:er abstract in Conference Proceedings for "C
.st Century", Vol. III, "Practices, Systems & A
;ouri: March 5-8, 1995.

Environmental and Farm Profitability Objectives in Water Quali the Tradeoffs

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Summary

This research project was designed to determine whether the economic incentives offered by recent environmental provisions of the federal farm program are sufficient to induce Western Corn Belt/Northern Great Plains farmers in environmentally sensitive areas to adopt sustainable farming practices and systems. Particular attention is being focused on the Integrated Crop Management (ICM) program and the Water Quality Incentive Program (WQIP). Results of the participation of farmers in a three-county water quality demonstration project area of eastern South Dakota—the Big Sioux Aquifer Demonstration Project—indicate that 45 out of 400 farms had enrolled in the ICM or the WQIP, or both, by the end of 1993. The most popular practices under these programs were nutrient management, pest management, conservation cropping sequence, and crop residue use. There was very little change in either crop type or crop rotation. Preliminary economic results for three case study farms in the project area indicated no change in "typical-year" net profits "after" participation in ICM or WQIP—compared to "before" participation—on one farm, modest increase on another, and substantial increase on the other. Simulation of possible additional practice changes thought to improve groundwater quality showed further possible modest increases in profits on all three case farms. Simulated system changes, involving changes to more diverse crop rotations, also appear to add to profitability; however, sensitivity analyses are yet to be carried out for the system changes to test the range of assumptions under which this conclusion is valid.

Project Description

The overall goal of this research project is to determine whether the economic incentives offered by recent environmental provisions of the federal farm program are sufficient to induce Western Corn Belt/Northern Great Plains farmers in environmentally sensitive areas to adopt sustainable

farming practices and systems. Particular attention is being focused on the Integrated Crop Management (ICM) cost-share program and the Water Quality Incentive Program (WQIP). These programs were started as pilot efforts in the early 1990s and, thus far, have had limited funding. National policymakers need to know whether these programs are viable policy options to expand upon and/or substantially modify in the 1995 Farm Bill. This research is intended to provide such policy insights for grain farming areas in which groundwater quality is a critical concern.

Specific project objectives involve: development of whole-farm models with which to estimate the effects of different farming practices and systems on profits and groundwater nitrate levels for representative farms; determination of the extent to which farmer participation in the ICM program and the WQIP would enhance the profitability—and, hence, adoption—prospects of those practices and systems which are most benign with respect to groundwater quality; and determination of what further changes may be needed in the federal farm program in order to induce adoption of sustainable farming practices and systems with potential to satisfy groundwater quality objectives.

The Big Sioux Aquifer (BSA) in eastern South Dakota is an unconfined aquifer which is sensitive to surface agricultural inputs. In 1990, the Big Sioux Aquifer Demonstration Project (a 5-year plan to implement improved management practices in this sensitive area) began as a pilot project to determine the acceptability of different production practices and systems by farmers. In this research project, we are attempting to evaluate the economic versus environmental tradeoffs associated with implementing these practices and systems on representative farms in the BSA area. The main environmental concern in the BSA area is with NO_3-N leaching through the soil profile into shallow groundwater used for drinking. The computer model NLEAP (Nitrogen Leaching and Economic Analysis Package) is being used to evaluate the nitrate leaching to groundwater.

Results

Results of the participation of farmers in these special programs has shown that, as of fall 1993, 45 out of 400 farms in the BSA area had enrolled in the ICM or the WQIP, or both. The most popular practices under these programs were nutrient management, pest management, conservation cropping sequence, and crop residue use. There was very little change in either crop type or crop rotation.

We are working with two representative dryland case farms enrolled in the ICM program, one dryland case farm enrolled in the WQIP, and one irrigated case farm enrolled in the WQIP. At the time this abstract was being prepared (early November 1994), ***preliminary*** economic results were available for the three dryland cases. Preliminary estimates of *net returns to land and management* for these three case farms under different farming systems and practices are shown in Table 1. Results are based on an aggregation of the fields on each case farm most affected by the ICM or WQIP program. A budget generator package called CARE (Cost and Return Estimator) was used in determining the net returns for all affected fields. Those field-by-field results were then aggregated into a "whole-farm" format with a separate spreadsheet that

Table 1. Preliminary Profitability Estimates for Selected Management Scenarios on Three Farms

Management scenario	Net returns to land and management ($/ac) Case Farm #1	Case Farm #2	Case Farm #3
Baseline ("before" ICM or WQIP)	$91.80	$39.34	$97.03
"After" ICM or WQIP	$91.80	$68.99	$102.59
Banding fertilizer at planting	Not applicable	$71.12	$103.23
Splitting nitrogen applications	$92.61	$73.29	$103.73
Diverse rotation with 1 yr oats, 2 yrs alfalfa, 2 yrs soybeans, & 1 yr corn (between soybean yrs)	$109.26	$96.28	$111.35
Diverse rotation with 1 yr oats, 2 yrs alfalfa, 2 yrs corn, & 1 yr soybeans (between corn yrs)	$106.15	$82.63	$113.13

also took federal farm program acreage set-aside requirements into account. The per-acre results shown in Table 1 are composites for all farming systems on the affected fields of each case farm; they were determined by dividing the "whole-farm" results by the number of acres.

Shown in the first row of data are "baseline" net returns per acre for each case farm; these represent net returns in a "typical" year "before" entering the ICM or WQIP program. In the second row are estimates of what net returns are likely to be in a typical year "after" entering into the ICM or WQIP program and making associated farm management adjustments. Since these farms have only recently entered into the program, and one of the years (1993) since entering had far from typical weather conditions, a good deal of farmer and researcher judgment was used in making yield and other estimates necessary for the "after" economic analysis. Each farm received cost-share payments for crop consulting and soil testing services. Estimated "before" and "after" net returns on Case Farm #1 were the same, because the crop consulting services received under the ICM program for that farm did not lead directly to any farming practice or system changes. Estimated net returns increased substantially on Case Farm #2 (by nearly $30/ac), where the ICM program contributed to a decision to switch to no-till practices for corn and soybeans and to begin drilling soybeans. Net returns were estimated to increase by $5-6/ac on Case Farm #3, where the WQIP program involved reduced usage of inorganic fertilizer and changes in pesticides on corn.

The third and fourth rows of data in Table 1 constitute profitability estimates for possible additional ***practice*** changes. These are changes that have not actually taken place, but that ***could*** be added to the "after" scenario. The first is banding fertilizer at planting and the second is splitting nitrogen fertilizer applications. Each—analyzed individually, rather than in combination—appears to add modestly to net profitability on each case farm. The final rows show estimates for two additional hypothetical scenarios, these involving ***system*** changes. Both involve changes to more diverse crop rotations than existed in the "before" and "after" scenarios, and they include oats (as a nurse crop for alfalfa), alfalfa (harvested for 2 years after seeding), soybeans, and corn in 6-year rotations. In one alternative, soybeans are grown 2 years out of 6 and corn is grown only 1 year; in the other, soybeans are grown 1 year and corn is grown 2 years. Both of these scenarios appear to add to net farm profitability—compared to the "after" scenario—on all three case farms. However, additional analysis will be conducted to determine how sensitive these results are to our estimates for such variables as alfalfa yields and prices.

The nitrate leaching results using NLEAP are presently being developed and the "frontiers" of whole-farm economic returns and environmental tradeoffs for the three case farms will be presented and made available at the symposium.

Technology Transfer

Findings reported here are preliminary. More complete results can be used by policymakers as inputs to decisions regarding whether and how to extend and revise the ICM program and the WQIP. The results also will be applicable to development of other incentives-based environmental policies for nonpoint source pollution in the agricultural sector. In addition, results of this study can be used in extension farm and agronomic management programs designed to enhance groundwater quality while maintaining farm profitability.