ANALYSES OF TWO PILOT "GREEN" PAYMENT PROGRAMS: INTEGRATED CROP MANAGEMENT AND WATER QUALITY INCENTIVE PROGRAM[1]

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The goal of this study is to determine if recently introduced "green payment" programs offer sufficient incentives to induce more sustainable farming practices and systems. Data from case farms were analyzed to estimate profitability before and after participation in two pilot programs.

Introduction

There has been a great deal of speculation regarding the course of U.S. farm policy in the remainder of this decade. As policymakers prepare the 1995 farm bill, there is an increased interest in weighing the promise of policy options such as "green" (or "stewardship") programs (Dobbs, 1993). A recent task force of the Great Plains Agricultural Council emphasized the challenges in the Great Plains region of providing sufficient economic incentives to induce voluntary adoption of farming practices and systems that are friendly to water quality (Water Quality Task Force, 1992). "Green" programs could help to provide the required economic incentive.

The overall goal of this study has been 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 started as pilot efforts in the early 1990's and, thus far, have had limited funding. National policymakers need to know whether these programs are viable 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.

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The ICM program incorporates pest and nutrient management, crop selection and rotation, and conservation measures into a more comprehensive management program than is usually associated with Agricultural Conservation Program cost share. Practices may include soil and tissue testing, field scouting, cover crops, green manures, improved rotations, composting, and other techniques for reducing the use of agrichemicals (Hoefner, et al., 1992).

The WQIP is a voluntary program to encourage producers to adopt practices that improve water quality. It provides incentive payments for farms to develop and implement 3- to 5-year farm management plans that will protect water quality through reduction in the waste stream of agricultural pollutants, including fertilizer, manure, and pesticides. Participating farmers must agree to implement a water quality plan approved by the USDA, report their usage rates of nutrient, pesticide, and animal waste materials for the previous 3 years, and supply well test results, soil tests, tissue tests, and application levels to the Natural Resources Conservation Service and the local conservation district for each year in the program (Hoefner, et al., 1992).

Only a very limited number of studies have thus far focused on the ICM and WQIP programs as policy options. Dicks, et al. (1993) and Osborn, et al. (1994) analyzed some of the effects of the ICM program in its first year of operation, 1990. Their analyses relied heavily on records farmers must keep as part of the program, and no farm-level modeling was done. Higgins (1995) analyzed barriers to full implementation of the WQIP and proposed some changes to make the program more fully utilized by farmers.

The study reported in this paper is being conducted on case farms over the Big Sioux Aquifer (BSA), a shallow aquifer located under the fertile soils of eastern South Dakota. Most of this land is devoted to intensive agriculture. Preventing groundwater contamination from fertilizers, pesticides, and animal wastes is a major objective of the Big Sioux Aquifer Water Quality Demonstration Project. The BSA is one of sixteen demonstration projects in the United States developed as part of a 5-year comprehensive program funded by the USDA. The BSA Project is aimed at protecting groundwater quality in shallow aquifers by identifying farm management practices which are environmentally sound and economically feasible. The goal is to promote voluntary adoption of innovative production practices, management systems, and land treatment to reduce or eliminate contamination of the aquifer by agricultural operations. (Cooperative Extension Service, 1992)

Methods of Analysis

Four case study farms are being used for analyses. They represent different farm sizes, soils, cropping systems, topography, and management in the Big Sioux Aquifer study area.

The case farms are a mix of three dryland operations and one irrigated operation. Farm #1 is a dryland operation that uses reduced tillage on a corn-soybean rotation, with some alfalfa. Farm #2 is a dryland operation that uses some aspects of reduced tillage on corn, soybeans, and oats. Farm #3 is a dryland operation that has corn, soybeans, oats, alfalfa, and clover. This is a part-time farm that uses a high level of stewardship. Farm #4 is an irrigated operation that uses conventional tillage on continuous corn under a center-pivot sprinkler irrigation system.

Crop enterprise budgets have been developed for these farms using a budget generator package called CARE (Cost And Return Estimator). Profitability results (from CARE) for individual crops, fields, and soils have been aggregated to a rotation and farming system level with special spreadsheets that take Federal farm program acreage set-aside requirements into account.

Baseline analyses were completed using data collected from each case farmer. When the data were collected, the farmers were asked to distinguish what practices would typically be used before enrollment in either the ICM program and/or the WQIP, and what practices would typically be used after enrollment in these special programs. 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 judgement has been used in making yield and other estimates necessary for the "after" economic analysis.

In this study, we also did profitability analyses for possible additional **practice** changes. These are changes that some farmers are not actually using yet, but that could be added to the "after" scenario. One is banding fertilizer at planting and another is splitting nitrogen fertilizer applications. Other changes involve **system** changes. The system changes involve switching to more diverse crop rotations than existed in the "before" and "after" scenarios for each individual case farmer.

Baseline Results[3]

Baseline analyses were conducted with the Federal farm program as it existed in 1993. Market prices were "typical"

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[3]See Dobbs, et al. (1995) for presentation of preliminary nitrate leaching results together with the following profitability results.

prices for the early 1990's in eastern South Dakota. The per acre profitability 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/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. ICM and WQIP payments were $7/ac for Farm #1, $3.50/ac for Farm #2, $3/ac for Farm #3, and $17/ac for Farm #4. These payments were not added into the budgets since the payments were used to directly pay for costs incurred to make management adjustments; these costs, such as for crop consulting and soil testing services, are not included in the budgets, either. Thus, those payments are treated as direct "pass throughs".

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 $30/acre), 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 $6/acre on Case Farm #3, where the WQIP involved reduced usage of inorganic fertilizer and changes in pesticides on corn. Estimated net returns increased substantially ($18/ac) on Case Farm #4, where the WQIP involved eliminating dry preplant inorganic fertilizer.

The third and fourth rows of data in Table 1 constitute profitability estimates for possible additional **practice** changes. Each--analyzed individually, rather than in combination--appears to add modestly to net profitability in each case. The final rows show estimates for four additional hypothetical scenarios, these involving **system** changes. All involve changes to more diverse crop rotations than existed in the "before" and "after" scenarios. The first two 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 only grown 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 Case Farms #1, #2, and #3.

The last two alternatives are system changes for Case Farm #4. This farm also has hypothetical scenarios that involve system changes to more diverse rotations, but the scenarios are different from those of the other farms because the irrigated farm's baseline involves a continuous corn rotation. In one alternative, a 6-year rotation, alfalfa (clear-seeded) is harvested 2 years, and soybeans and corn are each grown for 2 years. The other alternative for Case Farm #4 is a corn/soybean rotation. (Corn/soybean rotations were part of the baseline for some of the other case farms.) Neither one of these system alternatives appears to be as profitable as the continuous corn rotation in the "after" scenario.

Sensitivity analyses were conducted for alfalfa yields and prices. The purpose of these analyses was to determine how sensitive the rankings of the different systems were to assumed alfalfa prices and yields. Farm #1 and Farm #3 required a drop of 35% or more in alfalfa prices or alfalfa yields before the diverse systems became less profitable than the baseline "after" systems. These farms have some alfalfa in their baseline systems, which explains the large percentage drop in prices or yields needed to make the diverse systems less profitable. Farm #2 does not have alfalfa in its baseline system. This farm would require an 18% drop in prices or a 25% drop in yields before the diverse systems would become less profitable than the baseline system. Profitability comparisons are not considered to be very sensitive to assumed alfalfa prices and yields for these farms, since percentage decreases were in excess of 10% before profitability rankings were affected. These sensitivity analyses were not conducted for Farm #4 because the baseline system (continuous corn under a center-pivot irrigation system) was more profitable than the diverse rotation using assumed prices and yields.

<u>Alternatives to Green Payments</u>

Selected analyses were conducted to explore policy alternatives to green payments to induce more diverse rotations. A "free market" policy and a "normal crop acreage" policy were examined. In the "free market" scenario, set-aside acres and price supports (i.e., deficiency payments) would be dropped and crop mixes would be influenced only by market price. In the "normal crop acreage" scenario, the deficiency payments were decoupled from the crops grown (i.e., a flat payment equivalent to that in the "after" baseline scenario was made for each case farm) and overall set-aside acreage was left the <u>same</u> as in the "after" baseline (for all practices and systems). These analyses were done only for the "after" baseline and alternatives with a rotational change--to determine the relative profitability of different systems under these policy options, compared to the 1993 farm program. Case Farm #1 was not included in these analyses since it is not enrolled in the Federal farm commodities program.

Space does not permit a display of these results here.[4] However, the "free market" and "normal crop acreage" scenarios did not change the profitability rankings for Farms #2 and #3. For Farm #4, both scenarios changed the profitability ranking of the systems. Under the 1993 farm program scenario, the baseline "after" system was the most profitable (on Farm #4). Switching to either the "free market" or the "normal crop acreage" scenario, the corn/soybean rotation became the most profitable system. Neither the "free market" scenario nor the "normal crop acreage" scenario made the diverse rotation with alfalfa as profitable as continuous corn or corn/soybeans, under irrigation, however.

Conclusions

Economic results for the four case farms showed 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 increases on the other two. These results imply that the ICM program and the WQIP can enhance the profitability of some farms, while encouraging practices intended to improve water quality. Simulation of additional **practice** changes thought to improve groundwater quality showed possible modest increases in profits. Simulated **system** changes, involving adoption of more diverse crop rotations, also added to profitability under some circumstances. Additional policy analyses showed that for Farms #2 and #3, there is no difference between profitability rankings for the different systems enrolled in the 1993 farm program with ICM/WQIP compared to "free market" and "normal crop acreage" policy options. For Farm #4, the corn/soybean rotation becomes more profitable with both the "free market" and "normal crop acreage" policy options than the continuous corn system enrolled in the WQIP. This indicates that policy options involving more radical change than ICM and WQIP may be needed to induce **system** changes in some situations.

[4]The results are presented in bar charts in Dobbs (1995).

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Table 1. Profitability Estimates for Selected Management Scenarios on Four Case Farms

Management scenario	Net returns to land and management ($/ac.)			
	Case Farm #1	Case Farm #2	Case Farm #3	Case Farm #4
Baseline ("before" ICM or WQIP)	$92	$39	$95	$63
"After" ICM or WQIP	$92	$69	$101	$81
Banding fertilizer at planting	Not Applicable	$71	$102	Not Applicable
Splitting nitrogen applications	$93	$73	$102	$88
Diverse rotation with 1 yr oats, 2 yrs alfalfa, 2 yrs soybeans, & 1 yr corn (between soybean years)	$109	$96	$109	Not Applicable
Diverse rotation with 1 yr oats, 2 yrs alfalfa, 2 yrs corn, & 1 yr soybeans (between corn yrs)	$106	$83	$111	Not Applicable
Diverse rotation with 2 yrs Alfalfa, 2 yrs soybeans, & 2 yrs corn	Not Applicable	Not Applicable	Not Applicable	$54
Corn/soybean rotation	Not Applicable	Not Applicable	Not Applicable	$75