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Affective Factors in the Wheat Farmers' Adoption of Farming Methods of Soil Management in West Azerbaijan Province, Iran

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Abstract

Soil Management (SM) is critical to human well-being that it is more important now because of meeting the high demands for food production and satisfying the needs of an increasing world population. Therefore, the purpose of this descriptive-correlation study was to investigate the effective factors on wheat farmers' adoption of Farming Methods of Soil Management (FMSM). The research instrument was a structural questionnaire with close-ended questions, which its validity and reliability was confirmed. The target population included all wheat farmers in West Azerbaijan Province (N=24949) that among of them, 371 wheat farmers was chosen by using Krejcie & Morgan's table through multi-stage sampling (n=371). The descriptive results showed the majority of farmers (237 or 63.90%) had moderate adoption of FMSM. These results also indicated farmers used three FMSM namely 1) using crop rotation, 2) using animal fertilizers, and 3) using soil testing more than others did. On the other hands, there were significant relationships between some of personal, farming, social, economic, and extension-education characteristics of farmers and the amount of their adoption of FMSM. Finally, stepwise regression analysis revealed that 35.30% (R^2=0.353) of the variances in the amount of farmers' adoption of FMSM could be explained by the five variables namely farm size, knowledge about FMSM, the amount of extension contacts about FMSM, distance between farm and agricultural service centers, and the amount of attitude toward FMSM.

Keywords:
Adoption, Soil erosion, Soil management, Wheat farmer, West Azerbaijan Province

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INTRODUCTION

Reports stated that Asia continent takes pains for Soil Erosion (SE) in comparison with the other continents and among Asian countries, Iran has the amount of soil erosion too high (Dregne, 1992). The more accurate investigations showed that the amount of soil destruction in Iran varies from 20 to 30 million tons annually (Chizari *et al*., 2003). From this amount, more than 10 million tons silt up dams annually that result in the decrease reserve capacity of water and electricity production of dams (Ebrahimi *et al.,* 2003). The report of the Asia Productivity Organization (APO) explains that the amount of the annual SE in Iran is a tree, two, 14, and 16 times as much, on average, of soil erosion in Asia, Africa, America, and Europe continents, respectively (Abedi and Tabatabaei, 2007). Ma'roof (2007) also quoted from FAO that the amount of SE in Iran varied from one billion ton in the year 1973 to two milliard ton in the year 2003.

SE not only reduces soil fertility, crop production, and biodiversity but also changes to water quality and increases risks of global climate change and food insecurity (Blanco and Lal, 2008). This status results in migrating rural people to cities, increasing in agricultural arrears and pollution of surface and subsurface water (Alonge and Martin, 1995). Control and management of SE are important because when the fertile topsoil eroded away the remaining soil is less productive with the same level of input. While we cannot control SE completely, but we must manage excessive erosion to minimize adverse effects on productivity (Blanco and Lal, 2008).

Parvizi (2005) described SM as an optimal use of farm soil resources for improving production management and achieving sustainability goals. Cramb (2004) stated SM includes all activities in farms that prevent from destruction of soil and improve farm crop sustainability. Research's Lal (2003) indicated that SM could play important roles in improving utilization, increasing self-sufficiency of nutritious crop, decreasing poverty level, food security and sustainable agriculture. Totally, SM includes farming and mechanical methods. FMSM consists of using animal fertilizers, soil testing, sprinkler irrigation system, mineral fertilizers, tillage practices, green Fertilizers, crop residues, and crop rotation (Qassim, 2003; Debarry, 2004; Lal, 2003; Maiangwa *et al.*, 2007; Srivastava & Pandey, 1999; Yadav *et al*., 2006; Davenport, 2003) whereas mechanical methods consists of using dams, gradient breaker, terracing, and windbreaker (Davenport, 2003; Debary, 2004).

The success of programs of SM depends on increasing farmers' knowledge and awareness about SE and SM to improve their attitude toward it and finally to adopt and use it on farm level. On the other hands, the amount of farmers' adoption of such technologies and methods is restricted because of being not considered social, economic, and farming circumstances of farmers in the process of technology development (Balali & Afkhami, 2006). The several researches also showed that personal, economic, social, farming, extension-education factors affected on the amount of farmers' adoption of FMSM (Pezeshki Rad *et al*., 2010; Onweremadu and Matthews-Njoku, 2007; Bayard *et al.,* 2006; Isife *et al.*, 2006; Shahroudi *et al.*, 2010; Demeke, 2003; Bandara and Thiruchelvam, 2008; Fe'li *et al*., 2010 and 2011; Ghorbani and Kohansal, 2011; Rezvanfar *et al*., 2010; Mahboubi *et al*., 2005; Matata *et al.*, 2008; Lapar & Pandey, 1999; Cramb, 2004; Chomba, 2004). Therefore, the main purpose of this study was to investigate the effective factors on wheat farmers' adoption of FMSM. The specific objectives of this study were:

1- To describe farmers' personal and farming characteristics;

2- To investigate the amount of farmers' adoption of FMSM;

3- To identify the amount of farmers' knowledge about FMSM;

4- To investigate the amount of farmers' attitude toward FMSM;

5- To study the amount of farmers' extension contacts about FMSM;

6- To examine correlation between farmers' personal, farming, social, economic, and extension-education characteristics and the amount

of their adoption of FMSM; and

7- To identify the predication equation of the amount of farmers' adoption of FMSM.

MATERIALS AND METHODS

This study was a quantitative study from a philosophical point, an applied study in terms of goals, and descriptive-correlation in terms of method. All wheat farmers in the West Azerbaijan Province (state) of Iran in the farming year 2012, were the target population for this study (N=24949). The population frames were obtained from the West Azerbaijan's agricultural organization. The sample size was determined and supported by the studies of Krejcie and Morgan (1970). The sample also was obtained through multi-stage sampling (n=371).

The instrument for gathering data and information was questionnaire whose questions was designed in three parts based on the review of literature. The first part was devoted to identifying the amount of respondents' use of farming methods of soil management including 9 items in a four-part Likert scale which are ranked from not at all (0), seldom (1), sometimes (2), to all the time (3). The second part was devoted to test the respondents' knowledge about soil management methods with 13 four-choice questions and investigate their attitude toward soil management methods including 11 items in a five-part Likert scale which are ranked from completely disagree (1), disagree (2), no opinion (3), agree (4), to completely agree (5). The last part was devoted to information gathering about the individual, farming, social, economic, and extension-education characteristics of the respondents. It is mention to state that for investigating social, economic, and extension-education has been used from a six-part Likert scale which are ranked from at all (0), very low (1), low (2), moderate (3), high (4), to very high (5).

Content and face validity were established by a panel of experts consisting of faculty members in the departments of agricultural extension and education at Tarbiat Modares University, agricultural management at Mahabad Branch, Islamic Azad University and agricultural officers of Mahabad Township. A pilot test was conducted with 30 irrigated wheat farmers in the Bookan Township (out of a sample size) of the West Azerbaijan Province three weeks before the study. Minor changes in wording were made because of the pilot test. Questionnaire reliability was estimated by calculating Cronbach's alpha. Reliability for the main sections of instrument was estimated from 0.71 to 0.83.

Data were collected by personal interview with farmers at their farms. The data were coded and analyzed by using the Statistical Package for the Social Science (SPSS 16) for windows. Descriptive statistics (frequencies, means, standard deviations, minimum, and maximum) were used to describe analyze data. Spearman and Pearson correlation coefficients and multiple regressions were employed to analyze the relationships between variables.

RESULTS

Objective one - To describe farmers' personal and farming characteristics

The mean of age of farmers in the study was 42 years old (SD=11) that the majority of them (n=165 or 44.50%) ranged from 39 to 51 years old. On average, farmers had 22 years of expe-

Table 1: Farmers' personal and farming characteristics (n=371)

Variables	M	SD	Min.	Max.
Age (Year)	41.90	10.76	25	80
Agricultural experiences (Year)	21.35	11.48	2	70
Agricultural experiences in cultivating wheat (Year)	18.10	11.65	1	60
Farm size (Hectare)	15.62	15.36	2	70
Land under wheat cultivation (Hectare)	7.14	8.09	1	39
The amount of wheat produced per hectare (Ton)	4.59	1.54	3	10
Distance between farm and agricultural service centers (Km)	7.97	6.26	1	45
Education level (Year)	7.90	5.42	0	18

rience in agriculture (SD=11) that the majority of them (n=180 or 48.50%) ranged in agricultural experience from 2 to 18 years. On average, they also had 18 years of experience in cultivating wheat (SD=12) that the majority of them (n=200 or 53.90%) ranged in experience of cultivating wheat from 1 to 15 years. The mean of farmlands were 16 hectares that farmers had allocated 7 hectares of it to cultivate wheat. Farmer's education level average was 8 years whose 83 persons (22.40%) were illiterate and 74 farmers (19.90%) had a secondary school level education. On the other hand, the average of the distance of farmers' land to the nearest agricultural service centers was 10 Km and its standard deviations was 5 Km (Table 1).

Objective two- To investigate the amount of farmers' adoption of FMSM

Farmers were asked to indicate the amount of their adoption of FMSM for nine items. The nine items were measured on a four-point, Likert-type scale, that ranged items from not at all=0, seldom=1, sometimes=2, and all the time=3. Means and standard deviations for the nine adoption items were reported in table 2.

One of the nine items had a mean more than 2.00 indicating "all the time". This item was "using crop rotation". Another seven items had mean score more than one indicating sometimes. The highest mean was for the item of "using animal fertilizer" (Mean=1.99 & SD=0.86). One item also had a mean score less than 1.00 indicating seldom. This item was "using green fertilizers".

As table 3 results were shown, the amount of farmers' adoption of FMSM is divided into 3 levels with equal distance according to scores range. These results showed that Majority of farmers had moderate (n=237 or 93.90%) adoption of FMSM, whereas nearly 22 and 14 percent of them had good and weak adoption of FMSM, respectively.

Objective three- To identify the amount of farmers' knowledge about FMSM

For evaluating the amount of farmers' knowledge about FMSM, 13 statements about FMSM concepts, principles and methods are propounded. Farmers were asked to indicate their opinion about being right or false. One score is given to right item and 0 score is given to false and not respondent items. Hence, Farmers' knowledge

Table 2: Ranking the amount of farmers' adoption of FMSM (n=371)

Item	M*	SD	Rank
Using crop rotation	2.21	0.68	1
Using animal fertilizers	1.99	0.86	2
Using soil testing	1.73	0.92	3
Using chemical fertilizer according to soil testing	1.66	1.00	4
Using sprinkler irrigation system	1.52	1.25	5
Using crop residues	1.51	1.09	6
Using mineral fertilizers	1.45	1.03	7
Using tillage practices	1.32	1.11	8
Using green Fertilizers	0.98	1.10	9

Note: •not at all=0, seldom=1, sometimes=2, all the time=3

Table 3: Classification of the amount of farmers' adoption of FMSM (n=371)

Classification of score knowledge	Category	Frequency	Percent
0-8	Weak	52	14
9-17	Moderate	237	93.90
18-27	Good	82	22.10

Table 4: Classification of farmers' knowledge about FMSM (n=371)

Classification of score knowledge	Category	Frequency	Percent
0-4	Weak	0	0
5-8	Moderate	27	7.30
9-13	Good	344	92.70

Table 5: Ranking farmers' attitude toward FMSM (n=371)

Statement	M*	SD	Rank
Soil as life resource is forming during a long time•	4.27	1.13	1
I encourage other farmers to use SMM for improving the quality of their farms•	4.10	0.75	2
Soil erosion results from agricultural activities is an important problem in farm•	4.00	0.87	3
If our zone farmers use SMM, I also use one•	4.00	1.14	4
Farmers are familiar with SMM, so they don't need to extension agents or experts••	3.87	0.98	5
The much use of fertilizer causes water, air and nutrition pollution•	3.85	1.05	6
I must use SMM to improve and protect the quality of farm soil••	3.83	0.85	7
I prefer soil testing for fertilizer suggestions against the farm soil observations••	3.78	0.96	8
SM is an agricultural method that must do by government supports•	3.57	1.25	9
The use of the amount of chemical fertilizer suggested based on soil testing is not useful••	3.38	1.11	10
The much use of chemical fertilizer results in the low use of animal fertilizer in farm•	3.28	1.19	11

Note: • completely disagree=1, disagree=2, no opinion=3, agree=4, and completely agree=5
•• Completely disagree=5, disagree=4, no opinion=3, agree=2, and completely agree=1

about FMSM ranged from 0 to 13.

As table 4 results were shown, farmers' knowledge about FMSM is divided into 3 levels with equal distance according to scores range. These results showed that all farmers had "moderate (n=27 or 7.30%) and good (n=344 or 92.70%)" knowledge about SMM.

Objective four- To investigate the amount of farmers' attitude toward FMSM

Farmers were asked to indicate their attitude toward FMSM for 11 statements. The 11 statements were measured on a five-point, Likert-type scale, that ranged in 8 positive statements from completely disagree=1, disagree=2, no opinion=3, agree=4, completely agree=5 and in 3 negative statements from completely disagree=5, disagree=4, no opinion=3, agree=2, and completely agree=1. Means and standard deviations for the 11 attitudes statements were reported in Table 5.

Four of the eight positive statements had a mean equal or more than 4.00 indicating "agreement." The highest mean was for the statement of "soil as life resource is formed during a long time" (Mean=4. 27 & SD=1. 13). Another four positive statements had mean score more than 3.28 indicating they had no opinion about SMM. Three negative statements also had a mean score more than 3.38 indicating disagreement.

As a table 6 result was shown, the amount of farmers' attitude toward FMSM is divided into 3 levels with equal distance according to scores range. These results showed that majority farmers attitude (n=243 or 65.50 %) toward FMSM was at favorable level and 34.50%

Table 6: Classification of the amount of farmers' attitude toward FMSM (n=371)

Classification of score knowledge	Category	Frequency	Percent
1-15	Unfavorable	0	0
16-40	Neutral	128	34.50
41-55	Favorable	243	65.50

Table 7: Ranking the amount of farmers' extension contacts about FMSM (n=371)

Item	M*	SD	Rank
Visiting with extension agents and experts at agricultural service centers and agricultural officers	2.69	1.32	1
Attending extension-education courses	2.50	1.66	2
The existing amount of extension agents and agricultural experts in fields	2.08	1.36	3
Reading extension publications	2.03	1.43	4
Visiting sample fields and extension-research projects in that zone	2.01	1.36	5
Showing extension films	1.77	1.45	6

Note: • Very little=1, little=2, moderate=3, high=4, and very high=5

(n=128) of their attitude toward FMSM was neutral.

Objective five- To study the amount of farmers' extension contacts about FMSM

Farmers were asked to indicate the amount of their extension contacts about FMSM for six items. The six items were measured on a five-point, Likert-type scale, that ranged from Very little=1, little=2, moderate=3, high=4, and very high=5. Means and standard deviations for the six extension contact items are reported in table 7.

One of the six items had a mean less than 2.00 indicating very little. This item was "showing extension films". Three of six items also had a mean close to 2.00 indicating little. Finally, two items had a mean more than 2.50 indicating moderate. These statements were "visiting with extension agents and experts at agricultural service centers and agricultural officers" and "attending extension-education courses", respectively.

As table 8 results are shown, the amount of extension contacts of farmers about FMSM is divided into 3 levels with equal distance according to scores range. These results showed that the amount of extension contacts of majority farmers (n=216 or 58.20 %) about FMSM was at moderate level and nearly 29% (n=107) of their extension contacts was at weak level.

Objective six- To examine correlation between farmers' personal, farming, social, economic, and extension-education characteristics of respondents and the amount of their adoption of FMSM

Pearson Correlation Coefficients were employed for measurement of the relationships between personal, farming, social, economic, and extension-education characteristics of respondents and the amount of their adoption of FMSM (except for education level). Table 9 showed that there was no significant statistical relationship between the years of agricultural experiences ($r=-0.006$ & $p>0.05$) and the amount of access to agricultural inputs ($r=0.069$ & $p>0.05$) with the amount of farmers' adoption of FMSM. It is noteworthy that a Hinkle et al.'s (1988) model for describing the magnitude of correlation has been used; 0-0.30: negligible association, 0.30-0.50: low association, 0.50-0.70: moderate association, 0.70-0.90: substantial association and 0.90-1: very strong association.

The calculated Pearson Correlation Coefficients showed that there was a negatively significant relationship between age ($r=-0.123$ & $P\leq0.01$) as a "negligible association", and agricultural experiences in cultivating wheat ($r=-0.006$ & $P\leq0.05$) as a "negligible association", and furthermore positively significant relationships between farm size ($r=0.277$ & $P\leq0.01$) as a "low association", land under wheat cultivation

Table 8: Classification of the amount of farmers' extension contacts about FMSM (n=371)

Classification of score knowledge	Category	Frequency	Percent
0-9	Weak	107	28.80
10-20	Moderate	216	58.20
21-30	Good	48	12.90

Table 9: Correlation between farmers' personal, farming, social, economic, and extension-education characteristics and the amount of their adoption of FMSM (n=371)

Variables	The amount of adoption of FMSM r_s	p	Description
Age	-0.123**	0.001	negligible association
Agricultural experiences	-0.006	0.869	negligible association
Agricultural experiences in cultivating wheat	-0.121*	0.001	negligible association
Farm size	0.277**	0.000	negligible association
Land under wheat cultivation	0.459**	0.000	Low association
The amount of wheat produced per hectare	0.284**	0.000	negligible association
Distance between farm and agricultural service centers	-0.185*	0.013	negligible association
Education level	0.236**	0.000	negligible association
Knowledge about FMSM	0.287**	0.000	negligible association
The amount of attitude toward FMSM	0.296**	0.000	negligible association
The amount of extension contacts about FMSM	0.206**	0.000	negligible association
The amount of social participation	0.129*	0.014	negligible association
The amount of social status	0.330**	0.000	Low association
The amount of access to agricultural inputs	0.069	0.087	negligible association

*P ≤ 0.05 **P ≤ 0.01

(r=0.459 & P≤0.01) as a "low association", amount of wheat produced per hectare (r=0.284 & P≤0.01) as a "low association", distance between farm and agricultural service centers (r=0.284 & P≤0.05) as a "negligible association", knowledge about FMSM (r=0.287 & P≤0.01), the amount of attitude toward FMSM (r=0.296 & P≤0.01) as a "negligible association", the amount of extension contacts about FMSM (r=0.188 & P≤0.01) as a "negligible association", the amount of social participation (r=0.129 & P≤0.05) as a "negligible association", the amount of social status (r=0.284 & P≤0.01) as a "low association", and the amount of farmers' adoption of FMSM. Finally, the calculated Spearman Correlation Coefficient showed that there was a positively significant relationship between education level (rs=0.240 & P≤0.01) as a "negligible association" and the amount of farmers' adoption of FMSM.

Objective seven- To identify the predication equation of the amount of farmers' adoption of FMSM

In multivariate regression analysis, stepwise method has been used. A feature of the aforementioned method is that, at the first, the most important variable comparing with all other independent variables is there to be inserted in the equation, and that is as the most important variable that has much more power to explain the dependent variable. This trend will be repeated in other steps until no independent variable has the ability for being inserted in the

Table 10: Multivariate linear regression analysis (the amount of adoption of FMSM as dependent variable) (n=317)

Independent variables	Unstandardized coefficient	Standardized coefficient	t	Significant level
Constant	-6.939	-	-2.442	0.015
Farm size (X_1)	0.151	0.416	9.186	0.000
Knowledge about FMSM (X_2)	0.853	0.254	5.518	0.000
The amount of extension contacts about FMSM (X_3)	0.144	0.184	4.057	0.000
Distance between farm and agricultural service centers (X_4)	0.133	0.144	3.272	0.000
The amount of attitude toward FMSM (X_5)	0.125	0.112	2.412	0.016

Note: R=0.594, R^2=0.353, F=38.441, Sig= 0.000

Regression Linear equation. The results of table 10 showed five variables namely 1) farm size; 2) knowledge about FMSM; 3) the amount of extension contacts about FMSM; 4) distance between farm and agricultural service centers; and 5) the amount of attitude toward FMSM explained 35.30 percent of the variance of the amount of farmers' adoption of FMSM. According to Unstandardized coefficients, its prediction equation can be written below:

$Y= Constant + b_1 (X_1) + b_2 (X_2) + b_3 (X_3) + b_4 (X_4) + b_5 (X_5)$

$Y= -6.939 + 0.151 (X_1) +0.853 (X_2) + 0.144 (X_3) + 0.133 (X_4) + 0.125 (X_5)$

DISCUSSION

The results of this research indicated that the majority of farmers' adoption of FMSM were at moderate level. This result supports the previous finding study of Rezvanfar *et al*. (2010). The more accurate investigations showed that the farmers adopted and use three FMSM namely 1) using crop rotation, 2) using animal fertilizers, and 3) using soil testing more than other methods. The finding of researches' Onweremadu and Matthews-Njoku (2007) and Chomba (2004) also implied that "crop rotation" was the main methods of farmers for managing their farm soil in Nigeria and Zambia, respectively. This result also was against result of researches' Rezvanfar *et al*. (2010) and Pezeshki Rad *et al*. (2010) because the results of their researches showed Iranian farmers used FMSM namely "crop residues" and "soil testing" more than the others. This result means the farmers adopt and use some of FMSM according to time and place circumstances such as a farm slop, farm soil quality, etc. Besides, the other results of the study indicated the majority of farmers' knowledge, extension contacts, and attitude about FMSM were at moderate and favorable levels, respectively.

The correlation analysis results also showed that there was a positively significant relationship between education level (consenting to researches' Shahroudi *et al.*, 2010; Onweremadu and Matthews-Njoku, 2007; Lapar and Pandey, 1999; Fe'li *et al.*, 2010; Rezvanfar *et al.*, 2010; Bandara and Thiruchelvam, 2008), farm size (consenting to researches' Shahroudi *et al.*, 2010), farm size (consent to researches' Shahroudi *et al.*, 2010; Fe'li *et al*., 2010 and 2011; Mahboubi *et al.*, 2005; Onweremadu and Matthews-Njoku, 2007; Bandara d Thiruchelvam, 2008; Rezvanfar *et al.,* 2010; Demeke, 2003; Bayard *et al.*, 2006), land under wheat cultivation, amount of wheat produced per hectare (consenting to researches' Shahroudi *et al*., 2010; Bandara and Thiruchelvam, 2008), distance between farm and agricultural service centers (consenting to researches' Lapar and Pandey, 1999; Chomba, 2004; Fe'li *et al.*, 2010), the amount of knowledge about FMSM (consenting to researches' Fe'li *et al.*, 2010; Rezvanfar *et al*., 2010; Ghorbani and Kohansal, 2011; Mahboubi *et al*., 2005), the amount of attitude toward FMSM (consenting to researches' Rezvanfar *et al.*, 2010; Demeke, 2003; Fe'li *et al.*, 2011), the amount of extension contacts about FMSM (consenting to researches' Shahroudi *et al.*, 2010; Pezeshki Rad *et al*., 2010; Fe'li *et al.*, 2010 and 2011; Mahboubi *et al.,* 2005; Bayard *et al*., 2006; Demeke, 2003; Matata *et al*., 2008; Rezvanfar *et al*., 2010; Chomba, 2004), the amount of social participation (consenting to researches' Shahroudi *et al.*, 2010; Cramb, 2004), the amount of social status (consenting to researches' Shahroudi *et al.*, 2010; Cramb, 2004), and the amount of farmers' adoption of FMSM. These results mean the more increase one variable, the more increase the other variable. Furthermore, there was a significant negative relationship between age and agricultural experiences in cultivating wheat and the amount of farmers' adoption of FMSM. These results mean the more increase one variable, the more decrease the other variable.

The results of multivariate regression analysis showed five variables namely 1) farm size; 2) knowledge about FMSM; 3) the amount of extension contacts about FMSM; 4) distance between farm and agricultural service centers; and 5) the amount of attitude toward FMSM explained 35.30 percent of the variance in the amount of farmers' adoption of FMSM. These results mean the more increase five mentioned variables, the more increase the amount of farm-

ers' adoption of FMSM. Finally, according to standardized coefficients, it is clear that farm size in comparison with the other variables has a greater portion of the variance in the amount of farmers' adoption of FMSM.

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