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ARE THERE TRADEOFFS BETWEEN FARM PROFITABILITY AND ENVIRONMENTAL QUALITY IN SOUTH DAKOTA'S BIG SIOUX AQUIFER AREA?

SARE Project LNC93-55

by

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One year ago we reported to readers of the Economics Commentator on profitability findings for a study of farming practices and systems in South Dakota's Big Sioux Aquifer (BSA) area (No. 347, March 27, 1995). The study, funded in part by the USDA's Sustainable Agriculture Research and Education (SARE) program, was designed to help assess the effectiveness of two special Federal programs intended to reduce the risks of nitrate contamination of BSA groundwater. The programs are the Integrated Crop Management (ICM) program and the Water Quality Incentive Program (WQIP).

Through these programs, farmers receive cost-share and technical assistance to voluntarily shift to practices and systems that are thought to reduce adverse environmental effects. We examined implications for profits and potential nitrate contamination from non-point agricultural sources associated with crop production over the aquifer. This Commentator issue contains estimates of the environmental effects, which were not yet complete when the earlier issue (No. 347) was prepared.

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Study Area and Methods

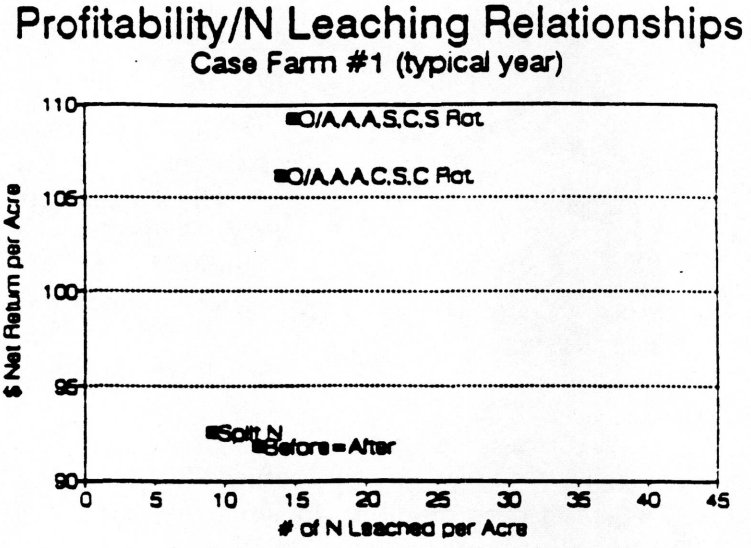
Three counties in the BSA area--Brookings, Moody, and Minnehaha--have been the focal point of the Big Sioux Aquifer Demonstration Project, a USDA-sponsored pilot effort based on technical assistance and cost-share under the WQIP and ICM. We used data collected from four representative case farms that participated in this program in the early 1990s. One "dryland" (non-irrigated) farm is in each of the three counties and an irrigated farm is in Brookings County: Case Farm #1--Brookings County; reduced tillage; corn-soybean rotation, with some alfalfa; ICM participant; Case Farm #2--Moody County; some aspects of reduced tillage; corn, soybeans, and oats; ICM participant; Case Farm #3--Minnehaha County; corn, soybeans, oats, alfalfa, and clover; WQIP participant; and Case Farm #4--Brookings County; continuous corn; center-pivot irrigated; WQIP participant.

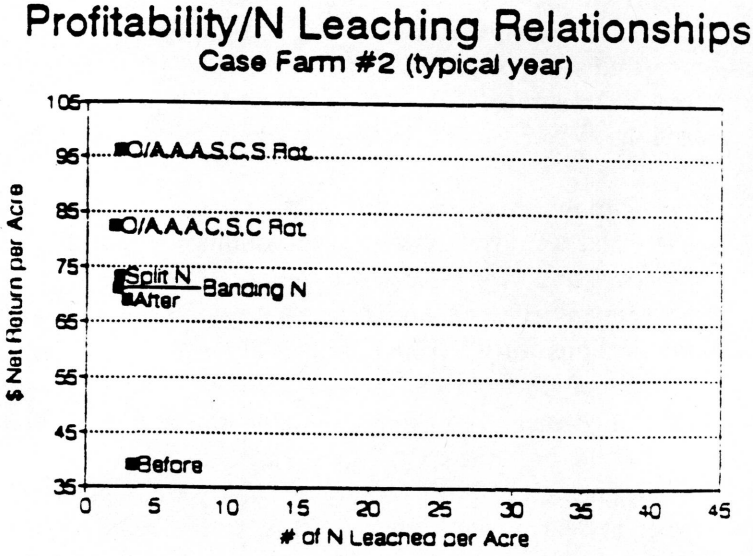
The methods for estimating farm profitability using a budget generator package called CARE (Cost and Return Estimator) were explained in the earlier Commentator issue (No. 347) dealing with this study. In the net return calculations, both market values of harvested crops and Federal farm program deficiency payments were included in gross receipts. Variable and fixed costs of production except for land and management charges also were included in the calculations. However, neither the payments from ICM and WQIP nor the costs of specialized services (e.g., crop consulting and soil testing) funded by those payments were included in the farm budgets. Thus, the payments were treated "as if" they were direct pass-throughs. ICM and WQIP payments were $7/ac for Farm #1, $4.93/ac for Farm #2, $7/ac for Farm #3, and $14.30/ac for Farm #4.

Impacts of different farming practices and systems on environmental quality, as measured by nitrate leaching to groundwater, were estimated with the Nitrogen Leaching and Economic Analysis Program (NLEAP). Estimates of nitrate leaching were made for each of the practices and systems for which farm profits were estimated. This was done under three different assumed rainfall scenarios: "typical", "wet", and "dry". The nitrate leaching estimates were made averaging the annual results over a 6-year time period for each climate scenario.

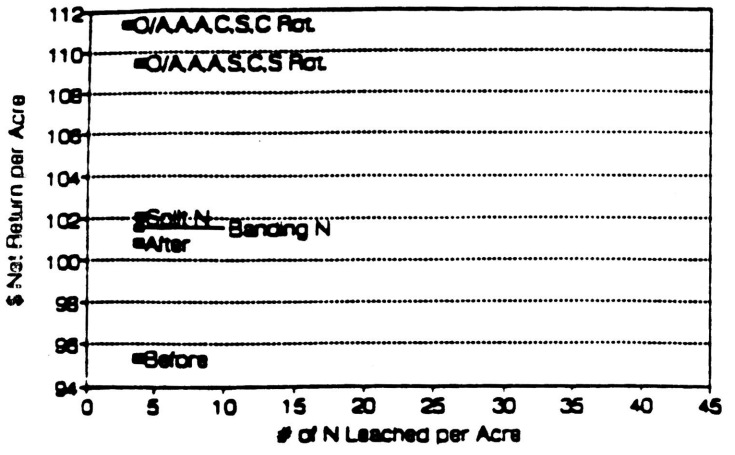
Results with Typical Rainfall

The relationships between farm profitability and nitrate leaching, assuming various crop management practices and systems, are shown for each case farm--under "typical year" rainfall conditions--in the four figures that follow. "Before" results represent the farming practices and systems in place prior to participating in the ICM or WQIP. "After" results are estimates for each farm after initial changes were made in response to ICM or WQIP technical assistance and cost-share, and with the same crop rotation. (For Case Farm #1, no significant changes were made initially, so "Before" and "After" were the same.) Also shown are profitability and nitrate leaching estimates for certain possible additional practice changes--such as banding fertilizer or splitting nitrogen fertilizer applications. Estimates also are shown for selected possible system changes which involve switching to more diverse crop rotations.

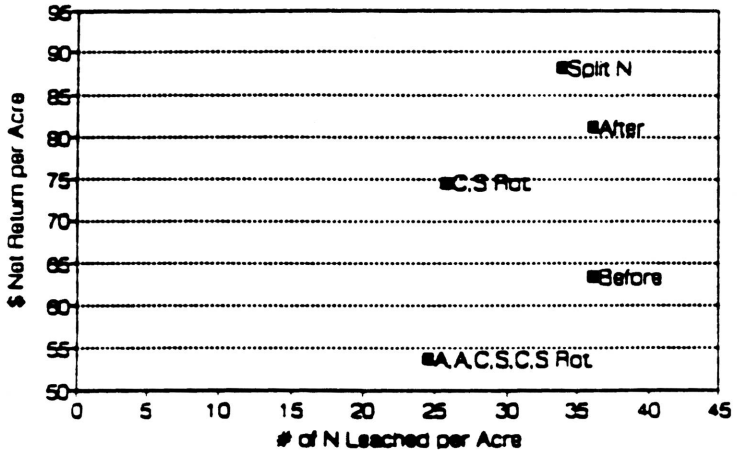




Profitability/N Leaching Relationships
Case Farm #3 (typical year)



Profitability/N Leaching Relationships
Case Farm #4 (typical year)



Under "typical" rainfall conditions, a number of possible practice and system changes (including the "After" practice changes made in initial response to ICM or WQIP participation) appear to offer promise of increasing farm profits on the dryland farms (#1, #2, and #3). Most of those changes also decrease leaching. Estimated leaching in typical rainfall years is relatively low even "Before" ICM and WQIP on Farms #2 and #3. Thus, changes in practices resulting from those programs (the "After" scenarios) and other possible practice and system changes appear to yield very little change in nitrate leaching. Estimated "Before" and "After" (ICM) leaching is somewhat higher in typical rainfall years on Farm #1. There the impacts of possible practice and system changes on leaching are slightly larger--a decrease in leaching from splitting N applications and increases from the more diverse rotations.

Estimated nitrate leaching is much greater on the irrigated case farm (#4) in typical rainfall years than on the three dryland farms. Although the "After" WQIP management change increased profits, it did not appear to decrease leaching. Splitting N applications would appear to further increase profits but have only a modest impact on leaching in typical rainfall years. Changing to more diverse crop rotations would have substantially greater impacts on nitrate leaching, but would decrease profits relative to the continuous corn "After" scenario. Here, tradeoffs between farm profitability and environmental quality appear to exist.

Results for Wet Years

Space does not permit us to display the results for "wet" and "dry" scenarios here. As expected, nitrate leaching estimates were greater for "wet" weather than for "typical" weather conditions on most of the case farms. Prospects for reducing nitrate leaching by moving to more diverse crop rotations were especially noteworthy on the irrigated farm under wet weather conditions. The corn-soybean rotation showed a substantial reduction in nitrate leaching on the irrigated farm in wet years, compared to continuous corn, with only a moderate sacrifice in profits.

Conclusions

This study focused on potential profitability/ environmental quality tradeoffs associated with different farming practices and systems where nitrate leaching to groundwater was the principal environmental concern. The findings can be summarized as follows:

--A number of practices and systems appear to offer good prospects for increasing farm profitability and modestly reducing nitrate leaching to groundwater.

--The potential for certain alternative practices and systems to reduce nitrate leaching is greatest in periods of unusually wet weather.

--Alternative farming systems appear to have their greatest potential for reducing nitrate leaching in irrigated farming situations.

--Cost-share programs like the ICM and WQIP, coupled with active extension programs, appear to have promise for increasing farm profitability and, in some cases, reducing nitrate leaching.

More detailed discussion of research procedures, features of the case farms, and findings are available in a series of SDSU Economics Pamphlets. Readers who want such detail may contact any of the first three authors of this Commentator article at SDSU.

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