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Adoption of conservation production systems within the upper region of the Scioto river watershed in Ohio

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Abstract
Data were collected from 113 land owner-operators within the upper region of the Scioto River watershed in central Ohio during the summer and fall of 1999 to identify factors influencing adoption of soil and water conservation production systems at the farm level. A theoretical perspective developed from selected components of the farm structure model was developed to guide the investigation. Linear regression analysis revealed that predictive factors included in the statistical analysis exhibited limited utility for explaining variability in a composite index of conservation adoption behavior. Gross farm income was the only independent variable that was significant at the 0.05 level for explaining variability in adoption of conservation production index scores. Findings are discussed in the context of future conservation efforts within the study watershed. Implications for future public soil and water conservation programs within the study watershed are examined.

Key words: Farm, adoption, watershed, soil, water, conservation.

Introduction
United States (US) farmers have made significant contributions to the well-being of global populations by producing high-quality food and fiber products in huge quantities. US farmers have become so efficient in the production of food that one farmer feeds approximately 130 people domestically and abroad. The contributions of the agricultural sector to the well-being of domestic and international consumers have not been achieved without significant environmental costs. Farm production techniques and technologies developed to sustain high levels of production within the US have contributed to environmental problems, such as the displacement of soil from crop land, sedimentation of waterways, and chemical pollution of surface and groundwater. It has been repeatedly observed that production agriculture is the major contributor to water pollution in the US [1, 2,10,12,13,14, 15,17, 21,29]. The primary cause of agricultural pollution is displacement of chemical-rich topsoil from cultivated farm land. Displaced topsoil is deposited within rivers and lakes which results in degradation of recreational opportunities, contributes to the disruption of transportation systems, reduces the water-retention capabilities of reservoirs, and results in the destruction of wildlife habitat [10,15,19]. The release of farm chemicals, such as nitrogen, phosphate, and potassium, attached to displaced topsoil contributes to the degradation of water that can pose a threat to human and animal health[21,30,31]. Chemical contamination of waterways can also reduce the aesthetic value of water resources via plant growth and hypoxia[25]. Loss of oxygen within hypoxic zones frequently destroys animal life contained therein[22,23]. Some erosion will inevitably occur when land is used for the production of food and fiber, however, soil displacement varies by type of production systems used[8,11]. Some farm production systems acerbate erosion, while others significantly reduce displacement of soil from crop land. Unfortunately, many farm operators in the US have elected not to adopt and use conservation production systems. Most farmers are aware of conservation production practices, however, many have elected not to adopt such farming systems. The purpose of this paper is to present the findings of a study conducted within an Ohio watershed to identify factors influencing adoption and use of conservation production systems at the farm level. Study findings are discussed in the context of future conservation efforts within the watershed.

Adoption of Conservation Production Systems in the US
Extensive research has been focused on conservation behaviors during the past two decades[3,9,10,13,14,15,16,1920,24,26, 27,28,29]. Many factors have been shown to be significantly related to conservation behaviors, however, relatively little of the variance has been explained by the statistical models. Factors such as access to information and learning experiences have been frequently argued to be important motivators of conservation adoption behaviors. However, research has shown that access to conservation information and educational experiences has not significantly influenced adoption of conservation production systems. Lack of awareness of environmental problems has been suggested as an explanation for lack of adoption of conservation production systems. However, research has shown that rejection of conservation production systems is not a function of a lack of awareness of environmental problems associated with production agriculture[14,19]. Some suggest that positive attitudes toward the environment will increase adoption of conservation practices, however, research suggests that it is not true. An increase in positive attitudes toward the environment has been shown not to be an effective means of motivating individuals to adopt conservation production systems[29]. One of the few factors consistently shown to affect adoption of conservation production systems is expected economic returns to investment[14,19]. If land owner-operators do not expect to receive profits from investment in conservation production systems, they will not adopt such farm production systems. All conservation adoption studies suggest that land owner-operators assess adoption of farm production systems in the context of farm-level economics. Therefore, the theoretical perspective chosen

to guide the investigation is the farm structure model.

Theoretical Modeling

The theoretical model used to guide the investigation is the farm structure model[4,18] which basically asserts that character. Adoption of most conservation production systems requires investment of economic resources. Farmers without adequate farm income to purchase requisite inputs will not be able to adopt conservation. It is hypothesized that measures of economic viability of the farm enterprise will be positively correlated with adoption of conservation production systems. The farm structure model also suggests that characteristics of the land owner-operator will affect adoption of conservation production systems. Human skills are essential to effectively use most technology-intensive conservation systems. Potential adopters who possess requisite human skills will have a higher probability of adopting conservation production systems because they will not have to invest time, effort, and economic resources to secure additional training. It is hypothesized that farming experience and higher levels of education will be positively correlated with adoption of conservation production systems. The farm structure model asserts that level of perceived risk associated with actions options affects decision making at the farm level. If potential adopters believe that use of conservation production systems will increase the risk of failure of the farm enterprise, they will not adopt. It is expected that measures of perceived risk associated with adoption of conservation production systems will be positively correlated with adoption of conservation production systems. The farm structure model also posits that public policies affect adoption of farm production systems. Many conservation programs exist within the US that provide incentives to adopt conservation production systems. Such programs provide subsidies and technical assistance to reduce the risk associated with adoption of conservation production systems. It is expected that participation in public programs that provide economic subsidies and technical assistance will be positively correlated with adoption of conservation production systems.

Methods

Research situation: The upper region of the Scioto River watershed was selected for study because area farmers have used technology-intensive production systems that have polluted one of Columbus's major sources of water. Nutrient pollution within the Scioto River is of such magnitude that alerts are issued frequently during planting season. If water quality is to be maintained future Columbus consumers, agricultural pollution must be controlled within the study area. Agricultural production has been a major occupational activity for many decades within the study area. Residential development has displaced agriculture in the southern section of the watershed and it is highly likely that production agriculture will become less important the future. Recreational use of the river is very high and will increase in importance as non-farm population increases. The topography varies from flat to gently rolling. Crop land within the watershed is highly productive and most land owner-operators produce corn and soybeans for market. A small percentage of farmers produce livestock and truck crops contribute a small percentage to gross farm income. Traditional conservation programs such as those provided by the Natural Resources Conservation Service/United States Department of Agriculture are the only soil and water protection programs available to the study population. The study group has not received targeted funding by any conservation agency.

Data collection: Data to examine the merits of the research expectations were collected in the summer and fall of 1999 from 113 farmers within the study area using a systematic random sampling approach. A trained field data collector selected every other residence along highways chosen at random each day and asked the primary farm operator to complete a structured questionnaire. Maps of the sample distribution were maintained to ensure that the study participants were distributed throughout the study area. About 80 percent of all farmers contacted in the watershed completed a questionnaire. Variables assessed in the study are as follows: agricultural production systems in use at the time of the data collection, characteristics of the farm enterprise, characteristics of the primary farm operator, perceptions about the costs and benefits of adopting conservation production systems, and perceptions of risk associated with use of farm chemicals. Measurement of variables: The dependent variable is called the "conservation adoption index." It measured by asking how frequently 18 agricultural production practices were used. Only production practices relevant to farming in Ohio were assessed. Practices examined are as follows: fall tillage, fall application of fertilizer, soil testing, no-till, chisel plowing with 1/3 ground surface covered at planting time, ridge tillage, deep (moldboard) plowing, winter application of manure, banded (in furrow) application of fertilizer, side-dressing of fertilizer, banded application of herbicides, mechanical weed control, use of nitrification inhibitor, crop rotation, contour planting, buffer strips, integrated pest management, and precision farming. The possible responses ranged from *never use* weighted 0 to *use every year* weighted 5. Missing data were attributed a value of 0 for all production practices assessed because it was assumed that respondents would provide data for production practices being employed. A panel of knowledgeable people ranked the various farm practices in terms of the impacts (both positive and negative) on the environment. The assessment procedure produced values used to weight responses to the specific farming practices examined. The original weighting values of 0 to 5 were reversed for fall tillage, deep plowing, fall application of fertilizer, and winter application of manure to reflect the negative impacts of these practices on the environment. The reverse weighting values for these four variables were then multiplied by 2 because they were defined by the evaluation panel as having very detrimental impact on the environment. Farmers who did not use degrading practices received higher scores, while those that did use such practices received lower scores. The original weighting values of 5 to 0 for no-till and chisel plowing with 1/3 groundcover were multiplied by 2 to give them differential weight for having the most positive impact on the environment. The weighted values for all 18 production practices assessed were summed to form the "conservation adoption index." The possible range of scores was from 0 to 120 with a median possible score of 60.

Factors selected to represent the theoretical model outlined above are as follows: perceived impacts of conservation production systems on production costs, perceived impacts of conservation production systems on farm output, farm chemical risk scale, use of technical assistance, perceived profitability associated with conservation production systems, age of primary farm operator, education of primary farm operator, years farming by primary farm operator, acres usually cultivated by primary farm operator, percent grain farmer, debt-to-asset ratio, and gross farm income.

These variables were measured as follows:

Perceived impacts of conservation on production costs was measured by asking respondents to indicate how production costs would be affected if their farms were operated in a manner that would prevent water from being polluted by farm chemicals and would prevent soil loss beyond replacement level. The possible responses ranged from "large decrease" weighted 1 to "large increase" weighted 7.

Perceived impacts of conservation on farm output was measured by asking respondents to indicate how output of food and fiber would be affected if their farms were operated in a manner that would prevent water from being polluted by farm chemicals and would prevent soil loss beyond replacement level. The possible responses ranged from "large decrease" weighted 1 to "large increase" weighted 7.

Farm chemical risk scale was measured by asking respondents to indicate the level of perceived risk associated with use of farm chemicals on the following: water quality, food safety, food quality, health of applicator, health of farm animals, wildlife, destruction of beneficial plants, destruction of beneficial insects, human health, and air quality. Likert-type scale items[7] were constructed with possible responses ranging from "no risk" weighted 0 to "serious risk" weighted 8. Item analysis[5] was conducted on the responses which produced an alpha of 0.97. Such a high alpha coefficient indicates that the items are highly intercorrelated and could legitimately be combined into a single variable. Weighting values were summed to form a composite scale score for each respondent and the resultant value was used in the statistical modeling.

Use of technical assistance was measured by asking respondents to indicate if they had ever received technical assistance to implement conservation programs during the past five years. A positive response received a value of 1 and a negative response received a value of 0.

Perceived profitability of conservation production systems was measured by asking respondents to indicate the likelihood that investments in conservation on the farm in the next crop year would generate profits in the next five years. Possible responses ranged from "highly unlikely" weighted 0 to "highly likely" weighted 10. The weighting values selected by respondents were used in the statistical modeling.

Age of primary farm operator was measured as the age in years of the primary farm operator at the time of data collection.

Education of primary farm operator was measured by asking respondents to report the educational achievement level of the primary farm operator in years at the time of the data collection.

Years farming by primary farm operator was measured by asking respondents to indicate the number of years the primary farm operator had been farming his/her own farm.

Acres usually cultivated by primary farm operator was measured by asking respondents to indicate how many acres of crop land were usually under cultivation each year.

Percent grain farmer was measured by asking respondents to

Table 1. Characteristics of Upper Scioto River Watershed Respondents (N=113).

	Characteristic
	Age in Years
Mean	51.3
SD	13.0
	Education in Years
Mean	12.6
SD	2.4
	Years Farming
Mean	30.0
SD	14.3
	Acres Usually Cultivated
Mean	751.1
SD	789.8
	Acres Owned
Mean	410.0
SD	410.2
	Acres Rented
Mean	337.8
SD	472.7
	Percent Grain Farmer
Mean	88.1
SD	24.2
	Days Usually Worked Off-Farm
Mean	92.7
SD	113.6
	Percent Who Received Government Economic Support to Implement Soil and Water Conservation Programs
Yes	8.8
No	91.2
	Percent Who Received Technical Assis tance to Implement Soil and Water Conservation Programs
Yes	21.2
No	78.8
	Debt-To-Asset Ratio (Percent)
0-10	23.9
11-20	19.5
21-30	17.7
31-40	15.0
41-50	8.0
51-60	5.3
61-70	0.0
71-80	0.0
81-90	0.9
91-100	0.0
Missing	9.7
	Gross Farm Income (Percent)
<60,000	24.8
60,000-119,999	21.3
120,000-179,999	27.4
180,000-239,999	5.4
240,000-299,999	8.0
300,000-359,999	0.9
>359,999	8.0
Missing	4.4

*SD=standard deviation

Table 2. Perceived Impacts of Adoption of Conservation Production Systems (percentages within parentheses) for the Upper Scioto River Watershed (N=113).

Large Decrease 1	Moderate Decrease 2	Slight Decrease 3	No Change 4 Slight	Increase 5 Moderate	Increase 6	Large Increase 7	Missing Data	Mean Standard	Deviation
Perceptions of How Production Costs Would Change									
1 (0.9)	2 (1.8)	10 (8.8)	31 (27.4)	39 (34.5)	20 (17.7)	8 (7.1)	2 (1.8)	4.8	1.2
Perceptions of How Farm Output Would Change									
1 (0.9)	17 (15.0)	21 (18.6)	38 (33.6)	22 (19.5)	9 (8.0)	3 (2.7)	2 (1.8)	3.9	1.3

Table 3: Perceived Risk Associated With Use of Agricultural Chemicals (percentages within parentheses) for the Upper Scioto River Watershed (N=113).

No Risk			Little Risk		Moderate Risk			Serious Risk	MD	Mean	SD
0	1	2	3	4	5	6	7	8			
Water Quality											
18 (15.9)	19 (16.8)	30 (26.5)	21 (18.6)	7 (6.2)	4 (3.5)	6 (5.3)	2 (1.8)	5 (4.4)	1 (0.9)	2.5	2.1
Food Safety											
26 (23.0)	31 (27.4)	26 (23.0)	9 (8.0)	6 (5.3)	5 (4.4)	5 (4.4)	1 (0.9)	3 (2.7)	1 (0.9)	2.0	2.0
Food Quality											
36 (31.9)	29 (25.7)	20 (17.7)	7 (6.2)	8 (7.1)	3 (2.7)	3 (2.7)	1 (0.9)	3 (2.7)	3 (2.7)	1.7	1.9
Applicator Health											
15 (13.3)	20 (17.7)	21 (18.6)	15 (13.3)	12 (10.6)	14 (12.4)	8 (7.1)	3 (2.7)	3 (2.7)	2 (1.8)	2.9	2.1
Farm Animal Health											
26 (23.0)	22 (19.5)	21 (18.6)	19 (16.8)	8 (7.1)	8 (7.1)	3 (2.7)	0 (0.0)	3 (2.7)	3 (2.7)	2.1	1.9
Wildlife											
25 (22.1)	21 (18.6)	22 (19.5)	19 (16.8)	10 (8.8)	3 (2.7)	5 (4.4)	2 (1.8)	3 (2.7)	3 (2.7)	2.2	2.0

Possible Responses

No Risk			Little Risk		Moderate Risk			Serious Risk	MD	Mean	SD
0	1	2	3	4	5	6	7	8			
Destruction of Beneficial Plants											
24 (21.2)	27 (23.9)	28 (24.8)	13 (11.5)	4 (3.5)	3 (2.7)	5 (4.4)	2 (1.8)	2 (1.8)	5 (4.4)	2.0	1.9
Destruction of Beneficial Insects											
20 (17.7)	27 (23.9)	20 (17.7)	21 (18.6)	6 (5.3)	4 (3.5)	5 (4.4)	4 (3.5)	3 (2.7)	3 (2.7)	2.3	2.1
Human Health											
20 (17.7)	27 (23.9)	27 (23.9)	13 (11.5)	9 (8.0)	5 (4.4)	3 (2.7)	3 (2.7)	4 (3.5)	2 (1.8)	2.3	2.0
Air Quality											
30 (26.5)	31 (27.4)	23 (20.4)	9 (8.0)	3 (2.7)	7 (6.2)	4 (3.5)	1 (0.9)	3 (2.7)	2 (1.8)	1.9	2.0

*MD= missing data; SD= standard deviation

Table 4. Perceived Return to Investment in Conservation (percentages within parentheses) for the Upper Scioto River Watershed (N=113)*

Possible Responses													
Highly Unlikely		Somewhat Unlikely		Slightly Unlikely		Slightly Likely		Somewhat Likely		Highly Likely	MD	Mean	SD
0	1	2	3	4	5	6	7	8	9	10			
17 (15.0)	4 (3.5)	14 (12.4)	7 (6.2)	15 (13.3)	12 (10.6)	16 (14.2)	9 (8.0)	8 (7.1)	4 (3.5)	3 (2.7)	4 (3.5)	4.2	2.8

*MD= missing data; SD= standard deviation

Table 5. Frequency of Use of Agricultural Production Practices (percentages within parentheses) for the Upper Scioto River Watershed (N=113).

Never use	Once every five years	Once every four years	Once every three years	Every other year	Use every year	Missing data	Mean	Standard deviation
Fall Tillage*								
11 (9.7)	9 (8.0)	8 (7.1)	26 (23.0)	25 (22.1)	33 (29.2)	1 (0.9)	1.7	1.6
Fall Application of Fertilizer*								
22 (19.5)	9 (8.0)	9 (8.0)	20 (17.7)	17 (15.0)	35 (31.0)	1 (0.9)	2.1	1.9
Soil Testing+								
9 (8.0)	5 (4.4)	10 (8.8)	38 (33.6)	15 (13.3)	29 (25.7)	7 (6.2)	3.3	1.5
No-Till+								
20 (17.7)	6 (5.3)	14 (12.4)	11 (9.7)	13 (11.5)	43 (38.1)	6 (5.3)	3.1	1.9
Chisel Plowing With One-Third Ground Surface Covered With Residue at Planting+								
39 (34.5)	9 (8.0)	10 (8.8)	16 (14.2)	10 (8.8)	29 (25.7)	0 (0.0)	2.3	2.1
Ridge Tillage+								
96 (85.0)	7 (6.2)	1 (0.9)	1 (0.9)	0 (0.0)	2 (1.8)	6 (5.3)	0.2	0.8
Deep (Moldboard) Plowing*								
63 (55.8)	18 (15.9)	8 (7.1)	8 (7.1)	1 (0.9)	10 (8.8)	5 (4.4)	4.0	1.6
Winter Application of Manure*								
50 (44.2)	7 (6.2)	4 (3.5)	10 (8.8)	12 (10.6)	22 (19.5)	8 (7.1)	3.1	2.1
Banded (in Furrow) Application of Fertilizer+								
46 (40.7)	3 (2.7)	7 (6.2)	14 (12.4)	8 (7.1)	35 (31.0)	0 (0.0)	2.4	2.2

Table 5. Continued.

Never use	Once every five years	Once every four years	Once every three years	Every other year	Use every year	Missing data	Mean	Standard deviation
Side-Dressing of Fertilizer During Growing Season+								
31 (27.4)	4 (3.5)	9 (8.0)	16 (14.2)	10 (8.8)	40 (35.4)	3 (2.7)	2.8	2.1
Banded Application of Herbicides+								
77 (68.1)	3 (2.7)	8 (7.1)	3 (2.7)	4 (3.5)	11 (9.7)	7 (6.2)	0.9	1.7
Mechanical Weed Control+								
66 (58.4)	5 (4.4)	4 (3.5)	12 (10.6)	7 (6.2)	18 (15.9)	1 (0.9)	1.5	2.0
Use of Nitrification Inhibitor+								
71 (62.8)	7 (6.2)	3 (2.7)	5 (4.4)	7 (6.2)	12 (10.6)	8 (7.1)	1.1	1.8
Crop Rotation+								
3 (2.7)	0 (0.0)	2 (1.8)	14 (12.4)	21 (18.6)	61 (54.0)	12 (10.6)	4.3	1.1
Contour Planting+								
87 (77.0)	6 (5.3)	4 (3.5)	2 (1.8)	2 (1.8)	2 (1.8)	10 (8.8)	0.4	1.0
Buffer Strips+								
80 (70.8)	8 (7.1)	4 (3.5)	3 (2.7)	2 (1.8)	12 (10.6)	4 (3.5)	0.9	1.7
Integrated Pest Management+								
81 (71.7)	5 (4.4)	4 (3.5)	4 (3.5)	3 (2.7)	12 (10.6)	4 (3.5)	0.9	1.7
Precision Farming+								
86 (76.1)	1 (0.9)	4 (3.5)	4 (3.5)	7 (6.2)	8 (7.1)	3 (2.7)	0.8	1.6

Mean conservation index score = 51.0 S.D. = 13.3
+Weighted 0 through 5 with "never use" receiving a value of 0 and "use every year" a value of 5.
*Weighted 5 through 0 with "never use" receiving a value of 5 and "use every year" a value of 0.

indicate sources of gross farm income for the past five years. Percentages reported for corn, soybean, wheat, and oats were summed.

Debt-to-asset ratio was measured by asking respondents to indicate the level of debt they had at the time data were collected. A total of 10 categories were provided which ranged from "0 to 10 percent" that was weighted 1 to "91-100 percent" that was weighted 10.

Gross farm income was measured using 21 income categories that ranged from "less than "$20,000" that was weighted 1 to "$400,000 and above" that was weighted 21.

Statistical modeling: Descriptive statistics were used to examine general trends within the data set, while linear regression analysis was used to assess the merits of the research expectations derived from the farm structure theoretical perspective. Missing data were attributed a value of 0 for technical assistance and for any tillage practice left blank. It was assumed that response categories would be left blank if respondents had not used technical assistance or production practices assessed. Mean substitution was used for any missing data for other variables which has been shown to be the best method for salvaging observations when the correlations are relatively low, the percentage of missing cases is low, and the number of cases is relatively high[6]. All of these conditions were satisfied within the data set.

Study Findings

Descriptive findings are presented in Table 1 and show that respondents are full-time farmers who are middle-aged and have

Table 6. Regression Findings for Adoption Index Scores and Selected Predictive Variables Presented in Standardized Regression Coefficient Form (N=113).

$Y = 0.376X_1* - 0.271X_2 + 0.225X_3 - 0.144X_4 - 0.104X_5 - 0.097X_6 + 0.094X_7 - 0.082X_8 + 0.074X_9 + 0.063X_{10} + 0.060X_{11} + 0.031X_{12}$

Where:
Y = Conservation adoption index
X_1 = Gross farm income
X_2 = Age of primary farm operator
X_3 = Years farming by primary farm operator
X_4 = Perceived impacts of conservation on production output
X_5 = Acres usually cultivated by primary farm operator
X_6 = Perceived impacts of conservation on production costs
X_7 = Use of technical assistance
X_8 = Farm chemical risk scale
X_9 = Debt-to-asset ratio
X_{10} = Perceived profitability of conservation production systems
X_{11} = Education of primary farm operator
X_{12} = Percent grain farmer
Adjusted Coefficient of determination = 0.123

* Significant at the 0.05 level.

operated their own farms for many years. Respondents had completed approximately 13 years of formal education and were farming more than 751 acres of land. Farmers reported owning about half of the cultivated land. About 88 percent of gross farm income was derived from grain production and 74 percent of the respondents reported gross farm income of less than $180,000. A large majority respondents indicated they had not received technical or economic support from government sources for conservation programming.

Findings focused on the perceived impacts of adoption of conservation production systems on farm production costs and output are presented in Table 2. The findings show that respondents believed that production costs would slightly increase if the farm was operated in manner to protect water from chemical pollution and soil from being degraded by erosion. Respondents also reported that production output would slightly decrease, if their farms were operated in a manner to protect soil and water resources. Findings focused on perceived risk associated with use of farm chemicals are presented in Table 3 and show that respondents perceived little threat posed by use of chemicals at the farm level. None of the factors assessed were perceived to be threatened by use of agricultural chemicals at the farm level. Findings focused on perceived return to investment in conservation production systems are presented in Table 4 and show that respondents perceived that investments in soil and water conservation would probably not generate profits in the next five years. Findings for agricultural production systems in use at the time of the data collection are presented in Table 5 and show that respondents had adopted some conservation production practices. The most frequently used conservation production practices were as follows: crop rotation, no till, and soil testing. Even though a large percentage of respondents reported using conservation practices, they also indicated they were also using several environmentally degrading production practices. Some of the most frequently reported degrading practices in use were fall tillage and fall application of fertilizer. Mold board plowing was used by a small percentage of respondents. Such a finding is encouraging from the perspective of soil and water conservation because mold board plowing is very degrading of soil resources. The mean score for the "conservation adoption index" is 51.0 which means that more extensive adoption of soil and water conservation production systems is probably needed from an environmental perspective. The mean value is below the median possible score of 60. Multiple regression findings are presented in Table 6 and show that one variable was significant at the 0.05 level in reducing the unexplained variance in the "conservation adoption index." As gross farm income increased, there was a concomitant increase in "conservation adoption index" scores. The coefficient of determination was 0.123 which means that 12.3 percent of the variance in the adoption index was explained by gross farm income. This finding indicates that farmers with higher gross farm incomes tended to adopt more soil and water conservation production systems.

Conclusions

Findings show that respondents have adopted some conservation practices, however, they also continue to simultaneously employ environmentally degrading practices. Such findings suggest that environmental benefits derived from adoption of conservation production practices probably have been partially negated by the failure of respondents to adopt whole-farm conservation planning. Study respondents indicated they believed that adoption of conservation production systems would increase production costs and would reduce farm output. They did not perceive that investments in conservation would prove to be profitable even in the long-term. Respondents did not believe that use of farm chemicals posed a threat to human health, to animal health, to the physical environment, or to the quality of food and fiber being produced. Such orientations cannot serve as motivators for adoption and use of conservation production systems. Attitude findings indicate that respondents do not perceive many benefits being derived from adoption of soil and water conservation production systems. Until the costs of agricultural pollution significantly increase for individual farmers or profits from adoption of conservation production systems are substantially increased, it is highly unlikely that farmers will be motivated to seriously consider alternative production systems to those presently being employed. Regression findings demonstrate that most farm structure factors included in the statistical modeling were not useful for predicting adoption conservation index scores. The only factor that was shown to be significant at the 0.05 level was gross farm income. Respondents with higher farm income had adopted more conservation production systems. Study findings strongly suggest that public polices need to be formulated and implemented to increase the benefits associated with adoption of soil and water conservation production systems. Public policies need to be created that make it more profitable to adopt and use conservation production systems at the farm level and more costly to ignore agricultural pollution. This can be achieved in at least two ways. Farmers could be penalized for using production systems that contribute to environmental degradation. Conversely, they could be rewarded for employing conservation production systems that contribute to environmental protection. Both incentive and disincentive systems will produce the desired outcome, however, incentives are strongly preferred by land owner-operators. Also, most policy makers do not have the political will to implement public policies that emphasize disincentives.

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