Farmers' Perception of Sustainable Agriculture and Its Determinants in Northern Bangladesh

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Abstract

The present study is an attempt to examine farmers' perception of sustainable agriculture and its determinants in Northern Bangladesh. Using farm-level survey data, the study measures the perception of the farmers toward sustainable agriculture and determines the extent to which different factors influence their level of perception. The perception of farmers about sustainable agriculture is measured using 5-point Likert scale. The sample farmers ranked 23 selected sustainable agricultural practices/statements, which are used to form the sustainable agriculture perception index. In addition, a regression model is fitted to identify the factors influencing perception level of the farmers about different aspects of sustainable agriculture. The results show that the index value for average level of perception of the farmers about sustainable agriculture is 66.67, which indicates moderate level of perception. However, majority (60%) of the respondent farmers have low level of perception about sustainable agriculture. When analyzed in a disaggregated way, it is found that they have high perception level on only 1 indicator, moderate level of perception on 11 indicators, low level of perception on 8 indicators and very low level of perception on 3 indicators. The regression results reveal that age, farming experience, education, extension contract, and farm size are statistically significant factors that influence the level of farmers' perception. While age and farm size negatively influence farmers' perception of sustainable agriculture; education, extension contract and experience of farming pose positive influence on their perception. Therefore, the government and non-government organizations should come forward to increase awareness of farmers in these areas through increasing education, training and extension services.

Keywords: Agriculture; Sustainability; Farmers' Perception; Determinants; Bangladesh

1. Introduction

Sustainable agriculture has become one of the emerging agricultural issues in Bangladesh as the farmers of the country have been practicing farming activities intensively. Sustainable agriculture is a dynamic system of farming that integrates environmental health, secures economic profitability, and promotes socio-economic

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equity. In its core meaning, it indicates the ability of agriculture to meet society's food and other needs of farm products without compromising the ability of future generations to meet such needs (Tatlidil *et. al.*, 2009; Flora, 1999). Bangladesh is an agrarian country with a total population of about 160 millions, along with a population growth rate of 1.37% per year (World Bank, 2011; BBS, 2012; Hasan *et al.*, 2013). Although the size of population of the country is very large, it has only 8.52 million hectares of cultivable land with 15.18 million farm holdings (BBS, 2012). Cultivable land per person in the country is only 0.05 hectare, which is equivalent to 0.125 acre (BBS, 2011; Hasan *et al.* 2013; World Bank, 2014). Again, high growth of population is causing the existing lower per capita cultivable land to decrease further due to increase of land use for non-agricultural purposes such as settlements, roads, industry and other infrastructural developments (FAO, 2004; Rasul & Thapa, 2004). Over the last 30-40 years, cultivable land in Bangladesh has been decreasing by around 1% annually and has been getting fragmented because of the property inheritance law of the country (NFPCSP, 2008). Thus, in the situation of large population with lower per capita cultivable land, farmers are compelled to adopt intensive agricultural practice to enhance agricultural production that would meet additional demand for food and other raw materials for the growing population. This has made Bangladesh agriculture more risky as far as sustainability of agriculture is concerned (Rasul & Thapa, 2004).

Bangladesh agriculture has experienced a rapid change after the introduction of green revolution technology in the 1960s, and after the Liberation War of 1971 (Andersen & Hazell, 1985; Hossain, 1988; ASR, 2006; Faroque *et al.*, 2011). Crop productivity has increased due to introduction of new technologies, mechanization, application of chemical fertilizers and pesticides, use of irrigation, and adoption of modern and high yielding crop varieties (HYVs) (Faroque *et al.*, 2011). As a result of intensified agricultural practices, food grain production in the country has increased by manifold and the country has emerged in the world as self-sufficient in food (rice) grain production (ASR, 2006; Faroque *et al.* 2011). Although, these rapid changes in agriculture have resulted in many sound effects on the economy of the country, they have also posed some harmful effects on the environment as intensified agriculture ignores different aspects of the environment such as biodiversity, human health, soil fertility, soil organism etc. (Hossain, 1988; ASR, 2006; Faroque *et al*., 2011, Pingali, 2012). Throughout the world, worries about intensive agricultural practices and their negative consequences are on the increase and environmentalists, ecologists, policy makers, researchers and farmers are concerned about the situation of soil degradation, soil erosion, water pollution, declining ground water tables, excessive use of chemical fertilizers and pesticides, destruction of natural habitats for wildlife and insects, and pest resistance against insecticides and pesticides (Leeuis, 2004; Al-Subaiee *et al*., 2005; Sadati *et al.*, 2010). Considering the negative impacts of intensive agricultural practices, sustainable agriculture could certainly be a remedy to the problems, and promoting sustainable agricultural development is the most important challenge of the 21st century (Pretty, 1995; Qamar, 2002; Rasul & Thapa, 2004; Leeuis, 2004).

Sustainable agriculture is still in its early stage in Bangladesh and promoting agricultural sustainability requires proper understanding and perception of farmers about different aspects and goals of this system (Adeola & Adetunbi, 2015). To ensure agricultural sustainability, agricultural practices need to be harmonious with the

environment, consistent with social systems, and it should be profitable so that it can sustain the farming families in terms of healthy income and good quality of life. Farmers must be knowledgeable and convinced of the value of sustainable agriculture to enable them in making an appropriate decision regarding its adoption (Adeola & Adetunbi, 2015). Thus, farmers' perception is crucial in adopting sustainable agricultural practices and it is worthwhile to examine farmers' perceptions to weigh the situation of agricultural sustainability in any country or region. There are several studies conducted in the context of different countries aimed at assessing agricultural sustainability on the basis of farmers' perception (Adeola & Adetunbi, 2015; Sadati *et al.*, 2010; Hosseini *et al.*, 2011; Tatldil *et al.*, 2009; Bagheri *et al*., 2008; Thanh *et al*., 2015). However, few studies are available in the context of Bangladesh (Rasul &Thapa, 2004). In Bangladesh, perception of sustainable agriculture is deemed to be very low as rural people of Bangladesh have lower level of formal education, and agriculture related knowledge and training (Islam & Hossain, 2016). As a result, farmers do not have clear knowledge about the need and value of sustainable agricultural practices (Sadati *et al.* 2010). That conventional intensive agricultural practices can damage the environment, reduce soil quality, reduce biodiversity, increase pollution and harm farmers' health, should be well percept by the farmers. Keeping this in mind, the objectives of this study are set as follows:

(i) to assess the level of farmers' perception of sustainable agricultural practices, and
(ii) to determine the extent to which the selected socio-economic and farm level characteristics influence the perception level of the farmers.

The paper is organized as follows: the background of study and research objectives are presented in Section 1. In Section 2, the research methodology is provided. The discussion of results are given in Section 3 and the major findings based on the discussion of results are stated in Section 4. Finally, Section 5 concludes.

2. Research methodology

2.1 Study Area and Data Collection

The present study is based on primary data collected directly from the farmers of Rajshahi district of Bangladesh. Rajshahi is one of the most agriculture based regions in Bangladesh. A total of 100 farmers are selected randomly and interviewed using a structured questionnaire. *Paba* Upazila (sub-district) of the district is selected randomly at first. Then from *Paba* Upazila two unions are selected randomly and from the two unions four villages are selected again at random basis. From each village 25 farmers are interviewed and during the interview, farmers' knowledge and perception are assessed using their opinions on 23sustainable agricultural practices or sustainability statements. The practices and statements that are consistent with Bangladesh agriculture are chosen following the earlier literature such as Tatlidil *et al.* (2008), Sadati *et al.* (2010), and Hosseini *et al.* (2011).

2.2 The Model

To achieve the objectives of the study a sustainability index is constructed using a 5-point Likert scale to measure the extent of perception of the farmers about sustainable agriculture and a multiple regression model is fitted to the collected data to identify the effects of different socio-economic and farm level factors on farmers' perception of sustainable agriculture.

2.3 Development of Sustainability Index

Five points Likert scale has been used in this study to assess farmers' perception of sustainable agriculture while influence of socio-economic and farm level characteristics on farmers perception has been identified using a regression model estimated by applying OLS method. The five point Likert scale has the range from 1= strongly disagree to 5= strongly agree. The respondent farmers are asked to rate each item as 1= strongly disagree or 2= slightly agree or 3= moderately agree or 4= highly agree or 5= strongly agree. If a respondent assigns the maximum rating of 5 to every practice or statement, he/she is assumed to have maximum perception of sustainability (5×23=115). On the other hand, if a respondent assigns the minimum rating of 1 to every practice or statement, he/she is supposed to have lowest perception of sustainability (1×23=23). Therefore, the perception value would lie in between 23 to 115. In his study, Rahman (2005) constructed a perception index for the farmers about the impact of using technologies in agriculture. The index is actually a weighted index for measuring perception. Following Rahman (2005), the adapted version of agricultural sustainability index used for this study is as follows:

$$SI_k = \sum_{i=1}^{23} \sum_{j=1}^{5} M_i N_j \qquad ...(1)$$

Where, SI_k refers to perception index of sustainable agricultural practices for the K^{th} farmer. M_i is the opinion of the K^{th} farmer on i^{th} sustainable agricultural practice or sustainability statement. A value of 1 is assigned for each sustainable agricultural practice or sustainability statement when the farmer is aware of the practice or statement and 0 otherwise. N_j is the level of awareness of the k^{th} farmer about a certain sustainable agricultural practice or statement based on 5 point Likert scale (very low, low, moderate, high and very high). A value of 1 is assigned for very low awareness and 5 for very high awareness (Rahman, 2005). The higher value of the index indicates positive perception of sustainable agricultural practices and the lower value of the index indicates ignorance about sustainable agricultural practices (Sadati *et al.*, 2010). In this study, average perception of the farmers about sustainable agriculture is estimated using simple arithmetic mean, and averageperception per sustainable agricultural practice or statement is estimated simply by dividing the total value of the index by total number of practices or statements.

Farmers are usually found to have low, moderate or high level of perception about sustainability issues of agriculture. Thus, classification of farmers has been done based on their perception level of sustainable agriculture using interval standard deviation from mean followed by Sadati *et al.* (2010) as follows:

p = very low: min ≤ p < (mean – standard deviation),
q = low: (mean – standard deviation) ≤ q < mean,
r = moderate: mean ≤ r < (mean + standard deviation),
s = high: (mean + standard deviation) ≤ s ≤ max

Using these intervals, farmers' perception of sustainable agriculture is categorized into four levels- vary low, low, moderate, and high.

2.4 Regression Model

It is generally believed that farmers' perception of sustainable agriculture expressed by the sustainability index estimated using Equation 1 is influenced by many socio-economic and farm level characteristics of the farm households. Tatlidil *et al.* (2008)

found that age, experience, education, family size, extension contacts, media exposure and farm size influence the perception level of the farmers about sustainable agricultural practices and other related issues of agriculture. Hosseini *et al* (2011) reported that age, sex and farming experience are the main determinants of perception, while Sadati *et al.* (2010) found age, sex, education, farming experience, total off-farm income, agriculture extension visits, total cultivable land and family size as the main determinants of farmers' perception about sustainable agriculture. Thus, to examine the determinants of farmers' perception about sustainable agriculture, a multiple regression model is employed and a total of eleven explanatory variables are included in the model to explain farmers' perception of sustainable agriculture, and the variables used in this study are selected by synthesizing the above literature. The perception index, as calculated using Equation (1), is used as the dependent variable in the regression model. The regression model takes the following form:

$$SI_k = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \mu_i \quad ...(2)$$

Where, SI_k= perception level of farmers on sustainable agriculture, X_1= age of farmer, X_2= farming experience, X_3= education level of farmer, X_4= total off-farm income, X_5= agriculture extension visits, X_6= farm size, X_7= family size, X_8= land ownership type, X_9= reading news paper, X_{10}= watching television, and X_{11}= training received

2.5 Measurement of Dependent and Independent Variables

The units of measurement for all the variables are not same as the variables are of different categories/types. The dependent variable is the level of farmers' perception of sustainable agriculture with a lower possible value equal to 23 and higher possible value equal to 115. The explanatory variables are- age, sex, experience, education level, total off-farm income, agriculture extension visits, farm size, family size, land ownership type, reading newspapers, and watching television. Similar variables are also used in earlier studies, such as Tatlidil *et al.* (2008), Sadati *et al.* (2010), Hosseini *et al.* (2011). In Table 2.1, description of the variables and their measurement methods are given.

Table 2.1: Description of Variables used in Regression Model

Variable	Type	Unit of Measurement
Perception level of farmers (SI_k)	Continuous	--
Age of farmer (X_1)	Continuous	Year
Farming experience (X_2)	Continuous	Year
Education of farmer (X_3)	Continuous	Years of schooling
Total off -farm income (X_4)	Continuous	Taka (Bangladeshi currency)
Agriculture extension visit (X_5)	Continuous	Number of visits in a year
Farm size (X_6)	Continuous	*Bigha* (equivalent to 33decimals)
Family size (X_7)	Continuous	Total members in household
Land ownership type (X_8)	Dummy	Own land = 1; 0 otherwise
Reading newspaper (X_9)	Dummy	Several times a month = 1; 0 otherwise
Watching television (X_{10})	Dummy	At least 5 hours a week = 1; 0 otherwise
Training received (X_{11})	Dummy	1 = yes, 0 = otherwise

3. Discussion of results

3.1 Descriptive Statistics of the Variables used in Regression Model

In Table 3.1, a summary of the socio-economic and farm level characteristics of the sample farmers that are used as variables in the regression model is presented.

Table 3.1: Summary Statistics of the Variables used in Regression Model

Variables used in the Regression Model	Continuous variable		Categorical variables	
	Mean	Std.	Percentage	
Perception index	66.67	9.59	-	-
Age of farmers (in year)	43.60	11.97	-	-
Farming experience (in year)	22.28	12.57	-	-
Education (years of schooling)	5.47	4.72	-	-
Total off-farm income (in Tk.)	84157	61,100.7	-	-
Extension contacts (No. of visits in a year)	2.42	2.10	-	-
Farm size (in *bigha*)	5.62	3.87	-	-
Family size (total persons in family)	5.20	2.24	-	-
Land ownership type (1= own land, 0= otherwise)	-	-	1 = 78	0 = 22
Reading newspaper (several times a month = 1, 0 otherwise)	-	-	1 = 34	0 = 66
Watching television (at least 5 h. a week = 1, 0 otherwise)	-	-	1 = 84	0 = 16
Training received (if received in five years =1,0 otherwise)	-	-	1 = 30	0 = 70

Source: Authors' calculation using field survey data

From the Table 3.1, it is found that mean perception level of the respondents about sustainable agriculture is 66.67. The level of perception is found to vary with respect to age and experience of the farmers. Table 3.1 reveals that average age of the respondents is 43.60 years whereas average farming experience of them is 22.28 years. Education generally plays vital role to enhance the perception of sustainable agricultural practices, although the level of education of the farmers is found to be very low. It is found that average education of farmers in the study area is only 5.47 years of schooling. Family size, off-farm income, farm size and ownership type of farm also affect the level of perception of the farmers. From Table 3.1, it is found that average family size is 5.20 persons per family, annual average off-farm income is Tk. 84157, average farm size is equal to 5.62 *bigha,* andmajority of the farmers (78%) are found as own land holders. Agriculture extension services provided by agriculture extension workers affect the perception level of the farmers about sustainable agriculture. Similarly, farmers who are found to have training, read newspaper and watch different TV programs, have better perception of sustainability issues of agriculture. Data from the study area show that average number of agriculture extension visits in the study area is 2.42 and most of the farmers (66%) do not read newspaper, although most of them (84%) watch television at least 5 hours a week. Only 30% respondents reported that they have received training on agricultural issues.

3.2 Description of Farmers' Perception of Sustainable Agricultural Practices or Statements

Perception of the farmers' about sustainable agriculture is calculated using

five points Likert scale and to perform this, farmers are asked to rate their perception level on a total of 23 sustainable agricultural practices or statements separately. Based on their expressed rating, perception level of the farmers on the selected sustainable agricultural practices and statements are calculated, which are shown in Table 3.2.

Table 3.2: Sustainability Indicators/ Statements by Rank and Perception Category

Sustainable Indicators/Statements	Mean	SD	CV	Rank	Perception Category
Organic and animal fertilizers increase soil fertility	4.22	0.71	0.17	1	high
Increased crop productivity is due mainly to increased use of quality seeds	3.92	0.73	0.19	2	medium
Green manure increases soil fertility	3.73	1.05	0.28	3	
Intensive irrigation reduces surface water availability (irrigation efficiency)	3.61	1.06	0.29	4	
Personal involvement in commodity marketing is helpful for agriculture (profitability)	3.59	1.48	0.41	5	
Effective extension contact is helpful for agricultural development	3.54	1.01	0.29	6	
Intensive irrigation reduces ground water table (irrigation efficiency)	3.47	1.13	0.33	7	
Indiscriminate use of pesticides is harmful for environment	3.46	1.22	0.40	8	
Use of high dosages of chemical fertilizers reduces soil fertility	3.31	1.12	0.34	9	
Proper use of chemical fertilizers and pesticides does not harm soil fertility and environment	3.16	1.28	0.40	10	
Indiscriminate use of fertilizers and pesticides is harmful for human health	3.06	1.22	0.40	11	
Crop diversification at farm level increases farm income	3.02	1.13	0.34	12	
Mixed cropping increases land fertility and farm productivity	2.79	1.51	0.54	13	Low
Crop rotation and diversification reduce farm pests and crop diseases	2.65	1.41	0.53	14	
Growing cover crop (pulse etc) increases soil fertility	2.39	1.53	0.64	15	
During farming people try to reduce environmental damage	2.38	1.62	0.68	16	
Fragmentation of farm land reduces crops production	2.35	1.25	0.53	17	
Intensive agricultural practices reduce water holding capacity of soil	2.35	1.46	0.62	18	
Use of modern machineries in agriculture increases productivity	2.22	1.78	0.80	19	
Intensive agricultural practices erodes soil surface	2.16	1.21	0.56	20	
Soil test should be carried out to keep soil fertility	1.96	1.28	0.66	21	Very Low
Burning residues on the land after harvest harms soil organisms	1.82	1.35	0.74	22	
Soil is getting toxic due to use of chemical fertilizers and pesticides	1.51	0.75	0.50	23	

Source: Authors' calculation based on field survey data

Calculated results on perception index show that farmers have high level of perception with only one sustainable practice- 'organic and animal fertilizers increase soil fertility'. By analyzing the mean scores, it is also found that a total of 11 practices/statements turned to be in the second level of priority (moderate perception) with regard to sustainability of agriculture, 8 practices/statements are in the third level of priority (low perception), and 3 practices/statements received forth level of priority (very low perception). All the practices/statements are discussed here based on the level and rank of perception. Not a single practice/statement is rated to be very high as percept by the respondents. It is noted that farmers' perception of intangible impacts of modern technologies is also found very low.

When taking the disaggregated analysis, it is found that use of organic and animal fertilizer in growing crops is considered by the farmers as one of the most important sustainable agricultural practices. Farmers gave highest importance (mean perception: 4.22) to this statement indicating that they are fully aware about the benefit of organic and animal fertilizers. Farmers consider that increased use of quality seeds would increase the productivity and sustainability of the farm. Therefore, they ranked 'increased crop productivity is due mainly to increased use of quality seeds' as the second most important (rank: 2, mean perception: 3.92) practice pertinent to sustainable agriculture.

It is well known that application of green fertilizers is another sustainable agricultural practice. This is endorsed by the farmers as they keep the statement 'green manure increases soil fertility' in the 3rd rank (mean perception level 3.73) as an indicator of sustainable agricultural practice. The availability of surface and ground water is very essential for sustaining agriculture in the long run. However, intensive irrigation has been leading to scarcity of both surface and ground water in Bangladesh. Therefore, farmers have percept and agreed with the statement 'reduction of surface water availability is due to intensive irrigation'. In Table 3.2, it is found that this statement received 4th rank (mean perception: 3.61) as perception about sustainable agriculture. Personal involvement in commodity market increases the viability of profit to the farmers in the absence of any influence by middleman. Economic viability through earning higher profit is a major component of sustainable agriculture and to the respondents this is pursued through 'personal involvement in commodity marketing', turned as the 5th important (mean perception: 3.59) practice for sustainable agriculture. Among other sustainable practices/statements 'effective extension contact is helpful for agricultural development', which enhances the knowledge of the farmers about sustainable agriculture, obtained 6th rank (mean perception: 3.54), while 'intensive irrigation reduces ground water table' as a sustainable agricultural practice received 7th rank (mean perception: 3.47).

In the study area, farmers are found to use excess chemical fertilizers and pesticides in agriculture indiscriminately, which is responsible for degrading the environment and soil at a large extent. From the results shown in Table 3.2, it is

revealed that farmers have moderate level of perception in this regard, measured by the mean perception level, 3.46, for the statement 'indiscriminate use of pesticides is harmful for environment'. Important sustainable practices/statements such as 'intensive irrigation reduces ground water table' (mean perception: 3.47), 'use of high dosages of chemical fertilizers reduces soil fertility' (mean perception: 4.31), 'indiscriminate use of fertilizers and pesticides is harmful for human health' (mean perception: 3.06) and 'crop diversification at farm level increases farm income' (mean perception:3.02) as indicators of sustainable agriculture are moderately percept by the respondent farmers. Again, the practices/statements like 'mixed cropping increases land fertility and farm productivity' (mean perception: 2.79), 'crop rotation and diversification reduce farm pests and crop diseases' (mean perception: 2.65), 'growing cover crop (pulse etc) increases soil fertility' (mean perception: 2.39), 'fragmentation of farm land reduces crops production' (mean perception: 2.35), and 'intensive agricultural practices erode soil surface' (mean perception: 2.16) obtained lower emphasis by the respondents in regard to sustainability of agriculture while 'soil test should be carried out to keep soil fertility' (mean perception: 1.96) and 'burning residues on the land after harvest harms soil organisms' (mean perception: 1.82) received least importance by the farmers.

3.3 Classification of Farmers based on their Perception Level

The perception level on sustainable agricultural practices of all the farmers are not same as their level of education, experience, training, age, etc. differ significantly and there is variation in socio-economic and farm level characteristics among the farmers. Based on the perception scores, the farmers are grouped into four categories which is shown in Table 3.3.

Table 3.3 : Classification of Farmers based on their Perception Level

Category of perception (SI_k)	% of total farmers	Cumulative %
Very low (p)	22	22
Low (q)	38	60
Moderate (r)	28	88
High (s)	12	100
p = very low: min $\leq$ p < (mean – standard deviation); q = low: (mean – standard deviation) $\leq$ q < mean; r = moderate: mean $\leq$ r < (mean + standard deviation); s = high: (mean + standard deviation) $\leq$ s $\leq$ max		

The results show that 22% farmers have very low perception level about the practices related to sustainable agriculture whereas 38% respondents have low level of perception and 28% have moderate level of perception. It is found in Table 3.3 that only 12% respondents have high perception level about the sustainability of agriculture. Thus, it is clear that most of the farmers in the study area are less aware about the sustainable agricultural practices indicating that sustainable agricultural activities are less practiced by the farmers.

3.4 Results of Regression Model

In order to determine the factors that affect farmers' perception of sustainable agriculture, a multiple regression analysis is carried out. The dependent variable

is the value of each respondent's perception index about sustainable agriculture, which is constructed and calculated for each farmer based on the 23 listed practices/statements pertinent to sustainable agriculture. The OLS estimates of the coefficients of explanatory variables on 'perception index of farmers' are presented in Table 3.4.

The regression results show that age, experience, education, farm size and extension visits are significant factors influencing farmers' perception of sustainable agriculture. However, age and farm size have negative influence on farmers' perception level, whereas experience, education and extension visits have positive influence on the perception level of the farmers. It is surprising that age of the farmers has negative impact on sustainability perception. This means that older farmers are less aware about sustainable agricultural practices compared to younger farmers. This could happen as younger farmers are relatively more educated than the elder ones and they are more exposed to learning the sustainability aspects of agriculture through training, meeting, conversation, media communication, etc.

Table 3.4: Regression Results

Variables	B	Std. Error	B	t-value	p-value	VIF
Constant	68.788***	7.809	--	8.809	0.000	
Age	-0.162*	0.088	-0.202	-1.841	0.073	6.501
Experience	0.248***	0.066	0.325	3.758	0.001	6.624
Education	0.128**	0.055	0.063	2.327	0.025	1.689
Off-farm income	-7.64E-07	-1.63E-05	-0.009	-0.047	0.962	1.663
Extension visit	0.089***	0.015	0.029	5.933	0.000	1.252
Farm area	-0.692*	0.411	-0.279	-1.684	0.099	1.474
Family size	-0.159	0.751	-0.037	-0.212	0.833	1.442
Land ownership	0.056	3.261	0.003	0.017	0.987	1.180
Reading news paper	-3.792	3.63	-0.199	-1.045	0.303	1.700
Watching television	-0.122	0.437	-0.039	-0.279	0.782	1.337
Training	2.94	3.589	0.140	0.819	0.418	1.371
$R^2 = 0.16$; *, **, and *** indicate significant at 1%, 5% and 10%, respectively.						

Similarly, farm size has negative impact on farmers' perception of sustainable agriculture. This result indicates that a farmer who has more cultivable land is less concentrated to sustainable agricultural practices. It may be the fact that it is difficult for a large farmer to continue sustainable agricultural practices. Therefore, he/she considers sustainability aspects of agriculture at a lesser extent compared to the smaller farmers.

From Table 3.4, it is found that experience, education and agriculture extension visits have positive effect on farmers' perception of sustainable agriculture. This result indicates that other things remaining constant, a one-unit increase in these factors would increase the perception level of farmers by the specified extents (coefficient values) towards sustainable agriculture. These results are expected from theoretical point of view, as experienced farmers capture the knowledge through 'learning by

doing' as to what effects emerge from their agricultural practices; education provides them with new knowledge about sustainability of agriculture, and extension visits by agriculture extension workers make them aware as to how production can be increased with efficient use of inputs as well as less harming the environment. The finding are mostly consistent with those found by Tatlidil *et al.* (2008), Sadati *et al.* (2010), Hosseini *et al.* (2011). It is observed that total off-farm income, family size, land ownership, reading newspaper, watching television, and training are not statistically significant. This means that these variables have no systematic impact on the variation of perception level of farmers about sustainable agriculture.

4. Major Findings

Some important findings are cropped out from the analyses performed in the earlier sections. From the analysis it is found that the sample farmers' perception level on different aspects of sustainable agriculture is not high. They have high perception level on 1 indicator, moderate perception level on 11 indicators, low perception level on 8 indicators and very low perception level on 3 indicators. The average perception score of the farmers on different aspects of sustainable agriculture is 66.67 indicating that the farmers lack proper knowledge about sustainable agriculture. Although the average level of perception among the farmers is moderate, it is revealed that 60 percent respondents in the study area have either low or very low perception level about sustainable agricultural practices. This indicates that unsustainable agricultural practices are dominant in the study area. It is also found that as long as sustainability of agriculture is concerned, farmers are found to be more knowledgeable on the impacts of the agricultural inputs- fertilizer, pesticide, irrigation etc. on production, environment, land fertility and human health. However, their perception of alternative options to promote agricultural sustainability such as crop rotation, crop diversification, cover crop production, soil conservation, soil quality, soil toxicity, burning residue and soil organisms, soil erosion, water holding capacity of soil, testing of soil, etc. is very poor. The factors that have significant influence on the perception level of farmers are identified using the multiple regression analysis. The results of the regression analysis confirmed that age, experience and level of education of farmers, farm size and agricultural extension contacts have significant influence on farmers' perception of sustainable agriculture. Age of farmer and farm size have negative influence on farmers' perception while farming experience, education level and extension contacts have positive influence on farmer's perception about sustainable agriculture. Interestingly, television watching, newspaper reading and training could not turned out as significant determinant of farmers' perception of sustainable agriculture.

5. Conclusion

Sustainable agriculture encompasses such agricultural practices and understandings by the farmers that protect environment, soil quality, human health and community integration as well as increase of crop production. This form of agriculture enables us to produce necessary and healthful food and other crops ensuring long run welfare of human and animal. However, intensive agricultural practices are prevalent around the world and their negative consequences pose concerns as intensified agriculture

ignores the aspects of environment, human health, soil quality and soil degradation. Promoting sustainable agriculture against conventional agriculture requires increased perception of the farmers about its different aspects. Based on 23 practices/statements, this study found that farmers average perception level on such practices/statements is moderate, although maximum farmers have low level of perception on these aspects. The regression analysis aiming at identifying the factors influencing farmers' perception level towards sustainable agriculture shows that age, farming experience, education, farm size and extension contacts are significant factors that influence the level of farmers' perception of sustainable agriculture. The direction of the impacts of the factors such as education, farming experience, extension contacts, training etc. on the level of perception by the farmers indicate that policy interventions towards increasing education level, extent of training, and extension contacts would result in positive outcome in regards to increase perception of the farmers about sustainable agriculture. Therefore, the government and non-government organizations should come forward to increase awareness of farmers in these areas through increasing education, training and extension services.

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