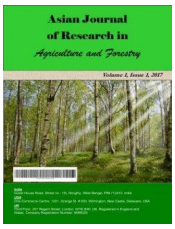

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Conservation Agriculture: Present Status and Cropping Pattern Adopted by the Farmer in Khulna Region

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

Conservation agriculture (CA) based tillage technology permits direct seeding through the moderate level of crop residue. The main purposes of the study were to identify present status of agriculture along with the problem identification by farmers and also determine the present cropping pattern adopted by the farms under conservation agriculture. Data were collected from randomly selected 91 farmers of three upazilla in Khulna region with the help of personal interview method by using interview schedule during January 2017 to May 2018. Data were collected on fifteen selected categories of the farmers and problems confronting them. Most of the respondents have small to medium sized cultivable lands. Bean, cauliflower, cabbage, potato, Indian spinach, brinjal, tomato etc, were more extensively cultivated. Most farmers belong to medium practice of conservation agriculture while very few of them had low or high practice. To determine the present status of agriculture data were also collected based on the name of crop rotation, use of fertilizers and manures, intercultural operation adopted by the respondents, pest and disease infestation in

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the field under cultivation. Out of all independent variables, only extension media contact, level of education and organizational participation of the farmers showed positive significant relationship with conservation agriculture practice. Extension media contact and organizational participation influence the extent of CA practices at farmers' field as confirmed by the backward linear regression model. The vital problems of conservation agriculture practices were lack of seed, high price of seed, lack of fertilizers, high price of fertilizer, impurity and high price of insecticides/ pesticides, lack of irrigation water, salinity, lack of CA knowledge. To popularize the CA practices, Government should organize more training and demonstration activities on CA involving block level extension workers as well as farmers plus strengthening research-extension-farmers linkage.

Keywords: Conservation agriculture (CA); Cropping Pattern (CP); Problem of CA.

1. INTRODUCTION

Feeding for a large population of a country like Bangladesh is the prime concern of Bangladeshi government. But producing quality food and maintaining sustainable soil health for future generation are possible future concerns. Future use of chemical fertilizer and pesticides while mistreatment (the action of mistreating or fact of being mistreated) organic compounds resulted in soil degradation and initiate decreasing trend of soil productivity [1]. Intensified High Yielding Variety (HYV) of rice and other crops cultivated in the local land to feed the huge population of the country, has led to huge amount of nutrients loss from the soil [2]. The outcome of this intensified rice based agriculture on soil fertility, soil microbial (characteristic of a microorganism, especially a bacterium causing disease or fermentation) activity and lastly to our environment is severe [3]. Increased cropping intensity of 1.90% (Standard value of cropping intensity of Bangladesh) that means raising of a number of crops from the same field 1.9 during one agriculture year in Bangladesh [4] with traditional rice based cropping pattern covering most of the land [5] complicates the situation further. That is why the incorporation of sustainable and conservable techniques to commercial farming is becoming popular all over the world [6]. Bangladesh is a small country in Southeast Asia and also trying to adopt Conservation Agriculture (CA) considering its positive impact on soil health and also for the environment.

Around 45.1 percent of total labor force of Bangladesh is involved in Agriculture but labor scarcity is increasing day by day [4] and labor wage is also very high (Statistical Bulletin, 2013) which creates bad impact on total production budget. Already minimum tillage and other conservation techniques are practiced in the country but not on large scale [5]. Conservation agriculture (CA) is associate degree approach that reduces agricultural operational prices while increasing yields while utilizing natural resources properly [7] with the adoption of sole minimum tillage, prices of production may be move to a massive extent [8]. The CA research in Bangladesh is few and previous research mainly focused on adoption of different conservation agriculture practices [9]. Research reports available in Bangladesh [10]. Revealed that wheat, maize, pulses, oilseeds, jute, rice can be established and grown successfully using CA technology. Farmers accept the concept of conservation agriculture (CA) based mostly on tillage technologies considering the benefits of higher yields, reduced value of tillage operation, and minimum work time between the crops [11]. Practicing conservation agriculture is not yet studied well. The present research was performed using different crops such as rice (*Oryza sativa*) (BR 23, BRRI dhan30, BRRI dhan40 and BRRI dhan41), wheat (*Triticum aestivum*), white maize *(Zea mays*), sesame (*Sesamum indicum*), sunflower (*Helianthus annuus*), jute (*Corchorus olitorius*), kenaf (*Hibiscus cannabinus*), dhaincha (*Sesbania bispinosa*), mung bean (*Vigna radiata*), chick pea (*Cicer arietinum*) with various vegetable crops. The soil fertility level in the south-west region (Khulna) is especially lower in organic matter content than other region in Bangladesh. The farmers of south-western part of Bangladesh practice traditional agriculture day after day without considering modern technology such as conservation agriculture. Farmers and other stakeholders who are new or are at the initial stages of converting to conservation agriculture (CA) require tangible evidence on the benefits and impacts of CA. In the light of the above, this experiment was aimed to satisfy the following objectives: a) To investigate the present status of farming system in Khulna region. b) To identify the existing cropping pattern in study area. c) To identify the constraints and opportunities to

adoption of CA pattern existing in Khulna region. D) To suggest policy guidelines for popularizing CA.

2. METHODS AND MATERIALS

This study was a survey based research and confined to three upazila eg. Dumuria, Paikgachha and Botiaghata of Khulna district, Khulna, located in the south-western region in Bangladesh. Khulna is situated between 21˚38' and 23˚10' north latitude and 88˚58' east latitude and is 12 ft. above mean sea level. This study was conducted in 4 types of areas namely high land, medium high land, medium low land and low land (shrimp farming area). The cultivators of the selected areas were treated as population of the study. Data were collected using random sampling technique where each farmer is considered as the sampling unit and each farmer was treated as active population of the study. A total of 91 respondents were selected randomly and the interview schedule (IS) contained both simple and direct forms of question to collect data on the selected variables. The interview schedule was pre-tested before final collection of data. The farmers' family was selected as respondents. Interviews were administrated on the respondents at their homes, field or market during their leisure period. Data were collected from the respondents during January to June, 2017.

Based on the practical and theoretical knowledge of CA, 10 characteristics of the farmers constituted the independent variables of the study. The characteristics of respondents which are treated as independent variables for the study were age, occupation, education, family size, experience in farming, annual income, farm size, organizational participation, Cosmo-politeness (A person who is cosmopolitan on his or ideas, life etc.), extension media contact and knowledge in vegetables cultivation using CA. Besides, data were also collected on the use of fertilizer and manures in the field, intercultural operation, pest and disease attack in the cultivation area.

The dependent variables of the study were the problems confrontated on conservation agri-culture practice and cropping pattern of the Khulna region. This problem was measured on the basis of their response to questions in the interview schedule.

In this study, problem confrontation score was computed for each respondent as ascertained from his responses. Each respondent was asked to indicate his problem against selected 14 issues. Cropping pattern means the proportion of land area under various crops at a point of time. Different crops are grown in rotation on this selected study areas are Dumuria, Paikgachha and Botiaghata.

After completion of survey all the interview schedules were compiled for its data processing. At the beginning of the data processing all the qualitative data were converted into quantitative form by means of suitable code and score whenever necessary. Local units were converted into standard units. In several instance, Indies and scales were constructed through the simple accumulation of scores assigned to individual or pattern of attributes. Indices and scales are considered the efficient instrument for data reduction and analysis. All personal traits were categorized and arranged in simple tables for interpretation and discussion. Number, frequency, percentage, mean and standard deviation were used as descriptive statistics.

3. RESULTS AND DISCUSSION

The data of this study are presented according to the objectives. This section is conveniently divided into three sections. The first section deals with the personal and socio-economic characteristics of the respondents. The second section isolates the problems faced by respondents and finally, the third section deals with existing cropping pattern present in Khulna region of Bangladesh following conservation agriculture.

3.1 Selected Characteristics of the Respondents

3.1.1 Age of the respondents

Based on age, the respondents were classified into three categories as shown in Table 1. The age the respondents ranged from 25-75 years. The data indicates that highest number of respondents (63%) belongs to the middle age group (31-50 years) and the lowest number of respondents (15%) followed by the young age group (below 30 years). Only 22% respondents are in the old age group. The mean and standard deviation of the respondents is about 42.57 and 9.27, respectively. Similar result was founded by

[12] in conservation agriculture practice and its impact on farmer's livelihood status in Bangladesh.

3.1.2 Level of education of the respondents

The education scores of the respondents ranged from 0-17 with a mean and standard deviation of 6.81 and 3.63, respectively. On the basis of education the respondents were classified into five categories shown in Table 1. The data revealed that the highest number of respondents (49.5%) has achieved secondary level of education followed by primary level (25.3%), higher secondary level (11%). The lowest number of respondents (2.2%) were graduate and above. Only 12% of the respondents were illiterate.

3.1.3 Family size

Data presented in the Table 1 indicates that most respondent (78.02%) belonged to medium sized family category followed by small size family (18.68%) while only 3.30% belong to large family sized category. The mean and standard deviation of the family size were 6.00 and 1.51, respectively.

3.1.4 Experience in farming

To measure experience, duration of involvement of the farmers in agriculture was considered. The mean and standard deviation of the experience in farming is 18.98 years and 8.42, respectively. Based on the experience in agriculture, the farmers were grouped into different categories as shown in the Table 1. The data shows that majority (47%) of the respondents had medium experienced and a very few (18%) had low experience. And the rest (35%) of the respondents was high experienced. So, the information seeking tendency of the farmers seem to be low to medium and similar trend observed by Dass [8] at the study of economic analysis of power tiller operated seeder operation at farm level.

3.1.5 Annual income of the farmers

On the basis of the family income the respondents, family was classified into three categories as shown in Table 1. The table shows that majority (58.24%) of the respondents were in income range of Bangladeshi Tk. 590-1200 followed by (24.18%) in the income range of Tk. <1200$ and the least (17.58%) were in the income range of Tk. <590$. Findings indicate that lower income group peoples are engaged in agriculture for increasing their income.

3.1.6 Farm size of the respondents

The mean value of farm size was 6 hectare with the standard deviation of 1.51. On the basis of their family size, the farmers were classified into five categories as shown in Table 1. The data were revealed that majority (45.05%) of the respondent belong to the small farmers, 32% marginal farmers, 12% medium farmers and 5 % was landless. The data also revealed that majority of the farmers of the study area were marginal to small farmers.

3.1.7 Extension media contact (year)

Respondents use various information sources and media to a different extent in order to receive agricultural information. The average and standard deviation of extension media contact score was found 9.42 and 5.44, respectively. Based on computed extension media contact score, the respondent were classified into three categories as shown in Table 1. Majority of the respondents (70.33%) had low media contact as compared to medium contact (27.47%) and high contact (2.20%). Respondent's exposure to a variety of information sources usually guides them to identify problems in vegetable cultivation and how to solve the identified problems.

3.1.8 Organizational participation

Depending on the individual organizational participation scores, the respondents were grouped into the following categories as shown in Table 1. The data revealed that majority of the respondents (76.93%) have low organization participation followed by medium participation (23.08%). The mean and standard deviation of organization participation was found 1.97 and 2.31, respectively.

3.1.9 Cosmopoliteness (A person who is cosmopolitan on his or ideas, life etc.)

The mean and standard deviation of cosmopoliteness scores of the respondents was 5.64 and 2.19, respectively. Based on Cosmopoliteness score, respondent were classified into three categories as shown in the Table 1. The data revealed that majority (58%) of the respondents had low cosmopoliteness. Only 3% of the respondents are highly cosmopolite

while 39% of the respondents had medium cosmopoliteness.

3.1.10 Use of conservation agriculture (CA) for Vegetable Cultivation

Based on use of conservation agriculture, farmers were classified into two categories as shown in Table 1. Ninety percent (90%) of the people use conservation agriculture for vegetable cultivation. Only 10% of the respondents cannot use conservation agriculture for vegetable cultivation. The mean and standard deviation of the use of conservation agriculture were 45.50 and 51.61, respectively.

3.1.11 Use of fertilizers and manures

Also observed was that most of the respondents used fertilizer and manures in their vegetables cultivation. Among the 91 respondents, 87 stated that they use urea while 87, 87, 84, 43, 24, 13 respondents used manures, TSP, MoP, gypsum, zinc and boron, respectively. The mean and standard deviation of utilization of fertilizers and manures respectively was 60.71 and 33.05 (Table 2).

3.1.12 Intercultural operation

Intercultural operations adopted by the respondents are shown in the Table 3. Among the 91 respondents, 78 respondents stated that they used weeding while 77, 14, 75, 65, 67, 42, 34, 27 and 6 respondents used irrigation, mulching, spading, disease control, insect control, thinning, pruning, inter-cropping and other intercultural operation for conservation agriculture. For traditional agriculture (TA) 84 respondents used weeding while 84, 61, 83, 82, 82, 52, 53, 41 and 11 respondents used irrigation, mulching, spading, disease control, insect control, thinning, pruning, inter-cropping and other intercultural operation. The mean of intercultural operation for CA and TA were 48.4 and 63.3, respectively. The standard deviation of CA and TA were 27.48 and 24.53, respectively.

3.1.13 Disease infestation in the vegetables cultivation

The disease infested in vegetable cultivation of the study area has been presented in Table 4. The data revealed that leaf rot is the most occurring disease in the vegetables cultivation noted by 43 respondents out of 91 respondents followed by root rot (29), fruit rot (31), brown spot (11), fungi (27), black spot (6) and late blight (13).

3.1.14 Insects infestation in vegetables cultivation

The occurrence of insect infestation is shown in the Table 5. Among the 91 respondents, 45 stated that most vegetables were infested greatly by rice brown plant hopper (current poka) followed by stem borer (31), dragon and damsel fly (3), aphid (22), termite (17) and fruit borer (11).

3.2 Problem Confrontation Related to Agriculture

The respondents gave their opinion about different problems confronted by them. The study revealed that the main problems of agriculture in Khulna region are the salinity (61.54%), lack of activities of extension workers (49.45%), high incidence of insect (29.67%), lack of knowledge (28.57), natural calamities (16.48%) etc. On the basis of problem confrontation score the respondents were classified into three categories which are shown in Table 7.

The data revealed that total 59 (64.84%) of the respondents were under medium problem confrontation, 21.98% were under low problem confrontation and 13.19% were under high problem confrontation. The respondents gave their opinion about the probable solution to the problems; which were ensuring adequate seed and seedlings, ensuring sufficient amount of insecticides and pesticides at reasonable price, ensuring high quality fertilizers, increase irrigation facilities etc. The score of problem confrontation had a mean value of 30.33 and standard deviation of 25.15.

3.3 Cropping Pattern in the Khulna Region Following Conservation Agriculture

This section was measured in four different types of study area such as high land area, medium high land area, medium low land area and low land area. Among the 91 respondents, 85.71% of the respondents produce crops in medium high land, 10.99% and 3.30% respondents produce crops in high and medium low land, respectively. The low land in the Khulna region was used for shrimp farming. In this four types land, crops are produced in three season in a year over summer and winter season.

Table 1. Selected characteristics of the respondents

Selected characteristics	Categories	Score	Respondents-91		Range	Mean	Standard deviation
			No.	Percentage			
Age (Year)	Young aged	Up to 30	14	15.00	25-75	42.57	9.27
	Middle aged	31-50	57	**63.00**			
	Old aged	>50	20	22.00			
Education (Class)	Illiterate	0	11	12.00	0-17	6.81	3.63
	Primary	1-5	23	25.30			
	Secondary	6-10	45	**49.50**			
	Higher secondary	11-12	10	11.00			
	Above higher secondary	>12	2	2.20			
Family Size	Small	<4	17	18.68	3-12	6.00	1.51
	Medium	5-8	71	**78.02**			
	Large	>8	3	3.30			
Experience in Farming	Low experience	<10	16	18.00	3-42	18.98	8.42
	Medium experience	11-20	43	47.00			
	High experience	>20	32	35.00			
	Low income	<580	16	17.58			
Annual Income ($)	Medium income	580-1200	53	58.24	34000-215000	92417.5	46372.66
	High income	>1200	22	24.18			
	Low contact	<10	64	70.33			
Extension Media Contact	Medium contact	11-20	25	27.47	2-24	9.42	5.44
	High contact	>20	2	2.20			
	Low participation	>5	70	76.92			
Organizational participation	Medium participation	6-10	21	23.08	0-7	1.97	2.31
	High participation	<10	0	0.00			
	Low cosmopoliteness	< 5	53	58.00	3-13	5.64	2.19
Cosmopoliteness	**Medium cosmopoliteness**	6-10	36	39.00			
	High cosmopoliteness	>10	2	3.00			
Use of CA	**Don't Use CA**		82	90.00		45.50	51.61
	Use CA		9	10.00			

Table 2. Use of fertilizers and manures by the respondents

Fertilizer name	Frequency	Percentage (%)	Mean	Standard deviation
Manure	87	96		
Urea	87	96		
TSP	87	96		
MOP	84	92		
Gypsum	43	47	60.71	33.05
Zinc	24	26		
Boron	13	14		

Table 3. Intercultural operation practices followed by the respondents

Name of intercultural operation	Frequency				Mean		Standard deviation	
	Conservational agriculture (CA)	Percentage (%)	Traditional agriculture (TA)	Percentage (%)	CA	TA	CA	TA
Wedding	78	85.71	84	92.31				
Irrigation	77	84.62	84	92.31				
Mulching	14	15.38	61	62.03				
Spading	75	82.42	83	91.21				
Disease control	65	71.43	82	90.11				
Insect Control	67	73.63	82	90.11				
Thinning	42	46.15	52	57.14	48.4	63.3	27.48	24.53
Pruning	34	37.36	53	58.24				
Inter-cropping	27	29.67	41	45.05				
Others	5	5.9	11	12.09				

Table 4. Status of disease infestation in vegetables cultivation

Disease name	Frequency	Percentage (%)	Mean	Standard deviation
Leaf Rot	43	47		
Root Rot	29	21		
Fruit Rot	31	34		
Brown Spot	11	12		
Fungi	27	30	22.86	12.22
Black Spot	6	7		
Late Blight	13	3		

Table 5. Status of insect infestation

Disease name	Frequency	Percentage (%)	Mean	Standard deviation
Stem Borer	31	34		
Rice brown plant hopper	45	49		
Dragon and Damsel Fly	3	3		
Aphid	22	24	21.5	14.94
Termite	17	19		
Fruit Borer	11	12		

3.3.1 High land

Among the 91 respondents, only 10 respondents stated that they produce crops on high land topography. During summer season, 100% (N=10) of the respondents cultivate paddy followed by 20% brinjal, 10% cultivate papaya, pointed gourd and turmeric. The crop rotation used in high land ranged from 1-10 (Number of respondents) with a mean and standard deviation of 2.6 and 3.05, respectively. Based on land topography, crops were cultivated in summer season as shown in Table 8.

In summer season, 40% (N=10) respondents cultivate bitter gourd where as 30% cultivate brinjal and 10% cultivate chili pepper. The mean and standard deviation found in summer season was 2.67 and 1.53, respectively. Based on land topography, crops group in summer season are shown in Table 8.

Table 6. Types of problems faced by the respondents

Sl. No	Name of the problem	Types of problem						Total percentage (%)
		Very severe	Severe	Moderately severe	Less severe	Very less	No Problem	
1	Lack of seed	6.59 (6)*	71.4(65)*	21.98(20)*				100 (91)*
2	High Price of seed	9.89(9)*	62.64(57)*	23.07(21)*	4.39(4)*			100 (91)*
3	Lack of Fertilizer	4.39 (4)*	63.74(58)*	27.47(25)*	2.20(2)*	2.20 (2)*		100 (91)*
4	High Price of Fertilizer	18.68(17)*	52.74(48)*	20.88(19)*	5.49(5)*	2.20(2)*		100 (91)*
5	Impurity of Insecticides/ Pesticides	2.20 (2)*	25.27(23)*	57.14(52)*	12.09(11)*	3.30(3)*		100 (91)*
6	High price of Insecticides/ Pesticides	6.59(6)*	25.27(23)*	37.36(34)*	18.68(17)*	12.09 (11)*		100 (91)*
7	High Incidence of Insect	29.67(27)*	51.65(47)*	9.89(9)*	6.59(6)*	2.20 (2)*		100 (91)*
8	Lack of Irrigation water	9.89(9)*	57.14(52)*	18.68(17)*	12.09(11)*	4.40(4)*		100 (91)*
9	Salinity	61.54(56)*	29.67(27)*	8.79(8)*				100 (91)*
10	Lack of land due to Shrimp Culture	5.49(5)*	47.25(43)*	19.78(18)*	17.58(16)*	3.30(3)*	6.59(6)*	100 (91)*
11	Salinity due to Shrimp Culture	8.79(8)*	16.48(15)*	28.57(26)*	35.16(32)*	7.69(7)*	3.30(3)*	100 (91)*
12	Lack of Knowledge	28.57(26)*	36.26(33)*	15.38(14)*	17.58(16)*	2.20(2)*		100 (91)*
13	Activities of extension worker	49.45(45)*	31.87(29)*	16.48(15)*	2.20(2)*			100 (91)*
14	Land become dry	14.29(13)*	39.56(36)*	25.27(23)*	20.88(19)*			100 (91)*
15	Natural calamities	16.48(15)*	34.07(31)*	30.77(28)*	14.29(13)*	4.40(4)*		100 (91)*
16	Others							
	Mean	16.53	39.13	21.93	11.85	4	4.5	
	Standard Deviation	15.79	14.96	10.82	8.45	2.91	2.12	

** indicate the number of respondents*

Table 7. Distribution of respondents according to their problem confrontation score

Categories	Score	No of farmers	Percentage (%)	Mean	Standard deviation
Low problem confrontation	<20	20	21.98		
Medium problem confrontation	20-30	59	64.84		
High problem confrontation	>30	12	13.19	30.33	25.15
Total		91	100		

Table 8. Distribution of crops in summer and winter season on high land

Season	Crop Name	Frequency (N=10)	Percentage (%)	Mean	Standard Deviation
	Papaya	1	10		
	Pointed Gourd	1	10		
Kharif 1	Turmeric	1	10	2.6	3.05
	Dhan(Paddy)	8	80		
	Brinjal	2	20		
	Bitter gourd	4	40		
Kharif 2	Brinjal	3	30	2.67	1.53
	Chilli	1	10		
	Tomato	10	100		
	Red Amaranth	2	20		
	Chilli	2	20		
	Yard Long Bean	1	10		
	Aus(paddy)	5	50		
	Broad bean	1	10		
Winter	Cabbage	3	30	2.55	2.77
	Pumpkin	1	10		
	Bottle gourd	1	10		
	Mustard	1	10		
	Cauliflower	1	10		

Data presented in the Table 10 revealed that winter crops cultivated by the respondents ranged from 1-10 (number of respondents) with a mean value and standard deviation of 2.55 and 2.77, respectively. Among 10 respondents, 100% (N=10) of the respondents cultivate tomato in winter season followed by 20% that cultivate red amaranth and chilli pepper, 50% cultivate summer paddy (aus), 30% cultivate cabbage and 10% cultivate yard long bean, broad bean, pumpkin, bottle gourd, mustard and cauliflower in high land. Based on land topography, crops were cultivated in winter season as shown in Table 8.

3.3.2 Medium high land

Also observed was that majority of the respondents (N=78) used medium high land for cultivation of crops. Among the 78 respondents, 32 respondents cultivate paddy while 13, 10, 8, 6, 5, 4, 3, 2 and 1 respondents cultivate brinjal, turmeric, lady's finger, jute, Indian spinach, wheat, cucumber, pumpkin, respectively during summer season on medium high land. Data presented in the Table 4. 20 indicate that the summer crops cultivated by the respondents ranged from 1-32 (Respondents number) with a mean value and standard deviation of 6.06 and 7.72, respectively. Based on land topography, crops were cultivated in summer season as shown in Table 9.

At summer season, 32 respondents cultivate paddy followed by 11 respondents that cultivate BRRI Dhan-28, 7 respondents cultivate indian spinach. Data in Table 9 indicate crops that are cultivated by the respondents in summer season on medium high land with a mean value and standard deviation of 5.83 and 8.81, respectively.

During winter season, farmers cultivate winter crops for local demand. Among 78 respondents, 43.59% respondents cultivate tomato, 29.48% produce red amaranth, 33.33% produce chili, 26.92% produce cauliflower, 28.21% produce potato, 21.79% produce cauliflower. Data presented in the Table 9 indicate the crops that were cultivated in winter season on medium high land topography.

3.3.3 Medium low land

Among the 91 respondent, only three respondents (N=3) used medium low land for cultivation of crops. Among 3 respondents, 100% (N=3) of the respondents cultivate paddy in summer season. They also produce indian spinach, banana, paddy (aus), lady's finger in summer season. Data presented in Table 10 indicate the crops cultivated by respondents ranged from 1-3 (Number of respondents) with a mean and standard deviation of 1.6 and 0.89.

Table 9. Distribution of crops in summer and winter season on medium high land

Season	Crop Name	Frequency (N=78)	Percentage (%)	Mean	Standard deviation
Kharif 1	Dhan(paddy)	32	41.03		
	Cucumber	3	3.85		
	Chilli	3	3.85		
	Indian Spinach	5	6.41		
	Brinjal	13	16.67		
	Onion	2	2.56		
	Yam	3	3.85		
	Turmeric	10	12.82		
	Lady's Finger	8	10.26		
	Shak	1	1.28	6.06	7.72
	Potato	2	2.56		
	Till	1	1.28		
	Jute	6	7.69		
	Bitter gourd	3	3.85		
	Wheat	4	5.12		
	Pumpkin	1	1.28		
Kharif 2	BRRI Dhan- 28	11	14.10		
	Dhan(paddy)	32	41.03		
	Lady's Finger	1	1.28		
	BRRI Dhan-52	1	1.28		
	Shak	6	7.69		
	Long yard Bean	2	2.56		
	Broad Bean	2	2.56	5.83	8.81
	Indian Spinach	7	8.97		
	Sunflower	1	1.28		
	Chilli	1	1.28		
	Jute	2	2.56		
	Bitter gourd	4	5.12		
Winter	Broad Bean	4	5.12		
	Indian Spinach	7	8.97		
	Khesarie	16	20.51		
	Cauliflower	21	26.92		
	Red amaranth	23	29.48		
	Sunflower	11	14.10		
	Tomato	34	43.59		
	Chilli	26	33.33		
	Brinjal	16	20.51	14.75	8.64
	Potato	22	28.21		
	Cabbage	17	21.79		
	Till	6	7.69		
	Bitter gourd	6	7.69		
	Turnip	6	7.69		
	Bottle gourd	11	14.10		
	Pumpkin	10	12.82		

Table 10. Distribution of crops in summer and winter season on medium low land

Season	Crop name	Frequency (N=03)	Percentage (%)	Mean	standard deviation
Kharif 1	Dhan(paddy)	3	100		
	Indian Spinach	1	33.33		
	Banana	2	66.67	1.6	0.89
	Dhan(Aus)	1	33.33		
	Lady's Finger	1	33.33		
Kharif 2	BRRI dhan 28	1	33.33		
	Aman-30	2	66.67		
	Lady's Finger	1	33.33	1.33	0.58
Winter	Mustard	1	33.33		
	Tomato	3	100		
	Potato	3	100		
	Spinach	2	66.67	2.2	0.84
	Red Amaranth	2	66.67		

In summer season, 2 respondents cultivate aman-30, 1 respondent cultivate BRRI dhan-28 and 1 respondent cultivate lady's finger. Data presented in the Table 10 indicate that the crops cultivated by the respondents ranged from 1-3 (Number of respondents) with a mean value and standard deviation of 1.33 and 0.58.

During winter season, majority (100%) of the respondents cultivate tomato, potato followed by spinach (66.67%), red amaranth (66.67%) and mustard (33.33%), respectively. Based on medium low land topography, crops were cultivated in winter season as shown in Table 10.

4. CONCLUSION

This study concluded that higher CA practices induced higher cropping intensity and farm income. Findings of the study shows that the highest number of the respondent farmers were middle aged having small family with small farm sized with low cosmopoliteness and low organization participation. About half of the respondent's secondary level of education. Majority of the respondents were in high income range and medium experience in farming. Highest number of the respondents used fertilizers and manure and different intercultural operations and takes control measures against disease and insect infestation. Households in Khulna region practice this method more than other regions. Some constraints and opportunities of CA were reported by farmers in the study areas. If these problem will be identified carefully, CA can be established in the coastal region of Bangladesh.

On the basis of the outcome of this experiment, promotion of knowledge on the benefits of CA technologies should be ensured through training by DAE (Department of Agricultural Extension) and local NGOs. In addition, government should come forward and be responsible to provide agro-machineries and other facilities through local workshop at reasonable price. Finally, further research on crop rotation and cropping patterns for harvesting the benefits of CA technologies is also suggested.

CONSENT AND ETHICAL APPROVAL

As per university standard guideline participant consent and ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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