

CCA ADVANTAGE

*The Voice of the Certified Crop Adviser Program
American Society of Agronomy
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CCAs Sign MOU to Serve as Technical Service Providers

Through a five-year Memorandum of Understanding (MOU) between USDA's Natural Resources Conservation Service (NRCS) and the American Society of Agronomy (ASA), Certified Crop Advisers (CCAs) will be eligible to serve as Technical Service Providers (TSPs) for conservation farm programs.

This partnership will allow ASA to recommend certified members to USDA as TSPs as provided for by the 2002 Farm Bill, which requires the USDA to provide conservation technical assistance to farmers and allows the department to approve who can provide this assistance.

"We at ASA recognize and accept the responsibilities that come with this

agreement," says Bob Hoeft, president of ASA. "We also recognize that this creates a great opportunity for our practicing agronomists to participate in programs that will benefit all of society. This partnership with NRCS will enhance the opportunity for science developed by members of ASA to be transferred to the public in a meaningful way.

"We cherish this partnership that will allow our practicing agronomists to serve as TSPs to assist NRCS in delivering quality conservation technical assistance," Hoeft says.

TSPs will provide technical assistance to farmers of private lands in protecting resources through conservation planning in soil, water, nutrient, pest and crop management. "TSPs will help

ensure all landowners receive timely technical assistance services, such as conservation planning and the design, layout, installation and review of approved conservation practices," says Jim Mosely, deputy secretary of USDA.

"This agreement will provide farmers with local assistance in implementing provisions of the conservation title of the 2002 Farm Bill through their local CCAs," says Luther Smith, executive director of the CCA program. "In signing this agreement, the USDA recognizes the experience, education, ethics and exam requirements for individuals to be certified as a CCA. And it mandates that the continuing education requirements that are necessary to maintain CCA certification are also needed to continue to serve as a TSP."

(l to r): Luther Smith, Executive Director, CCA Program; Tom Bruulsema, Chair, ICCA Board of Directors; Bob Hoeft, President of ASA; Jim Moseley, Deputy Secretary of NRCS; Bruce Knight, Chief USDA-NRCS; Mark Rey, Under Secretary USDA Natural Resources and Environment



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

As part of the overall MOU, agreements were established with four ASA certification programs — Certified Crop Advisers, Certified Professional Agronomists, Certified Professional Crop Scientists and Certified Professional Soil Scientists.

The agreement also provides for the CCA program to establish and maintain a registry of all individuals qualified to serve as TSPs.

“Farmers needing a TSP for assistance in their conservation plans and programs will be able to find a registry of qualified CCAs who serve as TSPs at USDA service centers and local conservation districts,” Smith says. “The registry also will provide their area of expertise and the geographic area they serve.”

Role of CCAs

The Bush administration has been a strong advocate of expanding the availability of technical assistance to landowners and increasing conservation funding and programs to bolster environmental stewardship on the nation’s farmland. In the 2004 budget request, President Bush proposed a record \$3.9 billion, an increase of \$582 million over the FY 2003 level, for conservation programs.

Bob Hoeft,
president
of ASA



“These MOUs provide a great opportunity to engage the largest number of qualified, private-sector TSPs to work with the NRCS and conservation district staff to meet the conservation needs on America’s farms and ranches,” ASA’s Hoeft says. “It continues to build on the very positive public-private partnership that exists between USDA-NRCS and ASA and its certification programs.”

“Certified crop advisers strive to apply — and help develop — the best knowledge on producing high yield of quality crops in harmony with the environment,” says Tom Bruulsema, chair of the International CCA Board and regional director for the Potash & Phosphate

A CCA’s Next Step

By Luther Smith, Executive Director, CCA Program



On Thursday, Feb. 6, the CCA program signed a Memorandum of Understanding (MOU) with USDA-NRCS. This MOU sets the framework for the certification of CCAs who meet the NRCS certification criteria as Technical Service Providers (TSP) in providing conservation technical services for nutrient management, pest management and residue management.

The opportunity to participate is now in front of you. Take advantage of it. NRCS is very interested in working with CCAs to implement the new farm bill.

The first thing you need to do as soon as possible to participate as a TSP is go to your local USDA service center and register for a user ID and password. You can print the forms by going to www.nrcs.usda.gov, clicking on “electronic government” and then clicking on “register.” You can either fax or mail the notarized forms to the service center or deliver them to the service center. This important first step will allow you to access and sign a certification agreement covering the terms and conditions of your certification, and it will allow you to conduct business with NRCS electronically. You will be able to carry out technical services as a TSP once you are certified by NRCS and are placed on the NRCS approved list of TSPs.

Evaluate your capabilities. Determine what you can and cannot do. Obtain appropriate training if needed. Poor-quality plans will be rejected by NRCS and jeopardize your TSP status. Adhere to the CCA code of ethics. Most of all, get involved. Meet with your county and state NRCS staff to develop a positive working relationship with them. They can also help you understand what they need and how they need it.

Remember this is all very new for everyone involved, so there will be some adjustments made along the way. We will do our best to keep you informed and provide more details as they become available.

Institute, a science organization funded by North American fertilizer producers. He explains that consumers are expecting more from producers and all of the players in the food supply chain. In turn, growers are expecting more from their advisers.

Tom Bruulsema,
chair of the
International
CCA Board
and regional
director for
the Potash &
Phosphate
Institute



“As advisers, we strive to lead agriculture to more sustainable and productive practices,” he says. The food supply chain demands quality assurance — and certification helps assure the quality of advice on crop production and the management of all the resources it requires.”

Bruulsema says the CCA program recognizes and rewards individuals who are at the leading edge of scientific knowledge, and motivates those who want to learn and improve. He notes that these individuals have become more effective and productive in delivering inputs and services to growers because of that education.

“Agribusiness has invested and continues to invest millions of dollars in this certification effort, in support of education,” Bruulsema continues. “Our industry also continues to support the research needed to develop new knowledge that is relevant to practitioners.”

Certification and Training

According to ASA, certified members have to pass two comprehensive examinations and continue to maintain their expertise through attending at least 40 hours of continuing education every two years. In addition, each member must sign and abide by a Code of Ethics.

To reiterate the importance of ethics to the certification programs, Hoeft tells of a pilot program conducted by NRCS in Illinois that demonstrates the integrity



Jim Moseley, Deputy Secretary of NRCS, speaks at the MOU signing between NRCS and the ASA CCA program.

of Certified planners. He says the planners “are willing to develop plans based on scientifically derived recommendations even though, in some cases, this might result in a reduction in product sales.

“I can tell you that more than one CCA has informed me that they refused to sell product to an individual because it was not in the best interest of the customer from an economical or environmental standpoint,” he continues.

The same pilot program illustrated CCAs’ dedication to the environment.

“As a result of these programs in the five targeted watersheds, phosphorus use has been reduced 22 percent and nitrogen use 9.1 percent without an observable impact on yield,” Hoeft explains. “The goal of this program was to increase the efficiency of nutrient use, not necessarily reduce nutrient sales. An educational program aimed largely at CCAs has resulted in reduced use of nitrogen by some 34 percent of farmers surveyed.

ASA is committed to developing programs that will make research find-

ings such as this available in a form that is useable to the more than 16,000 individuals that are certified in ASA’s certification programs. Efforts are under way at ASA to develop a new information technology delivery system for this very purpose.

“Our certified members look forward to the ability to utilize their science-based training to develop management programs that are economically and environmentally sound,” Hoeft says.

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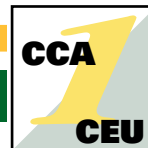
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By Cynthia A. Grant, Gary A. Peterson, and Constantine A. Campbell

In recent years, conservation tillage systems have emerged on the northern Great Plains as a means of increasing yield potential via increased moisture conservation. Moisture conservation under a minimum- or no-till system facilitates intensified cropping.

To take the greatest advantage of increases in stored water while reducing the risk of nutrient leaching and salinization, producers must shift away from rotations that include high proportions of monoculture cereals and summer fallow to more intensified and diversified rotations. Intensified rotations allow the use of the extra water retained from reduced tillage and take advantage of the predomi-

nantly summer precipitation pattern prevalent in the northern Great Plains. In addition, increases in available water allow greater crop diversification in the rotation and movement from rotations dominated by cereals to rotations with greater proportions of pulse crops, oilseeds and, in the subhumid areas, forages.

Intensification and diversification of cropping systems influence soil physical, chemical and microbiological characteristics. Increasing crop production increases the amounts of plant biomass produced and returned to the soil as surface residue or root material. This has potential to increase soil organic matter content and improve the soil's overall structure and stability. Soil microbiological diversity, microbial biomass and respiration are all influenced by intensity and diversity of cropping. Changes in such soil quality attributes can influence crop yield potential and the amount and distribution of roots in the soil profile.

Sustainability of cropping systems requires that nutrients removed from the soil be balanced by nutrient replacement. Crops differ in yield potential and in the amounts of nutrients they remove from the soil. This review paper describes effects of intensification and diversification of cropping systems on nutrient demand and dynamics, concentrating on N and P, and illustrates the impact that a cropping system may have on nutrient management decisions.

Nitrogen

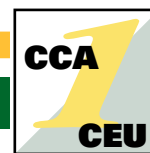
Nitrogen is the nutrient that is most frequently limiting to crop production and the nutrient applied in the greatest amounts in

the northern Great Plains. Nitrogen is also required for assurance of optimum crop quality as protein content of crops is directly related to N supply. It is also of major concern with regard to environmental sustainability because NO₃ leaching can reduce ground water quality and N₂O emissions can contribute to the greenhouse gas effect and global warming. An efficient cropping system will attempt to balance crop demands for N with timing and rate of N supply so that crop yield is optimized while N is neither over-depleted from the soil nor accumulated in quantities that result in the potential for contamination of ground or surface waters. Source, rate, timing and placement of fertilizer N can be chosen to meet these goals. However, optimal management will be influenced by crop type and crop rotation.

As cropping intensity increases, annualized grain yield increases. However, as crop production increases, so does N removal from the system. Therefore, total nutrient removal with continuous cropping will be substantially higher than with a fallow cropping system. With increased nutrient removal, responses to fertilizer applications become more likely.

Nitrogen returned to the system via crop residues from previous years of cropping must also be considered. While crop removal of nutrients is increased by cropping intensification, the amount of organic residues returned to the system is enhanced, which can increase the potential for nutrient release from organic matter residues, particularly in fertilized systems.

Diversified crop rotations can increase yield potential by influencing plant diseases, weeds, root distribution, moisture



utilization and nutrient availability. Ideally, diversification involves the inclusion of crop species with different resource requirements.

When water is limiting, rotating crops with different water use patterns and requirements can increase total crop yield and total nutrient removal. To optimize crop yield, the nutrient supply rates must be matched to the yield potential supported by the available water.

Diversified crop rotations not only influence the demand for nutrients, but may also influence the supply of nutrients to the growing crop. Crops differ substantially in the amount of N returned in crop residue for use by subsequent crops because N supplied depends on the amount of crop residue, primarily, and on the concentration of N in the residue. Nitrogen concentration in residue determines the net balance between immobilization and mineralization. If the N concentration in residue is below approximately 20 to 24 g N kg⁻¹, immobilization will exceed mineralization, and the decomposing residues will tie up N rather than release it.

As decomposition proceeds, all residues eventually release the minerals they hold. The time required for this to occur increases as the initial N concentration in the residue decreases and the C/N ratio widens. Straw from a well-fertilized wheat crop could decompose at a similar rate and produce similar amounts of N as a legume residue. Some residues also may have more nutrient present in a readily soluble inorganic or readily mineralizable organic form and so would release nutrients more readily than those holding most of the nutrients in a more recalcitrant form. Therefore, species and nutrient management of the preceding crop influence its nutrient content and the amount of nutrients it releases to the subsequent crop. Placement of residues and method of termination of the crop also influence N release. Soil incorporation of residues reduces N loss by volatilization, enhances mineralization and increases the short-term supply of plant-available N.

The amount and type of crop residue and factors influencing its rate of decomposition (e.g. moisture) may also influence the availability of fertilizer N. If fertilizer N is applied with high C/N ratio residues, N immobilization may be sub-

stantial because the microbial population will utilize the fertilizer N to build biomass as the residue decomposes. Further, residues can enhance the loss of N by volatilization from broadcast urea [(NH₂)₂CO] because the urease enzyme in the residues can increase the rate of NH₃ release. Therefore, where high amounts of crop residues are present, particularly if they contain a wide C/N ratio, separating fertilizer from the residues by placing N fertilizers below the soil surface can increase fertilizer use efficiency.

Annual legumes are often incorporated into cropping sequences and can increase the available N for the subsequent non-legume crop. Legume crops can symbiotically fix N in association with *Rhizobium* spp. If the legume crop is used as green manure, considerable amounts of N can be supplied to the succeeding crop as the legume residue decomposes. In the case of legume pulse crops such as soybean, field pea or lentil, where the seed is harvested and removed from the field, N fixation will reduce the fertilizer N requirement for optimum yield of the legume crop. The amount of N removed via the seed of pulse crops is generally similar to the amount of symbiotic N fixation. Despite this, N requirements are generally reduced and total N accumulation increased in crops following pulse crops, indicating that pulse crops increase the available N for subsequent non-legume crops.

Legume residues contain considerable amounts of N and have a relatively low C/N residue, leading to more rapid release of N than lower N-containing cereal residues. Increased N availability to crops following legumes may also be due to reduced immobilization because legume crops generally produce lower amounts of crop residue than do cereal crops.

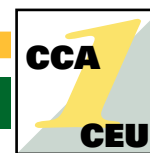
Prolonged inclusion of pulse crops such as lentil in rotation with cereals can increase the soil's N-supplying capacity and reduce fertilizer N requirements for the following nonlegume crop. Thus, crop rotations with legumes, as compared with continuous monoculture cropping systems with nonlegumes, can reduce inorganic N requirements. If fertility management is not adjusted for this, or if soil tests are not conducted to find fertilizer requirements, it could lead to overfertilization.

Nitrogen is an integral component of protein, and so is required for protein production in a crop. Grain protein content generally increases with increasing available N and decreases with increasing crop yield potential. Late uptake of N by crops can increase protein content compared with N absorbed by the crop earlier in the growth period. Grain protein content may be increased after fallow if high concentrations of N are accumulated at depth in the soil profile. Residual soil N unused by the preceding crop may also increase protein content.

Crop residues that mineralize rapidly and release more available N during the growing season (e.g. legume residues) result in higher protein concentration than those that mineralize slowly and release smaller amounts of available N.

Soil organic matter content has a large impact on both soil quality and nutrient cycling. Organic matter losses from soil as a result of cultivation have long been recognized as a serious long-term concern. Changes in soil organic C are of increasing importance because organic matter can serve both as a source and sink for atmospheric C. Therefore, the potential for reducing greenhouse gases by sequestering atmospheric C in soil organic matter storage is under investigation. If soil erosion and the addition of organic amendments are ignored, the soil organic C balance is the result of the difference between C inputs from organic residues and C loss by soil respiration. Crop residue return to the soil is the major method of replenishing soil organic matter. Thus, systems with frequent fallow deplete organic matter content more rapidly than continuous cropping. Changes in organic matter content may depend on the level of organic matter initially in the soil. Rates of increase in organic C vary with available water, inherent fertility of the soil, rates of fertilizer applied and length of time management is imposed.

Accumulation of NO₃ in ground water is an environmental and health concern. Nitrate leaching may occur if NO₃ is present in the soil profile and water moves through the profile to locations below the rooting zone. Under cultivated systems, NO₃ leaching below the rooting zone can occur even in semiarid conditions. The



problem of NO_3 leaching in fallow systems can be particularly serious if fallowing after a dry year results in downward movement of residual NO_3 left by a drought-restricted crop. Shallow-rooted crops with a low N demand may increase the risk of NO_3 leaching.

Proper management of the cropping sequence can reduce the potential for NO_3 leaching. Increasing cropping intensity to increase N uptake and reduce the risk of water percolation below the root zone reduces the risk of downward movement of NO_3 . Mobility of NO_3 in soil is similar to that of water, and roots may attract NO_3 from as far away as 35 cm. Increased nutrient use efficiency may result if sequential crops explore different parts of the soil profile. Rapid and deep rooting is important for accessing mobile nutrients such as NO_3 and SO_4 before they move below the maximum rooting depth, while intensity of rooting in the surface soil and interactions with mycorrhizae may be more important for less mobile nutrients that tend to accumulate near the soil surface (e.g. P, K and Zn).

Synchronizing the availability of N to the uptake requirements of the crop reduces risk of NO_3 leaching. In annual rotations, significant NO_3 leaching may occur between growing seasons, particularly if there is poor synchronization between N inputs and plant N uptake. Deep-rooted winter annual crops in rotation can be used to reduce accumulation of NO_3 at depth. Fall-seeded cereal crops use soil N and water efficiently because the plants have a well-established root system by spring and use water and mineral N early in the growing season. Roots of fall-seeded crops also reach the subsoil more quickly than spring-seeded crops, resulting in less potential for movement of NO_3 into the deeper soil depths.

Inclusion of annual legumes in rotation with cereal crops may be important in terms of an environmental buffer for NO_3 leaching. High-yielding, high-protein pulse crops remove large amounts of N in the harvested seed. The pulse crop will utilize soil or fertilizer N, if it is present in the system, but in the absence of available N, the crop can symbiotically fix N_2 to satisfy its needs.

Accumulation of NO_3 in the soil can increase the potential for nitrous oxide

(N_2O) emissions. Legumes in cropping systems can also enhance N_2O production. In theory, winter cereals should reduce risk of N_2O emissions by reducing the accumulation of NO_3 and water in soils over the fall and during the early spring when N_2O losses are often high.

Phosphorus

Phosphorus, N and other nutrients need to be available to the crop in balance to optimize crop yield and quality and efficiency of crop production. Phosphorus supply is commonly limiting for crop yield on the northern Great Plains.

Phosphorus dynamics can be affected by cropping intensity and diversification. Intensified cropping in the absence of P inputs from fertilizer or organic amendments will result in a depletion of soil P. The type of crop grown also influences P depletion because crops differ in yield potential and in the amount of P removed in the harvested portion. Increasing crop yield will increase P removal, but there may not be as great an impact on the P fertilizer requirements as there is with N because the amount of P removed by crops is small relative to the total available P in most soils.

The preceding crop may have an important influence on P nutrition of crops due to its effect on mycorrhizal activity. Vesicular-arbuscular mycorrhizae (VAM) are fungi that form symbiotic relationships with many plant species. The extended hyphae of the fungi can penetrate into the soil considerably further than the root hairs of the plant, thereby increasing the zone of absorption of immobile nutrients such as P. Mycorrhizal interactions are important for uptake of P and Zn, particularly under low-fertility conditions. Severe early growth problems can occur due to P deficiency when corn is planted on fields that were fallowed the previous year. The presence of living plants is required for multiplication of the VAM; thus, fallowing reduces the incidence of mycorrhizae and may lead to lower root colonization in the next crop. The type of preceding crop also has an effect on VAM dynamics and diversity.

P availability may also be affected by residue type and management. While residue type is important, the overriding factor is the amount applied. This implies

that crops that return large amounts of residue to the system will lead to more available P for subsequent crops.

Another consideration is the amount of erosion that has occurred. Inorganic and organic P are both present in the soil. Bringing sandier material to the surface does not change the total P content of the soil, but it does change the amount of P that is present in apatite-like materials. Therefore, changes in management practices that influence erosion can affect the amount and form of P present in a soil.

Biocycling of immobile nutrients through uptake from deep soil horizons by deep-rooted crops and redeposition near the soil surface through decomposing plant residues could be important, particularly in cropping systems with minimal inputs of nutrients from external sources, minimal disturbance or both. The amount of biocycling would increase with frequency of cropping and biomass production.

Special Nutrient Considerations

Moving to a diversified rotation may involve growing crops that differ in nutrient requirements from those traditionally grown. For example, the S requirement of canola is substantially greater than that of cereal crops. Sulfur depletion by canola may hasten the occurrence of S deficiency in subsequent wheat crops on soils containing marginal levels of available S. Conversely, if canola is grown with adequate S to optimize crop yield, cereal crops following the canola may be adequately supplied with S on marginal soils by mineralization of S from the high S-containing canola residue. This could mean higher grain protein content and/or quality for cereal crops.

Even optimal placement of nutrients may vary with crop type. To optimize crop yield and quality, the specific nutritional needs of each crop in the rotation must be carefully considered, as well as the nutrient balance throughout the rotation.

Editor's note: Content was adapted from the paper "Nutrient Considerations for Diversified Cropping Systems in the Northern Great Plains," which was published in Agronomy Journal, 2002 94, and is courtesy of the authors C.A. Grant, G.A. Peterson and C.A. Campbell.