Assessing the Conservation Farming Practices Adaption among Low-income Farmers: Case Study Albanian Part of Prespa Park

Dorina Grazhdani
Agricultural University of Tirana, Faculty of Economy & Agribusiness, Kamëz, Tirana-Albania
e-mail: d.grazhdani@yahoo.com

Abstract

There are a number of available farming practices that reduce soil erosion and improve resource conservation. The relative preference of farmers for one technology against the other depends on many factors, including the relative costs of each conservation farming practices which varies from place to place, the socio-economic and wealth incentives, physical variables of production incentives, off-farm incentives, irrigation management incentives and other relevant variables. The main objective of this study was to assess the conserving practices adoption among low-income farmers in Albanian part of Prespa Park (AL-Prespa). This was carried out by means of on-farm survey techniques. The key part of the survey was estimating farmers' willingness to adopt the proposed conservation farming practices. Results from a probit model of adoption are presented that focuses attention on the role of independent variables in influencing farmers' willingness to adopt conservation farming-sustainable practices. These econometric findings indicated patterns of proposed adoption reflect relative risk considerations in addition to farm and households characteristics. Al-Prespa with its geographical position with its young rural population and with low level use of external originated inputs on the farms, strong traditional features of agriculture, offers great opportunities for development of conservation farming. The results of this study showed that any policy aimed at conservation farming practices implementation in the AL-Prespa basin should take a flexible approach. This study should give policy makers a better understanding of which farmers adopt conservation farming practices in the AL-Prespa basin and what policies can effectively improve future their implementation. These results underscore a need for greater sensitivity among policy-markers to the role of farmer and government in influencing environment improvement in low-income settings.

Keywords: AL-Prespa, conservation practices, farmers' willingness, low-income settings, logit model

1. Introduction

The combination of a mountainous terrain of lakes Prespa region seasonally wet Mediterranean climate and wrong crop rotation has led to an irreversible loss of soil and nutrients in many areas of this region. Due to poor management, unsuitable land has been brought into cultivation and exposed to severe overgrazing. Economic circumstances have also encouraged farmers of this mountainous region to adopt a continuous rotation using cereals, grain legumes and wheat crops. The problems found in much of arable land of this region includes: a decline in soil organic matter and soil structure; an increase in crust formation consequent on a redaction in infiltration, an increase in runoff and a reduction in crop emergency and crop yield. With these practices, the soils of these cropping areas are at risk degradation. The erosion conditions are extreme and conservation measure urgently needed.

Conservation farming practices can be defined as a rational use of land resources, application of erosion control measures, and water conservation technologies, and adoption of appropriate cropping patterns to improve soil productivity and to prevent land degradation and thereby enhance livelihoods of the local communities (Traore et al., 1998; Norton, 1994). One such technology is increased surface crop residue, which reduces soil displacement and transport during rainfall events thereby decreasing erosion rates. However, increasing crop surface residue may involve added costs to the farm operation. In many areas, crop residues provide an important feed for livestock. In other areas, an increase in crop residue may cause an increase in pest populations and result in added crop damage or loss.

Associated with crop-residue management, changes in cropping systems and tillage practices can help reduce soil erosion rates. The adoption of no-till and reduced tillage (Gould et al., 1989) systems that leave more residues on the soil surface can decrease soil loss. The effectiveness of crop rotations to reduce water erosion will depend not only on the crops produced, but also on the timing of erosion events.

Contour tillage on rolling hills has also been shown to reduce water-erosion rates and risk reducing. Tied ridging or furrow digging is another tillage technology that can reduce surface runoff velocities, decrease erosion, and increase infiltration, thereby making more water available to crops. That in turn reduces draught risk.

Other farm-level adjustments to reduce soil erosion include structural measures. Bench-terracing of sloped soils is one structural practice which can reduce water erosion. Subsurface drainage can be also managed to reduce their potential for agricultural erosion and contamination of groundwater and surface water resources.

This study investigates patterns of conservation farming practices adoption among low-income farmers in AL-Prespa region. A model is presented that focuses attention on the role of independent variables (presented in four groups: physical variables of production; social economic and wealth incentives; off-farm income and irrigation management incentives) in influencing farmers' willingness to adopt resource-sustainable techniques. Results from a logit model (Chang, and Lusk, 2011; Revelt and Train, 1998; Train, 2003) of adoption are reported.

2. Materials and Methods

2.1. Case Study Background

The Region Park Prespa is situated in the Balkan Peninsula at the border triangle of Albania, Greece and Macedonia (Fig. 1). Possessing unique flora and fauna, the region as a whole, assemble one of the largest biological reserves in Europe. It is an area internationality known for its ecological importance. Soaring mountains border the lake itself, which consists of two parts, Micro and Macro Prespa. Meanwhile, Prespa area abounds in rare animal and plant species, and contains some extraordinary examples of Byzantine heritage. Farming, livestock and fishing are the most important sources of income in the Prespa lowland. The human interventions throughout the centuries have changed the natural conditions, especially of the terrestrial ecosystems.

Figure 1. **Prespa lakes region**

Nearly all households in Prespa Lake Watershed are engaged in farming. Farming is labour intensive. Women's labour is particularly important in crop production, while men's labour is crucial in animal husbandry. Livestock husbandry is integral to the farming system. On average, households cultivate all of their land growing wheat, potato, alfalfa, maize, and vegetables. Almost all of households have dairy cows, calf, sheep and chickens. Some farmers use horse for field cultivation. Most of farmers, also, have to rent tractors for cultivation, combines for harvesting, sprinkler for irrigation, as well as family labour for fertilizer and seed applications. The average farmers' work is about 35 hours per week and the education level of most farmers is at the middle school level. Some of the farmers hold one or two cows mainly for milk, ten to fifteen chickens and few sheep and goats. Fishery is another important income source in Prespa.

Non-farm income (wage from hired agricultural and non-agricultural work plus own business income) constitutes about 15% of total income, and about two-thirds of households earn some non-farm income. There is strong variation over householders in their (self-reported) knowledge of various resource conserving practices and productivity-enhancing practices. Agricultural profitability as well as price variability over time shows considerable variation across Watershed.

Many farmers use all capable of food production simply to stave off starvation and impoverishment. These farmers often realize that farming erodible land jeopardizes their future livelihood and that of their children, but they see no choice. It is imperative to either find non-agricultural employment for these people or to find farming systems that are sustainable on these erodible lands. Fortunately, have been developed farming systems that can produce food and profits while conserving natural resources. Experiences with sustainable farming have shown that farmers can help develop practices that are good for their land and for their profits.

2.2. Data Collection

Survey has been found by us to be almost the only practical means of collecting data about a large number of farmers. Because the farming units were large, our survey was based on samples, which were taken following the strategy to meet statistical reliability objectives. The sample size must be sufficiently large so that statistical interferences can be made with reasonable reliability.

After a preliminary analysis of the secondary data, we collected primary data by conducing farmer interviews and making both technical and socio-economic observation of the farming system. Then we analysed both primary and secondary data, described the farming system in the survey area in terms of biophysical and socio-economic setting, and drafted the on-farm survey background.

The chairman of the village provided a list of all households. A sample of 420 farm households was randomly drawn from the twelve villages. Samples were selected using a table of random numbers. However, some of selected farmers were not available and the next number in the random table was selected as a substitute. The head of each household was interviewed during September-October, 2011. The data were obtained concerning their last three years of crop production and the management of irrigation water and nutrients. Several socio-economic characteristics are taken, too.

Prior to field survey, during September 2011 we handed out some pages on the effect of soil and water pollution in the long run health of farming. An addition to this we expressed the idea for the necessity to adopt new environment improvement practices if the soil and water pollution becomes a reality. We took also into account the fact that before asking the questions on the adoption of resource sustainable methods, it is crucial that the farmers are explained the cost and benefits of such adoption, which will be done. During this period we also tested the questionnaire using twenty pilot interviews.

The questions of questionnaire were separated into three categories. The first category consisted of questions to be used in specification of a quantitative model (probit analysis). The second category consisted of questions on general characteristics of farms and farmers in study area. The third category consisted of questions to be used in a separate analysis to provide information for development of policy related to implementation of programs dealing with sustainable agriculture.

Some questions were considered for the questionnaire but were not used because it was determined that they would not explain any variation in the probability for adoption (based on pilot survey). These questions related to: Whether the head of the farm family was a male or a female; number of family members; storage buildings were deemed not important for application of nitrogen; land preparation was deemed not important within type of crop; management practices such as cover crops, legumes, no-till, buffer strips, terraces, composting and mulch; slope of land, soil type.

As farmers were less willing to give out information on their on-farm income (based on pilot survey) it was wise not to pose such questions directly to farmers. Given the crop yield and market price, one is able to formulate the total income from farm operations.

The farmers' willingness to adopt resource-sustainable techniques is estimated in this study using a probit analysis. The model explains in terms of the incentives facing farm households and the probability that households would adopt the new management practices. The probit regression equation is expressed as follows: Farmers' willingness to adopt resource sustainable techniques = f (**a.** physical variables of production incentives; **b.** socio-economic and wealth incentives; **c.** off-farm income incentives; **d.** irrigation management incentives).

The dependent variable is whether the farmers would or not adopts the proposed management practices. Meanwhile, the independent variables are given below:

a. **Physical variables of production incentives (**seed: 1- home production; 0- foreign production); umber of fertilizer application; the total cost per ha for insecticide; the total cost per ha for herbicide; amount of farmland that is rented (as % of total area); amount of available farmland not planted in crops (as % of total area).
b. **Socio-economic and wealth incentives (**farm net income; annual cost of equipment rental rate; amount of total production that was marked (as % of total production); distance of the household to the nearest main market; tenure security; labour availability; farm size; education of head of household; age of head of household).
c. **Off-farm incentives (**non-agricultural, non-wage income and wage income).
d. **Irrigation management incentives (**Irrigation water use; distance from farmer's field to the main canal; number of irrigations during the season; location of farmer's field in the system (0 for farms at the head-reaches of the system and 1 for farm at the tail-reaches); water user association membership of the farmer (0 for not-membership, 1 for membership); irrigation type (0 for furrow, 1 for sprinkler).

3. Results and Discussions

3.1 Estimating Farmers' Willingness to Adopt the Proposed Sustainable Practices

Regression results for the model of farmers' willingness to adopt resource-sustainable techniques are given in Table 1. The final model contains only variables significant at the 15 percent level according to the F-test.

Table 1. Regression results for the model of probit analyses

Variable	Coefficient	Standard error	Regression significance
Physical variables of production incentives			
Seed	0.136	0.193	0.006
Number of fertilizer's application	1.215	0.678	0.054
Herbicide	0.132	0.051	0.003
Socio-economic and wealth incentives			
Farm income	4.379	1.276	0.119
Per capita farm size	2.062	0.231	0.073
Tenure security	1.757	0.018	0.053
Labour availability	0.046	0.003	0.069
Labour availability per ha	1.638	0.082	0.071
Education of household head	0.037	0.009	0.002
Off-farm incentives			
Non-agricultural, non wage income per adult equivalent	-0.018	0.006	0.093
Wage income per adult equivalent	0.345	0.023	0.083
Irrigation management incentives			
Irrigation water use	-5.618	1.321	0.127
Number of irrigation during the season	1.792	0.036	0.032
Type of irrigation	2.347	1.028	0.052
Water user association membership	0.685	0.047	0.006
The distance from farmer's field to the main channel	- 0.321	0.028	0.014
Location of the farm in the irrigation system	- 1.875	1.003	0.039

Seeds, herbicides and fertilizer of the production variables are retained in the final model. Almost all of socio-economic and off-farm economic variables were significant. Of the irrigation management variables, the number of irrigation applications, the distance of the field to the canal, and the location of the field in the system are significant. Irrigation type (sprinkler or furrow) and WUA (Water User Association) membership are significant, too.

The Production Variables. The results suggest that seed and herbicides had significant positive effects on farmers' willingness to adopt resource-sustainable techniques. Fertilizer variables contributed substantially. There was a negative response to the number of fertilizer application, too.

Socio-Economic and Wealth Variables. In this study, these variables include farm size, tenure security, and labour quantity and quality. As a factor of production and store of wealth, land is probably the most important asset influencing adoption. Land provides collateral and is one of the few sources of credit and liquidity for low-income households. For these reasons, one might expect a household's willingness to invest in adoption of resources sustainable techniques to be positively correlated with farm size. Results of this study indicate that the adoption of resource sustainable techniques was more likely on large farms. Results suggest that farm size may be a proxy for lowers risk exposure, fewer liquidity constraints, or improved access to resources.

Land ownership is also likely to be an important determinant of adoption. Tenure security can influence access to credit, the length of a household's planning horizon, or a household's willingness to invest. The probability of adoption is positively and significantly correlated with the proportion of the household's holdings that are security held.

Labour requirements are widely regarded as a critical element influencing adoption of resource sustainable techniques. Measures of both labour quantity and labour quality are included in this study. Households had an average of two adult-male equivalent workers and average labour capacity of approximately 500 days per year. In the regression model, labour availability is measured as man-days per hectare. Labour quality is measured as educational attainment among household heads. The correlation between labour availability and adoption is weak, but per hectare labour availability is positively correlated with resource sustainable techniques adoption. Education of the household head exhibits a positive but statistically weak correlation with adoption. The statistical weakness likely reflects the fact that educational attainments in the sample were informally low.

Off-Farm Variables. Results from previous studies suggest ambiguous role for off-farm income in influencing resource technique adoption. A negative relationship may reflect competition between off-farm activities and farming as a primary likelihood. Some authors reported a negative correlation between the level of non-farm income in a household and the probability of resource sustainable technique adoption and concluded that households without off-farm income had greater incentives to maintain on-farm resources. In contrast, other authors have argued that off-farm income provides cash for investments in conservation's techniques, especially when labour or materials must be acquired. Two off-farm income variables are used in this study. The first measures non-agricultural, non-wage income. The second measures wage income. In both cases, the variable entered in the regression is expressed in lek per adult-equivalent unit. Regression results indicate that neither off-farm income variables is correlated with adoption at standard significance levels. Nevertheless, the patterns exhibited in the regression help to explain previous contradictions in empirical findings in two ways. First, the probability of adoption is negatively correlated with non-agricultural, non-wage income. This may reflect reduced interest in farming among households with non-agricultural income, some of who had stored small businesses that completed with farming for capital investments. Second, households with wage income appear to have invested in resource sustainable techniques at a higher rate than those without. For from indicating a tendency to invest wage earnings in resource sustainable techniques, however, thus more likely represent a greater reliance on annual crop income by wage earners, who tended to have below-average incomes?

Irrigation Management Variables. A particular focus of this analysis is the relationship between farmer's willingness to adopt resource sustainable techniques and irrigation. Both the field locations from the field to the canal were evaluated for their effect on farmer's willingness to adopt proposed technique. It was hypothesized that, because of inadequate water management, farmers further from the canal would have greater difficulty getting adequate water supplies and thus experience lower willingness. Regression results only partially support this hypothesis. Distance between the field and the canal was not significant. Thus, field distance had no adverse effects on farmer's willingness to adopt resource-sustainable techniques. Location along the canal, however, was negatively related to the proposed adaptation. The number of irrigation application and WUA membership had a significant positive effect on proposed adoption.

3.2 Factors Affecting Farmer Participation

The respondents had a good knowledge of the purpose for establishing resource sustainable practices as about 65 percent of them defining sustainable development as "development which meets the needs of the present without compromising the ability of future generation to meet their own needs". Most of the farmers, 86 percent felt that it is important to develop local practices for sustainable farming and almost the same number, 84 percent was to adopt nature-friendly practices based on local resources through reassessing historical practices. More than four-fifths, 80 percent of respondents had a high opinion that their assets trees, land, livestock and multiple skills for generating income from non-farm activities must be optimally utilized to generate sustainable livelihoods. The findings seem to show that the farmers knew about the irrigation system and that the cooperation was needed for it to be successful. Most of the respondents think that small farm systems constitute the backbone of Prespa agriculture and that sustainable agriculture is a positive response to limits and problems of both traditional and modern agriculture. It is neither a return to the past nor a simple dependence on the present. Some farmers, 39 percent may be willing to accept lower profit for long-term sustainability but a massive extension and training orientation combined with organizational and institutional change is needed to support this trend.

3.3 Policy Options

In questionnaire there was a category of questions, which were asked to determine possible responses to changes in government policy. The taken information is given in Table 2.

Table 2. Background Information on Policy Options

Questions	Respondents' Number
1. If yield and net income would remain the same:	
a. Do you adopt new management practices if someone (government or private) will cover 20% of cost of new management practices?	
Yes	311
No	109
b. Do you adopt new management practices if someone (government	

or private) will cover 80% of cost of new management practices?	
Yes	
No	336
2. If net return would be 20% lower with new management practice:	84
a. Do you adopt new management practices if someone (government	
or private) will cover 20% of cost of new management practices?	
Yes	
No	143
b. Do you adopt new management practices if someone (government	277
or private) will cover 80% of cost of new management practices?	
Yes	
No	
c. Do you adopt the new management practices if taxes on farmland	307
would be forgiven in exchange for adopting the environment	113
improvement practices?	
Yes	
No	
3. If taxes will be imposed as a means to obtain improvement in the	273
environment, what kind of taxes do you prefer:	147
a. A tax or charge on amount of pollution emitted from your farm	
b. A tax or charge on some of the inputs to production	
c. A tax or charge per hectare of land farmed	13
	63
	344

The results of Table 2 show: The farmer in the study area is a good businessman, alert to his own economic interests; the land and water are by far farmer's most important assets, so if its productivity declines, he loses; farmer knows when his land productivity is threatened, and he is likely to be more knowledgeable about this than anyone else, including those public officials who would urge to take extra measures to control environment.

4. Conclusions

Among the empirical findings observed were that land and labor poor households are less likely to adopt proposed technology. Larger farm size greater tenure security and higher labor availability were all correlated with higher probability of adoption on sample farms. Higher adoption probability was also positively correlated with wage income, but was negatively correlated with other forms of off-farm income.

Focusing on the change in predicted probability of resource sustainable techniques adoption associated with changes in available labour and land, the results show that individually, labour is relatively less important than land. In contrast, per capita farm size was positively and significantly correlated with the probability of adoption. Larger farms, of course, have both greater productive capacity and greater liquidity, both of which translate into lower consumption risk.

From a policy perspective, these patterns underscore the importance of risk management in promoting resource-sustainable techniques to resource-constrained farmers. Future work should focus on three related areas of research: first, investigating the extent to which risk considerations influence resource sustainable decisions in other settings; second, assessing the degree to which resource sustainable strategies influence consumption risk; and third, separating the impact of adoption on consumption risk from the possible impact of adaptation on production risk. A better understanding of these factors will likely contribute to efforts directed at the twin goals of improving environment and alleviating poverty in low-income regions.

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