Effects of the Agri-environmental Program Implemented in Sultan Reeds Area of Kayseri, Turkey

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Abstract:

This study was initiated to evaluate the effects of an agri-environment program implemented in the Sultan reeds area of Kayseri province, Turkey. The specific objectives of the study were (1) to compare the farmers who enrolled in the program with those who didn't enroll regarding their application of different sustainable agricultural practices, and (2) to determine factors affecting their enrolment in the program. The leading comparative indicators were selected from different sustainable agricultural practices either promoted by the agri-environmental program or not promoted but considered very useful for the locality. Two stratified samples of farmers (enrolled and unenrolled) were selected based on their farm size. Chi-square tests of independence were used to compare farmers on the selected sustainable agricultural practices. The logistic regression model was used to determine factors affecting the enrolment of the agri-environment program. The findings of the chi-square test showed that enrolled farmers grow more forage legumes, are more conscious about pesticide use and chemical applications, and they use more pressurized irrigation systems. The findings of the logistic regression model showed that using rental land negatively; still, contacts with extension personnel, and using long term loans for farming investments positively influenced the enrolment of the agri-environment program. Legislative effort must concentrate on these issues when promoting agri-environmental programs in the region.

Keywords: Agri-environment, agri-environmental programs, sustainable development; sustainable agriculture; environmental problems; diffusion of innovations.

1. Introduction

The Sultan reeds area is one of the essential bird paradises in Turkey. It takes 70 km from Kayseri province and consists of the triangle of Develi, Yahyali, and Yesilhisar districts. According to the seasons, the area of the reeds varies between 8 and 13 thousand hectares. Although the large part of the plain is covered with reeds, other plants such as weeds, lilies, and irises are seen in some places and open areas of the plain. There are so many floating islands of reeds that cannot be seen until the center of the scene. They are displaced by strong winds and descend with decreasing water. This freshwater complex in the north and the south parts is the same as the Lake Yay, which centers the Sultan reeds and contains freshwater. The depth does not exceed a few decimeters. There are no plants around. It sets in summer and leaves a salt layer. Artemisia steps are located around these core layers. These are the most critical elements of the biotope. The area was taken under protection by the Ministry of Agriculture, Forestry and Rural Affairs in 1971 based on the Land Fencing Act. It is distinguished and established as a waterfowl protection and production site. The National Parks and Hunting Department, the International Wildlife Foundation, and the International Union for the Conservation of Nature provide support for the Sultan reeds (Sultan Sazlığı, 2016).

Long-term work showed that there are about 251 different species of birds, including one thousand flamingos and 600 thousand ducks in the area. Apart from these, pelicans, cormorants, avocets, cranes, black terns, herons, and many other species of birds enrich the bird variety of the national park of the Sultan reeds. Of the 251 bird species in the area, 80 are hatching here. Experts think that the presence of a large number of species of birds in this area is due to its production of nutritious substances like a tropical forest. It has begun to attract more foreign experts and ornithologists after being taken under protection as a national park (Sultan Sazlığı, 2016).

In order to protect the natural beauties and bird species in environmentally sensitive areas, the government initiated an agri-environmental program in 2006. The name of the program was the "Environmentally Friendly Agricultural Land Protection Program," and it was initially implemented in four pilot areas, namely, Konya-Ereğli Reed Bed, Kayseri-Sultan Reeds, Kırsehir-Lake Seyfe, and Isparta-Kovada Canal region. As of 2015, 51 provinces all around the country have started implementing this program. The primary goal of the program was to protect soil and water quality and native vegetation, to take measurements for wind and soil erosion, effectively and efficiently cultivate the farm commodities and reduce surpluses, develop alternative commodity production models, and support agricultural practices that can help to protect natural resources and the environment (Eryilmaz et al., 2019; Eryilmaz and Kilic, 2018; Boz, 2018: MFAL, 2016; Boz, 2016; Olhan, 2010; Official Gazette, 2005).

"Ministry of Food Agriculture and Livestock" divided the eco-friendly practices into two categories for which incentives were given to farmers who agreed to apply these practices at their farms. In the first category, incentives were given to minimal tillage or no-soil operations in the field. The purpose of farming practices included in this category was to protect water and soil resources and to prevent wind and soil erosion. Specific practices covered by this program were embankment, stone collection, screening, mulching, drainage, applying farm manure, preventing overgrazing, and covering land surface by forage legumes (except alfalfa) and perennial grains. In the second category, incentives were given to farmers who agreed to apply ecological friendly cultural practices and farming technologies. These practices were categorized into three sub-sections as (1) proper application of irrigation systems, (2) controlled the use of chemical fertilizers and pesticides, and (3) adopting organic farming and good agricultural practices. In order to become eligible to receive incentives from the government, farmers must apply at least one practice from the first category or two or more practices from the second category. In every project implementation province, a project committee consisting of agricultural engineers, agronomists, horticulturists, and agricultural economists were formed and trained in advance. The committee was responsible for all project activities such as registration, training, extension services, follow-up, and evaluation (Boz, 2016; MFAL, 2016, Öz and Boz, 2014). Since training farmers towards environmental protection reflects their behavior (Eryilmaz and Kılıç, 2019), this committee was expected to provide sustainable training and development to the organic farming community.

The objectives of this study were to compare enrolled and unenrolled farmers regarding the selected fifteen sustainable agricultural practices, to determine the factors that affected the adoption of the program, and to develop recommendations to increase farmers' participation in agri-environmental programs. Results are expected to provide useful information for all stakeholders engaged in these programs at different levels.

2. Materials and methods

Data for this study were collected by administering a questionnaire to two samples (enrolled and unenrolled farmers to the EFALP program) of farmers residing around Sultan reeds. In addition to the questionnaires, focus-group interviews were also conducted in every village, and farmers' opinions and comments about agricultural issues and environmental programs were noted. Moreover, earlier studies on sustainability and environmental economics, the information provided during the informal meetings conducted with the employees of the district agricultural office, and subject-matter experts were utilized. This study intended to generalize its results to the target population of all farmers engaged in agricultural activities around the Sultan reeds.

Initially, the villages in which the farmers are actively involved in the program were determined. These were the Central district, Karacaoren town, Sindelhuyuk, and Soysalli villages of Develi district; Central district, Cubuklu, Yerkoy, and Ilyasli villages of Yahyali district; and Cadirli, Kayadibi, and Imece Villages of Yesilhisar district. According to the lists provided by the provincial directorate of the Ministry of Food, Agriculture, and Livestock of Kayseri province, there were 229 registered farmers in the Sultan reeds area, and this was the accessible population of the study. Using Yamane's (2001) stratified sample size determination formula, two samples (76 enrolled and 55 unenrolled) of farmers were drawn. An extensive description of this method can be found in the earlier studies of Boz et al., (2005), and Boz (2016).

A well-structured questionnaire was prepared to collect data. The sustainable agricultural practices included in the questionnaire were selected from Tatlidil et al., (2009) and Boz's (2018) studies, while questions relating socioeconomic characteristics were picked up from Rogers (2010). A panel of experts assessed the validity of the data collection instrument. It consisted of three college professors and four agriculturists

employed by the Ministry of Food Agriculture and Livestock. Reliability was assessed by conducting a pre-test, and slight amendments were made in the questions that caused misunderstanding by the respondents. The pre-test survey wasn't included in the data analyses. Data were collected in the Spring season of 2013. Chi-square test of independence was used to compare the two group farmers regarding their enrolment status in the agri-environmental program. Logistic regression analysis with the codes of '1' for enrolled and '0' for unenrolled farmers was used to determine factors affecting the enrolment of the program. Independent variables consisted of selected socioeconomic characteristics and the communication behavior of farmers. These variables have entered the model as dummies of continuous variables. Extensive use of the model can be found in Boz et al., (2005) and Boz's (2016) studies.

3. Findings

Objective one of the study was to compare enrolled and unenrolled farmers regarding the selected fifteen sustainable agricultural practices. As can be seen in Table 1, four of these were statistically significant at an alpha level of 0.05 or better. The first significant variable was 'growing forage legumes in the rotation', and the rates of growers were 80.9% for all subjects, 89.5% for the enrolled farmers, and 61.9% for the unenrolled farmers. The rates of not growing forage legumes in the rotation were 19.1% for all subjects, 10.5% for the enrolled, and 30.9% for the unenrolled farmers. The chi-square test revealed that using forage legume crops in the rotation is associated with the enrolment of the agri-environment program, as the number of farmers using forage legumes in the rotation increases the rate of farmers enrolling the agri-environment program also increases.

The second significant sustainable practice was the 'controlled use of pesticides', which had rates of 59.5% for all farmers, 68.4% for the enrolled farmers, and 47.3% for the unenrolled farmers, while the rates of uncontrolled using pesticides were 40.5%, 31.6%, and 52.7%, respectively. The chi-square test conducted between these two variables showed that there was a statistically significant association between the controlled using pesticides and the enrolment of the agri-environment program, such that as the enrolment rate of the program rises, the number of farmers controlled using pesticides also rises.

The third significant sustainable practice was 'proper use of chemical fertilizers', which was applied by 53.4% of all subjects, 60.5% of the enrolled farmers, and 43.6% of the unenrolled farmers, corresponding to 46.6%, 39.4%, and 56.3%, respectively, not properly use of chemical fertilizers. The chi-square test yield that this practice was significantly associated with enrolment such that as the enrolment rate of the program increases, the number of farmers properly using chemical fertilizers increases.

The last significant sustainable practice was 'using pressurized irrigation systems', applied by 48.1% of all subjects, 61.8% of the enrolled farmers, and 38.3% of the unenrolled farmers, which corresponds to rates of 51.9%, 44.7%, and 61.8%, respectively, for those not using pressurized irrigation systems. The chi-square test yield that the use of pressurized irrigation systems was statistically associated with the adoption of the program such that as the number of farmers adopting the program rises, their rate of using pressurized irrigation systems increases.

In summary, comparisons of the enrolled and unenrolled farmers of the agri-environmental program showed that (chi-square tests) enrolment of the program was associated with growing forage legumes, controlled using pesticides, properly use of chemical fertilizers, and using pressured irrigation methods. However, the enrolment of the program was independent of crop rotation, using animal manure, taking adequate measures for soil erosion, intention of buying more land and enlarging the farm, the intention of selling the farmland for using non-farming purposes, the intention of equally dividing the farmland among heirs, taking adequate measures to protect the pastures and meadows, the afforestation of environmentally sensitive farmland, burning residues, regular vaccination of livestock, and reducing off-farm inputs.

To determine the factors that affected the adoption of the program, a logistic regression model was used. The variables used in the model were coded, as shown in Table 2. The model was statistically significant (X^2(9, N = 131) = 36.904, p≤0.01). The -2Log Likelihood value of the model was 141.319, while the Cox and Snell R^2 value was 0.246, and the Nagelkerke R^2 value was 0.330. According to the classification table, the model was correctly explained the enrolled farmers by 78.9%, the unenrolled farmers by 54.5%, and all farmers by 68.7%.

The results of the logistic regression model are given in Table 3. All significant variables had the expected signs, and they were assessed at an alpha level of 0.05 or better. Of the nine variables entered the model

three were statistically significant. These were operating rental land, meeting frequency with extension personnel, and using loans for farming investments. These are the main variables influencing the enrollment of the agri-environmental program in the region. The Exp(B) values were interpreted as the following: Holding all other explanatory variables constant, farmers those who operated rental land had 0.443 times smaller likelihood of being enrolled in the program. Those who met with extension personnel had 2.733 times higher likelihood of being enrolled farmers as compared with those who had less contact with extension personnel. Farmers who took loans for farming investments had 3.273 times higher likelihood of being enrolled than those who didn't use loans for farming investments.

Table 1. Chi-square comparisons of enrolled and unenrolled farmers by the selected sustainable agricultural practices.

Sustainable agricultural practices	Enrolled		Unenrolled		Total	
	N	%	n	%	N	%
1. Practicing crop rotation.						
Yes	59	77.6	36	65.5	95	72.5
No	17	22.4	19	34.5	36	27.5
TOTAL	76	100.0	55	100.0	131	100.0
$X^2=2.374$, p=0.09						
2. Growing legume crops in rotation.						
Yes	68	89.5	38	69.1	106	80.9
No	8	10.5	17	30.9	25	19.1
TOTAL	76	100.0	55	100.0	131	100.0
$X^2=8.585$, p=0.002						
3.Using animal manure.						
Yes	59	77.6	36	65.5	95	72.5
No	17	22.4	19	34.5	36	27.5
TOTAL	76	100.0	55	100.0	131	100.0
$X^2=2.374$, p=0.09						
4.Control of pesticides.						
Yes	52	68.4	26	47.3	78	59.5
No	24	31.6	29	52.7	53	40.5
TOTAL	76	100.0	55	100.0	131	100.0
$X^2=5.924$, p=0.012						
5.Proper use of chemical fertilizers						
Yes	46	60.5	24	43.6	70	53.4
No	30	39.5	31	56.4	61	46.6
TOTAL	76	100.0	55	100.0	131	100.0
$X^2=3.658$, p=0.041						
6.Taking adequate measurements for soil erosion.						
Yes	43	70.5	30	62.5	73	67.0
No	18	29.5	18	37.5	36	33.0
TOTAL	61	100.0	48	100.0	109	100.0
$X^2=0.417$, p=0.249						
7. The intention of buying more land and enlarging farm size.						
Yes	43	56.6	27	49.1	70	53.4
No	33	43.4	28	50.9	61	46.6
TOTAL	76	100.0	55	100.0	131	100.0
$X^2=0.719$, p=0.251						
8. The intention of selling farmland for non-farming purposes (housing, factory, etc.)						
Yes	21	27.6	13	23.6	34	26.0
No	55	72.4	42	76.4	97	74.0
TOTAL	76	100.0	55	100.0	131	100.0
$X^2=0.265$, p=0.379						
9. The intention of equally dividing farmland among heirs.						
Yes	51	67.1	34	61.8	85	64.9
No	25	32.9	21	38.2	46	35.1
TOTAL	76	100.0	55	100.0	131	100.0
$X^2=0.391$, p=0.329						
10. Taking adequate measurements to protect pasture and meadows						
Yes	14	29.2	11	26.2	25	27.8
No	34	70.8	31	73.8	65	72.2
TOTAL	48	100.0	42	100.0	90	100.0
$X^2=0.099$, p=0.470						
11. Using pressurized irrigation systems.						
Yes	42	55.3	21	38.2	63	48.1
No	34	44.7	34	61.8	68	51.9
TOTAL	76	100.0	55	100.0	131	100.0

$X^2=3.729$, p=0.039

12. Tree planting in sensitive farmlands.						
Yes	24	31.6	19	34.5	43	32.8
No	52	68.4	36	65.5	88	67.2
TOTAL	76	100.0	55	100.0	131	100.0

$X^2=0.127$, p=0.432

Table 1. Continued from the preceding page.

13. Burning residues?						
Yes	18	23.7	12	21.8	30	22.9
Nor	58	76.3	43	78.2	101	77.1
TOTAL	76	100.0	55	100.0	131	100.0

$X^2=0.063$, p=0.486

14. Regularly vaccination of livestock.						
Yes	58	84.1	34	82.9	92	83.6
No	11	15.9	7	17.1	18	16.4
TOTAL	69	100.0	41	100.0	110	100.0

$X^2=0.024$, p=0.538

15. Reducing off-farm inputs.						
Yes	21	27.6	13	23.6	34	74.0
No	55	62.4	42	76.4	97	26.0
TOTAL	76	100.0	55	100.0	131	100.0

$X^2=0.265$, p=0.379

Table 2. Name and codes of the variables entered in the logistic regression model

Explanatory variables	Codes and definitions
Specialization area of the farm	1 = Operating mixed farms producing crops and livestock together 0 = Producing crops only
Age of the farmer	1 = Younger than 47 years of age (the average age in the research area) 0 = 47 or older
Level of education	1 = Higher than elementary school 0 = Elementary school or lower
Cooperative partnership	1 = Partner of cooperative 0 = Not partner of any cooperative
Farm size	1 = Larger than 92 decares (Average farm size in the region) 0 = Smaller than 92 decares
Rental land	1 = Operate rental land 0 = Have no rental land
Level of income*	1 = High level income 0 = Medium or low-level income
Meeting frequency with extension Personnel	1 = At least once a week 0 = More seldom
Use of loans for agricultural Investments	1 = Used loans for farm investments 0 = Didn't' use loans for farming investments
Dependent variable	1 = Enrolled in the agri-environmental program 0 = Not enrolled in the agri-environmental program

*Farmers were divided into three groups as high income, medium income, and low income.

Table 3. Factors influencing the enrollment of the agri-environmental program

Name of the variable	B	SE	Wald	DF	Sig	Exp(B)
Specialization area of the farm	-,431	,641	,450	1	,502	,650
Age of the farmer	,039	,458	,007	1	,932	1,040
Level of education	-,774	,802	,931	1	,334	,461
Cooperative partnership	,642	,507	1,601	1	,206	1,899
Farm size	,493	,529	,867	1	,352	1,637
Rental land	-,814	,316	6,656	1	,010	,443
Level of income	,272	,330	,681	1	,409	1,313
Meeting frequency with extension Personnel	1,006	,433	5,395	1	,020	2,733
Use of loans for agricultural Investments	1,186	,571	4,307	1	,038	3,273
Constant	-,617	1,28	,248	1	,618	,540

4. Conclusions and recommendations

During the survey, a vast majority of farmers in the vicinity of Sultan reeds stated that agricultural supports are absolutely necessary for improving the economic conditions of farmers. Even farmers who are not registered to the agri-environment program emphasized that this program is very useful, but only the farmers who own lands in the surrounding area of the reeds can benefit the program. This area already consists of more fertile lands as compared to the remote areas. The landlords in the area are also better off as compared to other farmers. Therefore, there was a belief in the locality that the governmental support for this agri-environmental program means "making rich farmers even richer". Some farmers also stressed the point that the project implementing committees didn't behave fairly in the selection of the project implementation areas, as well as the farmers who will benefit from the program.

The results of this study showed that farmers who enrolled in the agri-environment program grew more forage legumes in crop rotation, had more control on pests, were more careful with the use of chemical fertilizers, and used more pressurized irrigation systems instead of furrow irrigation. All these practices are really crucial for the region to establish a sustainable agricultural system.

The results of the logistic regression model showed that operating on a rental land negatively influenced the enrolment of the agri-environment program. This was because, in the early stages of the program, it was covered only the landowner farmers. Since the program was initiated to ensure environmental protection for the Sultan reeds and to increase sustainability for the agricultural communities surrounding the reeds, not only landlords but also rental farms must practice sustainable agriculture. Therefore, concerns and objections raised by different stakeholders, and the government found a middle solution to include rental and shareholder farmers in the agri-environment program.

Extension services found to be effective in the enrollment of the program. Provincial and district directorates of the Ministry of Food Agriculture and Livestock provide general extension services to farmers in rural areas. More specific information and training are given by the project implementation committees, which consists of pre-trained experts with adequate skills and experiences. This committee organized informative meetings in advance to familiarize the farmers with the objectives, implementation process, enrolment process, and promotion conditions of the program.

Enrollment of the agri-environment program was also influenced by using long-term loans for agricultural investments. This factor can be considered as a long-term intension of dealing with farming activities and living in a rural community. Farmers who use long-term loans may also be considered as risk-takers and courageous individuals. All of these findings should be taken into consideration when developing agri-environmental programs in the region.

5. Acknowledgment

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