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Exploring Factors Affecting Application of Soil Conservation Practices (SCPs) By Iranian Farmers

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ABSTRACTS

This study aimed at exploring factors affecting application of soil conservation practices (SCPs) among Iranian farmers. Statistical population of this study consisted of all farmers in the Ilam province of Iran. Using Cochran's sampling formula, 137 farmers were selected as a sample. Respondents were selected by using Stratified random sampling method. For increasing reliability of the findings, 250 questionnaires distributed among farmers, ultimately 228 questionnaires completed and analyzed in SPSS software. The instrument of the study was a questionnaire which its validity was confirmed by a panel of experts and its reliability was established by calculating Chronbach's Alpha Coefficient ($\alpha > 0.7$). Results of the study showed that majority (67.1%) of the farmers applied the SCPs in moderate and low level. Results of means comparison showed that there is significant difference between application of SCPs by farmers in the terms of variables of membership or non membership in the rural organizations and receiving or not receiving loans for implementing SCPs. Also, results of correlation analysis showed that application of SCPs by farmers significantly correlated with the size of farming land, amount of annual income, level of farmers' education, number of participation in extension- education courses, amount of using communication channels and information sources, knowledge and attitude toward SCPs ($P < 0.01$). Finally, results of the stepwise multiple regression analysis showed that three variables consisting attitude toward SCPs, number of participation in extension- education courses, and size of farming land account for 56.2 percent of dependent variable (SCPs) variances among farmers in the study area.

Keywords: Soil Conservation Practices (SCPs), Sustainable Agriculture, Soil Management.

INTRODUCTION

Soil conservation, as a part of the environmental knowledge of soil, is a set of strategies for prevention of soil erosion caused by excessive use of chemicals, acids and other soil pollutions. The proper practices of soil conservation, like crop rotation and cultivating windbreak and cover crops, leads to the ability soil surface to maintain its integrity by reducing both the erosive forces and chemical changes in soil nutrients. Nowadays, soil erosion is considered as one of the most important ecological and economical problems in agricultural and rural communities. Furthermore, soil erosion is one of the most important environmental issues among different kinds of land degradation [1]. Although drought and rainfall reduction, are being considered as the main reasons for low

agricultural productivity and food shortages, soil erosion plays more considerable role than the others [2]. That nutrient depletion and soil erosion is one of the biggest environmental challenges of this century. The decision process for applying soil and water conservation practices by farmers involve three stages: the assessment of soil erosion and environmental issues, decision making about applying protective s, and determination levels of applied actions [3]. Some studies have focused only on the first and second stages of soil and water conservation [4].

Literatures show that effective factors on adoption and application of protective practices by farmers have been studied in depth by different researchers [3]. Some studies showed that farmers understanding about negative effects of soil erosion and its consecutive environmental issues leads to forming positive attitudes towards soil conservation and utilization practices [3, 5, 6 and 4]. Biolders et al. [7], in a study in Belgium found a positive relationship among applying the soil conservation practices and education level, social, economic, and individual features of farmers. Shafiee et al. [8], showed that most of farmers apply soil conservation practices (SCPs) in an intermediate level. The result of this study showed the usage of communication channels and information sources has positive effect on applying of soil conservation practices. Hoover & Wiitala [9], in a study on Nebraska farmers founded age is an important factor in predicting the adoption of soil conservation strategies. These researchers showed that soil conservation is more important for young and educated farmers than the old and non-educated ones. The other effective factors on soil conservation are: social and economical condition [10], farm size [11], family income [12], farm pure income [13], cost sharing, and Relationship with agricultural organizations (extension) [14].

Agriculture, after oil export, is the second largest source of economy and an important source for economic growth in Iran. So, it is important to apply soil conservation strategies in order to improve sustainable development in agriculture and natural resources sectors. Hence, the success of soil conservation programs needs the knowledge about the different aspects of human behavior and its effective factors. This paper focus on some variables like knowledge and attitudes to soil conservation practices, the amount of using of farmers from communication channels and information sources, and personal, social, and economical characteristics of farmers, in order to investigate the influencing factors on applying soil conservation practices in Iran. The Conceptual framework of this study is as following:

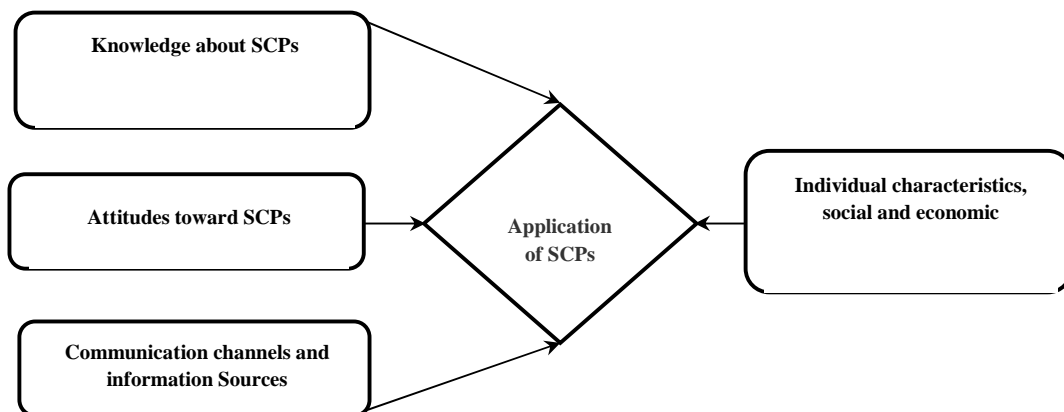


Figure1. Conceptual framework of study

MATERIALS AND METHODS

The design of the study was a descriptive survey that done by single cross-sectional study. Statistical population of this study consisted of all farmers in the Ilam province of Iran. Using Cochran's sampling formula, 137 farmers were selected as a sample. Respondents were selected by using Stratified random sampling method. For increasing reliability of the findings, 250 questionnaires distributed among farmers, ultimately 228 questionnaires completed and analyzed in SPSS software. The questionnaire consisted five parts: personal, social, and economical characteristics and level of using communication channels and information sources, knowledge about SCPs, attitude toward SCPs and level of application of SCPs. To determine the validity of questionnaire the panel of experts including; Agricultural Extension and Education faculty members of the Tehran University was used. In order to

estimate the reliability of the questionnaire Cronbach's alpha coefficient was established (Table 1). For each part of the questionnaire Cronbach's alpha coefficients was 0.7. Thus, the reliability of the questionnaire was excellent for research. In order to classifying farmers according to their amount of availability of communication channels and information sources, attitudes and knowledge about soil conservation practices and level of application of soil conservation practices, difference of the mean or ISDM based formula as showed below [15]:

Low: $A < \text{mean} - \frac{1}{2}SD$

Moderate: $\text{mean} - \frac{1}{2}SD < B < \text{mean} + \frac{1}{2}SD$

High: $C > \text{mean} + \frac{1}{2}SD$

SD is standard deviation. The data analysis implemented in two parts, consisting descriptive and inferential statistics by using SPSS_{win16} software. In the descriptive part of the statistical analysis frequency, percentage, mean and standard deviation were used. In the t inferential statistical analysis comparison, correlation analysis and regression analysis were used.

Table 1- The Cronbach's alpha coefficients is calculated

Variables	Number of statements	Cronbach's Alpha Coefficients
Amount of using communication channels and information sources	18	0.83
Knowledge about SCPs	15	0.81
Attitudes towards SCPs	20	0.73
Application of SCPs	15	0.76

RESULTS AND DISCUSSION

1. Social, economic, and individual features of the farmers:

The results of the study showed that the average age of farmers was 45.17 years old and SD 12.65. Which the youngest of them have at 22 years old and the oldest was 73 years. The average farming experience was 24.03 years and a SD 13.28 respectively. And also, the average land available to farming 6.91Ha and SD 4.54. Average annual incomes in terms of the statements themselves were almost 4000 USD. Farmers Participated on average almost in the 4 extension- education courses. And among of them were 23.2% illiterate, 28.9%, 11.4% guidance, 11.4% high school, 16.2% diploma and 8.8% of them had a higher degree. Results show that 39.5% of farmers in the study were members of rural organizations and 62 individuals (27.2%) of them had received credit for soil conservation practices.

2. Frequency distribution of respondents according to their level of using communication channels and information sources:

In order to evaluating amount of using communication canals and information source by farmers sum of score of 18 statements were calculated based on standard deviation of mean or ISDM. The results of this section are shown in Table 2.

Table 2 - Frequency distribution of respondents according to their level of using communication channels and information sources

levels	Frequency	Percent	Cumulative percent
Low	63	27.6	27.6
Medium	116	50.9	78.5
High	49	21.5	100

Mean: 29 SD: 13.13

According to findings on the Table 2 above 50.9% of farmers are using communication channels and information sources in medium level. However, 21.6 percent of them are using those sources and channels in the low and only 21.5 are using such resources and channels in the high level.

3. Frequency distribution of respondents according to their knowledge about SCPs

In order to evaluating knowledge level of farmers about SCPs sum of scores of 18 statements were calculated based on standard deviation of mean or ISDM. The results of this section are shown in Table3.

Table 3 - Frequency distribution of respondents according to their level of knowledge about SCPs

levels	Frequency	percent	Cumulative percent
Low	71	31.1	31.1
Medium	81	35.5	66.7
High	76	33.3	100

Mean: 51.77 SD: 10.74

Based on findings on the Table 3 n that amount of knowledge majority of farmers (66.7 %) have low to medium level of knowledge about soil conservation practices. Only 33.3% of them have a large level of knowledge about soil conservation practices.

4. Frequency distribution of respondents according to their attitude towards SCPs

In order to evaluation attitudes of farmers toward SCPs in sample farmers was used of sum of score of 18 statements was calculated based on standard deviation of mean or ISDM. The results of this section are shown in Table 4.

Table 4 - Frequency distribution of respondents according to their attitude towards SCPs

levels	Frequency	percent	Cumulative percent
Negative	71	31.1	31.1
Moderate	87	38.2	69.3
Positive	70	30.7	100

Mean: 60.66 SD: 13.17

The findings in the Table 4 shown that, majority of farmers (66.7 %) have moderate to negative attitude towards SCPs and only 33.3% of them have a positive attitude towards SCPs.

5. Prioritize Statements related to application of soil conservation practices:

In order to prioritize statements related to application of SCPs by sample farmers C.V. statistical method was used. The results are given in Table 5.

Table 5- prioritize Statements related to application of soil conservation practices

Statements*	Mean	CV	SD	rank
Protection of plant residues in soil	3.25	32.53	1.09	1
The use of organic fertilizers on the farm	3.60	35.00	1.26	2
In order to plow the ground slope	3.41	39.88	1.36	3
Observance of crop rotation	3.25	40.30	1.31	4
Optimal management of farm water	3.18	41.19	1.31	5
Land leveling	3.00	42.33	1.27	6
Use of pesticides and chemical fertilizers on the farm**	2.88	44.09	1.27	7
Minimum Tillage	2.83	45.22	1.28	8
Improve of systems plowing and tillage	2.78	48.20	1.34	9
Covered Soil surface by vegetation and remnants	2.79	48.38	1.35	10
Planting shrubs and Shrubs in the water channels	2.56	53.90	1.38	11
Burning straw and plant remains in the field**	2.68	57.08	1.53	12
Biological control of pests and diseases	2.53	62.05	1.57	13
The use of green manure on the farm	2.58	65.50	1.69	14
The use of compost on the farm	2.07	85.99	1.78	15

Scale: 0 = any, 1 = very low, 2 = low, 3 = moderate, 4 = high, 5 = very high

*** For Negative score of statements has been reversed.*

In the Table 5 results shown that the most of the farmers used SCPs such as "Protection of plant residues in soil" and "use of organic fertilizers on the farm", and they used soil conservation practices such as "The use of compost on the farm" and "the use of green manure" in low level on the farm. In addition, in order to evaluation application of SCPs among sample farmers, sum of score of 18 statements was calculated based on standard deviation of mean or ISDM were used. The results of this section are shown in table 6.

Table 6 - Frequency distribution of respondents based on level of application of SCPs

Levels	Frequency	percent	Cumulative percent
Low	76	33.3	33.3
Moderate	77	33.8	67.1
High	75	32.9	100

Mean: 43.48 SD: 10.82

The findings in the Table 6 shown that majority of farmers (67.1 %) applied SCPs in the moderate level and only 32.9% of them performed the soil conservation practices at high level.

6. Comparison of application of SCPs by farmers based on selective variables:

In order to compare of applying SCPs by farmers in based on of independent classified variables used of mean comparison t-test. Results of these sections shown in table 6.

Table 7 - Comparison of application of SCPs by farmers in terms of selective variables

Independent variable	Categories	Ranking Mean	SD	t	sig
Membership in organizations rural	yes	51.11	7.99	10.804**	0.000
	no	38.51	9.46		
Credits received for soil conservation practices	yes	47.33	8.98	3.357**	0.001
	no	42.04	11.12		

**Significant at $P < 0.01$

Based on the findings presented in Table 7, show that between applying SCPs by farmers in based on of independent variables of membership in organizations rural and loan or credit for perform soil conservation practices, there are significant differences in the level of 1%. Since the farmers who are members of rural organizations and loans and credits received for soil conservation practices they have higher ranking mean than of other farmers. Thus, they perform SCPs better than others. This result is an agreement with finding's Samarakoon et al. [10] and Gorbani & Kohansal, [12].

7. Analysis of relationships between the selective variables with application of SCPs by farmers:

In order to examine the relationship between the independent variables (interval and ordinal) and applying soil conservation practices used of Pearson and Spearman correlation coefficients. The results summarized in the table 8. Results presented in Table 8 shown that there is not any significant relationship between age and farming experience and level of application of soil conservation practices. Meanwhile, other results shows that there are positive and significant relationship between, size of farming land and annual income, level of farmers' education, the number of participation in extension-education courses, level of using communication channels and information sources, Knowledge and attitudes toward SCPs and application of soil conservation practices. This result is an agreement with findings of Samarakoon et al. [10], Woldeamlak [16], Long [17], Bieters [7], Gorbani & Kohansal [12] and Shafiee et al. [8].

Table 8 - Relationship between the application of SCPs and selective variables

Independent variables	Application of SCPs	
	r	Sig
1. Age	-0.017	0.749
2. Farming experience	0.025	0.710
3. Size of farming land	0.373**	0.000
4. Annual income	0.383**	0.000
5. level of farmers' education	0.197**	0.003
6. Number of participation in extension-education courses	0.556**	0.000
7. Amount of using communication channels and information sources	0.210**	0.001
8. Knowledge about soil conservation practices	0.427**	0.000
9. Attitudes towards soil conservation practices	0.625**	0.000

**Significance at $P < 0.01$

8. Determining the effective factors on the application of SCPs by farmers:

Stepwise multiple regressions were used to determine the factors affecting the application of SCPs by farmers. The stepwise method of regression analysis is the method in which the most powerful variables enter into the regression analysis and equation and this continues until the error of significance test reaches 5 percent. In this study, after entering the variables correlated significantly with the dependent variable (application of SCPs) the equation was processed to the three steps. The results summarized in the table 9.

In the Table 9 results show that the first step; attitudes variable to SCPs was entered into the equation. The multiple correlation coefficients (R) were equal to 0.625 and determination coefficient (R²) was equal to 0.391. In other words, 39.1% of the variability (SCPs) explained by this variables. In the second step, variable of the number of participation in extension-education courses enter into the equation. This variable increase multiple correlation coefficient (R) to 0.695 and determination coefficient (R²) to 0.484. In other words, 9.3% of the variability (SCPs) explained by this variables. Then, in the third step, variable of Size of farming land enter into the equation. This variable increase the multiple correlation coefficient (R) to 0.750 and the determination coefficient (R²) to 0.562. Therefore, 7.8% percent of changes in the dependent variable (SCPs) explained by this variable. Based on these findings, these three variables could explain about 56.2 percent (R² = 0.562) of changes in the dependent variable of applying SCPs by farmers. Research results of Ervin *et al.* [18] and Bandara & Thiruchelvam [11], is consistent with this finding.

Table 9 - Multiple regressions analysis on the determinants of application of SCPs by farmers

Step	variables	Adjusted coefficient			Sig
		R	R ²		
1	Attitudes toward (SCPs)	0.625	0.391	0.388	0.000
2	Number of participation in extension-education courses	0.695	0.484	0.479	0.000
3	Size of farming land	0.750	0.562	0.556	0.000

Table 10 - Effect and importance of independent variables on application of SCPs by farmers

variables	Unstandardized coefficient(B)	Standardized coefficient (β)	t	Sig
Constant Coefficient	12.652	-	5.378	0.000
Attitudes toward soil conservation practices (x ₁)	0.361	0.439	8.794	0.000
Number of participation in extension-education courses (x ₂)	1.092	0.327	6.564	0.000
Size of farming land (x ₃)	0.673	0.283	6.330	0.000

Given the above results of Table 10, the linear regression equation is shown as follows:

$$Y = 12.652 + 0.361 X_1 + 1.092 X_2 + 0.673 X_3$$

Significant results of F and T tests indicate the regression model is valid. But the regression equation does not say anything about the relative importance of independent variables. To determine the relative importance of independent variables, Standardized coefficient (β) should be considered. This statistics shows the effect of each independent variable separately from the effects of other variables on the dependent variable (application of SCPs by farmers). Accordingly, the most influential independent variable on the dependent variable, was the variable attitude toward SCPs with β=0.439. This means that a unit change of standard deviation of the attitude toward SCPs variable, explain 0.439 of unit change in standard deviation of the dependent variable. Other important variables influenced the dependent variable were: the number participation extension- education courses with β = 0.327 and the amount of literacy with β = 0.283.

CONCLUSION

Based on the results of the literature, soil is a vital source for to producing food, clothing and other necessities of human life. Soil erosion is considered as one of the most important ecological and economic problems in agricultural and rural communities. It has become, however, an important issue through its adverse effects on national natural resources, food security, and the livelihood of the world population. Furthermore, soil erosion, either natural or induced by human, is a continuous process which various aspects of human behavior can

partly affect degradation of soil. Hence, the success of soil conservation programs needs the knowledge about the different aspects of human behavior and its effective factors. This paper focus on some variables like knowledge and attitudes toward soil conservation practices (SCPs), the using communication channels and information sources, and personal, social, and economic characteristics of farmers, in order to investigate factors affecting application of soil conservation practices (SCPs) by Iranian farmers. That found the following results:

Based on the results of descriptive statistics; majority of farmers used communication channels and information sources at low and medium level. Furthermore, they had moderate and low level of knowledge about soil conservation practices. In addition, results showed that the majority of farmers attitude toward soil conservation practices was neutral and negative and soil conservation practices was applied at a moderate and low level in their farms.

Results of mean comparison test showed that there was significant difference between application of SCPs by farmers in the terms of variables of membership or credits received for soil conservation practices. Since the mean ranking of farmers who were members of rural organizations and also those who received loans and credits for SCPs, was higher than other farmers, thus, they apply SCPs better than others.

Finally, the results showed that the variables size of farming land, amount of annual income, level of farmer's education, the number of participation in extension-education courses, amount of using communication channels and information sources, knowledge and attitude toward SCPs had positive and significant relationship with dependent variable of study (application SCPs by farmers). Moreover, the results of stepwise multiple regression analysis showed that among these variables, three variables, the attitude toward SCPs, number of participation in extension-education courses, and Size of farming land, were capable of explaining 56.2% of the dependent variable variance.

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