CCA ADVANTAGE
The Voice of the Certified Crop Adviser Program
www.agronomy.org/cca

CCAs, Expert Share Service Pricing Tips

By Bob Wanzel
Senior Editor

If there's one obvious common thread among CCAs it's that the business they conduct involves service to the farmer. For some sales agronomists it has been common practice to build part of the cost of these services into product margins, while other CCAs rely upon getting paid solely for their advice.

We asked **Stephen Rezac**, president and CEO, NuVue Business Solutions, a company specializing in advising those in the business of serving agriculture, to help us with some tips on pricing services. Armed with a sampling of these tips, we went into the field asking CCAs how they approached the pricing challenge.

Rezac: You bring certain value to your customers and maybe a 20 percent increase in price if you clearly articulate your value to your customers. What do you bring to the market: honesty, integrity, reliability, experience or knowledge?

"We're a geo-referenced company trying to stay on the cutting edge," says **Nathan Hudson**, Hudson Consulting, Laurel, DE. "Nutrient management is a major service here and we let our customers know that all of our scouts have or are working on their CCA certification."

"We admit that we don't do a good enough job selling the quality of our people," says **Larry Tempel**, agronomy manager, Growers Co-op, Terre Haute, IN. "Our people are the most important competitive advantage we have."

Rezac encourages CCAs to formulate a list of the special or unique qualities they have that customers cannot get elsewhere.

"We have one of the first licensed comprehensive nutrient management plan (CNMP) writers in the state," says Agronomy Department Manager **Bud Smith**, Caledonia Farmers Elevator, Caledonia, MI. Smith says these services along with manure sampling and tissue testing have been great value-adds to the business.

Rezac: Does the RIGHT customer want high-quality products and customized services? If so, then offer high-quality products and services and be ready to charge more than cash and carry.

"We have customers who say, 'I never know what weed control is going to cost, I want a fixed cost per acre for my herbicide applications.' I say I can do that, but I have to anticipate problems," says Smith. "Sometimes when I have a large farmer with special demands I go right to the manufacturers and ask for their support."

Rezac: What is supply and demand in your market? When supply is greater than the demand, prices will naturally fall. You then have two choices, constantly lower your prices and become a commodity, or create value with bundled services that meet customer needs.

"I don't pay much attention to my competitor's prices," says Hudson. "Maybe I should. But if my customers are getting good value for their dollar, good service at a fair price, then if someone undercuts me, I just have to let it go."

"Farmers' price sensitivity varies by area," says Tempel. "We've merged several co-ops in the past 20 years. We had one acquisition where we had to raise the pricing bar. They were caught up in a bidding war. The last three or four years we've had to back away from some business that was not in our best interest."

Rezac also points out that two fundamental keys for a pricing strategy involve calculating the break-even point and understanding the business cash flow needs.

Nathan Hudson summarizes this short lesson in pricing well: "I have a business plan and I have a business philosophy. I have a target clientele."

CCA EVENTS

December 16: 2004 CCA Convention
Springfield, IL
Contact: 815/844-6677

December 14-15: Indiana CCA Conference
Indianapolis, IN
Contact: 800/387-1283

January 11-12: AAI Expo
Des Moines, IA
Contact: 800/383-1682

January 12-13: 2005 CCA Conference and Annual Meeting
Niagara Falls, Ontario
Contact: 519/669-3350

For a complete list of CCA Events go to www.AgProfessional.com

ICCA OFFICERS

CHAIRMAN
Stephen Dlugosz
Agriliance
ph: 317/432-5562
stevedlugosz@comcast.net

VICE-CHAIRMAN
Fred Vocasek
Servi-Tech
ph: 620/227-7123
fredv@servi-techinc.com

PAST-CHAIRMAN
Robert Beck
Pioneer Hi-Bred International, Inc.
ph: 515/334-6778
robert.beck@pioneer.com

EXECUTIVE DIRECTOR
Luther Smith
American Society of Agronomy
ph: 608/268-4977
lsmith@agronomy.org

New ICCA Board Members Elected

Four new board members were welcomed to the International Certified Crop Advisers (ICCA) Board of Directors meeting in Chicago last month.

Cliff Snyder, CCA, is certified in Arkansas and is the Southeast director for the Potash and Phosphate Institute (PPI). He earned his Ph.D. in soil science and forestry from North Carolina State University and his M.S. and B.S. degrees from the University of Arkansas in agronomy and soil science respectively.

During his term on the ICCA Board he would like to work for greater recognition of the CCA as the preferred professional by farmers, as well as the public and governmental agencies. He feels the geographic diversity among CCA professionals and their dedication to crop management excellence are real strengths of the program but CCAs need to increase their own appreciation for the value of their certification.

Cliff Snyder

Cliff said he supports the CCA program because "I believe in the ability of CCAs to help the U.S. and Canadian farmer stay competitive in the global agriculture economy. The association with other professionals and mutual interests in educational development and technology adoption stimulate me to become a better agronomist … and a better person."

Norm Flore, CCA, is one of two Canadian members of the board and represents the Prairie Provinces. He attended the University of Alberta where he earned a B.S. degree in agriculture. In 1980 Norm joined Westco, where he continues to work as an account manager.

During his first 18 years at Westco, Norm was actively involved in research, extension, crop diagnostics and training. He has worked with a wide range of crops and has found the most gratifying part of his agronomic work was sharing results with farmers and gaining their feedback, which in turn initiated new research.

As an ICCA Board member Norm would like to see the program continue to gain more recognition for CCAs both inside and outside of the industry. The CCA program is an excellent vehicle to demonstrate to our urban neighbors that agriculture does act in a very responsible manner.

Norm Flore

In closing Norm said, "I would like to see our CCAs promoting themselves more. None of us like to brag, but we all worked hard to gain our credentials and we should show pride in our accomplishments."

Adam Hayes, CCA, represents the Ontario region on the ICCA Board. He earned his B.S. degree in agriculture with a major in crop science from the University of Guelph. Adam began his employment with the Ontario Ministry of Agriculture and Food in 1985 and has served in a number of positions including soil conservation adviser, resource management specialist and soil and crop adviser. In commenting on this he said, "I have a dual role in the program, as a practicing CCA and as an employee of the provincial government. Part of my involvement is to assure that there is a good exam program and that good educational opportunities are available."

Adam Hayes

As the chair of the Ontario CCA Exam Committee Adam feels one of the strengths of the program is the exam structure and continuing education requirement. They provide an incentive for CCAs to continue to learn and stay on top of new developments in their field.

"While on the ICCA Board I would like to help find an easier and faster process for collecting CEUs at events," Adam explained. "I would also like to increase recognition of the value of certification and find new roles for CCAs to fill in agriculture. Finally, I would like to encourage CCAs to become involved with their local program to make it what they want it to be."

Dave Franzen, CCA, is an Extension soil specialist at North Dakota State University and a past chair of the North Dakota CCA Board. He has statewide responsibilities for soil and crop nutrient issues and fertilizer recommendations. Dave also works with the Tri-State Recommendations Committee that includes North Dakota, South Dakota and Minnesota.

He earned his Ph.D., M.S. and B.S. degrees from the University of Illinois, is an associate editor of *Agronomy Journal* and serves on the North Dakota Extension Program Council.

Dave Franzen

When asked about the strengths of the program Dave answered, "When I was working in industry it was often tough to get away for education programs, something else was always more important and I felt myself getting stale professionally. As a CCA I am required to earn CEUs and education doesn't get pushed to the bottom of the list."

Dave supports the CCA program because it is great for the industry. "Anyone scrutinizing agriculture will be impressed by the standards we set and the professionalism that is evident in the way our CCAs work with their customers. We will never know how many regulations haven't happened because of this," he said. "I would like to encourage my fellow CCAs to contact me if they have a question, thought or problem about the CCA program. I am sure there are a lot of good ideas out there that the ICCA Board hasn't heard yet."

Chairman's Corner

Charting the Course for the Next 12 Months

By Steve Dlugosz
CCA, Chairman International CCA Program
Agronomist, Agriliance
ph: 317/432-5562
e-mail: stevedlugosz@comcast.net

Hello, my name is Steve Dlugosz, (pronounced "Dew-gosh") and I will represent you the next 12 months as Chair of the International CCA Program. I am originally from South Bend, IN, and became involved in agriculture while working for a local truck crop farmer. I attended Purdue University and received a BS in Agronomy in 1980 and an MS in entomology in 1991.

My first job was with the Cooperative Extension Service as an area IPM specialist in southwest Indiana. I left Extension in 1985 to become an agronomist for Indiana Farm Bureau Cooperative in Indianapolis, IN. I survived multiple mergers within the Cooperative system and continue to work as agronomist for Harvest Land and Ag One Co-ops. I provide agronomic support for 23 retail locations across eastern Indiana and western Ohio.

CCA REPRESENTS YOU

It's quite humbling to consider that the chair of the Certified Crop Adviser Program represents around 14,000 individual CCAs across the U.S. and Canada. The job of representing you and our profession is even more important during these changing times. Everyone needs to know who we are and how we support farmers.

Several recent examples of how the CCA Program represents you:

- National conference calls concerning the CCA's role in biosecurity.
- Discussions with industry trade groups as they struggle with the consolidation of farmers and manufacturers.
- National and state government agencies continue to hear about the importance of CCAs, and how we and our farmers are affected by government programs and ag policy.

CONCERNS OVER THE VALUE OF CCA

Unfortunately, I sometimes hear concerns that being a CCA has little value. I wonder — how many CPAs or professional engineers fret over the value of their professional certification, and the effort it takes to maintain it?

I believe this feeling sometimes results from assumptions and misconceptions that have developed over the years. A few of the more common fallacies include: (1) CCA will be mandatory someday; (2) My CCA certification will give me an advantage over my competitor and make farmers want to work with me; (3) CCA will help clean up unethical practices in the field.

THE TRUE MISSION OF CCA

The truth is the CCA Program was formed so individuals from agribusiness and the public sector could work together to grow professionally and demonstrate competence in the area of crop advising. In particular, the vision was to help regulators understand our key role in production agriculture, be included in future government programs when appropriate and not be hampered from practicing our profession.

A CCA would be recognized as having a known level of competence and would subscribe to a Code of Ethics. Becoming a CCA would not be easy, and maintaining this certification would take effort and commitment.

THE NEXT 12 MONTHS

I want to assure you that your International CCA Board is focused on the needs of the individual CCA as we start our second decade of certification. My personal goals for the CCA Program include:

- Encourage and support local and international CCA activities that help *you* grow professionally.
- Increase our visibility and work more closely with government agencies. They must recognize the importance of our role on the farm and have confidence in our abilities.
- Help *you*, as individual CCAs, recognize your responsibility in supporting production agriculture and furthering your profession.

PAYING THE BILLS

It's funny, away from home I am often introduced as the chair of the CCA program. But what I really am is a balding agronomist who works with farmers in Indiana and Ohio.

My position as agronomist with Ag One and Harvest Land is what pays the bills, not my CCA Certification. I'm sure most CCAs share a similar setup with their employers.

All levels of CCA leadership need to keep this in mind as the CCA Program grows into the future. Our initiatives need to bring value to the individual CCA, in addition to our farmers and society.

I'm proud to be a CCA and hope you are too.

Herbicide Loading to Shallow Groundwater Beneath Nebraska's MSEA

By Roy F. Spalding, Darrell G. Watts, Daniel D. Snow, David A. Cassada, Mary E. Exner, and James S. Schepers

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 pest management, read this article, fill out the attached exam and mail the tear-out form, along with $10, to the American Society of Agronomy.

Triazine and acetamide herbicides' mobility and moderate persistence cause them to be the most frequently reported pesticides in groundwater in agricultural areas. Atrazine and its transformation products together with cyanazine, simazine, alachlor and metolachlor and their transformation products are the herbicides most commonly detected in row-cropped regions. Atrazine is the most widely detected pesticide in the nation's groundwater and the EPA has set 3 µg L^{-1} as the maximum contaminant level (MCL) in drinking water.

The groundwater assessments that are the basis for EPA's strategy of developing state Pesticide Management Plans for atrazine, cyanazine, simazine, alachlor and metolachlor have done little to explain the transport mechanisms of pesticides to shallow groundwater and the temporal variability of concentrations. Especially prevalent in groundwater are the triazine metabolites deethylatrazine and deisopropylatrazine.

The USDA sponsored Management Systems Evaluation Area (MSEA) projects in five Midwestern states in the Corn and Soybean Belt. The Nebraska MSEA focused on the development of methods to mitigate nitrate leaching and the impact of irrigated agriculture on groundwater quality.

The objectives of this paper are to assess pesticide loading on shallow groundwater quality beneath the Nebraska MSEA and to determine the relative effects of precipitation and irrigation management on pesticide transport to the groundwater.

The Nebraska MSEA site was chosen because it is centrally located within 202,000 contiguous ha underlain by a shallow, nitrate- and atrazine-contaminated, sand and gravel aquifer that is the primary source of both drinking and irrigation water. Historically, the atrazine concentrations have been exceptionally high.

Annual precipitation during the six-year study (1991-1996) ranged from 468 mm (1991) to 879 mm (1993). With 585 mm of precipitation the 1993 growing season was the wettest in more than 100 years of record keeping. One week before to two weeks after planting is the most critical period for the potential flush of mobile compounds below the shallow root zone. While the average precipitation during this window was quite low (36 mm) from 1991 to 1994, it tripled to an average of 111 mm during 1995 and 1996. Evapotranspiration (ET) in excess of precipitation during the growing season results in an average seasonal irrigation requirement of 280 mm for corn in the central Platte Valley, although it ranged from 0 to >450 mm during the 30-year period ending in 1996.

The unsaturated zone of the research–demonstration site is a 1.1-m-thick, well-drained silt loam overlying approximately 4.3 m of fine to medium-textured sands. During the six-year investigation, the depth to water in the water table aquifer fluctuated from approximately 3 to approximately 6 m beneath the land surface. The direction of horizontal groundwater flow switched from east–northeast to east in response to anomalously heavy recharge and limited pumping during the 1993 growing season and reverted back to east–northeast after the 1994 growing season. The horizontal groundwater flow rate is 0.55 m d^{-1}. The estimated 0.0 ± 0.5 year residence time for the shallowest groundwater beneath the Nebraska MSEA supports its origin as seasonal recharge.

The site was subdivided into four 13.4-ha management fields. Three fields were cropped to corn and the fourth to alfalfa. Each spring the cooperating farmer prepared the cornfields by shredding stalks and tilling twice with a tandem disk harrow. Each cornfield received 46-cm banded applications of 1.68 kg atrazine ha^{-1} and 0.75 kg metolachlor ha^{-1} as Bicep between April 29 and May 20. Metolachlor was not used on the site prior to 1991. While each cornfield was subject to identical herbicide application practices, the irrigation practices were different. Irrigation supplements averaged 752, 267 and 198 mm $year^{-1}$ on the conventional-, surge- and center pivot–irrigated corn, respectively, and 246 mm $year^{-1}$ on the center pivot–irrigated alfalfa. The center pivot was equipped with a corner system capable of irrigating the entire field. Applications of herbicide and irrigation water were restricted in the irrigated buffer upgradient of the research–demonstration site to reduce recharge upgradient of the management fields.

Conventional furrow-irrigated corn management field: The landowner managed the conventional field and irrigated through gated pipe into furrows with 12-hour continuous sets. Every furrow was irrigated, and runoff water accumulated behind the end-of-field dike. The field was irrigated weekly barring significant precipitation or very cool temperatures. With the exception of 1996, annual irrigation applications were significantly less than they were prior to the study.

Surge-irrigated corn management field: Surge irrigation provides a more uniform water application than conventional furrow irrigation and, therefore, is considered an improved furrow irrigation technique. To improve water distribution the gently sloping field was graded in fall 1990 with a laser-guided system. Water was delivered to the surge valve, distributed through gated pipe to furrows on both sides of the valve and conveyed through the furrows, and the excess discharged to a ditch at the lower end of the field and eventually to a lined tailwater recovery pit. Irrigations were scheduled by standard water balance techniques. Typical beginning-of-season net applications ranged from 55 to 75 mm. Subsequent applications usually averaged approximately 50 mm.

Center Pivot–Irrigated Corn Management Field: Irrigation via the corner system center pivot followed the same scheduling technique employed on the surge-irrigated cornfield. Typical irrigation applications were approximately 25 mm. After mid-July a soil-water deficit of approximately 25 mm was maintained to provide storage of rainfall, thereby reducing leaching. The deficit was gradually increased in late summer.

Center Pivot–Irrigated Alfalfa Management Field: Water applications were based upon precipitation, evapotranspiration and the need to keep the field dry during hay harvest. Four cuttings of alfalfa were removed annually.

RESULTS AND DISCUSSION

Temporal and areal variability in atrazine concentrations: With the exception of a few short-lived peaks, the average atrazine concentration in the shallow (<1.5m) groundwater downgradient of the cornfields progressively decreased from approximately 5.5 to <0.5 µg L^{-1} during the six years of MSEA management. The source of the especially high concentrations in the initial years was atrazine applied prior to the study.

Improved irrigation management during the study appeared to significantly reduce atrazine loading to the shallow groundwater. This improvement may result from a combination of increased soil residence time and concurrent rapid microbial transformation of atrazine.

After heavy rainfall average atrazine concentrations peaked in the shallow groundwater in fall 1993 and summer 1995 and 1996. Since herbicide applications and practices at the cornfields were identical during the study, only rainfall and irrigation practices affect shallow groundwater herbicide loading. All three peaks are the result of atrazine being flushed from the vadose zone in response to precipitation. The 1993 growing season was the wettest in more than 100 years and although atrazine concentrations peaked in the irrigation season, very little water was applied. Spring rains were excessive after atrazine applications in 1995 and 1996.

The differences in atrazine and nitrate loading of shallow groundwater observed at the Nebraska MSEA can explain the very weak correlation of nitrate and atrazine concentrations in regional groundwater studies in the central Platte Valley. While both compounds are present in most wells in the region, they do not infiltrate at the same time. Nitrate loading occurred annually during irrigation season and was controlled by improved water and nutrient management. Peak atrazine loading after herbicide application was unpredictable and occurred only when excessive rains caused rapid infiltration.

Deethylatrazine (DEA) to atrazine molar ratios: The concept of DARs, the ratio of the molar concentrations of DEA and atrazine introduced by researchers in 1991, is useful for evaluating the timing of leaching processes. In groundwater DARs may range from very low values to infinity (DEA present and atrazine below reporting limits). The average DAR in the shallow groundwater downgradient of the cornfields gradually increased from approximately 1 in 1991 to greater than 4 in 1995, retreated to approximately 1.5 in summer 1996 and abruptly increased to greater than 7 at the next sampling in fall 1996. The trend toward higher DARs coincided with improved water management, which favors the retention of atrazine in the biologically active upper soil horizon. The longer residence time enhances metabolism, thereby increasing the DEA available for subsoil transport to the shallow groundwater. Below the soil zone DEA is more mobile than atrazine in sand and gravel, which may partially explain the high DARs. The reversal of the trend toward higher DARs occurred in summer 1996 prior to irrigation and coincided with flushing rains several days after herbicide application. The low DARs suggested that the parent compound was rapidly leached below the biologically active root zone before significant metabolism occurred.

The reversal in DARs and the increase in atrazine concentrations in the summer 1996 samples were greatest downgradient of the two furrow-irrigated corn management fields and suggest that anomalously high amounts of atrazine were preferentially introduced to the aquifer. Ponding of storm runoff in the drainage ditch on the eastern edge of the surge-irrigated field and at the lower end of the conventionally irrigated field within days of herbicide application appears to have exacerbated the leaching of atrazine. In contrast, the average atrazine concentration downgradient of the pivot-irrigated cornfield increased only slightly and there was little, if any, concentration change beneath the irrigated alfalfa field. Both pivot-irrigated fields have minimal propensity for ponding and runoff.

Temporal and areal variability in metolachlor concentrations: Downgradient of the corn management fields, the frequency of metolachlor detections in shallow groundwater increased during the six years, as did average metolachlor concentrations. The driving mechanism for the sharp increase in concentration and frequency of detection appeared to have been the 100-year record rainfall during the 1993 growing season, which increased matrix flow through the overlying soils and also caused atrazine concentrations to peak. Metolachlor leaching was pronounced again in summer 1996, when concentrations rose and were sustained through fall sampling. The 1996 metolachlor peak was broader than the atrazine peak due to inherent differences in mobility. Metolachlor is more retarded than atrazine and is transported more slowly through the vadose zone. As with atrazine concentrations in summer 1996, peaks in metolachlor concentrations in the shallow groundwater downgradient of the furrow-irrigated fields and their absence downgradient of the pivot-irrigated cornfield resulted from focused recharge of ponded runoff from the furrow-irrigated fields shortly after herbicide application. Thus, peak loading occurred prior to irrigation and was related mostly to the ponding of precipitation runoff by drainage control structures that are inherent in furrow irrigation in Nebraska.

Enhanced leaching of metolachlor and atrazine by focused recharge beneath the surge irrigation drainage ditch and the diked lower end of the conventionally irrigated field is further supported by the shallow groundwater data upgradient of the site. Located immediately west of a 1-m deep road ditch that receives runoff from the north half of the pivot-irrigated corn buffer upgradient of the research–demonstration site, ML1 through ML8 are grout-sealed from the surface to the water table to ensure they do not convey surface water to the aquifer. The sharp atrazine and metolachlor concentration peaks in the shallow groundwater of ML1 through ML8 in summer 1995 and 1996 followed the only intense precipitation within two weeks of herbicide application during the study. Data indicate the pesticide-contaminated runoff that filled the road ditch after the intense rains was rapidly flushed through the unsaturated zone, which has only a thin layer of soils. Upgradient atrazine concentrations exceeded those of DEA, causing a reversal in DAR, and provided further indication that much of the shallow groundwater atrazine contamination originated from infiltration of runoff from recently treated fields.

Impacts of irrigation management practices: Although peaks in atrazine and metolachlor concentrations were best controlled on the pivot-irrigated corn field, there were only slight differences in herbicide loading beneath the conventionally furrow-irrigated field and the center pivot–irrigated field during most sampling periods. From 1993 through 1995 there was a similar trend toward lower atrazine concentrations beneath the conventional and pivot-irrigated fields. The slightly greater decrease in atrazine concentration beneath the conventionally irrigated field suggested that the application of larger quantities of irrigation water further diluted the atrazine concentration. Throughout most of the Nebraska MSEA study, DEA concentrations were significantly higher beneath the pivot-irrigated cornfield, suggesting there was less leaching of atrazine and more active microbial transformation than beneath the conventionally irrigated field.

Deisopropylatrazine (DIA) to deethylatrazine molar ratios: Concentrations of DIA, a metabolite of atrazine, simazine and cyanazine, exceeded the reporting limit (0.1 µg L^{-1}) in 86.4% of the 7,848 samples from the water table aquifer. Simazine, which was occasionally used for weed control in the shelterbelt south of the management fields, was reported in only 6.3% of the samples while cyanazine, with no history of use at the site, was detected in less than 0.1% of the samples. Thus, most of the DIA was the product of atrazine metabolism.

The molar ratio of DIA to DEA (D^2R) was used as a tool to better confirm the parent contribution to water bodies. Regression analysis showed the slope of DIA to DEA in a surface drainage basin where atrazine was almost exclusively applied was 0.4 ± 0.1 while proportionally constant concentrations of DIA and DEA had D^2Rs ranging from about 0.5 to 0.6 during a runoff event in eastern Nebraska. Seasonal average D^2Rs in the shallow groundwater downgradient of the Nebraska MSEA corn management fields were very low and ranged from 0.06 to 0.18. In general, DEA concentrations were 10 times higher than DIA concentrations and there was not a hint of association between the two metabolites. The lower persistence of DIA in soil solution and its lower mobility relative to DEA accounted for low concentrations in the groundwater. The very low values and wide range of D^2Rs in groundwater areas dominated by atrazine usage indicated that, in this groundwater, D^2Rs have limited value for distinguishing triazine herbicide inputs. Proportionally, groundwater DIA concentrations beneath the site represented less than 15% of total triazine residue.

CONCLUSIONS

Major improvements in water management quickly lowered atrazine concentrations in the shallow groundwater downgradient of the three corn management fields and concentrations remained well below the 3 µg L-1 maximum contaminant level except for transient peaks in concentration. The highest levels of pesticide contamination were largely associated with focused recharge of ponded contaminated runoff at the diked end-rows and in the runoff collection ditches at the furrow-irrigated fields and in the road ditch after heavy spring rains closely followed herbicide application. Although not as dramatic as the effect on surface water, the spring flush can negatively affect groundwater quality. The results challenge presently accepted paradigms that assess herbicide vulnerability by focusing solely on soil characteristics, such as soil permeability, organic content and slope. At least in this region, peak herbicide concentrations were associated with infiltration through road ditches that, with the soil stripped almost to the vadose zone sands and the additional head caused by the ponded runoff, acted as infiltration galleries during runoff events in the days following herbicide application. The end rows of the furrow-irrigated fields where the soils were altered or eliminated in the construction of dikes and ditches also became avenues for focused infiltration of pesticides during runoff events in the days after herbicide application.

Sprinkler irrigation technology benefited groundwater quality by reducing the areas for focused recharge of contaminated storm runoff and providing a favorable environment for soil microbial degradation of atrazine. In Nebraska, groundwater beneath areas of pivot-irrigated corn was characterized by lower atrazine concentrations and higher DARs than groundwater in areas dominated by furrow irrigation.

Molar ratios of deethylatrazine to atrazine indicated that during the study atrazine remained in the biologically active soil zone longer than it did prior to MSEA management. Except for one sampling event, more DEA than atrazine was present in the shallow groundwater. Deisopropylatrazine concentrations were very low and appeared inconsequential in proportion to atrazine and DEA concentrations.

Metolachlor, which had no history of use at the site prior to initiation of the project, was detected in the very shallow groundwater at frequencies of approximately 10% in the first year. Frequency of detection tended to increase during the six-year study and reached approximately 50% in 1996. Mechanisms of metolachlor transport appeared to be both matrix flow during anomalously wet years and focused recharge in areas with disturbed or partially removed soils.

Editor's note: *Content was adapted from the paper "Herbicide Loading to Shallow Ground Water Beneath Nebraska's Management Systems Evaluation Area," which was published in J. Environ. Qual., Vol. 32, January-February 2003, and is courtesy of the authors, Roy F. Spalding, Darrell G. Watts, Daniel D. Snow, David A. Cassada, Mary E. Exner and James S. Schepers.*

CCA 1 CEU

Continuing Education Self-Study Course

Pest Management

Get a CEU!

This exam is worth 1 CEU in **Pest Management**. An exam score of 70% or higher will earn CEU credit. The International CCA program has approved self-study CEUs for 20 of the 40 CEUs required in the two-year cycle.

DIRECTIONS

1. Read the self-study article on pages 40-42 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

Herbicide Loading to Shallow Groundwater Beneath Nebraska's MSEA

November Self-Study Examination

1. The most widely detected pesticide in the nation's groundwater is:

[ ] a. metalachlor.
[ ] b. atrazine.
[ ] c. cyanazine.
[ ] d. alachlor.

2. The EPA has set the maximum containment level in drinking water for atrazine at:

[ ] a. 1 µg L^{-1}.
[ ] b. 2 µg L^{-1}.
[ ] c. 3 µg L^{-1}.
[ ] d. 4 µg L^{-1}.

3. The most critical period for the potential flush of mobile compounds below the shallow root zone is:

[ ] a. one week before to two weeks after planting.
[ ] b. one week before to three weeks after planting.
[ ] c. two weeks before to two weeks after planting.
[ ] d. two weeks before to three weeks after planting.

4. The average atrazine concentration in the shallow groundwater down gradient of the cornfields:

[ ] a. progressively decreased.
[ ] b. progressively increased.
[ ] c. stayed the same.
[ ] d. varied each year.

5. Nitrate loading:

[ ] a. was unpredictable.
[ ] b. occurred only when excessive rains caused rapid leaching.
[ ] c. occurred annually during the irrigation season and was controlled by improved nutrient and water management.
[ ] d. occurred annually during the irrigation season; however, improvements in nutrient and water management could not control the loading.

6. Peak atrazine loading:

[ ] a. was unpredictable and occurred only when excessive rains caused rapid leaching.
[ ] b. occurred annually during the irrigation season and was controlled by improved water management.
[ ] c. differed by soil texture.
[ ] d. did not change with improved irrigation management.

7. Peaks in atrazine and metolachlor concentrations were best controlled on the:

[ ] a. surge-irrigated corn management field.
[ ] b. conventional furrow-irrigated management field.
[ ] c. center pivot-irrigated corn management field.
[ ] d. center pivot-irrigated alfalfa management field.

Over

Continuing Education Self-Study Course

Pest Management

8. Throughout most of the Nebraska MSEA study, DEA concentrations were significantly higher beneath the pivot-irrigated cornfield than the furrow irrigated fields, suggesting there was less leaching of the atrazine and:

[ ] a. greater sorption by the soil.
[ ] b. greater adsorption by the soil.
[ ] c. more active chemical transformation.
[ ] d. more active microbial transformation.

9. The highest levels of pesticide contamination were largely associated with:

[ ] a. surge-irrigated corn management fields.
[ ] b. focused recharge of ponded contaminated runoff.
[ ] c. high organic matter.
[ ] d. clay textured soils.

10. Sprinkler irrigation technology benefited groundwater quality by:

[ ] a. reducing the areas for focused recharge.
[ ] b. decreasing microbial activity.
[ ] c. increasing atrazine infiltration.
[ ] d. increasing soil organic matter.

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: ____________

Enclose a $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 November 2004 expires November 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: ____________________