CCA ADVANTAGE

The Voice of the Certified Crop Adviser Program
American Society of Agronomy
www.agronomy.org/cca

CCAs Represent the Best of the Best

By Gordon Carlson

Reg Helwer is an ag retailer who believes firmly in the CCA program and how it benefits his company. "I feel that the CCA membership works to improve industry professionalism as a whole and greatly increases the value of a retail outlet in the eyes of the producer," he says.

Helwer is vice president of marketing for Shur-Gro Farm Services, Brandon, Manitoba. Shur-Gro is an independently owned agribusiness that sells crop input products at the retail level through a network of locations across Manitoba. He presented his thoughts about the CCA program at the recently held ICCA Canadian Summit.

Helwer holds two degrees, is a professional agrologist, and has worked in agriculture all his life. He points to the worth of the CCA program as a major reason for ag retailers to embrace it. "I am impressed by how rigorous the CCA program is and that adds a great deal to its credibility," he says.

Shur-Gro considers the CCA program "a huge asset" to the company and to agriculture throughout Canada because it helps agribusinesses serve customers more effectively, improves the professional image of the ag retail staff and works to ensure the sustainability of the agriculture industry, Helwer says. Twenty five percent of Shur-Gro's full-time staff are CCAs, and that number will grow "as more employees are being encouraged to become certified," he says.

An Integral Part of Their Customers

It's been pointed out on more than one occasion that as farm size expands, CCAs will become a more integral part of making the operation effective. Helwer believes the same.

He noted one study that found the shift from small farms to large-scale operations with more than one operator "places a greater demand on the need for professionalism and expertise from the crop adviser."

But it's one thing to have quality assurance as part of your staff and another to convey that reality to clients and prospective clients. Pamphlets and brochures are one way to get the message out. And as that message reaches farmers, it signifies that CCA-certified employees have proven their knowledge on the core aspects of the CCA program, have met the mandatory crop advising experience requirements established by the CCA board and are committed to continually upgrading their education.

"For me, having individuals on staff with these types of credentials makes good business sense and is a key factor in the evolution and longevity of my company and the entire industry," says Helwer.

Many of Shur-Gro's CCAs consider themselves as having accomplished something special; they are not just "guys behind the counter selling product," he says. Instead, "they are highly skilled professionals who have proven their knowledge and skills against the strict protocol and measured up to 'the bar' of this national program."

Gives Them the Edge

CCA membership gives a company another edge: instead of "just talking about" banding or broadcasting crop nutrients, "we can discuss implementing global positioning systems for crop nutrient applications and developing integrated management strategies," Helwer notes.

Evolution is "an essential key" to the retailer's success, and CCAs are a major component of that success.

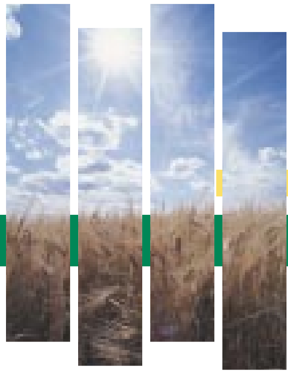
Sustaining agriculture as an effective industry capable of feeding U.S. consumers with enough left over for much of the rest of the world also concerns Helwer.

Often that involves having to counter public misperceptions such as one Helwer noted that farmers simply "dump" fertilizer as part of common agricultural practices.

"This is simply not the case, and we are able to confidently respond by stating that crop nutrient selection is made by trained individuals who take soil type, crop choice and fertility information from a soil test into consideration prior to making a recommendation."

Participation in the CCA program means members are the "best of the best" in agronomics, and for these reasons, "I can proudly say that Shur-Gro Farm Services is a proud supporter of the CCA program," he says.

An electronic version of CCA Advantage, including the test, is available on our Web site: www.AgProfessional.com



Innovative CCA Receives Farm Bureau's National Award

This year's winner of the American Farm Bureau Federation's "Excellence in Crop Advising" award can be termed an aggressive innovator — ready to apply new technology for the betterment of his clients rather than waiting for others to prove the technology's worth. But not without using the wisdom of experience as an effective guide.

David Scheiderer, CCA, CPCC-I, owner-operator of the independent crop consulting firm Integrated Ag Services, Ltd. (IAS), Marysville, OH, says flatly, "I have found it to be critical for the growth of the business to be open to new and progressive ideas. I feel it is my job to make sure we stay one step ahead of our clients in new technology adoption. Our clients rely on us to investigate new technologies and give them an unbiased opinion whether they are worth the price."

He cites as an example the purchase of a Veris on-the-go pH sampler, a machine pulled behind a pickup truck that measures soil pH as the rig is driven through a field. Only a few machines were sold in the United States this past fall, but one of them went to IAS.

Payback Is Tremendous

"The potential payback to farmers on this type of technology is tremendous," says Scheiderer. "We purchased the machine knowing we would have to deal with all the headaches of trying something new, but we felt it was important to have this experience ahead of the pack."

IAS was one of the first companies in that area of the country to use GPS to map fields, take soil samples and generate variable-rate fertility and lime recommendations. The firm bought the only SST information lab in Ohio to mass process multiple layers of field information and pool regional data.

"We are currently working on setting up some of our clients' corn and soybean planters to do variable-rate seeding. We have ongoing test plot studies to determine the viability of variable-rate nitrogen and herbicide applications. So yes, I would have to say we try to be a progressive consulting firm," Scheiderer says.

He admits it can be risky and expensive at times. "You must have the intestinal fortitude to work through the bugs, let alone the financial resources needed to absorb the technologies that fail."

Superior Service

Bob Stallman, AFBF president, termed Scheiderer's consulting performance as "superior service for ... farmer clients in nutrient management, soil and water management, integrated pest management and crop production" – quite a list of responsibilities.

Nutrient management, says Scheiderer, "has always been the cornerstone of our business. We provide a menu of services for our clients to choose from and almost all of them have some sort of nutrient management service."

The company uses GPS to generate field boundaries and pinpoint sample locations. "We use electro-conductivity measurements to determine management zones, and we use yield monitor data to determine crop removals," he says. "We take all this information and combine it together using GIS software to develop agronomic as well as economic fertilizer and lime recommendations."

Starts Own Business

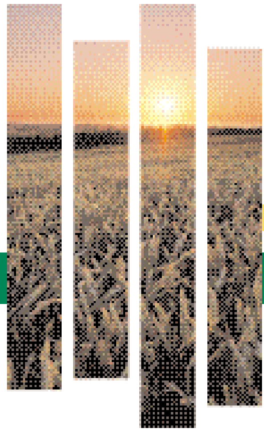
Scheiderer was in the ag retail fertilizer and crop protection chemical business for nine years before starting his own business. Then in 1990 he became a consultant on his own. In his first year he managed to scrape together 12,000 acres of business. Now the company's client size varies from 70 to 17,000 acres with an average of 1,300. The primary crops are corn and soybeans.

David Scheiderer
CCA, CPCC-I
Integrated Ag Services, Ltd. (IAS)

And there are staff responsibilities: One employee handles municipal biosolids accounts, another handles manure management accounts, a third handles the seed testing program and Scheiderer handles business management accounts. They all share responsibilities for traditional consulting accounts.

Being a certified crop adviser is difficult to quantify, he adds. "Most farmers don't place as much value on CCA certification as on personal reputation. The advantage I see from being CCA certified is that it's a way of showing others in the industry IAS is committed to strive for professionalism."

The more professional an industry is, the greater the need for each individual within the industry "to keep pace with that higher standard," he says.



Chairman's Corner

Bob Beck, CCA, Chairman

ICCA's Second Decade

By Bob Beck, CCA, Chairman, International CCA Board, Pioneer Hi-Bred International

I wish you a happy new decade! When we offer our exams on Feb. 6, ICCA will begin the second decade of certifying our colleagues.

These colleagues may be experiencing that dreaded affliction known as "Test Anxiety!" Looking back on this past decade, the path was definitely not a "cake walk" as we have given 35,886 exams with a 60 percent average passing rate.

Why would anyone want to go through that to join 14,869 Certified Crop Advisers (CCA) who reside and work in Canada and the United States?

Pride of Professionalism

I cite some of your colleagues from past editions of our newsletter (1997-2003). The program sets a standard level of competence, allows crop advisers to be recognized as a group, instills a sense of pride among ag professionals and, by subscribing to the CCA code of ethics, provides an opportunity to demonstrate a partnership with growers rather than just a business. The pride of professionalism is alive and well.

During that same time, the articles written by the 10 outstanding chairs that have preceded me have a reoccurring theme: You need to speak up for yourself, your professionalism and your professional certification.

You are part of an organization that has been recognized in Washington, DC, as capable to provide the technical services necessary to implement farm conservation programs managed by the USDA-NRCS. You have heard much about the memorandum of understanding (MOU) signed by the American Society of Agronomy and USDA-NRCS.

You were represented at this signing by Tom Bruulsema, chair of the International Certified Crop Advisers. I find it fascinating that Tom, a Canadian citizen, added awareness of our international status as well as our professionalism.

This MOU demonstrates the voice that you have in Washington, DC. In addition, we began conversations with the ministers of Parliament and Canadian officials during the Crop Advisers Summit held in Ottawa, Canada, last October. You are important enough that Bruce Knight, chief of USDA-NRCS, joined the Summit to address some of the issues that pertain to the Technical Service Provider process in the MOU.

Listening and Leading

So where am I headed? It is important that your elected leaders listen and lead. But you must speak up: to your clients, colleagues and ICCA board.

We hear about the positives of certification, but we also hear questions about "why did I work so hard to become certified, why does it cost so much to re-certify, what's in it for me?" Legitimate questions, but when they become statements of doubt disguised as questions we need to examine our intent.

Your CCA certification indicates you have met the following requirements:

- Have at least two years of documented crop advising experience with grower references and
- Have passed two comprehensive exams covering a base standard of agronomic expertise and
- Earn 40 hours of continuing education every two years and
- Have signed and adhere to a code of ethics that emphasizes a focus on grower profitability while optimizing and protecting natural resources.

As we begin this second decade as CCAs, let's follow some simple guidelines shared by Peter Bloom. The most useful and valuable organizational guidelines are simple and straightforward and make common sense. Without stating such guidelines, these important ideas are often missing in an organization.

Listen, really listen. Pay attention when others speak and allow them to finish their thoughts. Listen for feelings as well as thoughts. Listening in this way lets people know you care about them.

Say what you are thinking. If you have something to add to the discussion, always be willing to speak. You are the only one with your view of the world and you can easily share it without devaluing others' views.

Use X by Y and then deliver. X by Y means being clear about who will do what (X) by when (Y). Give your word and then keep it. Help others to be clear about the commitments they are making.

Take care of each other. Check in with people, look out for the interests of people who are not present, be courteous and civil.

Acknowledge people. Tell people what you appreciate about them. Let them know how they contribute to your work, your life and the organization.

Here's wishing you a Happy New Decade!

Continuing Education Self-Study Course

Nutrient Management

CCA 1 CEU

Phosphorus Bioavailability Following Incorporation of Green Manure Crop

By Michel A. Cavigelli and Steve J. Thien

Earn one CEU!
All CCAs may earn up to 20 Continuing Education Units (CEUs) per two-year cycle as board-approved self-study articles which will include CCA Advantage articles. The CCA CEU logo (above) marks all pre-approved material, with the CEU value indicated by the number in the middle. To receive one CEU in nutrient management, read this article, fill out the attached exam and mail the tear-out form, along with $10, to the American Society of Agronomy.

Green manures may enhance P nutrition of succeeding crops via a number of mechanisms. Green manure crops may convert relatively unavailable native and residual fertilizer P to chemical forms more available to succeeding crops. Alfalfa, red clover, sweet clover and lupine can absorb more P than most other crops from soils testing low in P. On decomposition, organic P (P_o) in green manure tissues could provide a relatively labile form of P to succeeding crops, thus providing a larger pool of mineralizable soil P_o to supplement soluble inorganic P pools. P_o mineralization supplies significant amounts of plant P in grasslands, and perhaps in some perennial and organic agricultural systems.

Decomposition processes, which are stimulated when green manure residues are incorporated into the soil, can further increase P availability by releasing CO_2, which forms H_2CO_3 in the soil solution, resulting in the dissolution of primary P-containing minerals. Also, organic acids released during decomposition may help dissolve soil mineral P. In soils with high P-fixing capacities, organic compounds released during decomposition processes may increase P availability by blocking P-adsorption sites or via anion exchange. Some amino acids, however, can increase P adsorption by soil. Repeated incorporation of green manures can also result in decreased soil bulk density and increased soil aggregation and moisture retention, all factors that may help increase P uptake by succeeding crops via their effects on increased root and mycorrhizal growth.

Adding plant residues to soil can increase soil test P, increase P_o, increase P uptake by succeeding plants and decrease soil P sorption. However, plant P availability does not always increase following green manure incorporation since the soil microbial biomass and soil sorption processes compete for available P. Most studies report that net P immobilization occurs when the total P concentration of plant tissues incorporated into soil is below 2 to 3 g kg^{-1}, although a study in 1988 found that net P mineralization occurred when plant tissue P concentrations were as low as 1 g kg^{-1}. Increases in soil P fertility following green manures may be difficult to detect since conventional soil P tests do not assess readily mineralizable P_o.

The objectives of this greenhouse study were (1) to evaluate the effects of green manure growth and subsequent soil incorporation on the P uptake of a succeeding sorghum crop and (2) to evaluate the ability of the Bray-1 soil P test to measure relative soil P bioavailability for green manure crops and for a subsequent sorghum crop. We hypothesized that sorghum biomass and P uptake would be highest following green manure crops with the highest P contents.

We conducted two crop rotation experiments in the greenhouse, one using perennial forages as green manures and one using winter annual cover crops. In each experiment, green manure shoots and roots were incorporated into the same soil in which they were grown before planting grain sorghum. Perennial forages were Riley alfalfa, Nitro alfalfa, Medium Red red clover and Yellow Blossom yellow sweet clover. Winter cover crops were Hope white lupine, common Austrian winter pea, common hairy vetch and Arkan winter wheat.

Results

Green Manures. In the perennial forages experiment there were no differences in tissue P and N concentrations among the four perennial forage crops. There were, however, small differences in P uptake among perennial forages, with sweet clover and Nitro alfalfa having higher P uptake than red clover. Sweet clover produced more biomass and had higher N content than did the other three cover crops.

In the winter cover crops experiment all three winter cover crop legumes had higher tissue N concentrations than did wheat. Cover crop P uptake and N content, however, varied with plant biomass. For example, although vetch had the highest tissue P and N concentrations, vetch had the lowest biomass and among the lowest N contents, P uptake and adjusted P uptake (P uptake minus seed P content).

Sorghum Following Green Manures. In the perennial forages experiment sorghum P uptake was greater following Nitro alfalfa than in all other treatments. Sorghum P uptake following Riley alfalfa and red clover were greater than following no cover crop, but sorghum P uptake following sweet clover was not different than sorghum P uptake following no cover crop.

Soil inorganic N levels when sorghum was planted were similar among all cropped pots, indicating that no additional fertilizer was needed to reach sorghum grain yields of 11,290 kg ha^{-1}. Sorghum in the control pots was fertilized with NH_4NO_3 25 days after planting, at which point the sorghum plants visually were smaller in the control pots than in the cropped pots. At harvest, sorghum biomass and P uptake were much lower and N content was much higher in control pots than in any other pots, probably because of the late fertilization date.

In the winter cover crops experiment sorghum P uptake and biomass following lupine were lower than sorghum P uptake and biomass following all other winter cover crops. Sorghum P uptake following lupine was even lower than sorghum P uptake following no cover crop. Among other cover crops, sorghum biomass was higher following wheat, pea and vetch than following no cover, but there were no differences in sorghum P uptake among these four treatments. There were significant negative correlations between cover crop characteristics and sorghum P uptake and biomass. These negative relationships were due to lupine's unique behavior (high lupine biomass, N content and P uptake, and low succeeding sorghum biomass and P uptake): We ran all correlation analyses without the lupine data to determine if there were any relationships between characteristics of the other three cover crops and sorghum biomass and P uptake. These analyses show that cover crop characteristics and sorghum P uptake and biomass were not related.

Soil inorganic N levels when sorghum was planted were affected by differences in cover crop N contents and were highest in soils containing lupine residues, intermediate in soils containing pea residues and lowest in soils containing vetch, wheat or no residues. The observed soil inorganic N levels indicate that legumes provided sufficient N to reach sorghum grain yields of at least 9410 kg ha^{-1}.

Bray-1 Soil Phosphorus. In the perennial forages experiment Bray-1 soil P in control soils stayed relatively constant during perennial forage growth and decomposition. Bray-1 soil P in cropped soils, however, decreased by about 4 mg kg^{-1} in all soils during perennial forage growth and increased by about 2 to 3 mg kg^{-1} during perennial forage residue decomposition. Bray-1 soil P values at the time of sorghum planting were lower in cropped soils than in the uncropped control soils. During sorghum growth, Bray-1 P decreased by 4 to 5.6 mg kg^{-1} in all treatments, with only slight differences among treatments.

In the winter cover crops experiment, during winter cover crop growth, Bray-1 soil P decreased in all cover cropped soils relative to uncropped control soils. The resulting Bray-1 soil P was slightly lower in pea and vetch pots than in lupine pots and slightly lower in pea than in wheat pots. Correlation analyses showed no relationship between winter cover crop adjusted P uptake and the decrease in Bray-1 soil P during cover crop growth.

During cover crop decomposition, Bray-1 P increased by about 4 mg kg^{-1} in soils cropped to pea, vetch and wheat, which was a greater increase than the 1.6 mg kg^{-1} increase in control soils. The slight increase in Bray-1 soil P during lupine residue decomposition was not significantly different from that in the control pots. There was a negative correlation between the change in Bray-1 soil P during winter cover crop decomposition and cover crop adjusted P uptake. This negative relationship was due to lupine's anomalous behavior (high adjusted P uptake, no change in soil P), so we also ran the correlation analysis without the lupine data. In this analysis we found no relationship between cover crop adjusted P uptake and change in Bray-1 soil P. During sorghum growth, Bray-1 soil P decreased in all treatments and these decreases were correlated with sorghum P uptake.

Discussion

For the perennial forages experiment, sorghum P uptake was highest following Nitro alfalfa. This result supports our hypothesis that sorghum P uptake would be highest following green manures with the highest P content. Perennial forage P uptake accounted for 22 percent of the observed variability in sorghum P uptake. This relationship is particularly noteworthy because the soil used was categorized in the medium range for Bray-1 soil P, which indicates that crop yield responses to fertilizer P are expected to be small and inconsistent.

Our hypothesis also predicts that sorghum biomass would be higher following Nitro alfalfa and sweet clover than following the other perennial forages, but we found no differences in sorghum biomass (or N content) following the four perennial forages. Low sorghum biomass in the control treatment is likely due to the late fertilization date. Tissue N concentrations for perennial forages were above levels at which net N mineralization is expected. We assume that sorghum received adequate N following perennial forages.

Perennial forage tissue P concentrations were lower than the commonly reported 2 to 3 g kg^{-1} net P mineralization threshold level but higher than the 1 g kg^{-1} threshold level identified in a study in 1988. Since Bray-1 soil P increased following perennial forage decomposition, our data support the 1988 finding that net P release can occur when plant residue P concentrations are lower than 2 to 3 g kg^{-1}.

For the winter annual cover crop experiment, our hypothesis predicts that sorghum following lupine would have the highest P uptake and biomass. However, sorghum P uptake following lupine was lower than for any other treatment, including the control, and sorghum biomass following lupine was as low as for the control. Among the other three winter cover crops we found no relationships between cover crop characteristics and sorghum P uptake and biomass. We therefore cannot generalize about the four winter cover crops' behavior from these data, and we conclude that there is no consistent positive relationship between winter cover crop P uptake and sorghum P uptake and biomass in this experiment. Also, cover crop N content and biomass did not affect sorghum P uptake.

Winter cover crop tissue N concentrations were above levels at which net N mineralization is expected, and soil inorganic N levels at the time of sorghum planting suggest that N would not limit sorghum growth following winter cover crops. Differences in N content among winter cover crops did not seem to affect sorghum N uptake. However, sorghum biomass was higher following pea, vetch and wheat than following no cover crop, suggesting that among these three cover crops there was a positive cover crop rotation effect on sorghum biomass.

Although lupine absorbed almost two to three times more P than the other winter cover crops, Bray-1 soil P during lupine's growth changed by the same amount as it did in the other cover crop treatments. This result indicates that lupine is able to take up soil P from non-Bray-1 pools, which is consistent with reports that lupine grows well in low P soils because of its ability to solubilize a significant amount of soil P that is unavailable to other crops.

Low sorghum P uptake and biomass following lupine were probably not caused by N limitation since soil inorganic N was highest following lupine, and sorghum tissue N concentration and N content were as high or higher for sorghum following lupine than for sorghum following the other three cover crops and the N-fertilized control. High soil inorganic N levels indicate that lupine residue decomposition had progressed sufficiently to provide adequate N at the time sorghum was planted. There is some evidence that white lupine can be allelopathic to weeds and that soil organisms stimulated by lupine residue decomposition may have allelopathic effects, but there seems to be no other indication in the literature that lupine might be allelopathic to succeeding crops. Numerous other mechanisms may have been responsible for lower sorghum P uptake and biomass following lupine

Results from the winter cover crop experiment suggest that plant type seems more important than residue application rate in influencing subsequent P bioavailability. Others have reported that residue application rate is more important than plant type in affecting soil P availability. These authors added plant residues to soils at rates between 0.1 and 1.0 g kg^{-1}. Assuming that crop residues are incorporated to a depth of 15 cm and that one quarter of cover crop biomass is root biomass, a 0.1 g kg^{-1} residue application rate is equal to aboveground cover crop biomass production of about 16,800 kg ha^{-1}, which is up to five times as much above-ground biomass as can be expected from most cover crops in the Great Plains. Thus, results from experiments using these high residue application rates may not be relevant to our experiment or to cover crop residue application rates typically used in the Great Plains. We applied residues at rates more typical for field-grown cover crops in the Great Plains states.

Many researchers studying the effect of plant residue applications on soil P bioavailability apply plant residues to soils in which the plants have not been grown. This fact may have an important influence on their results. Although lupine may be an extreme case, roots of other plant species also exude many compounds that can influence P solubility and uptake. We incorporated green manure residues into the same soils in which they were grown. Therefore, each residue was added to a soil that had been treated differently before residue application, as is the case when green manures are used in agricultural settings. Therefore, applying plant residues to soils that have previously been treated equally may not reflect the effects of green manures on soil P bioavailability in field situations.

While changes in Bray-1 soil P were relatively small during the course of the experiments, the general lack of relationship between changes in Bray-1 soil P and P uptake suggests that measuring relative changes in P uptake and release among green manure crops and other P_o sources will require a more sensitive measure of bioavailable soil P.

We reached different conclusions with respect to our hypotheses in the two experiments, possibly because of our selection of green manure crops in each experiment. The four perennial forages are more closely related to each other than are the four winter cover crops. Therefore, green manure plant characteristics other than P uptake may have been more similar among perennial forages than among winter cover crops. If this is the case, plant characteristics other than P uptake may have been significant confounding factors in the winter cover crop experiment. The different results in the two experiments may also have been due, at least in part, to running the experiments for different lengths of time, especially the portion of the experiment during green manure growth.

Conclusions

Phosphorus uptake of previous green manure crops in one of two experiments affected sorghum P uptake. Among four perennial forages sorghum P uptake increased with P uptake of the preceding perennial forage crop. Among winter cover crops, however, there was no consistent relationship between P uptake of green manures and P uptake of a subsequent sorghum crop. Lupine, however, which had high N content and P uptake, had no effect on sorghum biomass and a negative effect on sorghum P uptake. Green manure characteristics other than their P uptake can affect P uptake of a subsequent sorghum crop and these complex relationships warrant further study. Green manure P uptake and sorghum biomass were not related in either experiment. Nonetheless, our results indicate that, even in a soil-testing medium in soil P, in which small and inconsistent P fertilizer yield responses are expected, Nitro alfalfa increased soil P bioavailability relative to other perennial forages. Testing the effect of green manures on soil P bioavailability and on P uptake by subsequent crops warrants further research.

Such studies might benefit from using soil P tests that more accurately measure readily mineralizable soil P_o than does the Bray-1 soil P test. Relative increases and decreases in Bray-1 soil P generally were not correlated with relative P uptake among crops. Although changes in Bray-1 soil P among treatments were small, the lack of relationships, in most cases, between Bray-1 soil P and crop uptake suggest that a soil P test that measures P sources made available through microbial activity and other changes in soil characteristics may be more useful for measuring P availability following incorporation of green manures than is the Bray-1 soil P test.

Editor's note: *Content was adapted from the paper "Phosphorus Bioavailability following Incorporation of Green Manure Crop," which was published in Soil Sci. Soc. Am. J., Vol. 67, July-Aug. 2003, and is courtesy of the authors Michel A. Cavigelli and Steve J. Thien*

Continuing Education Self-Study Test

Nutrient Management

CCA 1 CEU

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DIRECTIONS

1. Read the self-study article on pages 38-40 carefully.
2. Answer the questions by clearly marking an "X" in the box next to the best answer for each question.
3. Complete the self-study exam registration form on the back of this page.
4. Clip out this self-study examination page, fold and place in envelope.
5. Enclose a check for $10.00 made payable to the American Society of Agronomy, for processing fees. Payment in U.S. funds only.
6. **Mail your self-study exam and fee to:** ASA c/o CCA Self-Study Exam, 677 S. Segoe Road, Madison, WI 53711. *Please allow 60 days for processing.*
7. An electronic version of this test is also available at *www.AgProfessional.com*. Go to the Certified Crop Advisers section (lefthand column) and access the "CCA Advantage" link.

DETACH HERE

Phosphorus Bioavailability Following Incorporation of Green Manure Crop

January Self-Study Examination

1. Lupine and sweet clover are examples of plants that:

[ ] a. are invasive species.
[ ] b. can absorb more P than most cover crops from soils testing low in P.
[ ] c. require supplemental P.
[ ] d. remove excessive amounts of P from the soil.

2. Decomposition processes can further increase P availability by:

[ ] a. releasing CO_2 which forms H_2CO_3.
[ ] b. releasing H_2O.
[ ] c. releasing H_2CO_3.
[ ] d. releasing O_2.

3. Repeated incorporation of green manure:

[ ] a. leaches N.
[ ] b. fixes P.
[ ] c. decreases bulk density.
[ ] d. reduces water retention.

4. Most studies report that net P immobilization occurs when total P concentration of plant tissues incorporated into soil is below:

[ ] a. 10 g kg^{-1}.
[ ] b. 7 g kg^{-1}.
[ ] c. 5 g kg^{-1}.
[ ] d. 3 g kg^{-1}.

5. This study conducted 2 crop rotation experiments using:

[ ] a. perennial forages and winter annual cover crop green manure.
[ ] b. 2 rounds of perennial forages.
[ ] c. 2 rounds of winter annual cover crops.
[ ] d. applied organic P.

6. In the perennial forages experiment, sorghum P uptake was greatest following:

[ ] a. Medium Red clover.
[ ] b. Yellow Blossom yellow sweet clover.
[ ] c. Riley alfalfa.
[ ] d. Nitro alfalfa.

7. In the winter cover crops experiment, sorghum P uptake was lowest following:

[ ] a. Hope white lupine.
[ ] b. common Austrian winter pea.
[ ] c. common hairy vetch.
[ ] d. Arkan winter wheat.

8. Lupine absorbed almost 2 to 3 times more P than other winter crops:

[ ] a. and Bray –1 soil P during lupine's growth increased 2 to 3 fold.
[ ] b. and Bray –1 soil P during lupine's growth increased 4 to 6 fold.
[ ] c. however Bray – 1 soil P during lupine's growth changed by the same amount as it did in other crop treatments.
[ ] d. suggesting lupine is able to solubilize more available P than other winter crops.

9. Results from the winter cover crop experiment:

[ ] a. suggest residue application rate is more important than plant type in influencing subsequent P bioavailability.
[ ] b. suggest plant type is more important than residue application rate in influencing subsequent P bioavailability.
[ ] c. are similar to results from the perennial forages experiment.
[ ] d. yielded very little data.

Over

10. Measuring relative changes in P uptake and release among green manure crops and other organic P sources:

[ ] a. can be accurately measured using the Bray – 1 soil test.
[ ] b. will require replications of this experiment.
[ ] c. will require a less sensitive measure of bioavailable P.
[ ] d. will require a more sensitive measure of bioavailable P.

SELF-STUDY EXAM REGISTRATION FORM

Name: ______________________________

Address: ______________________________

City: ____________________ State/Province: ______________ Zip: ______________

CCA Certification #: ______________________________

Credit Card #: ____________________ Type of Card: Visa ❏ Mastercard ❏ Discovery ❏ Am Express ❏

Expiration Date ____________________ Name on Card: ____________________

A $2 processing fee will be added to all credit card charges, or enclose $10 check payable to American Society of Agronomy.

X ______________________________

Signature of Registrant as it appears on Code of Ethics

I certify that I alone completed this self-study course and recognize that an ethics violation may revoke my CCA status.

This exam issued January 2004 expires January 2007.

DETACH HERE

SELF-STUDY EXAM 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 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: ______________________________