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Research paper

Adoption prospects and implication problems of practicing conservation agriculture in Bangladesh: A socioeconomic diagnosis

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ABSTRACT

The research was conducted to evaluate the problems and prospects of adopting conservation agriculture in Jamalpur and Bogra districts of Bangladesh. A total of 120 farmers (20 from focal and 100 from control group) were surveyed for collecting necessary data and information. A combination of descriptive statistics and mathematical techniques was used to analyze the data. Focal farmers followed the basic principles of conservation agriculture but control farmers continued conventional crop farming practices. Focal farmers were more profitable compared to control farmers in terms of wheat and bean production. Less production due to minimum tillage, difficulties in maintenance, lack of extension service etc. was the major problems faced by the farmers. Knowledge on soil conservation and soil quality improvement, use of organic fertilizer, etc. was found as strengths; management of crop residue, scarcity of cowdung, etc. were found as weaknesses; labour opportunities, market demand, etc. were found as opportunities; and climate change and price fluctuation were found as threats of adopting conservation agriculture. Regular extension contact, arrangement of training programmes and input support are to be ensured by different government and non-government organizations to motivate farmers for adopting conservation agriculture practice.

1. Introduction

Bangladesh is a role model for the United Nations to be showcased for its excellent development performance to developing nations in the field of agriculture. Soil fertility and crop productivity are reducing over the time in Bangladesh due to monoculture of cereal crops (mainly rice) (Kafiluddin and Islam, 2008). Introduction of conservation agriculture plays a vital role in increasing organic matter content in soil and in reducing soil erosion. It is a modern agricultural practice which is gaining popularity in many parts of the world. It aims to make better use of agricultural resources through the integrated management of available soil, water and biological resources, combined with limited external inputs. It offers an opportunity for arresting and reversing downward spiral of resource degradation, decreasing cultivation costs and making agriculture more resource-use-efficient, competitive and sustainable by maintaining a permanent or semi-permanent organic soil cover, crop rotation and minimum soil disturbance (FAO, 2007). Crop production profitability under this farming practice tends to increase over time relative to conventional agriculture. In economic terms, conservation agriculture performs better than tillage-based farming. Three or four years crop rotations can reduce the use of nitrogen fertilizer and pesticide. The labour inputs in this farming practice could be reduced by 75% (IFAD, 2005).

Modalities of such farming have been described in a good number of literatures in the global context (USDA, 1980; Lampkin, 1990; IFOAM, 1996; FAO, 2007) as well as in the context of Bangladesh (Rahman, 2001; Sarker and Itohara, 2008). Although conservation agriculture aims to help farmers to earn more income with reduced amount of labour, irrigation and other high energy external input costs; keep land healthy and productive; and conserve natural environment (Lampkin and Padel, 1994); about 8–10% farmers around the world follow this practice (Parrott et al., 2006; Willer et al., 2008). There is also policy debate on whether conservation agriculture can ensure better sustainability and livelihood enhancement of the resource poor farmers. In light of this situation, this research aimed to identify the problems and possible opportunities of conservation agriculture practice, and suggest policy recommendations.

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2. Materials and methods

2.1. Study areas and sample selection

The study was conducted in two districts of Bangladesh which were: Sadar upazila of Jamalpur district [conservation agriculture practice by wheat farmers under the observation of International Maize and Wheat Improvement Center (CIMMYT); major crop: wheat] and Shajahanpur upazila of Bogra district [conservation agriculture movement under Comprehensive Village Development Cooperative Limited (CVDCL) and Village Development Association (VDA); major crop: bean]. Two categories of farmers were targeted for investigation namely, focal farmers (farmers practicing conservation agriculture, receiving technical and logistic support from the researchers and having regular contact with extension agents) and control farmers (farmers practicing traditional agriculture and receiving no training and technical support from the researchers/extension agents). In each locale of the study, a total of 60 farmers (10 focal and 50 control) were selected; of which focal farmers were selected purposively and control farmers were selected randomly. Thus, a total of 120 farmers were included as the sample for observation and data collection (socioeconomic characteristics of focal and control farmers has been represented in Tables 1 and 2, respectively). Primary data were collected through questionnaire survey, focus group discussion (FGD) and key informant interview (KII) with local stakeholders. Secondary sources of data in the form of handouts, reports, publications, notifications, etc. having relevance with this study were also consulted.

The focal farmers were selected by the consultation with the members of the concerned community based organizations. The farmers were agreed to adopt a number of conservation agriculture practices as suggested by the researchers through FGD. The researchers provided with a limited amount of input support to the focal farmers without any cost for practicing conservation agriculture. Necessary technical advices were provided and the implementation of the conservation agriculture practices in the farmers' fields time to time was monitored by the research team and local extension agents.

In orthodoxy with the research objectives, a structured questionnaire was developed for collecting relevant primary data from the both categories of farmers. At first, the draft questionnaire was prepared and pre-tested on handful respondents for its validity and reliability. In the pre-test, concentration was given to identify and categorise information which was not included in the draft questionnaire. Then some parts of questionnaire were improved, rearranged and modified in light of the field experiences. Lastly, the final questionnaire was prepared to importune information. The questions were properly structured so that even the most reluctant informant could have no hesitation in passing on the necessary information. Sometimes, the farmers could not remember some information in accurate manner which was exactly needed to the researchers. In case of that situation, the researchers noted the information in the questionnaire based on the ideas of the respondents. For some cases, the researchers faced startling intrusion from over interested side talkers while collecting data from the respondents. However, the researchers tried to overcome this problem as far as possible with ample dexterity and proficiency.

2.2. Analytical techniques

A combination of descriptive statistics (i.e., averages, percentages, minimum, maximum, etc.) and mathematical techniques (problem confrontation index) was used to achieve the objective of the study. Problems of adopting conservation agriculture practice were analyzed with problem confrontation index (PCI) (Uddin et al., 2017). An overall score of the problems faced by the focal and control farmers was computed for each farmer by adding their scores of the problems in all 13 selected problems. Each farmer was asked to indicate the extent of difficulty caused by each of the problems by checking any of the four responses such as 'frequently, 'occasionally, 'rarely and 'not at all', and weights were assigned to these responses as 3, 2, 1 and 0, respectively. Thus, the possible range of the problem confrontation score for each problem could be 0 to 3 and possible range of overall problem confrontation score for 13 constraints could range from 0 to 39. In this case, 0 indicated there was no problem and 39 indicated that the problem was very frequent. A problem confrontation index (PCI) for each 13 selected problems was computed by using the following formula:

$$PCI = (P_{frequently} \times 3) + (P_{occasionally} \times 2) + (P_{rarely} \times 1) + (P_{not\ at\ all} \times 0)$$

Where, $P_{frequently}$ = Number of responses indicating the problem occurred frequently; $P_{occasionally}$ = Number of responses indicating the problem occurred occasionally; P_{rarely} = Number of responses indicating the problem occurred rarely; and $P_{notatall}$ = Number of responses indicating no problem at all.

Problem confrontation index (PCI) for any of the selected problem could range from 0 to 60 for focal farmers and 0 to 300 for control farmers where 0 indicated that the problem was not faced at all by the farmers; and 60 and 300 indicated that the problem was frequently faced by focal and control farmers, respectively.

SWOT analysis was done to identify the problems and potentials of conservation agriculture practice. A SWOT analysis guides to identify the positives and negatives inside of the organization (S-W) and outside of it in the external environment (O-T). Finally, suggestions and recommendations were provided with by the author in the form of recommendation matrix for expanding conservation agriculture that will be synchronized for policy options.

Table 1
Socioeconomic characteristics of focal farmers.
Source: Field survey, 2015–16.

Particulars		No.	%	Avg.	Std. deviation	Kurtosis	Skewness	Range	Min.	Max.
Sex	Male	13	65	–	–	–	–	–	–	–
	Female	7	35	–	–	–	–	–	–	–
Age	15–29 years	6	30	20	5	−2	0	12	15	28
	30–49 years	11	55	40	6	−2	0	16	31	48
	Above 50 years	3	15	57	6	–	2	11	53	65
Land holding (ha)	Homestead area	–	–	0.09	0.01	−0.91	−0.13	0.05	0.06	0.11
	Owned cultivable land	–	–	0.19	0.03	−0.84	0.14	0.09	0.15	0.24
	Rented/mortgaged/leased-in	–	–	0.23	0.02	−1.57	−0.07	0.06	0.20	0.26
	Rented/mortgaged/leased-out	–	–	0.04	0.01	−1.49	0.29	0.03	0.03	0.06
	Area under pond	–	–	0.03	0.01	−0.73	0.46	0.03	0.01	0.05
	Fallow land	–	–	0.02	0.01	−1.20	−0.01	0.04	0.00	0.04
Farming types	Subsistence	4	20	–	–	–	–	–	–	–
	Commercial	16	80	–	–	–	–	–	–	–