ISSN 2286-4822
www.euacademic.org

EUROPEAN ACADEMIC RESEARCH
Vol. II, Issue 6/ September 2014

Impact Factor: 3.1 (UIF)
DRJI Value: 5.9 (B+)

Practice of Soil and Crop Management Technologies by the FFS Farmers for Maintaining Sustainable Agriculture

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Abstract:

The purposes of the study were to determine the extent of practice of soil and crop management technologies by the FFS farmers and to explore the relationships of the selected characteristics of the FFS farmers with their extent of practice of soil and crop management technologies. Data were collected using personal interview method from 100 FFS farmers of Mymensingh district in Bangladesh from 10 to 30 April, 2013. The findings showed that highest proportion of the FFS farmers (82%) had medium extent of practice followed by high extent of practice (15%) of soil and crop management technologies. About three-fourth of the respondents (75%) had medium extent of practice of soil management technologies, while, 'Use of organic manure in the crop field' had the highest Technology Practice Index

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(TPI-282) and 'soil testing for nutrient statuses had the lowest TPI (10). On the other hand, the highest proportion of farmers (93%) had medium extent of practice of crop management technologies, while, 'Line sowing of crops' had the highest TPI (290) and the 'use of light trap for pest control' had the lowest TPI (12). The selected characteristics of the FFS farmers, such as farm size, engagement with FFS, extension media contact, risk orientation and knowledge on soil and crop management showed significantly positive relationship with the extent of practice of soil and crop management, where, farming experience of the FFS farmers showed significant and negative relationship. Therefore, it can be mentioned that FFS farmers significantly practice soil and crop management technologies to maintain sustainable agriculture.

Key words: Sustainable agriculture, extent of practice, soil management technology, crop management technology, FFS.

Introduction

Sustainable agriculture is defined as a system that, "over the long term, enhances environmental quality and the resource base on which agriculture depends; provides for basic human needs (food and fibre); is economically viable; and enhances the quality of life for farmers and society as a whole"[Crews *et al.* (1991), Flora (1992) and Kambewa (2007)]. Sustainable agriculture should be taken as an eco-system approach, where soil-water-plants- environment-living beings live in harmony with a well balanced equilibrium of food chains and their related energy balances (Abubakar and Attanda, 2013). In agriculture, soil and crop are complementary to each other. For maintaining agricultural sustainability, it is important to properly manage the soil and crop in eco-friendly manner. Bangladesh is a developing country of which a core of national economy depends of agricultural activities. On the other hand, its population is increasing which needs to rely on the limited production from its limited resources. So, for the development of the nation it is important to emphasis the sustainable agricultural productivity.

Farmer Field School (FFS) is described as a Platform and "School without walls" for improving decision making capacity of farming communities and stimulating local innovation for sustainable agriculture. It is considered as an extension approach where the farmers are being trained up about different aspects of crop production especially management of soil and crop in a low cost and environment friendly means through a season long training program. In the FFS, the participants are taught about various soil and crop management technologies through participatory manner. But, a few of the farmers practiced these technologies in their farm after completion of the training sessions. The study area was selected purposively because highest number of FFSs has been launched here and provided training to a significant number of farmers. But, the extent of practice of different soil and crop management technologies is rarely observed except few. Considering the above facts, the researchers conducted the study to get the answers of the following questions.

i. What is the extent of practice of soil and crop management technologies by the FFS farmers for sustainable agriculture?
ii. What is the relationship between the selected characteristics of FFS farmers and extent of practice soil and crop management technologies?

Methodology

The study was conducted in three unions of Muktagacha Upazila under Mymensingh district of Bangladesh. The study area was selected purposively for investigation, because highest number of ICM-FFSs has been conducted there. There were five ICM-FFSs and the male farmers (125) of the ICM-FFSs of the selected unions of Muktagacha upazila were considered as the population of the study. Simple random sampling was used in selecting the respondents from each ICM-FFS and a total of 100 ICM- FFS farmers were selected as sample size from the population i.e. about eighty (80) percent of the total population was the sample size of the study. The empirical data were collected using personal interview method along with Focus Group Discussions and observations during the period of 10 to 30 April, 2013.

Extent of practice of soil and crop management technologies

Practice of soil and crop management technologies was computed by using a four point ranting scale as used by Ali (2004) who measured adoption of integrated homestead farming technologies by the rural women members of RDRS. Weights of responses were: 3 for regularly, 2 for occasionally, 1 for rarely and 0 for not at all.

The practice score was obtained by adding weights of responses of the technologies and therefore, the practice score could vary from 0 to 66 where 0 indicating 'no practice' and 66 indicating 'highest practice'.

For better understanding Technology Practice Index (TPI) was computed separately for soil and crop management technologies using the following formula.

$$TPI = N_1 \times 3 + N_2 \times 2 + N_3 \times 1 + N_4 \times 0$$

Where,

TPI = Technology Practice Index

N_1 = Number of the respondents practiced soil and crop management technologies regularly

N_2 = Number of the respondents practiced soil and crop management technologies occasionally

N_3 = Number of the respondents practiced soil and crop management technologies rarely
N_4 = Number of the respondents never practiced soil and crop management technologies

Thus, the value of TPI of each individual item could range from 0 to 300, where 0 indicating no practice and 300 indicating highest practice of soil and crop management technologies.

Findings and Discussion

Selected characteristics of the FFS farmers

Data in Table 1 reveal that majority of the FFS farmers (41%) were middle-aged and considerable proportion of the FFS farmers (39%) was illiterate. The highest proportion of the FFS farmers (64%) had the medium sized household while the farm size of the highest proportion of the FFS farmers (65%) were small. Data also reveal that the majority of the FFS farmers (47%) had medium farming experience while the highest proportion of the FFS farmers (60%) had medium engagement with FFS.

Table 1: Characteristics profile of the FFS farmers (n=100)

Characteristics (Measuring units)	Score ranges		Categories	FFS farmers		Mean	SD
	Possible	Observed		No.	%		
Age (Years)	unknown	20-63	Young (up to 35)	29	29	43.67	11.93
			Middle aged (36-50)	41	41		
			Old (> 50)	30	30		
Year of schooling (Total years of schooling)	unknown	0-17	Illiterate (0)	39	39	5.22	4.88
			Primary (1-5)	15	15		
			Secondary (6-10)	35	35		
			Above secondary (> 10)	11	11		
Household size (No. of members)	unknown	2-13	Small (up to 4)	31	31	5.47	1.94
			Medium (5-8)	64	64		
			Large (> 8)	5	5		
Farm size			Landless (<0.02 ha)	0	0		
			Marginal (0.02-0.2 ha)	11	11		

(Hectare)	unknown	0.05-2.61	Small (0.21-1.0 ha)	65	65	0.71	0.57
			Medium (1.01-3.0 ha)	24	24		
			Large (>3.0 ha)	0	0		
Farming experience (Years)	unknown	6-45	Less (up to 15)	33	33	22.47	9.57
			Medium (16-30)	47	47		
			High (> 30)	20	20		
Engagement with FFS (Years)	unknown	1-5	Low (up to 2)	20	20	3.16	1.40
			Medium (3-4)	60	60		
			High (> 4)	20	20		
Annual family income (000' Taka)	unknown	17-460	Low (up to 153)	64	64	155.47	106.93
			Medium (154-305)	24	24		
			High (> 305)	12	12		
Extension media contact (Scores)	0-30	4-25	Low (up to 10)	20	20	14.26	4.74
			Medium (11-20)	73	73		
			High (> 20)	7	7		
Risk orientation (Scores)	6-18	7-17	Low (up to 9)	11	11	13.21	2.50
			Medium (10-13)	36	36		
			High (> 13)	53	53		
Knowledge on soil and crop management (Scores)	0-40	11-37	Low (up to 13)	4	4	21.44	5.29
			Medium (14-26)	77	77		
			High (> 26)	19	19		

Data related to annual family income indicate that the highest proportion of the FFS farmers (64%) were in low income category but a satisfactory proportion of the FFS farmers (73%) had medium extension media contact. Data also reveal that more the half of the FFS farmers (53%) were highly risk oriented while the highest proportion of the FFS farmers (77%) had medium level of knowledge on soil and crop management.

Extent of practice of soil and crop management technologies

The extent of practice of soil and crop management technologies has been presented by dividing into three subsections. Such as - i) Extent of practice of soil management technologies

ii) Extent of practice of crop management technologies

iii) Overall extent of practice of soil and crop management technologies

i. Extent of practice of soil management technologies

The scores obtained for practicing soil management technologies ranged from 9 to 26 against a possible range of 0-30, with an average of 16.94 and standard deviation 4.26. On the basis of their extent of practices, the respondents were classified into three categories i.e. low, medium and high. Distribution of the respondents according to their extent of practice of soil management technologies has been shown in Table 2.

Table 2: Distribution of the respondents according to their extent of practice of soil management technologies

Categories of FFS farmers	FFS farmers (n=100)		Mean	SD
	Number	percent		
Low (up to 10)	5	5	16.94	4.26
Medium (11-20)	75	75		
High (above 20)	20	20		

Data presented in the Table 2 show that the highest proportion of the FFS farmers (75%) had medium level of practice of soil management technologies, where 20% of them had high level of practice and only 5% of them had low level of practice of soil management technologies. The findings indicate that majority of the FFS farmers (95%) had medium to high level of practice of soil management technologies. This may be due to that the FFS farmers could gain more knowledge about soil management technologies from FFS training and also may be due to the technologies were more or less readily available in the study area.

For better understanding a Technology Practice Index (TPI) was computed. The TPI was calculated by multiplying the corresponding score such as 3 for 'regularly', 2 for 'occasionally' 1 for 'rarely' and 0 for 'not at all'. Finally, by adding all the frequency counts of each of the cells of the scale the value of TPI was calculated. Thus, the value of TPI of each individual item could range from 0 to 300, where 0 indicating no practice and 300 indicating highest practice of soil and crop management technologies.

Table 3: Rank order of the soil management technologies based on extent of Practice (n=100)

Technologies	Extent of practice (%)				TPI	Rank order
	Regularly	Occasionally	Rarely	Not at all		
Use of organic manure in the crop field	86	10	4	-	282	1
Decaying crop residues in the field	76	18	4	2	268	2
Leveling of soil surface	50	43	6	1	242	3
Reduced use of chemical fertilizers	34	52	12	2	218	4
Balanced fertilizer application	35	45	4	16	199	5
USG fertilizer application	33	18	9	40	144	6
Composting and mulching for soil fertility management	20	28	14	38	130	7
Crop rotation for soil nutrient management	15	19	14	52	97	8
Cultivation of nitrogen fixing plants	5	17	18	60	67	9
Soil testing for nutrient status	2	18	14	66	56	10

TPI=Technology Practice Index

Among the soil management technologies the top five highly practiced soil management technologies have been discussed here. The first one is 'Use of organic manure in the crop field (TPI-282)'. This may be due to the availability of organic materials in the farming and the FFS farmers could understand the beneficial effects of using organic manure in the crop field. The second one is 'Decaying crop residues in the field (TPI-268)' and this may be due to the farmers could understand from FFS training that decayed crop residues add necessary nutrients to the fields. The third one is 'Leveling of soil surface

(TPI-242)'. For easy and equal movement of irrigation water throughout the crop field it is essential to level the soil surface and the finding indicates that the FFS farmers could understand its importance from FFS training. The fourth one is 'Reduced use of chemical fertilizers (TPI-218)'. This may be due to that chemical fertilizers are costly and the participants of FFS were small to medium farmers. Another point is that less chemical fertilizers application does not hamper the crop production while FFS farmers using adequate organic manure in the field. The fifth one is 'Balanced fertilizer application (TPI-199)'. This may be due to that farmers could gain more knowledge about balanced fertilizer application from FFS training, There were another three technologies with TPI over 50 and the technology 'Soil testing for nutrient status' got the lowest score (TPI-56) and hence got the lowest (10^{th}) position in the order. This may be due to that soil testing was a complicated job and the instruments for testing soil e.g. Soil health testing kit were not readily available in the study area.

ii. Extent of practice of crop management technologies

The scores obtained for practicing crop management technologies ranged from 12 to 27 against a possible range of 0-36, with an average of 19.21 and standard deviation 3.38. On the basis of their extent of practices, the respondents were classified into three categories i.e. low, medium and high. Distribution of the respondents according to their extent of practice of crop management technologies has been shown in Table 4.

Table 4: Distribution of the respondents according to their extent of practice of crop management technologies

Categories of FFS farmers	FFS farmers (n=100)		Mean	SD
	Number	percent		
Low (up to 12)	1	1		

Medium (13-24)	93	93	19.21	3.38
High (above 24)	6	6		

Data presented in the Table 4 show that the highest proportion of the FFS farmers (93%) had medium level of practice of crop management technologies, where 6% of them had high level of practice and only 1% of them having low level of practice of crop management technologies. The findings of the study may be due to that the farmers could gain considerable knowledge about the beneficial effects of different crop management technologies from FFS training and also the technologies were comparatively easier to conduct and readily available to the farmers.

For better understanding a Technology Practice Index (TPI) was computed. The value of TPI of each individual item could range from 0 to 300, where 0 indicating no practice and 300 indicating highest practice of soil and crop management technologies.

Among the crop management technologies the top five highly practiced crop management technologies have been discussed here. Firstly, 'Line sowing of crops (TPI-290)' and this may due to the FFS farmers could understand that line sowing of crops reduces the number of seedlings per hill and on the other hand, increases crop production where inter cultural operations are easy to conduct. The second one is 'Perching in the crop field for insect control (TPI-281)' and this may be due to that FFS training has nourished the indigenous knowledge of the farmers and hence, the FFS farmers could understand the benefits of perching in the crop field.

Table 5: Rank order of the crop management technologies based on extent of practice (n=100)

Technologies	Extent of practice (%)				TPI	Rank order
	Regularly	Occasionally	Rarely	Not at all		
Line sowing of crops	90	10	-	-	290	1
Perching in the crop field for	86	10	3	1	281	2

insect control						
Maintaining proper spacing of crop	81	14	3	2	274	3
Production of healthy and quality seeds	48	46	3	3	239	4
Germination test of seed	43	38	8	11	213	5
Rouging of weed from crop field	20	67	8	5	202	6
Management according to growth stages of crops	9	30	29	32	116	7
Ail crops cultivation for pest control	1	29	22	48	83	8
De-tillering and defoliation for pest management	1	24	23	52	74	9
Cultivation of insect resistant variety	6	12	22	60	64	10
Conservation and augmentation of natural enemies	1	12	7	80	34	11
Use of light trap for pest control	-	2	12	86	16	12

TPI=Technology Practice Index

The third one is ‘Maintaining proper spacing of crop (TPI-274)’ and this may be due to that the farmers could realize the benefits of proper spacing of crop where intercultural operations are easy to conduct e.g. application of urea super granule fertilizers. The fourth one is ‘Production of healthy and quality seeds (TPI-239)’. The FFS provides opportunities to enhance farmers’ indigenous knowledge on farming activities i.e. different aspects of crop production and hence, it can be said that the farmers could understand the importance of producing healthy and quality seeds by own selves. And the fifth one is ‘Germination test of seed (TPI-213)’. There were another three technologies with TPI over 50, and the technology ‘Use of light trap for pest control’ got the lowest score (TPI-16) and hence got the lowest (12th) position in the order. This may be due to that the FFS farmers perceived it as a complex ways to control pests or the materials for preparing light trap were not readily available in that area.

iii. Overall extent of practice of soil and crop management technologies

The scores for the extent of practice of soil and crop management technologies ranged from 23 to 49 against a possible range of 0-66, with an average 36.15 and standard deviation 7.01. On the basis of their practices, the respondents were classified into three categories i.e. low, medium and high. Distribution of the respondents according to their extent of practice of soil and crop management technologies has been shown in Table 6.

Table 6: Distribution of the respondents according to their extent of practice of soil and crop management technologies

Categories of FFS farmers	FFS farmers (n=100)		Mean	SD
	Number	Percent		
Low (up to 22)	0	0	36.15	7.01
Medium (23-44)	82	82		
High (above 44)	18	18		

Data show that the highest proportion of FFS farmers (82%) had medium level of practice of soil and crop management technologies, where 18% of them had high level of practice and there was no FFS farmer having low level of practice of soil and crop management technologies. These findings are in line with Ahmed (2002) and Miah (2006). The findings indicate that all the FFS farmers had medium to high level of practice of soil and crop management technologies. The probable reasons for this result may be the farmers were well interested to participate in the FFS training and they could understand the benefits of practicing soil and crop management technologies for maintaining sustainable agriculture and moreover, the technologies might be readily available in the study area.

Relationship between the selected characteristics of the FFS farmers and practice of soil and crop management technologies

Pearson's Product Moment Co-efficient of Correlation (r) was used to ascertain the relationships between the selected characteristics of the FFS farmers and the extent of practice of soil and crop management technologies. The correlation has been shown in the Table 7.

The findings indicate that farm size, engagement with FFS, extension media contact, risk orientation and knowledge on soil and crop management had significant and positive relationship and farming experience had significant and negative relationship with the extent of practice of soil and crop management technologies. Farm size is an important indicator for socio-economic status of the farmers. The FFS farmers with larger farm size were more innovative and risk oriented to adopt new agricultural technologies in their farming. They took part in many agricultural training programmes and hence, they practice soil and crop management to maintain sustainable agriculture.

Table 7: Correlation between explanatory and focus variables (n = 100)

Focus variable	Explanatory variables	Correlation co-efficient (r) values with 98 df	Tabulated r values with 98 df	
			0.05 level	0.01 level
Practice of soil and crop management technologies	Age	-0.192	0.197	0.257
	Year of schooling	0.184		
	Household size	-0.027		
	Farm size	0.234*		
	Farming experience	-0.252*		
	Engagement with FFS	0.219*		
	Annual family income	0.116		
	Extension media contact	0.534**		
	Risk orientation	0 .244*		
	Knowledge on soil and crop management	0.344**		

***** = *Significant at 0.05 level*

****** = *Significant at 0.01 level*

The findings indicate that farming experience of the FFS farmers showed significant and negative relationship with the extent of practice of soil and crop management technologies.

The FFS farmers who have higher engagement with FFS practice soil and crop management for maintaining sustainable agriculture. This might be due to that the farmers having long time engagement with FFS could understand the benefits of practicing different soil and crop management technologies provided in the FFS training. Extension media contact had significant and positive relationship with the extent of practice thus, it can be concluded that the FFS farmers having higher contact with extension media perceived soil and crop management technologies effective for sustainable agriculture. On the other hand, the FFS farmers who had comparatively higher contact with extension workers as well as other media practiced more soil and crop management technologies in their crop field. The FFS farmers having higher risk orientation towards new agricultural technology practiced soil and crop management technologies as effective mean for maintaining sustainable agriculture. This finding is in line with Chandrashekhar (2007). Findings also indicate that the FFS farmers having higher knowledge on soil and crop management practiced soil and crop management technologies for maintaining sustainable agriculture.

Conclusions

The findings of the present study demonstrate that about cent percent of the respondents (100%) practice soil and crop management technologies for maintaining sustainable agriculture, where, majority of them (82%) had medium extent of practice. The findings lead to the conclusion that the FFS farmers could be aware about the benefits of sustainable agriculture with special emphasis on soil and crop management technologies. Again, the findings indicate that farm size, farming experience, engagement with FFS, extension media contact, risk orientation and knowledge on soil and crop management has considerable influence on the FFS farmers in practicing of soil and crop management technologies. So, for enhancing the practice, the extension personnel should provide regular visit to the farmers so that they can make effective communication with them for their farming activities. These, soil and crop management technologies should be disseminated to the non-FFS farmers so that they can practice effectively. Moreover, different GOs and NGOs need to take collaborate measures to scale up the practice of soil and crop management technologies as well as to maintain sustainable agriculture.

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