World Essays Journal / 10 (2): 55-61, 2022
Available online at www. worldessaysj.com
ISSN online: 2310-1377, Print: 2310-8509

Socioeconomic Status and Soil Crop Management Practices of the Farmers in Bangladesh

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Paper Information

Received: 7 February, 2022

Accepted: 19 March, 2022

Published: 05 June, 2022

A B S T R A C T

There are many constraints, major of them are inadequacy of credit, lack of knowledge for improved agricultural practices, inconvenient transportation, low market prices and high cost of production, existing among farmers of Bangladesh for sustainable crop production. This study was conducted at Shutia Khali ward of Boira union in Mymensingh to identify the constraints to adoption of sustainable agricultural practices among crop farmers (various crops cultivated farmers) and agricultural land management techniques practiced by the farmers, their effectiveness, problems and thereby to make a guideline. A simple random sampling technique was used in selecting a total of one hundred and forty small scale crop farmers. Descriptive statistics and correlation co-efficient "r" model were used to analyse the data for the study. The study revealed that food crop production in study area was dominated by middle aged farmers (44.3%) who were poorly educated and had less access to agricultural extension services. In case of their level of education majority 45% respondents can sign only and 2.9% had primary level of education while majority 60.7% possessed medium size family and 7.9% had large family size. The maximum 38.5% of the respondents had small farm size and 27.9% were large farm size. Maximum 80.7% of the respondents were practicing residue management, 72.1% of the respondents were practicing crop rotation, 71.4% of the respondents were practicing minimum tillage, 55.7% of the respondents were practicing planting trees, 55% of the respondents were practicing mixed cropping and 25.7% of the respondents were practicing intercropping system. The study recommended the necessity for training program on the use of appropriate sustainable practices that will take into account the cropping systems adopted by the farmers.

Key words: *Crop rotation; mixed cropping; residue management; socio-economic*

Introduction

Bangladesh is a country whose economy is largely based on Agriculture which contribution to GDP was 18.64% (current prices) for the fiscal year 2008-2009. The total cultivable land is estimated to be 9.10 million hectares with an average cropping intensity of 179 percent (BBS, 2009 and DAE, 2009). Major cropping pattern existing at Old Brahmaputra Floodplain (Agro-ecological Zone 9) are Mustard-Aus/Jute-Fallow, Vegetable (R)-B. Aus-Fallow, Boro-Fallow-T. Aman, Fallow-Jute-T. Aman, etc. Crop rotations, mixed cropping, intercropping, residue management, minimum tillage are the soil management techniques practiced by the farmer. Cropping intensity in Mymensingh, Bangladesh is 212%, and 53% of the cropped area is under T. Aman-Boro rice system. These crops are grown under conventional tillage i.e. 4-5 passes of tillaging followed by 2-3 passes of laddering (Hossain et al., 2014) with inadequate addition of organic matter. During Boro harvest some amount of residue is retained on the soil surface but not after T. Aman. This repeated plowing and cross plowing causing land degradation (Bezuaychu et al., 2002) and soil organic matter (SOM) declined <1%. Recently, the adoption of maize cultivation has increased in this area replacing Boro rice due to higher production cost of the later. In this situation, strip tillage with crop residue retention on the soil surface is essential for sustaining soil productivity through the retention of higher soil

moisture content, replenishing SOM and so forth. Evidence suggests that strip tillage lowers production cost compared to conventional tillage, and increases soil-water conservation, and N and P availability (Zhang et al., 2009). Lal (1990) points out that confusion often arises over the relationship between the terms; soil erosion, soil depletion and soil or land degradation. Soil erosion refers to a loss in soil productivity due to: physical loss of topsoil, reduction in rooting area, removal of plant nutrients, and loss of water. Soil erosion is a quick process. In contrast, soil depletion means loss or decline of soil fertility due to crop removal or removal of nutrients by water passing through the soil profile. The soil depletion process is less drastic and can be easily remedied through culture practices and by adding appropriate soil amendments. Similarly, land degradation is defined as the temporary or permanent lowering of the productivity of land. Soil erosion is not a new phenomenon, it has been a problem ever since human beings started cultivating the land; in other words, soil erosion is as old as human history (De Roo, 1993). Tesfaye (2003) points out that conservation agriculture achieves sustainable benefits through minimal soil disturbance (i.e., zero or reduced tillage farming; hereafter conservation tillage), permanent soil cover, and crop rotations.

The study is significant as the identification of effective determinant factors of land use and management practices will inform decision makers and instruct policy on successful food security enhancement practices. Based on the background the study was conducted with a view of the following objectives:

1. To study the soil crop management techniques practiced by the farmers of the selected area.
2. To identify the problems faced by the farmers in practicing those techniques.
3. To explore the socio-economic status of the farmers of this area.

Materials And Methods

Area selection

The Shutia Khali ward of Boira Union of the Mymensingh Sadar Upazilla, Bangladesh was selected as the study area as this ward is situated at the flood plain of the old Brahmaputra River i.e. AEZ 9 (Islam et al., 2014 & 2016). The soil falls under the general soil type non-calcareous dark grey floodplain and taxonomically it belongs to order inceptisols. Hence, lot of problems arises due to the soil erosion, due to flood, surface run-off, due to rain water etc. Its geographical coordinates are 24^0 $41^{'}$ 0" North and 90^0 $26^{'}$ 0" East.

Method of data collection and period of study

For collecting data, personal interview from the individual respondent was carried out at their home. An introductory visit was made to the study area to become familiar with the respondents and their environment. During visit the objectives of the study were explained clearly to most of the respondents. This assists the researcher to have a friendly orientation with the respondents. The researcher also established desired rapport with respondents. Questions were asked systematically and explanations were made whenever it was felt necessary. The information supplied by the respondents was recorded directly on the interview schedule. The information was checked carefully before leaving the study area in order to minimize errors. Data were collected in local unit. These were subsequently converted into appropriate standard units. The respondents were interviewed at their own house in leisure time so that they could give accurate information in a sound mind. The data were collected from 140 respondents from February 3 to March 31, 2015. Excellent co-operation was received from all respondents during collection of data. The questionnaire was carefully designed keeping the objectives of the study in view.

Sampling technique adopted

The study was conducted in rural areas of Mymensingh sadar upazila. The people of the villages are constituted the population. The population constituted 680 households. Among the population, 140 respondents were selected by simple random sampling technique. A structured interview schedule with open-ended and closed-ended questions was developed. Data were collected through personal interview during February 3 to March 31, 2015.

Measurement of Variables

A variable is any characteristics which can assume varying or different values in successive individual cases (Ezekiel and Fox, 1959). There are two types of variables such as independent and dependent variables. A dependent variable is that factor which appears, disappears or varies as the researcher introduces, removes or varies the dependent variables (Townsend, 1953). The independent variables were age, sex, educational status, farm size, annual income, household size and extension service. The land management techniques (crop rotation, mixed cropping, residue management, planting trees/agroforestry, intercropping) were dependent variable in this research. The procedure followed to measures these variables are described below:

Measurement of independent variables

The age of a respondent was measured in terms of actual complete years from his birth to the time of interview. A score of one was assigned for each year of age. Sex of the respondents was measured by giving one score for male and zero

score for female. Education was measured in terms of one's year of schooling. One score was given for who can read and write only, 0.5 was given for the respondent who can only sign, 5 was given for primary level education, 10 was given for SSC level education and 12 for HSC level education. If a respondent did not know how to read and write, his educational score was given as zero. Extension service was measured by Yes or No. The household size of the respondents was measured by small (up to 4), medium (5 to 7) and larger (>7) according to their size of the family. Farm size of a respondent was measured by small farm (0.2-1.0 ha), medium farm (1.0-3.0 ha) and large farm (>3.0 ha). On the basis of family annual income, the respondents were divided into three categories as low income (up to Tk.100000), medium income (Tk.100000-Tk.150000) and high income (>Tk.150000).

Measurement of dependent variables

The dependent variable land management techniques (crop rotation, mixed cropping, residue management, planting trees/agroforestry, intercropping) were measured by Yes or No.

Relationship between the dependent and independent variables

Pearson's Product Moment Coefficient of Correlation (r) was computed in order to explore the relationships between the selected characteristics of the respondents and the land management techniques practice by the respondents. The coefficient of correlation (r) was used to test the null hypothesis for grading the relationship between two concerned variables. The null hypothesis was formulated as H_0: There is no relationship between the selected characteristics of the respondents and their land management activities.

Data analysis

The information obtained from all the respondents were coded, compiled and tabulated in MS Excel sheet after completion of the survey. Then (SPSS v 20) data software was used for analyzing the coded data from MS Excel sheet. Basic statistics such as frequency (number of the respondents), percentage distribution, range, mean and standard deviation were used in describing the variables of the study. Pearson's Product Moment Correlation co-efficient (r) was used to compute the linear relationship among the variables with one percent (0.01) level of probability and five percent (0.05) level of probability was used to accept or reject any null hypothesis.

Results And Discussion

Socio- Economic Conditions of the Respondents

Age

The age of the respondents ranged from 18 to 63 years. The respondents were classified into three categories as young aged (18-30), middle aged (31-55) and old aged (>55) and found that 44.3% of the respondents were middle aged, 33% of the participants belonged to the young age and 25.7% of them belonged to old age category.

Sex

Among the respondents 93% were male and 7% were female. It was found that female farmers are not involved in cultivation rather than household work.

Education status

Among the respondents 45% of them can sign only, 24.3% can't read and write, 15% can read and write only, 12.9% of the respondents had secondary level of education and 2.9% of them having primary level of education. An educated individual is likely to be more receptive to the modern ideas. Hence, education gives favorable disposition to the respondents to adopt new ideas skills related to land management activities to improve crop production.

Household size

The survey reveal that 60.7% of the respondents possessed medium size family, 31.4% of them possessed small size family and 7.9% of the respondents had larger family.

Farm size

The majority of the respondents (38.5%) belonged to the small farm size category, 33.6% of the respondents belonged to the medium farm size category and 27.9% of the respondents belonged to the large farm size category. It indicates that most of the respondents were in the small farm size category.

Annual income

The survey indicates that majority 60.7% of the respondents had low income, 26.4% of the respondents had medium income, 12.9% of the respondents had high income.

Relationship between the dependent and independent variables

From the study it was found that 90% of the respondents had knowledge about soil erosion and 10% of the respondents had no idea about it. There were 140 numbers of respondents and each of them practiced multiple management methods and shows that 80.7% of the respondents were practicing residue management (Table 4).

Relationship between crop rotation and characteristics of the respondents

Most of the respondents (72.1%) were fond to practice crop rotation. There was no relationship between age and crop rotation (''r" value 0.100). Hence, the concerned null hypothesis could not be rejected. In case of sex and crop rotation there was no relationship "r" value (-0.049). Hence, the concerned null hypothesis could not be rejected. There was a significant positive relationship between the educational status of respondents and crop rotation practice at 0.01 level of probability ("r" value (0.338**). Hence, the concerned null hypothesis was rejected. There was a significant positive relationship between farm size and crop rotation practice at 0.01 level of probability ("r" value 0.549$^{**)}$. Hence, the concerned null hypothesis was rejected. It is assumed that if the farm size increases then the crop rotation practice increases. A significant positive relationship between extension service and crop rotation practice was recorded at 0.01 level of probability and followed positive trend computed ("r" value 0.479**) (Table 1). Hence, the concerned null hypothesis was rejected. It is assumed that if the extension service increases then the crop rotation practice increases. The practice of crop rotation started in the late nineteenth century and is still being practiced today on smaller farms, as well as plantations, all around the world (DEFRA, 2011). Crop rotation can lead to vast yields and have great economic benefits (USEPA, 2004).

Relationship between mixed cropping and characteristics of the respondents

A total of 55% of the respondents were practicing mixed cropping and 25.7% of the respondents were practicing intercropping system. There was no relationship between age and mixed cropping ("r" value 0.110) and sex and mixed cropping (r" value -0.028). Hence, the concerned null hypothesis could not be rejected. There was significant positive relationship between the educational status of the respondents and mixed cropping practice at 0.01 level of probability ("r" value 0.300**), farm size and mixed cropping practice at 0.05 level ("r" value 0.200*) and also extension service and mixed cropping practice at 0.05 level of probability ("r" value 0.166*) (Table 2). Hence, the concerned null hypotheses were rejected. More educated respondents can practice more mixed cropping. It is assumed that if the farm size increases then the mixed cropping practice increases. It is also assumed that if the extension service increases then the mixed cropping practice increases.

Relationship between minimum tillage and characteristics of the respondents

Mos**t** of the respondents (71.4%) of them were practicing minimum tillage. There was no relationship between age and minimum tillage ("r" value 0.036), sex and minimum tillage ("r" value 0.070) and farm size and minimum tillage practice negatively correlated at 0.01 level of probability ("r" value -0.445**) (Table 3). Hence, the concerned null hypothesis could not be rejected. It is assumed that if the farm size increases then the minimum tillage practice decreases. But there was significant positive relationship between the educational status of respondents and minimum tillage practice ("r" value 0.203**) and extension service and minimum tillage practice ("r" value 0.365**) at 0.01 level of probability followed a positive trend (Table 3). Hence, the concerned null hypotheses were rejected. We mentioned that more educated respondents can practice more minimum tillage. It is also assumed that if the extension service increases then the minimum tillage practice increases. Chan et al. (1999) indicated that air filled porosity of soil would be decreased and soil organic matter would be increased in the minimum tillage instead of intensive tillage. They also found decreasing Na from soil at minimum tillage, would increase the chemical quality of soil.

Relationship between residue management and characteristics of the respondents

There was no relationship between age and residue management ("r" value 0.077), sex and residue management ("r" value 0.146) and negative relationship between farm size and residue management practice at 0.01 level of probability ("r" value -0.271**) (Table 4). Hence, the concerned null hypothesis could not be rejected. It is assumed that if the farm size increases then the residue management practice decreases. But there was significant positive relationship between the educational status of the respondents and residue management practice ("r" value 0.168*) and extension service and residue management practice ("r" value 0.186*) both at 0.05 level of probability. Hence, the concerned null hypotheses were rejected. It is assumed that if the extension service increases then the residue management practice increases. Cropping systems which retain large amounts of residues and have adequate fertilization will maintain a large and active microbial population (Schnurer et al., 1985; Biederbeck et al., 1984). Crop residues have a number of functions. When left in the field after grain harvesting,

crop residues play a significant role in nutrient cycling, soil and water conservation, maintenance of favorable soil properties and enhance subsequent crop yields (Power et al., 1986; Bationo and Mokwunye, 1991; Unger et al., 1991).

Relationship between planting trees and characteristics of the respondents

Most of the respondents (55.7%) were practicing planting trees. There was no relationship between age and planting trees ("r" value -0.007) and sex and planting trees ("r" value 0.098) (Table 5). Hence, the concerned null hypothesis could not be rejected. But significant positive relationship between the educational status of the respondents and planting trees practice ("r" value 0.276^{**}) and significant negative relationship between farm size and planting trees ("r" value -0.309^{**}) both were practice at 0.01 level of probability (Table 5). Hence, the concerned null hypothesis was rejected. More educated respondents can practice more planting trees and it is assumed that if the farm size increases then the planting of trees decreases. There was a significant relationship between extension service and planting tree ("r" value 0.237^{**}) practice at 0.01 level of probability and followed positive trend. Hence, the concerned null hypothesis was rejected. It is assumed that if the extension service increases then the planting of trees practice increases.

Relationship between intercropping and characteristics of the respondents

It was found that 25.7% of the respondents were practicing intercropping. There was no relationship between age and intercropping ("r" value 0.142) and also sex and intercropping ("r" value 0.163) (Table 6). Hence, the concerned null hypothesis could not be rejected. But there was significant positive relationship between the educational status of the respondents and intercropping practice ("r" value 0.600^{**}) and significant negative relationship between farm size and intercropping practices ("r" value -0.280^{**}) both at 0.01 level of probability (Table 6). Again, there was a significant relationship between extension service and intercropping practice ("r" value 0.452^{**}) with same level of probability. Hence, the concerned null hypotheses were rejected. We mentioned that more educated respondents can practice more intercropping and it is assumed that if the farm size increases then the intercropping practice decreases. It is also assumed that if the extension service increases then the intercropping practice increases.

Table 1. Relationship between crop rotation and characteristics of the respondents

Management practice	Frequency	Percent	Characteristics of the respondents	r' value with 140 df
Crop rotation	101	72.1	Age	0.100
			Sex	-0.049
			Educational status	0.338^{**}
			Farm size	0.549^{**}
			Extension service	0.479^{**}

* Correlation is significant at the 0.05 level.
** Correlation is significant at the 0.01 level.

Table 2. Relationship between Mixed cropping and characteristics of the respondents

Management practice	Frequency	Percent	Characteristics of the respondents	'r' value with 140 df
Mixed cropping	77	55	Age	0.110
			Sex	-0.028
			Educational status	0.300^{**}
			Farm size	0.200^{*}
			Extension service	0.166^{*}

* Correlation is significant at the 0.05 level.
** Correlation is significant at the 0.01 level.

Table 3. Relationship between minimum tillage and characteristics of the respondents

Management practice	Frequency	Percent	Characteristics of the respondents	'r' value with 140 df
Minimum tillage	100	71.4	Age	0.036
			Sex	0.070
			Educational status	0.203^{**}
			Farm size	-0.445^{**}
			Extension service	0.365^{**}

*Correlation is significant at the 0.05 level.
** Correlation is significant at the 0.01 level.

Table 4. Relationship between residue management and characteristics of the respondents

Management practice	Frequency	Percent	Characteristics of the respondents	'r' value with 140 df
Residue management	113	80.7	Age	0.077
			Sex	0.146
			Educational status	0.168^{*}
			Farm size	-0.271^{**}

			Extension service	0.186*

*Correlation is significant at the 0.05 level.
** Correlation is significant at the 0.01 level.

Table 5. Relationship between planting trees and characteristics of the respondents

Management practice	Frequency	Percent	Characteristics of the respondents	'r' value with 140 df
Planting trees	78	55.7	Age	-0.007
			Sex	0.088
			Educational status	0.276**
			Farm size	-0.309**
			Extension service	0.237**

*Correlation is significant at the 0.05 level.
** Correlation is significant at the 0.01 level.

Table 6. Relationship between intercropping and characteristics of the respondents

Management practice	Frequency	Percent	Characteristics of the respondents	'r' value with 140 df
Intercropping	36	25.7	Age	0.142
			Sex	0.163
			Educational status	0.600**
			Farm size	-0.280**
			Extension service	0.452**

*Correlation is significant at the 0.05 level.
** Correlation is significant at the 0.01 level.

Constraints faced by the respondents during practicing land management

Farmers are often faced with various challenges in the use of sustainable practices in crop production. An assessment of the constraints faced by the farmers is presented in (Table 7). The problems considered inadequacy of credit faced by 80.7% of the respondents. About 60% of the respondents were faced high cost of production and 20.7% of the respondents were faced the constraint of inconvenient transportation which involved high costs in crop production. The low market price may be reported by the 35.7% of the respondents which make it difficult for the farmers to afford the various costs associated with sustainable agricultural practices

Table 7. Distribution of the constraints faced by the respondents

Constraints	Frequency	Percent
Inadequacy of credit	113	80.7
High cost of production	84	60
Low market price	50	35.7
Inconvenient transportation	29	20.7

Conclusion And Recommendations

The study assessed sustainable soil management practices in food crop production among small scale farmers at Shutia Khali village of Boira union of the Mymensingh sadar upazilla, Bangladesh which is situated at the flood plain of the old Brahmaputra river. Among the respondents 44.3% of the respondents were middle aged and 25.7% of them belonged to the old aged category and 93%of the respondents were male and 7% respondents were female. In case of their level of education majority 45% respondent can sign only and 2.9% had primary level of education while 60.7% possessed medium size family and 7.9% had large family size. The maximum 38.5% of the respondents had small farm size and 27.9% were large farm size. Study reveals that maximum 60.7% had low annual income and 12.9% had high annual income. Maximum 80.7% of the respondents were practicing residue management, 72.1% of the respondents were practicing crop rotation, 71.4% of the respondents were practicing minimum tillage, 55.7% of the respondents were practicing planting trees, 55% of the respondents were practicing mixed cropping and 25.7% of the respondents were practicing intercropping system. Correlation analysis indicates that significant positive relationship among farm size, educational status and extension service and significant negative relationship among farm size, minimum tillage, residue management, planting trees and intercropping. However, age and sex of respondents had no relationships with their soil management activities. It was found that 80.7% of the respondents were facing problems of inadequacy of credit, 60% of the respondents were facing high cost of production, 35.7% were facing low market price problem and 20.7% of the respondents were facing transportation problem.

Findings from the study revealed that while farmers engaged in a number of soil management practices, the majority who constitute the population do not apply soil management practices in crops production. In order to improve on this situation, this study makes the following recommendations based on its findings:

Efficacy information is essential for the complementary use of organic manure and inorganic fertilizer in crop production among the farmers of Shutia Khali, Mymensingh. It is very much important to increase communication with

extension personnel for small scale crop farmers with specific emphasis on soil management practices. This may be called for a stakeholder conference, including farmers, on the appropriate land management practices that would suit their cropping systems. Besides, there may be the needed for regular joint training programs for the farmers on relevant agricultural land management practices. Agriculture should be accorded more priority in youth empowerment scheme of the farmers of Shutia Khali, Mymensingh. This is with a view to encouraging the youth to take better interest in agricultural crops production using soil management practices. Land fragmentation which often results from high number of farm plots operated by the farmers should be curtailed. Therefore it calls for consolidation of land holdings among the farmers which may be achieved through rejuvenation of farmers' cooperatives and other farmers' associations.

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