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CERTIFIED CROP ADVISER

# NRCS's Nutrient Management Program Offers Opportunities to CCAs

*By Gordon Carlson*

USDA's Natural Resources Conservation Service (NRCS) has set out to promote the use of nutrient management systems that keep the maximum amount of applied nutrient material in the plant's root zone so it's available when it's needed. This effort should be attractive to Certified Crop Advisers (CCAs) who want to develop nutrient management programs as Technical Service Providers (TSPs).

Charles (Chuck) Lander is the NRCS national agronomist working with the program full time. He explains the agency got involved in this in 1999 when a decision was made to adopt a nutrient management policy that included the needs of agricultural production and a consideration of the environmental impacts on water quality when nutrients are not managed properly. The current NRCS conservation practice standard for nutrient management (590) was also adopted in 1999.

The initial 1999 effort to address plant production and water quality has expanded to include air quality because nitrogen in manure and/or some commercial nitrogen fertilizer materials can be lost into the air.

Manure is an important source of nutrients, especially in areas where animal production is extensive. An example of poor nutrient management using manure is a fall application for a crop that won't be planted until the next cropping year. "A large amount of the nitrogen may be lost, particularly if it was surface-applied and not incorporated," Lander says.

With a commercial fertilizer applied in the fall without some type of inhibitor to stabilize the nitrogen, nitrogen can be lost into the air. In some cases nitrogen may also leach into shallow groundwater. Some of it may reappear in surface water.

## Three Levels

NRCS has developed the concept of "intensity" of nutrient management, built around the premise that 590 allows for systems that include different types of technologies or management activities and that achieve different levels of performance. Guidance under development identifies three levels of nutrient management, A, B and C.

A Level A system includes components that meet the minimum requirements of the NRCS conservation practice standard for nutrient management (590). An example would be a system in which nitrogen is applied at recommended rates based on a current soil test from the land grant university or a private lab whose tests and recommendations are recognized by that state's land grant university. It could allow over-application of phosphorus and potassium if manure is the source.

A Level B system meets the same requirements as the Level A system but integrates additional technologies or management activities. It might include manure testing to determine nutrient content instead of using book values. Or it might include split nitrogen application of commercial fertilizer and use of the pre-side-dress nitrate test (PSNT).

*Charles Lander, NRCS National Agronomist*

A Level C system is a "conservation performance system" for nutrient management. It incorporates additional technologies or management activities to improve its overall performance. A Level C system might schedule the timing of manure applications to not more than 30 days before planting and include immediate incorporation of the manure. Or it might include voluntary adoption of a phosphorus standard for manure application. For commercial fertilizer, it might include variable-rate application technology or other precision nutrient management technology.

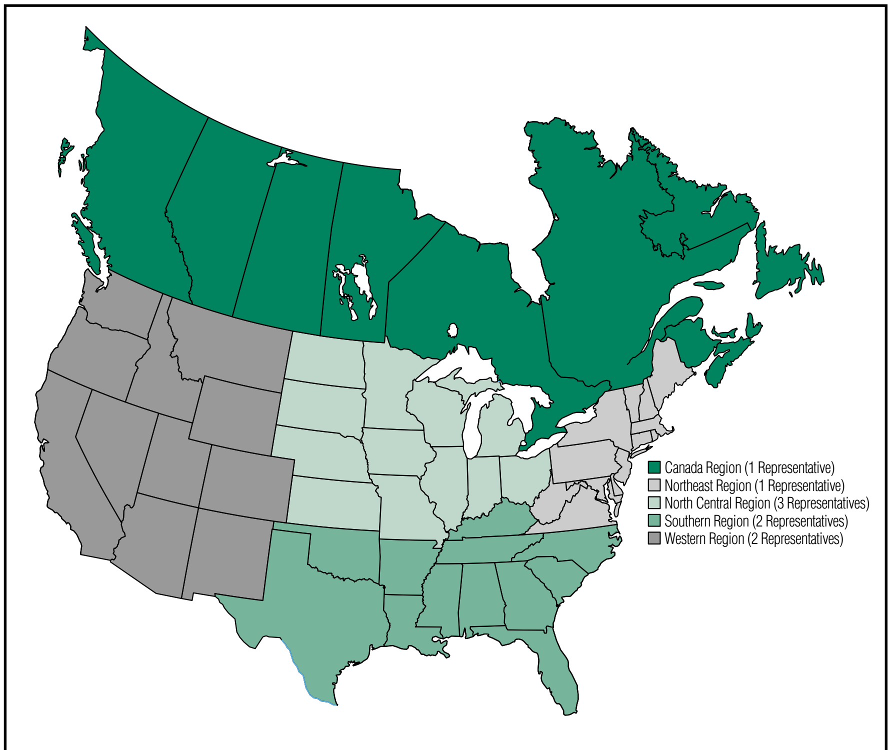
NRCS in Virginia will be the first state to use the multiple-level system concept. "Our goal is to have this available in all states by the next program year – 2004," Lander says. Probably not all states will use it, since it's not mandatory. NRCS and state officials will decide whether it will be used in any particular state and also determine the components that will comprise the different levels.



**An electronic version of CCA Advantage, including the test, is available at: *www.cropdecisions.com***

# ICCA Regional Election Time

The ICCA Board regional representative elections are coming up later this summer. Three regions will have elections in 2003, Northeast, North Central and Western. The Northeast and Western regions have one seat each up for election while the North Central has two. Each CCA in the region will receive a ballot in July. This article will give you a brief introduction to each nominee and recognize the nominees for their willingness to serve. This was the best year so far on the number of nominees that were received.




## NORTH CENTRAL REGIONAL REPRESENTATIVE

**Howard Brown** was nominated by the Illinois CCA Board. Brown is manager of agronomy services with GROWMARK, Inc., in Bloomington, IL. He makes in-field service calls for member cooperatives in Illinois, Iowa and Wisconsin and assists in assessment of problems and suggested corrective measures. He also provides phone technical support for member cooperatives and works closely with USDA-NRCS in those three states to stay current with issues surrounding Technical Service Providers. He is a past chair of the Illinois CCA Board, Exam Committee and is currently an ex-officio member of the IL Board. He is a member of IFCA and the agronomy committee. He also is a member of the Crop Science Research and Education Center Advisory Committee, Plant Management Network Advisory Council, Illinois Fertilizer Research and Education Council, Illinois Technical Committee and Illinois Nutrient Management Task Force. He is ARCPACS certified and a member of the American Society of Agronomy, Crop Science Society and Soil Science Society of America.

**Jeff Marsh** was nominated by the Iowa CCA Board. Marsh is agronomy manager with West Bend Elevator Co., West Bend, IA. His crop advising responsibilities in that position include sales to producers.

**Doug Lueders** was nominated by the Minnesota CCA Board. Lueders is general manager and a shareholder with Dill Company LLC, Wabasha, MN. He assists his agronomy staff with daily contacts with producers in the Karst area of southeast Minnesota and western Wisconsin. He consults with growers on seed, fertilizer and chemical programs as well as nutrient management plans as they relate to the dairy business. He has been on the Minnesota CCA Board since its inception, is currently the chair and is a past vice chair. He also serves on the MN CCA exam and the CEU compliance committees. He is a member of the SE Minnesota Elevator Managers Assn. and Northwest Agridealers Assn., director of District 1 of Minnesota Crop Production Retailers (MNCPR), president of MNCPR, chairman of MNCPR legislative committee, and a past MNCPR Washington, DC, Legislative Conference delegate.

**Raymond Ward** was nominated by the Nebraska CCA Board. Ward is the owner and president of Ward Laboratories Inc., Kearney, NE. His crop advising activities include helping production agriculture use resources efficiently and providing information and data for developing the best use of soil and water resources while maintaining environmental quality. He is finishing his first term as North Central Regional Representative to the ICCA Board. He is chair of the Soil Testing and Plant Analysis Council, board member with ASA and the Council for Agricultural Science & Technology and chairman of the SSSA soil test committee. His memberships include ASA, SSSA and the Association for Analytical Chemists.

**Paul Belzer** was nominated by the North Dakota CCA Board. Belzer is an agronomist with Minn-Dak Growers Ltd. in Dickinson, ND. He has provided technical support on all major crops in the western U.S., advising producers and consultants on crop production of mustard, sunflower, buckwheat, potatoes and sunflowers. While employed at J.R. Simplot Co., he managed a CCA training and education program. His activities include the ASA, Dickinson Chamber of Commerce Ag Committee and AOPA.

**Harold Watters** was nominated by the Ohio CCA Board. Watters is an Extension agent, Agricultural and Natural Resources/Community Development in Raymond, OH. He makes daily farm visits and phone calls to crop producers discussing product practices, conservation measures, environmental concerns and pest management practices. In addition, he is a weekly contributor to "CORN" newsletter, is involved in monthly meetings for Agronomic Crops discussion group of Miami County crop producers and does field research. He is a past Ohio CCA Board chair, member of the Tri-State Exam and PO review committee, and the Ohio credential and CEU review committee and the ICCA CEU standards development task force. Other professional activities include ARCPACS Agronomy Board and membership in the OSU Agronomic Crops, Watershed and Land Use teams.

**Bruce Barganz** was nominated by the Wisconsin CCA Board. Barganz is an agronomy manager with Jefferson County Farmco Cooperative in Jefferson, WI. His crop advising activities include acquiring and designing programs with which to train crop specialists in crop advising activities, as well as producer crop advising and sales responsibilities for a number of customers. He is vice chair of the Wisconsin CCA Board, chair of the Wisconsin Fertilizer Research Council and past president of the Wisconsin Fertilizer & Chemical Assn. He has been on numerous Wisconsin Department of Agriculture, Trade and Consumer Protection advisory boards.

## NORTHEAST REGIONAL REPRESENTATIVE

**Terry Williams** was nominated by the Pennsylvania CCA Board. He is employed by Royster Clark Inc. as a crop adviser in Dresher, PA. His responsibilities also include management and sales. He works with 25 growers in fertility, pest management and crop management. His CCA service activities include giving technical talks at grower meetings. He is a certified professional agronomist, crop scientist and soil scientist.

**Richard Blessing** was nominated by the Mid-Atlantic CCA Board. As manager of S.S. Bristol Co-op in Bristol, VA, he makes crop and fertilizer recommendations for corn, tobacco, small grains, produce and hay production, does soil testing, and follows and assists on nutrient management plans. He advises the local Extension office and is a member of the Virginia Crop Production Assn., the Tennessee Crop Production Assn. and the Bristol Chamber of Commerce.

## WESTERN REGIONAL REPRESENTATIVE

**Nat Dellavalle** was nominated by the California CCA Board. Dellavalle is president of Dellavalle Laboratory Inc., Fresno, CA. He advises clients in areas of nutrient, irrigation, salinity and crop management, and his specialties include agricultural reuse of biosolids. He is a member and a past chair of the California CCA Board of Directors and a member of the National CCA Continuing Education Standards Development task force. He is on various Soil Science Society of America committees and is past president and secretary-treasurer of the California Chapter of the American Society of Agronomy, past chair of the Soil and Plant Analysis Council, past member of the North American Laboratory Proficiency Testing Advisory Board and past vice president, agriculture for the Fresno Chamber of Commerce. He is on advisory committees to the Department of Land, Air, and Water Resources at the University of California, Davis; Soil Science Department at Cal Poly, San Luis Obispo, and The Plant Science Department at California State University Fresno.

**Allan Smith** was nominated by the Northwest CCA Board. Smith is a crop consultant with Wilbur-Ellis Co. in Quincy, WA. He consults on mint, small grains, forage crops, potatoes, carrots and seed crops as well as on fertility, moisture-related aspects and crop protection decisions. He has served on the Columbia Basin Crop Consultants Assn. Board and Columbia Basin Crop Consultants Short Course planning committee, which puts together CCA training for the association. He has served on the Washington State Pest Consultants Board.

**Chuck Gatzemeier** was nominated by the Rocky Mountain CCA Board. Gatzemeier is a branch manager with Hiline Chemical in Cut Bank, MT. He is an Independent Crop Consultant for 50,000 acres, mostly dryland, in northern Montana, makes recommendations based on soil analysis concerning fertility, pre- and post emergent crop protection products, and follows growth stage through harvest. He is finishing his first term as a Western Regional Representative to the ICCA Board of Directors, has been on the Rocky Mountain Board since 1996 and is co-chair for training activities for CCAs in the Rocky Mountain Region. He also spent nine years on the Montana Agri Business Assn. Board, was past president in 2000, reviews nutrient management modules in Montana, and participated in many meetings with NRCS pertaining to the TSP relationship with CCAs.

# Economics of Conservation Tillage in a Wheat–Fallow Rotation

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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 crop management, read this article, fill out the attached exam and mail the tear-out form, along with $10, to the American Society of Agronomy. Note: Exams have been included only in copies mailed to registered CCAs. If you did not receive an exam but would like one, contact the CCA program at (608) 273-8085.

*By Jeffrey S. Janosky, Douglas L. Young,and William F. Schillinger*

While land area under summer fallow in the U.S. has declined in the past three decades, the winter wheat–fallow rotation remains the dominant cropping system in areas receiving <350 mm of annual precipitation. In eastern Washington and north-central Oregon, winter wheat–summer fallow is the prevailing cropping system on approximately 2.0 million ha. Farmers in the northern Great Plains have markedly reduced wind erosion on fallow cropland by adopting minimum-tillage (MT) and no-tillage practices, and recent evidence shows similar reductions in wind-borne dust and wind erosion in the Pacific Northwest.

The Conservation Tillage Information Center reported that farmers in the western Great Plains and Pacific states used MT and no-tillage on 34 percent of cropland. However, in Washington, only 26 percent of cropland was in MT and no-tillage. In east-central Washington, where annual precipitation typically ranges from 150 to 300 mm, even MT fallow is rare.

Most previous studies of the economics of no-tillage and MT in wheat–fallow systems have been conducted in the U.S. Great Plains and the Canadian Prairies. Reviews of this work have found that the relative profitability of these reduced-tillage systems in semiarid regions varied by location; however, reduced tillage generally increased net returns when crop planting intensity also increased. While these systems offer recognized soil and air quality benefits, some researchers have reported higher production costs for no-till. However, recent case studies of experienced no-till farmers in a semiarid region of eastern Washington revealed that their production costs for spring-sown crops were lower than with conventional tillage (CT).

CT practices during fallow are intensive and often leave the soil vulnerable to erosion. A soil surface deficient in residue, clods and roughness can pose a serious wind erosion threat. Conservation tillage systems in the inland Pacific Northwest generally employ non-inversion implements such as wide-blade V-sweeps for primary spring tillage, combined with use of herbicides in lieu of one or two tillage operations, and retain higher levels of surface residue and soil roughness during fallow compared with CT. A study in 1998 predicted that suspended dust particulates that were 10 µm (PM-10) and smaller in Spokane, WA, would be reduced by 31 to 54 percent if conservation tillage or no-tillage replaced conventional summer fallow.

Both the Spokane and Tri-Cities urban areas in eastern Washington have failed on several occasions to meet the Federal Air Quality Standards for PM-10. Violations of federal air quality standards mandate that regional air quality agencies develop plans to solve this problem.

Why don't most wheat–fallow farmers in the inland Pacific Northwest practice conservation tillage? Some cite concerns of inadequate seed-zone water for winter wheat stand establishment, difficulty in controlling grass weeds, and plugging of grain drills due to excessive residue. Concerns about financial risk from investing in conservation tillage implements also appear to underlie the eastern Washington farmers' reluctance to adopt conservation tillage fallow systems. This paper reports on grain yield performance and profitability of MT and delayed MT (DMT) versus CT for wheat–fallow farming in semiarid eastern Washington.

## Description of Experiment

A wheat–fallow rotation tillage system experiment was conducted from August 1993 to July 1999 at the Washington State University Dryland Research Station at Lind, Washington. The research is referred to as a five-year study as wheat harvests occurred from 1995 through 1999 (Table 1).

The Shano silt loam soil is more than 2 m deep with <2 percent slope. The experimental design was a randomized complete block of three tillage systems replicated four times. Individual plots were 18 by 46 m. Paired adjacent parcels of land were used so that data could be collected from both crop and fallow phases of the study each year. The three tillage management systems were (1) CT — standard frequency and timing of tillage operations using implements commonly used by farmers; (2) MT — standard frequency and timing of tillage operations, but herbicides were substituted for tillage when feasible and a noninversion V-sweep implement with attached rolling harrow was used for primary spring tillage; and (3) DMT — similar to MT, except primary spring tillage with a noninversion V-sweep was delayed until at least mid-May. The DMT system was included to test its impact on soil moisture retention and wind erosion control as well as economic feasibility. A complete list of field operations and timing is shown in Table 1.

## Economic Analysis

Standard enterprise budgeting techniques were used to estimate average fixed and variable costs of production for each system. Fixed costs include depreciation, interest, taxes, housing, and insurance on machinery and a farm overhead charge. Land costs were based on the region's prevailing two-thirds tenant — one-third landlord crop share rent. Variable costs include seed, fertilizer, herbicides, crop fire and hail insurance, fuel, repairs, and labor. Production costs were based on actual operations conducted in the experiment (Table 1). The wide-blade V-sweep was the only additional implement required for switching from CT to MT or DMT. Fertilizer, herbicide, and seed rates are those used in the Lind experiment (Table 1). Grain yields are the 1995 to 1999 averages recorded from the experiment (Table 2).

All cost and revenue figures are presented per rotational hectare. For example, for winter wheat–summer fallow, costs and revenues are computed for 0.5 ha of winter wheat and 0.5 ha of fallow. This correctly portrays the average return per hectare per year of a farmer who has one-half of the farm in fallow and one-half in winter wheat. For the economic analysis, it is assumed that farmers will incur the cost of replanting their winter wheat crop to spring wheat one out of five years due to inadequate winter wheat stands or winter kill.

The wheat prices used, \$144.02 Mg$^{-1}$ for soft white and \$187.3 Mg$^{-1}$ for hard red spring wheat, are regional benchmark, 1993 through 1997 marketing-year averages of farm-gate prices in the study area. A sensitivity analysis is included to show the effects of a broader range of wheat yields and prices. Net market returns are defined as returns over production costs.

## Yields, Residue, Water Storage

Winter wheat grain yield from 1995 to 1999 ranged from 1.79 to 5.20 Mg ha$^{-1}$. There were no significant statistical differences in yield among tillage systems within any year or in the five-year average (Table 2). While not statistically significant, the yields for MT exceeded or equaled those for CT every year. Retention of surface residue at the end of the 13-month fallow period averaged 770, 1,390, and 1,440 kg ha$^{-1}$ for CT, MT, and DMT, respectively. Using CT, the minimum surface residue required for highly erodible soils for gov-

**Table 2. Annual wheat grain yield by three fallow tillage systems.**

| Fallow tillage system | Year 1995† | 1996 | 1997 | 1998 | 1999 | Avg.‡ |
|---|---|---|---|---|---|---|
| | Mg ha$^{-1}$ | | | | | |
| Conventional (CT) | 1.79 | 3.52 | 5.13 | 3.89 | 2.32 | 3.72 |
| Minimum (MT) | 1.91 | 3.76 | 5.20 | 3.89 | 2.69 | 3.89 |
| Delayed minimum (DMT) | 1.79 | 3.73 | 4.94 | 3.58 | 2.48 | 3.68 |
| | NS | NS | NS | NS | NS | NS |

*† Fallow tillage systems were initiated in August 1993, and the first winter wheat was sown in September 1994. Due to insufficient seed-zone water, the winter wheat stand failed in fall 1994, and hard red spring wheat was sown in March 1995. Within-column means show no significant grain yield differences at $P < 0.05$ in any year or when averaged across years. ‡ Average soft white winter wheat yield (1996–1999).*

**Table 1. Field operations for the three tillage management systems during six fallow cycles (1993–1999) at Lind, WA.**

| Date | Conventional tillage (CT) | Minimum tillage (MT) | Delayed minimum tillage (DMT) |
|---|---|---|---|
| Aug. | Sweep—30-cm shank spacing, 36-cm-wide sweeps, 13-cm depth. Sweeping was not conducted in 1996, 1997, and 1998. | Herbicide—0.38 kg a.e. ha$^{-1}$ glyphosate + 0.67 kg a.e. ha$^{-1}$ 2,4-D in 1993; 0.85 kg a.e. ha$^{-1}$ glyphosate in 1994 and 1995. Not required in 1996, 1997, and 1998. | Herbicide—0.38 kg a.i. ha$^{-1}$ glyphosate+ 0.67 kg a.e. ha$^{-1}$ 2,4-D in 1993; 0.85 kg a.e. ha$^{-1}$ glyphosate in 1994 and 1995. Not required in 1996, 1997, and 1998. |
| Nov. | Chisel—60-cm shank spacing, straight point, 25-cm depth. | Chisel—120-cm shank spacing, straight point, 25- to 40-cm depth. Not conducted in 1996. Rotary subsoiler, 40-cm depth in 1987 and 1998. | Chisel—120-cm shank spacing, straight point, 25- to 40-cm depth. Not conducted in 1996, 1997, and 1998. |
| Feb. | Herbicide—0.32 kg a.e. ha$^{-1}$ glyphosate. | Herbicide—0.32 kg a.e. ha$^{-1}$ glyphosate. | Herbicide—0.32 kg a.e. ha$^{-1}$ glyphosate. |
| Mar.†‡ | Primary tillage—cultivator, overlapping 18-cm-wide sweeps, 13-cm depth + 5-bar spring-tooth harrow (two passes). Tandem disk, 13-cm depth (one pass) in 1997 and 1998. | Primary tillage—undercutter, over-lapping 80-cm-wide V-blades, 13-cm depth + rolling harrow. | |
| Apr. | Anhydrous $NH_3$–N injection at 45 kg ha$^{-1}$ | | |
| May | First rod weeding, 10-cm depth | First rod weeding, 10-cm depth | Primary tillage—undercutter, Overlapping 80-cm-wide V-blades, 13-cm depth + rolling harrow |
| June | Second rod weeding, 10-cm depth | Second rod weeding, 10-cm depth | First rod weeding, 10-cm depth |
| July | Third rod weeding, 10-cm depth | Third rod weeding, 10-cm depth | Second rod weeding, 10-cm depth |
| Sept.§ | Sown to winter wheat at 45 kg ha$^{-1}$. | Sown to winter wheat at 45 kg ha$^{-1}$+ aqua $NH_3$–N injection at 45 kg ha$^{-1}$. | Sown to winter wheat at 45 kg ha$^{-1}$ + aqua $NH_3$ injection at 45 kg ha$^{-1}$. |

*† All tillage systems were sown to hard red spring wheat in March 1995 because winter wheat failed due to dry seed-zone conditions in September 1994.*
*‡ Skew tread to cut and incorporate high quantities of residue in all tillage systems on March 1 and again on May 15 in 1998.*
*§ MT and DMT systems were first blind-sown in 1997 with just the drill's packer wheels to pass through 2000 kg ha$^{-1}$ residue without plugging during actual sowing.*

ernment farm program compliance (390 kg ha$^{-1}$) was not achieved in one year and was only marginally met in another, whereas ample residue was present in all years in the MT and DMT systems. In addition, twice the amount of surface clod mass and a rougher surface was achieved with MT and DMT compared with CT. Averaged over all fallow cycles, soil water content in the 0- to 15-cm seed zone depth, as well as in the entire 180-cm soil profile, was not affected by tillage system. Therefore, CT held no agronomic advantages over MT or DMT, but it did have distinct environmental disadvantages.

## Profitability, Sensitivity Analysis

Variability in net returns reflects different yields and production costs over the five years. As noted above, wheat prices were held constant. Net returns over total costs for the three tillage systems were not statistically different (Table 3).

The P-value for differences in mean profitability among tillage systems was 0.161. Measured by net returns over variable costs, DMT was less profitable than the other two tillage systems. Based on the average prices and yields, market returns of all three systems fell short of covering total costs by $27 to $40 ha-1. Total costs include a wage for the operator, a land charge, machinery depreciation, interest costs, and variable input costs. Negative market net returns over total costs are fairly common in grain production when government payments are not included. The results in Table 3 are based on average prices and yields; however, market prices and farm yields vary widely over time.

To illustrate the effect of price and grain yield variation on market net returns, Table 4 shows net-return sensitivity to different price and grain yield combinations for DMT, MT, and CT. Sensitivity results for MT, the most competitive conservation tillage system, are discussed here to illustrate the effects of price and yield variability. If MT wheat averages 4.03 Mg ha$^{-1}$ and a price of $146.96 Mg$^{-1}$ is received, market returns over total costs equal $9.83 ha$^{-1}$. Prices of $128.59 Mg$^{-1}$ or less are shown to generate losses before government payments for all yields of 4.37 Mg ha$^{-1}$ or less (Table 4). Given the experiment's 1996 through 1999 average grain yield for MT of 3.89 Mg ha$^{-1}$, one can compute that a price of $147.19 Mg$^{-1}$ is required to cover the total cost of $286.29 per rotational hectare. If grain yield for MT falls below 3.03 Mg ha$^{-1}$, the farmer will fail to meet total costs from market sales even with the relatively high wheat price of $183.70 Mg$^{-1}$.

## Conclusions

Results from this study show no statistical difference in grain yield among two MT fallow systems and a CT fallow system. The three systems were economically equivalent based on market returns over total production costs. The reduced-tillage systems promise potentially greater future productivity by controlling wind erosion. They also reduce the risk of government payment denial due to inadequate residue. Economic analysis indicates that no or minimal subsidies should be needed to entice producers to switch from conventional to reduced-tillage fallow because the systems are equally profitable. This is especially true for the MT system, which had statistically equivalent profitability with CT for both net returns over variable and total costs.

***Editor's note:*** *Content was adapted from the paper "Economics of Conservation Tillage in a Wheat–Fallow Rotation," which was published in Agronomy Journal, 2002 94, and is courtesy of the authors Jeffrey S. Janosky, Douglas L. Young and William F. Schillinger.*

**Table 4. Market returns over total costs as affected by soft white winter wheat price and grain yield for three fallow tillage systems *(positive net returns are highlighted in italic).*†**

| | Wheat price, $ Mg$^{-1}$ | | | | | |
|---|---|---|---|---|---|---|
| Yield | 91.85 | 110.22 | 128.59 | 146.96 | 165.33 | 183.70 |
| Mg ha$^{-1}$ | $ ha$^{-1}$ | | | | | |
| | Conventional (CT) | | | | | |
| 2.02 | -182.23 | -163.68 | -145.12 | -126.57 | -108.02 | -89.46 |
| 2.69 | -151.46 | -126.75 | -102.05 | -77.34 | -52.63 | -27.92 |
| 3.36 | -120.69 | -89.83 | -58.97 | -28.11 | 2.75 | 33.62 |
| 4.03 | -89.92 | -52.91 | -15.89 | 21.12 | 58.14 | 95.16 |
| 4.71 | -58.69 | -15.43 | 27.83 | 71.09 | 114.35 | 157.61 |
| | Minimum (MT) | | | | | |
| 2.02 | -193.52 | -174.97 | -156.41 | -137.86 | -119.31 | -100.75 |
| 2.69 | -162.75 | -138.04 | -113.34 | -88.63 | -63.92 | -39.21 |
| 3.36 | -131.98 | -101.12 | -70.26 | -39.40 | -8.54 | 22.33 |
| 4.03 | -101.21 | -64.20 | -27.18 | 9.83 | 46.85 | 83.87 |
| 4.71 | -69.98 | -26.72 | 16.54 | 59.80 | 103.06 | 146.32 |
| | Delayed minimum (DMT) | | | | | |
| 2.02 | -188.99 | -170.44 | -151.88 | -133.33 | -114.77 | -96.22 |
| 2.69 | -158.22 | -133.51 | -108.81 | -84.10 | -59.39 | -34.68 |
| 3.36 | -127.45 | -96.59 | -65.73 | -34.87 | -4.01 | 26.86 |
| 4.03 | -96.68 | -59.67 | -22.65 | 14.36 | 51.38 | 88.40 |
| 4.71 | -65.45 | -22.19 | 21.07 | 64.33 | 107.59 | 150.85 |

*† Returns reflect 0.5 ha of wheat and 0.5 ha of summer fallow. Total cost - $275.00 per rotational ha for CT, $286.29 for MT, and $281.76 for DMT.*

**Table 3. Mean market net returns over variable and total costs per rotational hectare for winter wheat from 1995 to 1999 as affected by fallow tillage system.**

| | | $ ha$^{-1}$ cost | | | $ ha$^{-1}$ net returns over cost† | |
|---|---|---|---|---|---|---|
| Fallow tillage system | $ ha$^{-1}$ revenue | Variable | Fixed | Total | Variable | Total |
| Conventional (CT) | 247.73 | 144.34 | 130.66 | 275.00 | 103.39a | -27.27a |
| Minimum (MT) | 259.67 | 155.69 | 130.59 | 286.29 | 103.97a | -26.62a |
| Delayed minimum (DMT) | 245.56 | 157.52 | 124.24 | 281.76 | 88.03b | -36.21a |

*† Within-column mean net returns followed by the same letter are not statistically different at the 0.05 level.*

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DETACH HERE

# Economics of Conservation Tillage in a Wheat-Fallow Rotation
## May/June Self-Study Examination

**1. Land under summer fallow has:**
[ ] a. increased in the past 15 years.
[ ] b. increased in the past 10 years.
[ ] c. been on the decline the past 30 years.
[ ] d. remained steady in the United States.

**2. Winter wheat-fallow rotation remains the dominant cropping system in areas receiving:**
[ ] a. <150 mm annual precipitation.
[ ] b. <200 mm annual precipitation.
[ ] c. <275 mm annual precipitation.
[ ] d. <350 mm annual precipitation.

**3. Case studies of experienced no-till (NT) farmers in semi-arid regions revealed that production costs for spring sown crops were:**
[ ] a. lower than with conventional tillage.
[ ] b. higher than with conventional tillage.
[ ] c. high when considering compromised soil and air quality.
[ ] d. the same as conventional tillage.

**4. conventional tillage practices during fallow:**
[ ] a. leave plenty of soil roughness, thus reducing wind erosion.
[ ] b. leave the soil susceptible to wind erosion be reducing residue and roughness.
[ ] c. increase herbicide use.
[ ] d. increase soil moisture.

**5. A 1998 study predicted if conservation or no-tillage replaced conventional summer fallow, dust particulates near PM-10 or smaller in Spokane, WA, would be reduced by:**
[ ] a. 9 to 26%.
[ ] b. 17 to 33%.
[ ] c. 31 to 54%.
[ ] d. 41 to 52%.

**6. Reasons given by farmers for not practicing conservation tillage include:**
[ ] a. inadequate seed-zone water for winter wheat establishment.
[ ] b. inadequate information.
[ ] c. increased soil erosion.
[ ] d. increased air quality problems.

**7. Production costs were based on:**
[ ] a. actual operations conducted in the experiment.
[ ] b. predicted operations for the experiment.
[ ] c. average operation costs for farmers in the area.
[ ] d. earlier experimental data.

**8. In every year of the study, the yields for minimum tillage:**
[ ] a. were less than conventional tillage (CT).
[ ] b. exceeded or equaled those for CT.
[ ] c. were inconclusive.
[ ] d. made a significant profit.

**9. Based on market returns over total production costs:**
[ ] a. conventional tillage was the most profitable.
[ ] b. minimum tillage was the most profitable.
[ ] c. delayed-minimum tillage was the most profitable.
[ ] d. the three systems were economically equivalent.

**10. The reduced-tillage systems:**
[ ] a. increased the risk of government payment denial due to inadequate residue.
[ ] b. promise potentially greater future productivity by controlling wind erosion.
[ ] c. had statistically equivalent returns over variable costs.
[ ] d. had higher risk.

Over

# CCA ADVANTAGE Newsletter

ASA C/O CCA SELF-STUDY EXAM
677 S SEGOE ROAD
MADISON WI 53711

AMERICAN SOCIETY OF AGRONOMY
CERTIFIED CROP ADVISER

Your May/June Issue Inside!

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## Continuing Education Self-Study Test

*Crop Management Self-Study Test (continued)*

CCA 1 CEU

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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 June 2003 expires June 2005.**

### 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

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Briefly explain any "1" ratings: ______________________________

Topics you would like to see addressed in future self-study materials: ______________________________