-till and strip-till, sampling position is an important consideration when determining K fertility. For instance, the 46, 69, and 92 lb K₂O/ac rates had “true” mean levels recommending fertilization to increase soil K to at least the critical level of 300 lb K/ac needed to maximize corn and soybean production. Those same K rates in the strip-till treatments showed no need to
apply additional fertilizer to increase soil K when using a 1:0 sampling ratio. Although not statistically different than the “true” mean, increasing the ratio of IR/BR samples to 1:1 resulted in numerically greater soil K test levels, and collecting samples that do not account for the higher soil K at IR (0:3 ratio) resulted in numerically smaller soil K test levels. Our data indicate that the 1:3 or 1:2 sampling ratio would be most appropriate to measure soil K in fields where the planting band remains constant from year to year.

For STDB, using a 1:3 or 1:2 sampling ratio was adequate regardless of the fertilizer rate (Table 1). The 92-92 lb P₂O₅-K₂O/ac rate showed an increase for these sampling ratios, but it was likely the result of a lower-than-expected soil test level for the “true” mean, for which there is no apparent explanation. We also observed that for low P-K rates (46-46 and 69-69 lb P₂O₅-K₂O/ac), it may be possible to soil sample at an IR/BR ratio of 1:1 without over-estimating soil P or K relative to the “true” mean. This would indicate that in fields with adequate fertility where P and K fertilizers are applied only in small quantities or as a starter application, the fertilizer band should not pose a substantial challenge for accurate soil sampling. On the other hand, for maintenance P and K fertilizer rates (92-92 lb P₂O₅-K₂O/ac or greater), the IR/BR ratio of 1:1 or 1:0 will cause over-estimation of soil P and K relative.

Table 1. Calculated mean soil P and K test level in fall 2010 for the top 8 inches of soil for different P and K fertilizer rates with various ratios of samples collected in the crop row (IR) to between the crop rows (BR) for strip-till broadcast (STBC) and strip-till deep-band (STDB) compared with the “true” mean calculated for no-till broadcast (NTBC).

<table>
<thead>
<tr>
<th>P-K rate lb/ac</th>
<th>NTBC “true” mean 1:3</th>
<th>STBC</th>
<th>STDB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1:3</td>
<td>1:2</td>
<td>1:1</td>
</tr>
<tr>
<td>0-0</td>
<td>24</td>
<td>34</td>
<td>34</td>
</tr>
<tr>
<td>46-46</td>
<td>42</td>
<td>38</td>
<td>38</td>
</tr>
<tr>
<td>69-69</td>
<td>40</td>
<td>42</td>
<td>40</td>
</tr>
<tr>
<td>92-92</td>
<td>32</td>
<td>44</td>
<td>42</td>
</tr>
<tr>
<td>115-115</td>
<td>52</td>
<td>48</td>
<td>48</td>
</tr>
<tr>
<td>138-138</td>
<td>48</td>
<td>60</td>
<td>58</td>
</tr>
<tr>
<td>161-161</td>
<td>52</td>
<td>66</td>
<td>66</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>lb P/ac</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-0</td>
<td>256</td>
</tr>
<tr>
<td>46-46</td>
<td>278</td>
</tr>
<tr>
<td>69-69</td>
<td>286</td>
</tr>
<tr>
<td>92-92</td>
<td>270</td>
</tr>
<tr>
<td>115-115</td>
<td>302</td>
</tr>
<tr>
<td>138-138</td>
<td>314</td>
</tr>
<tr>
<td>161-161</td>
<td>310</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>lb K/ac</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-0</td>
<td>250</td>
</tr>
<tr>
<td>46-46</td>
<td>264</td>
</tr>
<tr>
<td>69-69</td>
<td>286</td>
</tr>
<tr>
<td>92-92</td>
<td>270</td>
</tr>
<tr>
<td>115-115</td>
<td>302</td>
</tr>
<tr>
<td>138-138</td>
<td>314</td>
</tr>
<tr>
<td>161-161</td>
<td>310</td>
</tr>
</tbody>
</table>

* Significant differences at P < 0.05.
** Significant differences at P < 0.01.
† Significant differences at P < 0.1.
to the “true” mean. For instance, the “true” mean soil P and K of the higher P and K fertilizer rates would indicate the need to apply a fertilizer rate equal to what the crop removes in order to maintain fertility levels. However, soil test results from the 1:0 sampling ratio were above 66 lb P/ac and 400 lb K/ac where additional fertilization is not recommended because there is no expectation of a yield response to additional fertilizer. Similarly, avoiding sampling at the IR is not recommended since it would cause substantial under-estimation of the “true” fertility. This is because banding all the P and K fertilizer, as shown in Fig. 1B and 1C and Fig. 2B and 2C, respectively, caused a depletion of soil P and K at BR similar to when no P or K fertilizers were applied (Fig. 1A and Fig. 2A, respectively). Our results indicate that avoiding the fertilizer band would result in overapplication of fertilizer. While this overapplication is highly unlikely to result in a negative impact on seed yield, it can result in lower short-term return on the fertilizer investment.

In fall 2007, starting soil P test levels were 44 lb P/ac for NTBC and STBC and 42 lb P/ac for STDB. Examining test levels in fall 2010 using the 1:3 ratio for each of the tillage/fertilizer placement treatments showed maintenance or a slight buildup with the 92 lb P₂O₅/ac rate, except for the NTBC that started at the 115 lb P₂O₅/ac rate (Table 1). Though as mentioned earlier, we suspect that the soil test level for the 92 lb P₂O₅/ac rate for NTBC was lower than expected, this fertilizer rate was likely sufficient to maintain or slightly build up soil P and agrees with measured P removal in seed. On the other hand, starting soil K levels were 320, 300, and 316 lb K/ac for NTBC, STBC, and STDB, respectively. Except for STBC where the highest K rate (161 lb K₂O/ac) increased soil K test levels, rates considered sufficient to maintain or build up soil K by current recommendations and based on actual removal rates for this study failed to do so (Table 1). This may reflect either a need to evaluate current K recommendations for Illinois or that the soils in our study fail to build up with the fertilizer rates used. Finally the 1:3 sampling ratio showed no change in soil P and K for different tillage/fertilizer placement treatments and indicate that fertilizer rate should not be adjusted based on tillage or fertilizer application method.

Conclusions

Soil P and K were highly related to the placement method but not to tillage since both NTBC and STBC showed similar results. Within treatment, the different sampling positions for BR were always similar to each other. Deep banding the fertilizer reduced the surface to subsurface P and K stratification ratio by increasing test levels in the subsurface with the fertilizer application, and by decreasing soil test levels in the surface as crops likely continued to remove nutrients from that layer. Deep banding the fertilizer created a pattern of high soil P and K test levels at IR and lower levels at BR. Movement of P and K below the fertilizer band occurred with the highest fertilizer rate. Also, maintaining the crop row always in the same position increased soil K test levels, but not soil P test levels, at the 0- to 4-inch depth increment at IR compared with BR in all tillage/fertilizer placement treatments. This increase in soil K at IR was likely the result of greater K leaching from plant materials before harvest compared with P. Changes in soil P averaged across sampling position followed closely what was expected in terms of incline, decline, or maintenance of soil P levels by current recommendations and as measured by actual P removal rates in seed. On the other hand, soil K was not maintained or increased as expected by current recommendations or measured K removal rates in seed, possibly indicating a need to re-evaluate the current recommendation system at least for the soils in the study. Nonetheless, the fact that changes in soil P and K were similar across the different treatments indicated that fertilizer rate need not be adjusted based on the tillage/fertilizer placement conditions of this study.

In general, this study clearly showed that when the fertilizer band and the planting row are maintained in the same location from year to year, sampling location is an important consideration. Underestimation of soil test levels can occur if the band is deeper than the recommended sampling depth or the location of the band (for P and K) or the planting row (for K) is avoided during sampling. On the contrary, if soil samples are collected only from the location of the fertilizer band, this would result in overestimation of soil P and K test levels. This study showed that this can be a substantial mistake when the overestimation of soil fertility indicates no need for fertilizer application when actual soil test levels may be yield limiting. In systems where RTK satellite navigation technology is used and the location of the fertilizer band or planting row is maintained constant, a ratio of 1:3 IR/BR sampling procedure appears to be adequate to estimate soil fertility across a wide range of P and K fertilizer rates and soil test levels. While this approach appears to be adequate for both P and K, the fact that K accumulation occurred at IR in the NTBC system may not allow an accurate representation for soil K test.

July-August 2012
self-study quiz

Soil P and K following RTK-guided broadcast and deep-band placement in strip- and no-till (no. SS 04810)

1. Strip-till allows for _____ of fertilizers, which for slowly mobile nutrients, such as P and K, has been proposed as an alternative to improve nutrient availability, fertilizer use efficiency, and yield.
   - a. concurrent strip banding
   - b. alternate-row sidedressing
   - c. simultaneous deep banding
   - d. broadcasting

2. Which of the following is NOT mentioned in the article? Underestimation of soil test levels can occur if
   - a. the band is deeper than the recommended sampling depth.
   - b. the location of the band (for P and K) is avoided during sampling.
   - c. the location of the planting row (for K) is avoided during sampling.
   - d. the band is wider than the recommended application width.

3. In this study, the degree of vertical stratification in soil test levels was greater for P than K and was likely the result of _____ before this study.
   - a. immobilization due to increased microbial activity
   - b. deep banding with some soil disturbance
   - c. mineralization following strip-till operations
   - d. broadcast applications with minimal soil disturbance.

4. In this study for the check fertility treatment, there was a decline in
   - a. P only at the 4- to 8-inch depth of the soil.
   - b. K only at the 4- to 8-inch depth of the soil.
   - c. P and K at the 4- to 8-inch depth of the soil.
   - d. P and K at the top 4 inches of the soil.

5. Which tillage/placement treatment is NOT mentioned in the article?
   - a. no-till broadcast.
   - b. no-till shallow band.
   - c. strip-till broadcast.
   - d. strip-till deep band.

6. According to the article, the current P maintenance rate recommendations developed for conventional tillage systems are adequate for
   - a. surface injection under conventional tillage systems.
   - b. deep banding under strip-till systems.
   - c. broadcast applications under conservation tillage systems.
   - d. spot placement in no-till systems.

7. There is consensus that deep banding
   - a. P and K fertilizers are beneficial.
   - b. creates a challenge when soil sampling to try to accurately represent soil P and K test levels of a field.
   - c. results in soil disturbance that could actually increase the potential for K loss by soil erosion compared with conventional tillage systems.
   - d. may increase levels of P and increase the potential for environmental degradation associated with P runoff from fields compared with repeated broadcast applications of P.

This quiz is worth 2 CEUs in Nutrient Management. A score of 70% or higher will earn CEU credit.

DIRECTIONS

After carefully reading the article, answer each question by clearly marking an “X” in the box next to the best answer. Complete the self-study quiz registration form and evaluation form on page 41. Clip out pages 39–41, place in an envelope with a $33 check made out to the American Society of Agronomy (or provide your credit card information on the form), and mail to: ASA c/o CCA Self-Study Quiz, 5585 Guilford Road, Madison, WI 53711. Or you can save $5 by completing the quiz online at www.certifiedcropadviser.org/certifications/self-study.
8. In systems where RTK satellite navigation technology is used and the location of the fertilizer band or planting row is maintained constant, a ratio of ___ appears to be adequate to estimate soil fertility across a wide range of P and K fertilizer rates and soil test levels.
   a. 1:3 BR/IR sampling procedure.
   b. 1:3 IR/BR sampling procedure.
   c. 1:2 BR/IR sampling procedure.
   d. 1:1 IR/BR sampling procedure.

9. Despite placement technique, corn and soybean crops take most of their P from
   a. the surface layer.
   b. the 4- to 8-inch layer.
   c. the 8- to 12-inch layer.
   d. foliar applications.

10. With the highest P rate in STDB at IR, the researchers observed
    a. a decrease in soil P below the application band in the 4- to 8-inch depth increment.
    b. a decrease in soil P above the application band in the 8- to 12-inch depth increment.
    c. an increase in soil P below the application band in the 8- to 12-inch depth increment.
    d. an increase in soil P above the application band in the 4- to 8-inch depth increment.

11. For the broadcast treatments at BR for K, in contrast to P, there was
    a. no buildup for the highest K fertilizer rate.
    b. buildup for the highest K fertilizer rate.
    c. an increase in soil surface K at the lowest rate.
    d. a decrease soil surface K at the maintenance rate.

12. In this study, the fact that ___ in the NTBC system may not allow an accurate representation for soil K test.
    a. K accumulation occurred at IR
    b. K reduction occurred at BR
    c. K remained constant at BR
    d. K reduction occurred at both IR and BR

13. In this study, soil P and K were
    a. highly related to both tillage and the placement method.
    b. not related to either tillage or placement method.
    c. highly related to tillage but not the placement method.
    d. highly related to the placement method but not to tillage.

14. What fertilizer rate adjustment should be made based on the tillage/fertilizer placement method of this study?
    a. P and K fertilizer rates need not be adjusted.
    b. P fertilizer rates should be increased for NTBC but not for STBC.
    c. K fertilizer rates should be increased for STBC but not for NTBC.
    d. K fertilizer rates should not be adjusted, but P rates should be decreased for STBC.

15. In this study, the use of RTK satellite navigation technology made it possible to
    a. plant and band fertilizers always in the same location.
    b. reduce the intensity in the formation of fertilizer patterns in the field.
    c. obtain a sample that accurately represents the fertility of a field.
    d. improve the seedbed conditions of no-till fields.

16. Data in this study indicate that continuous band application of P in the same location can result in
    a. a substantial localized increase in soil P and depletion in the rest of the root zone.
    b. a substantial increase in soil P throughout the root zone.
    c. increased accumulation of P below 12 inches.
    d. a substantial depletion of P below 12 inches.

Quiz continues next page
17. The 8- to 12-inch depth increment at IR for STDB had no significant changes in P levels for the
   a. 161 lb P₂O₅/ac rate.
   b. 131 lb P₂O₅/ac rate.
   c. 115 lb P₂O₅/ac rate.
   d. all of the above.

18. Deep banding the fertilizer created a pattern of
   a. high soil P and K test levels at BR and lower levels at IR.
   b. high soil P and K test levels at IR and lower levels at BR.
   c. high soil P test levels at BR and low soil K test levels at IR.
   d. Low soil P test levels at IR and high soil K test levels at BR.

19. Always sampling in the location of the tilled strip (IR position)
   a. is usually recommended.
   b. overestimated soil K.
   c. underestimated soil P.
   d. is recommended when fertilizer is shallow banded.

20. Deep banding the fertilizer reduced the surface to subsurface P and K stratification ratio by
   a. decreasing test levels in the surface and subsurface.
   b. decreasing test levels in the subsurface.
   c. increasing test levels in the subsurface.
   d. increasing soil test levels in the surface.

---

**Self-Study Quiz Registration Form**

Name: ____________________________________________
Address: __________________________________________
City: ___________ State/province: ___________ Zip: ___________ CCA certification no.: ______________________

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

Credit card no.: __________________________________________
Name on card: ____________________________________________
Type of card: □ Mastercard □ Visa □ Discover □ Am. Express
Expiration date: ____________________________________________

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 July 2012 expires July 2015**

---

**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: __________________________________________
The amount of data available to today’s grower is overwhelming. Used correctly, it’s also invaluable. Ag Leader’s SMS™ Advanced software gives you powerful tools – like batch analysis, comparison analysis, multi-year averaging and customized booklet printing – to help you help your grower clients make smarter, more profitable decisions.

Ag Leader’s SMS™ Mobile software makes in-field data logging – like soil sampling, crop scouting and boundary logging – easy. Its Navigation View feature also makes navigating to specific locations in the field simple.

When combined, you have one of the most powerful, integrated precision farming data management tools available. And, because you can analyze data across multiple fields and growers, you can provide insights that your grower clients could never uncover themselves.

Learn more at www.sms.agleader.com. Download a free trial, visit www.agleader.com or call 515-232-5363 to request a demo CD.
Stevens Hydra Probe Soil Sensor
your solution for quality soil data

All-in-One Multi-Parameter Sensor
- Soil Moisture (WFV %)
- Soil Temperature
- Soil Electrical Conductivity
- Real Dielectric Permittivity
- Imaginary Dielectric Permittivity
- and many more!

Features of the Stevens Hydra Probe
- Excellent precision and accuracy
- Temperature corrected measurements
- Smart Sensor technology
- No calibration required for most soils
- SDI-12 or RS-485 signal output
- Measure temperature down to -10° F
  (-30° F probe option also available)

The most robust and consistent soil sensor ... Guaranteed!
5 year performance warranty

Over 100 universities, government agencies (USDA, USGS, NOAA, DOD, NASA), farms, vineyards and other companies rely on the Hydra Probe for quality data collection and analysis!

Other Soil Measurement Solutions from Stevens Water

The POGO Portable Soil Sensor: just poke and go!
The POGO enables manual soil readings to be taken quickly and easily. Simple insert the probe into the soil and select “Sample” on the PDA’s screen. Soil measurements are instantly displayed on the screen and logged to the PDA for further analysis.

Stevens pF Sensor
The Stevens pF Sensor is a matric potential probe that measures soil water potential using an innovative heat capacitance method. This makes the Stevens pF Sensor more accurate and provides high-accuracy readings even in dry or saline soils. Additionally, the sensor offers a measurement range of 10,000 bar, for a wider range of applications.

Data Loggers
Weather Sensors
Data Communication
Data Collection & Analysis

Tel: 800.452.5272
503.445.8000
Web: www.stevenswater.com

Celebrating 100 Years of History and Innovation
1911 - 2011