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Keywords: socioeconomic, impacts, mustard, inclusion, field study, boro rice, farming.

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Influencing of Socioeconomic Impacts Through Mustard Inclusion in Fellow Period Preceding Boro Rice Farming of Bangladesh: A Field Study

Running title: Socioeconomic Impacts on Mustard Inclusion

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Abstract- An endeavor was made in this study to evaluate the Socioeconomic impacts of farmers' influencing through mustard inclusion in the fallow period preceding Boro rice farming in study area namely Mymensingh, Jamalpur and Tangail districts of Bangladesh. Field level data were collected by face to face interview using pre-tested questionnaire from 90 respondent farmers' who were belonged to small, medium and large farm households, a school teacher and businessman while secondary data collected from printed documents such as DAEDAE-Department Agricultural Extension (www.dae.gov.bd) progress reports and other development statistics. Considering the over locations dominant cropping pattern was found Fallow-BRRI dhan28 (Boro rice)-BRRI dhan49 (T. Aman rice) followed by BARI Sarisha-14-BRRI dhan29 (Boro rice)-BRRI dhan49 (T. Aman rice). The farmers' who were cultivated the mustard crop preceding Boro rice farming achieved the maximum profitability $ 1218.1 ha-1 in Tangail region followed by in Mymensingh region profitability was $ 1114.5 ha-1 which were from 39.0% to 48.0% higher profitability than non-mustard farmers'. The traditional cropping system shifted to profitable cropping system through the inclusion of mustard crop. Hence, there is enough scope of cultivation high yielding mustard crop in the Fallow period preceding Boro rice farming by which 24.4% respondent of the surveyed areas may fetch a higher income of the farm families.

Keywords: socioeconomic, impacts, mustard, inclusion, field study, boro rice, farming.

I. Introduction

For establishment of new roads and highways, buildings, industries, markets, crop land of Bangladesh (Extends from 20°34′ North Latitude to 26°38′ North Latitude and from 88°01′ East Longitude to 92°41′ East Longitude) has declined by 68,760 ha year^{-1} (0.73%) since 1976 (Hasan et al. 2013). These will cause serious shortage of cultivable land for crop production and a severe food shortage to feed the increased population in the near future.

So, to feed the increased population production potentiality of different crops must be increased through the development of new varieties, improved cropping pattern, intercropping practices, etc. Increasing the cropping intensity through the development of improved cropping system by the selection of suitable crop varieties would be one of the methods. Farmers usually prefer the patterns which involve fewer risks and offer the best economic returns for investment. Most of the cropping patterns in Bangladesh are based on rice or have rice in common with other crops (Alam et al. 2011). Most observable cropping patterns are Aus rice/Jute-Fallow-Rabi crops, Aus rice/Jute-Aman rice-Fallow, Aus rice/Jute-Aman rice-Rabi crops, Fallow-Aman rice-Fallow, Mixed Rice-Rabi crops, Rice (B. Aman)-Fallow-Rice (Boro), Fallow-Rice (Boro)-Rice (T. Aman), Mixed Aus rice and other *Kharif* (wet season) crops (Jhum cultivation) are generally practice in Bangladesh. From the above cropping pattern, it is identified that the aristocratic crop mustard as conjunction crop between T. Aman and Boro is very negligible. Bangladesh Rice Research Institute (BRRI; www.brri.gov.bd) has developed several improved Aman and Boro rice varieties along with their optimum sowing and harvesting time for farm-level cultivation. A large number of local rice varieties are available in the markets which are also practicing by the farmers.

Farming System Research and Development Programme (FSRDP, 1987) found that the farmers' were continuously changing cropping pattern keeping Aman rice in constant. For this reason, farmers' were changing the Aman rice varieties which face relatively less natural hazard and uncertainty. On the other hand, assuming that the area of improved mustard varieties is gradually increasing and local varieties area is decreasing year after year might be due to the development of wide yielding mustard varieties by the different research organization.

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The earlier study was conducted by Akter et al. (2010) and Miah and Alam (2008) respectively on the adoption status of BARIBARI-Bangladesh Agricultural Research Institute, (www.bari.gov.bd) released mustard varieties and relative profitability and farmer's attitude toward BARI's mustard cultivation in some areas of Bangladesh and they found the positive attitude and profitability from the respondent farmers' through the farming of mustard preceding Boro rice farming.

Mustard which is a leading oilseed crop, contributing to more than 60% of the total oilseed production in Bangladesh providing calories and aiding in digestion of several fat-soluble vitamins, for example, Vitamin A (National Research Council, 1989). For maintaining good health, at least, 15% of the total calories must come from visible and invisible oils or fats. Some oilseeds are also a source of good quality protein, vitamins, and fuel.

Many areas of the country new numbers of cropping pattern are being practiced by the farmers' because the rate of expansion depends on yield and profit potentiality of the cropping systems. Khan et al. (2017) revealed that the highest gross return and gross margins were respectively $ 4248.7 and $ 2010.7 ha^{-1} which were 80% and 207% higher due to the inclusion of mustard between two rice crops. Similarly, Paul et al. (2016) opined that based on benefit-cost ratio (BCR) most profitable cropping patterns was Mustard-Jute-T. Aman rice. Further, relevant information on the adoption rate of local and high yielding Aman and Boro rice, mustard varieties, their sowing and harvesting situation, constraint in mustard production of the study areas is very scanty and sporadic. Therefore, it was needed to identify the farming system of the study areas from which farmers' will be benefited by gathering information on high yielding and local varieties for adopting at farm level that will influence the social impacts. Therefore, the present study was conducted to fulfill the following objectives;

i. To observe the shifting rate of socioeconomic impressions of farmers' influencing by mustard inclusion preceding Boro rice farming
ii. To identify the farm-level adoption of Aman and Boro rice, mustard varieties along with their planting and harvesting time
iii. To categorize the possible limitations for the adoption of mustard crop preceding Boro rice farming
iv. To find the present dominant rice-based cropping pattern(s) in the study areas and economic profitability.

II. Materials and Methods

It is an empirical study based on collected primary data from the selected district farmers' who cultivated the T. Aman (wet season rice) and Boro rice (dry season rice) dominantly. Previously, secondary data of selected districts were collected from printed report of DAE and other Non-Government Organization (NGO).

a) Selection of Study Area and Study Period

Based on easy access for the researcher (communication facilities) and less prone to natural calamities Mymensingh Sadar and Muktagachha from Mymensingh district, Jamalpur Sadar and Melandaha from Jamalpur district, Mirzapur and Delduar Upazila from Tangail district selected for this study. Geographically Mymensingh district lies between $24^0 15'$ and $25^0 15'$ North and $90^0 49'$ East longitudes, Jamalpur district lies between $24^0 34'$ and $25^0 26'$ North latitudes and between $40^\circ 89'$ and $12^\circ 90'$ East longitudes and Tangail district lies between $24^\circ 01'$ and $24^\circ 47'$ north latitudes and between $89^\circ 44'$ and $90^\circ 18'$ east longitudes. The study was based on the farm level as well as the market level and conducted during the period from June 2014 to October 2014.

b) Sample Size and Sampling Technique

A purposive sampling technique was adopted in this study to select the respondent farmers' of Fallow /Mustard-Boro rice-T. Aman rice cropping pattern to know the existing crop varieties practiced under this pattern, their planting and harvesting time at farmers' level, dominant cropping system and as well as economic profitability. In the first stage of sampling, three mustard growing districts between T. Aman and Boro rice, namely Mymensingh, Jamalpur and Tangail selected based on high, medium, and low-intensity area. In the second stage, two Upazilas carefully chose from each district. In the third stage, a total of 90 farmers, taking 15 farmers from each Upazila were chose by random sampling technique.

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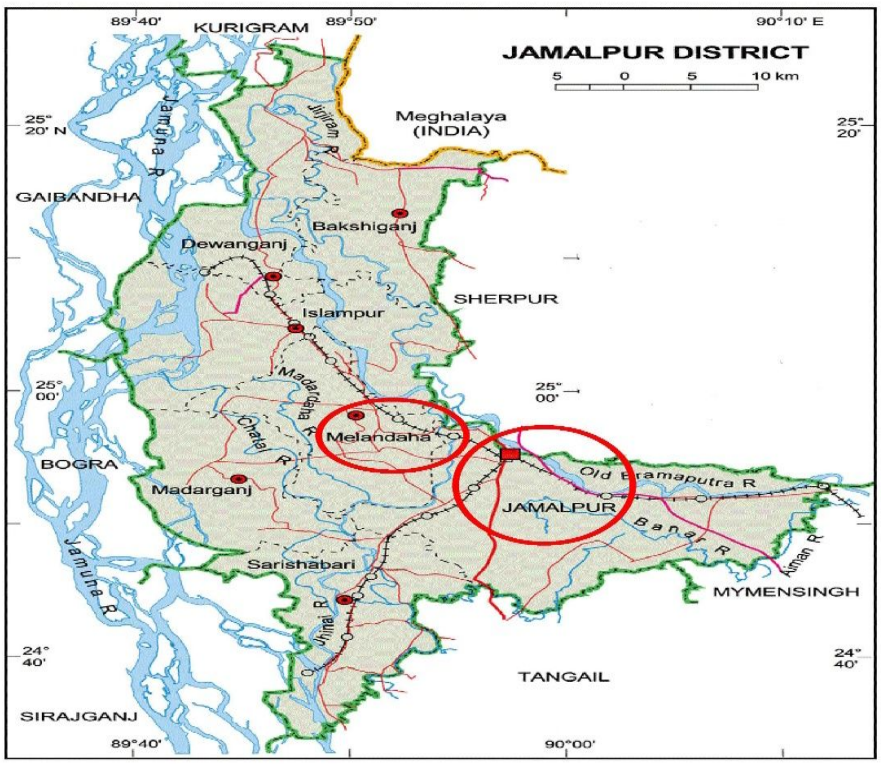

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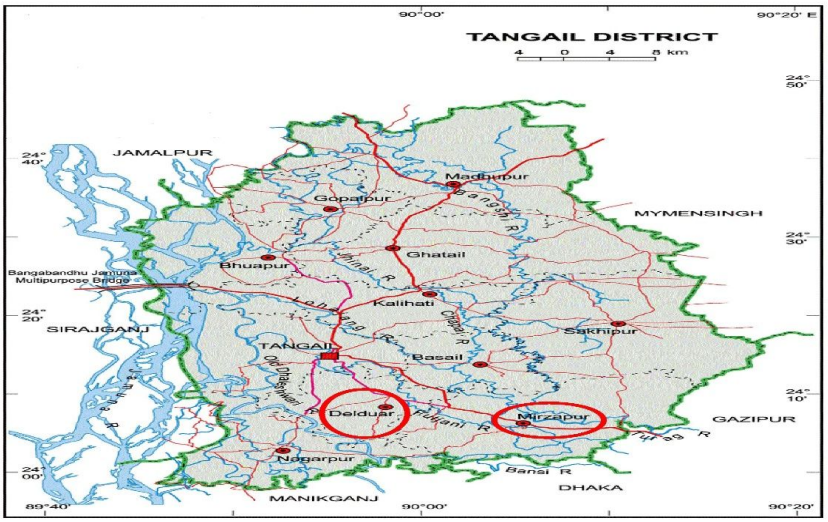

(Source: https://www.thebangladesh.net/mymensingh-district.html#maps, https://www.thebangladesh.net/jamalpur-district.html# maps, https://www.thebangladesh.net/tangail-district.html#maps

Figure 1: Map of the surveyed district of Bangladesh indicating surveyed Upazila within the circle

c) Preparation of Interview Schedule

A preliminary interview schedule planned to collect data from the respondents. The introductory interview schedule contained the socioeconomic profile of the respondents, the existing crop varieties and their sowing and harvesting time, dominant cropping pattern, cost and return of Mustard inclusion in the preceding period of Boro rice farming.

d) Methods of Data Collection

The researcher himself collected field-level data by face to face interview using a preliminary interview schedule. The unit of data collection was multiple plots of each selected farmers, where detailed information regarding Mustard/Fallow-Boro rice-T. Aman rice cropping pattern was taken, and these data analyzed on a hectare basis. Data about existing cultivated variety, cost of input, market price, yield, etc considered.

e) Analytical Techniques

The collected data were scrutinized, edited, summarized, tabulated, and analyzed to fulfill the objectives of the study. Profitability studies of Fallow/Mustard-Boro rice-T. Aman rice cropping patterns were estimated using the cost of cultivation (based on farmers' information), gross return (based on local market price), and profit analysis.

Gross return (GR) was calculated multiplying the total output of an enterprise by the average market price during the harvesting period. The following equation was used to estimate Gross return.

$$GRi \sum_{i=1}^{n} QiPi$$

Where, GR_i= Gross return from the ith product ($ ha^{-1}), Q_i= Quantity of the ith product (kg), P_i= Average price of the ith product ($), i=1, 2, 3

Gross margin is an estimate of the difference between total return and variable costs.

i.e, GM= TR-VC

Where, GM= Gross margin

TR= Total return

VC= Variable cost

III. Result and Discussion

a) Socioeconomic Profile of sampled farmers'

Age is the important factors that were about individuals in qualities make up, his need, and way of thinks and behaves that are all closely related to the whole life (Smith and Zope, 1970). In the study areas, the highest percentage of farmers' (43.3%) was in the age group of 41-50 years in Mymensingh region. The lowest percent of the farmers' (10%) were under the age group of up to 30 and 31-40 years in Mymensingh region. On an average of the three locations, the highest respondent farmers' (31.1%) were under the middle age group of 41-50 years (Table 1). If these young aged respondents would be trained, motivated, and guided, they would be able to struggle against poverty by engaging themselves in employed occupation.

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Education is a vital factor that makes the farmers' to access the relevant technical expertise and scientific information. The study revealed that the highest percentage of illiterate farmers found in Mymensingh region (30%) followed by Jamalpur region (13%). Mean of all locations indicated that 18 percent of respondents had at the secondary, 23 percent at SSC, 4 and 8 percent had at HSC, and graduate and above level education (Table 1). Ray (1998) defined the main occupation as the work for a man who has engaged him throughout the year. The survey results reflected that on an average of three locations, 69 percent of farmers solely engaged in Agriculture (Table 1). But small/medium farmers' with their small land cannot survive on agriculture alone. For this reason, they have to go for subsidiary/off-farm activities for supplementing the family income. For this reason, some of the respondents were found to depend on business. On an average of three surveyed areas, the farm family size practicing Mustard/Fallow-Boro rice-T. Aman rice cropping pattern was 5.44 members (Table 1) while it was 5.89 in Tangail region, 5.40 in Mymensingh region, and the lowest 5.05 in Jamalpur region.

b) *Aman varieties cultivated by the sampled farmers of the surveyed areas*

To choice, a crop or variety, different factors like prevailing farm condition, varietal adaptability, resistance to pests and diseases and marketability and profitability should be taken into consideration. From the survey program, it reflected that the high yielding T. Aman rice variety BRRI dhan49 was cultivated in the 47 percent of respondent in Mymensingh region followed by Madhobi and Hari dhan (e.g.; dhan is Bengali word and Rice is English word) was cultivated by 33.3 and 30 percent of respondents respectively. Similarly, in Mymensingh region, the variety BRRI dhan49 occupied the highest 28.1% land (DAE, 2014). In Jamalpur region, the local variety Hari dhan (e.g.; dhan is Bengali word and Rice is English word) was cultured by 47 percent respondent farmers followed by HYVHYV-High Yielding Variety BRRI dhan49 was practiced in 43 percent respondent whereas in Tangail region, 90 percent respondent farmers adopted BRRI dhan49. Thus BRRI dhan49 was found as the most prominent Aman rice variety. Within the sampled farmers from 3 to 13 percent respondent cultivated BRRI dhan30, Gutishurna, Kalijira, Binadhan-7, Kartikzone, Lalchamara, etc. (Table 2).

c) *Sowing and harvesting time of cultivated Aman rice varieties by the respondent farmers' of Mustard-Boro rice-T. Aman rice or Fallow-Boro rice-T. Aman rice cropping pattern in surveyed areas*

The sowing and harvesting time of any crop depends on rainfall, irrigation facilities, soil condition, and other climatic factors. Sowing time is an important factor for getting better yield, to fit the new crop in a cropping pattern to increase the cropping intensity. The survey results revealed that in Mymensingh region 100 percent respondent farmers' sowed the high yielding and long duration local Aman rice varieties (e.g., BRRI dhan49, Hari Dhan, Madhobi, Gutishurna, and Kalijira) before BRRI recommended time and harvest the local varieties in recommended time and High yielding varieties in before recommended time. In Jamalpur region, 57 percent of respondents reaped the local Aman rice variety ''Hari Dhan'' (e.g., Dhan is Bengali word and Rice is English word) after the recommended time. In Mymensingh and Jamalpur regions, 100 percent of respondents sowed the variety Pajam (e.g, name of rice variety) and BRRI dhan49 before the recommended time and also harvested them earlier than the recommended time. While in Tangail region 62.9 percent of respondent sowed the seeds of BRRI dhan49 before the recommended time and 37 of percent respondent in the recommended time. But the 100 percent of respondents harvested this variety before the recommended time. It might be due to non-photosensitivity character. On the other hand, BR10, BR11, and BRRI dhan30 are less-photosensitive varieties, and in the surveyed areas, 100 percent of respondent sowed and harvested these crops in recommended time (Table 3).

d) *Mustard and non-mustard growing farmers in the surveyed areas*

The survey revealed that in Tangail region, 18 respondents (60%) engaged themselves in mustard production in between T. Aman and Boro rice, and it was followed in Mymensingh region. Data showed that in Jamalpur region, there were the lowest six respondents (20%) engaged themselves in mustard production among the surveyed farmers (Figure 2).

e) *Problems of mustard production between T. Aman and Boro rice*

The survey result revealed that on an average of three locations, 43.0 percent of respondent opined that poor yield, low price of seeds are the problem for mustard cultivation. On an average of 28% respondent opined that transplantation of Boro becomes late due to mustard cultivation. In Mymensingh and Jamalpur regions, 11% and 13% respondents opposed the mustard cultivation for lack of short duration improved variety. In Jamalpur and Tangail regions, 8% and 17% respondent farmers opined that the lands are not suitable for mustard cultivation (Table 4).

f) *Name of Boro varieties, their seeding and harvesting time by the respondent farmers' in the surveyed areas*

The survey result revealed that during the Boro season BRRI dhan28, BRRI dhan29, Pajam, Hybrid

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variety Hira was cultivated by the respondent farmers' after harvest of mustard or T. Aman rice. Among the above mentioned Boro varieties in Tangail region, 100 percent of respondents cultured the BRRI dhan29 followed by Mymensingh region. On average, 64% of respondents refined BRRI dhan28 in Mymensingh and Jamalpur regions. Considering the Over locations, 1-2 percent of respondents adopted different hybrid varieties during Boro season (Table 5). On an average of Mymensingh and Jamalpur region, 77% of respondents cultivated the variety BRRI dhan28 at the recommended time. But 94% of respondents harvested them after the recommended time. Similarly, the highest 82% (mean of three locations) of respondents cultivated the variety BRRI dhan29 at the recommended time. But 70% of respondent harvested in the recommended time. Also, the 20% and 28% of respondents harvested the BRRI dhan29 at before the recommended and after the recommended time respectively (Table 6).

g) Dominant rice-mustard based cropping patterns followed in the study areas

The survey result revealed that there were twenty-six, rice-mustard based cropping patterns in the where the survey was conducted. Alone in Mymensingh district, the dominant cropping pattern was Fallow-BRRI dhan28-BRRI Dhan49 (30%) followed by Fallow-BRRI dhan29-Madhobi (27%). Cropping patterns Fallow-BRRI dhan28-Hari Dhan and Fallow-BRRI dhan29-Hari Dhan moderately adopted by the respondent farmers in the Mymensingh region. As like as Mymensingh region Fallow-BRRI dhan28-BRRI Dhan49 cropping pattern was dominantly adopted by the farmers of Jamalpur region followed by Fallow-BRRI dhan29-Hari Dhan cropping pattern. In Tangail region BARI Sarisha-14-BRRI dhan29-BRRI dhan49 cropping pattern dominantly adopted by the respondent farmers. On an average of three locations, the dominant cropping pattern found Fallow-BRRI dhan28-BRRI Dhan49 followed by BARI Sarisha-14-BRRI dhan29-BRRI dhan49. In Mymensingh and Jamalpur regions Fallow-BRRI dhan29-Hari Dhan was a promising cropping pattern (Table 7).

Table 1: Socioeconomic profile of the sampled farmers collected through field survey 2014

Profile	Mymensingh (n = 30)		Jamalpur (n = 30)		Tangail (n = 30)		All areas (n = 90)	
Age group (years)	Number of farmers	Percentage	Number of farmers	Percentage	Number of farmers	Percentage	Number of farmers	Percentage
Up to 30	3	10.0	4	13.3	6	20.0	13	14.4
31-40	3	10.0	4	13.3	4	13.3	11	12.2
41-50	13	43.3	8	27.0	7	23.3	28	31.1
51-60	4	13.3	7	23.3	9	30.0	20	22.2
61-above	7	23.3	7	23.3	4	13.3	18	20.0
Total	30	100	30	100	30	100	90	100
Educational level								
Illiterate	9	30.0	4	13.0	2	7.0	15	17.0
Primary	11	36.6	4	13.0	12	40.0	27	30.0
Secondary	3	10.0	9	30.0	4	13.0	16	18.0
SSC	5	16.6	5	17.0	11	37.0	21	23.0
HSC	0	0.0	3	10.0	1	3.0	4	4.0
Graduate and above	2	6.66	5	17.0	0	0.0	7	8.0
Total	30	100	30	100	30	100	90	100
Occupational status								
Agriculture	21	70.0	26	87.0	15	50.0	62	69.0
Agriculture + Business	9	30.0	4	13.0	14	47.0	27	30.0
Agriculture+ Van/Auto puller	-	-	-	-	1	3.0	1	1.1
Total	30	100	30	100	30	100	90	100
Family size								
Total	5.40	100	5.05	100	5.89	100	5.44	100
Male	2.90	54.0	2.65	52.5	2.86	48.5	2.80	51.5
Female	2.50	46.0	2.40	47.5	3.03	51.4	2.64	48.5

Source: Field survey, 2014

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Table 2: T. Aman rice varieties cultivated by the respondent farmers' of the surveyed areas (field survey 2014)

Varieties	Mymensingh (n = 30)		Jamalpur (n = 30)		Tangail (n = 30)		All areas (n = 90)	
	Number of farmers	Percentage	Number of farmers	Percentage	Number of farmers	Percentage	Number of farmers	percentage
Hari dhan	9	30.0	14	47.0	-	-	23	25.5
Madhobi	10	33.3	-	-	-	-	10	11.1
BRRI dhan49	14	47.0	13	43.0	27	90	54	60.0
Pajam	4	13.0	4	13.0	-	-	8	9.0
BRRI dhan30	1	3.0	-	-	-	-	1	1.1
BRRI dhan34	6	20.0	-	-	-	-	6	7.0
Gutishurna	4	13.0	-	-	-	-	4	4.4
Kalijira	1	3.0	1	3.0	-	-	2	2.2
BR10	-	-	1	3.0	-	-	1	1.1
Binadhan-7	-	-	-	-	1	3.0	1	1.1
Kartikzone	-	-	-	-	2	7.0	2	2.2
Lal chamra	-	-	-	-	2	7.0	2	2.2
BR11	-	-	-	-	4	13.0	4	4.4

Note. Total number of respondents is higher than n=30 as because in some cases the same farmers cultivated more varieties.

Table 3: Seeding and harvesting time of T. Aman rice varieties cultivated by the farmers of the surveyed areas

Varieties	Seeding/harvesting time categories	Mymensingh (N = 9)		Jamalpur (N = 14)		Tangail (N = 0)	
		Seeding time	Harvesting time	Seeding time	Harvesting time	Seeding time	Harvesting time
Hari dhan	Before recommended	9 (100)	-	5 (35.7)	1(7.14)	-	-
	Recommended	-	9 (100)	9 (64.2)	5 (35.7)	-	-
	After recommended	-	-	-	8 (57.1)	-	-
Madhobi	Before recommended	Mymensingh (N = 10)		Jamalpur (N = 0)		Tangail (N = 0)	
		10 (100)	-	-	-	-	-
	Recommended	-	10 (100)	-	-	-	-
	After recommended	-	-	-	-	-	-
Gutishurna	Before recommended	Mymensingh (N = 4)		Jamalpur (N = 0)		Tangail (N = 0)	
		4 (100)	-	-	-	-	-
	Recommended	-	4 (100)	-	-	-	-
	After recommended	-	-	-	-	-	-
Kalijira	Before recommended	Mymensingh (N = 1)		-		Tangail (N = 0)	
		1 (100)	-	1 (100)	-	-	-
	Recommended	-	-	-	-	-	-
	After recommended	-	1 (100)	-	1 (100)	-	-
Pajam	Before recommended	Mymensingh (N = 4)		Jamalpur (N = 4)		Tangail (N = 0)	
		4 (100)	4 (100)	4 (100)	4 (100)	-	-
	Recommended	-	-	-	-	-	-
	After recommended	-	-	-	-	-	-
BRRI dhan49	Before recommended	Mymensingh (N = 14)		Jamalpur (N = 13)		Tangail (N = 27)	
		14 (100)	14 (100)	13 (100)	13 (100)	17 (62.9)	27 (100)
	Recommended	-	-	-	-	10 (37.0)	-
	After recommended	-	-	-	-	-	-

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Table 3: (Contd.) Seeding and harvesting time of T. Aman rice varieties

Varieties	Seeding/harvesting time categories	Mymensingh (N = 1)		Jamalpur (N = 0)		Tangail (N = 0)	
		Seeding time	Harvesting time	Seeding time	Harvesting time	Seeding time	Harvesting time
BRRI dhan30	Before recommended	--	--	--	--	--	--
	Recommended	1 (100)	1 (100)	--	--	--	--
	After recommended	--	--	--	--	--	--
BRRI dhan34	Before recommended	Mymensingh (N = 6)		Jamalpur (N = 0)		Tangail (N = 0)	
		6 (100)	6 (100)	--	--	--	--
	Recommended	--	--	--	--	--	--
	After recommended	--	--	--	--	--	--
BR10	Before recommended	Mymensingh (N = 0)		Jamalpur (N = 1)		Tangail (N = 0)	
		--	--	--	--	--	--
	Recommended	--	--	1 (100)	1 (100)	--	--
	After recommended	--	--	--	--	--	--
BR11	Before recommended	Mymensingh (N = 0)		Jamalpur (N = 0)		Tangail (N = 4)	
		--	--	--	--	--	--
	Recommended	--	--	--	--	4 (100)	4 (100)
	After recommended	--	--	--	--	--	--
Binadhan-7	Before recommended	Mymensingh (N = 0)		Jamalpur (N = 0)		Tangail (N = 1)	
		--	--	--	--	--	--
	Recommended	--	--	--	--	1 (100)	1(100)
	After recommended	--	--	--	--	--	--
Lal chamara	Before recommended	Mymensingh (N = 0)		Jamalpur (N = 0)		Tangail (N = 2)	
		--	--	--	--	2 (100)	--
	Recommended	--	--	--	--	--	2 (100)
	After recommended	--	--	--	--	--	--
Kartikzone	Before recommended	Mymensingh (N = 0)		Jamalpur (N = 0)		Tangail (N = 2)	
		--	--	--	--	2 (100)	--
	Recommended	--	--	--	--	--	2 (100)
	After recommended	--	--	--	--	--	--

Note: N = Number of respondent farmers; Hari, Madhobi, Gutishurna, Kalijira, Lal chamra (Chamara is a Bengali word and local name), Kartik zone (Local Aman variety): Recommended sowing time 30 June-30 July (source: Adhunik dhaner chash, 18th edition, May, 2015) and Harvesting time 01 November-20 November (Source: Field survey). , BRRI dhan49: Recommended sowing time 15 June-14 July, Harvesting time 24-29 November, Pajam: Recommended sowing time 29 June-14 July, Harvesting time 15-29 November , BRRI dhan30: Recommended sowing time 8-29 June, Harvesting time 30 October 29 November , BRRI dhan34: Recommended sowing time 20-25 July, Harvesting time 19-24 November , BR10: Recommended sowing time 8-29 June, Harvesting time 30 Oct-29 Nov. , BR11: Recommended sowing time 8-29 June, Harvesting time 20 October 24 November (BRRI, 2016)

Table 4: Problems and constraints of mustard production in the fallow period before Boro rice transplantation

Sl. No.	Problems and constraints	Mymensingh (N = 19)		Jamalpur (N = 24)		Tangail (N = 12)		Average
		Number of farmers	Percentage	Number of farmers	Percentage	Number of farmers	Percentage	
1.	Lack of short duration improved variety	2	10.5	3	13.0	--	--	8.0%
2.	Transplantation of Boro become late	4	21.0	7	29.0	4	33.0	28.0%
3.	Low soil moisture/land is not proper	1	5.3	2	8.00	2	17.0	10.1%
4.	Excessive soil moisture/ land is not proper	2	10.5	2	8.00	2	17.0	12.0%
5.	Poor yield, low price of seed	10	53.0	10	42.0	4	33.0	43.0%
Total		19	100	24	100	12	100	

Note: N = Number of respondent farmers

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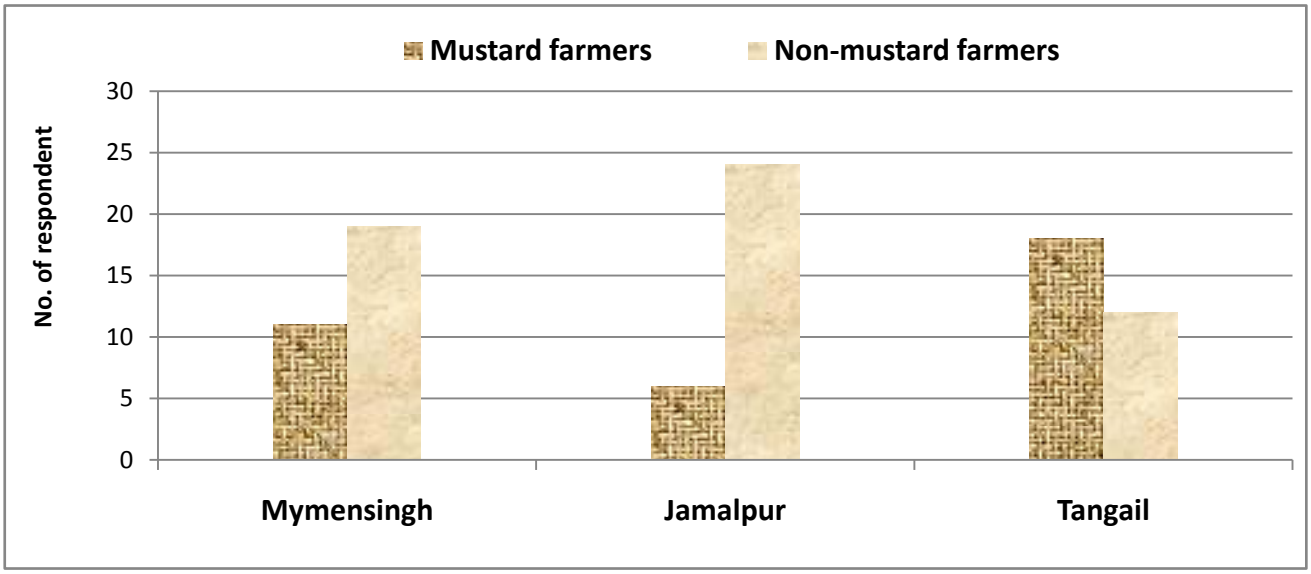

Figure 2: Number of mustard and non-mustard farmers in surveyed areas

Table 5: Boro rice varieties cultivated by the sampled farmers of the surveyed areas

Varieties	Mymensingh (n = 30)		Jamalpur (n = 30)		Tangail (n = 30)		All areas (n = 90)	
	Number of farmers	Percentage	Number of farmers	Percentage	Number of farmers	Percentage	Number of farmers	Percentage
BRRI dhan28	21	70.0	17	57.0	-	-	38	42.0
BRRI dhan29	27	90.0	14	47.0	36	120	77	86.0
Pajam	1	3.3	-	-	-	-	1	1.1
Hira	-	-	2	7.0	-	-	2	2.2

Note: Total number of respondents is higher than n=30 as because in some cases the same farmers cultivated more varieties.

Table 6: Seeding and harvesting time of Boro rice varieties cultivated by the sampled farmers of the surveyed areas

Varieties	Seeding/harvesting time categories	Mymensingh (N = 21)		Jamalpur (N = 17)		Tangail (N = 0)	
		Sowing time	Harvesting time	Sowing time	Harvesting time	Sowing time	Harvesting time
BRRI dhan28	Before recommended	-	-	-	-	-	-
	Recommended	15 (71.4)	-	14 (82.3)	2 (11.7)	-	-
	After recommended	6 (28.5)	21 (100%)	3 (18)	15 (88.2)	-	-
Pajam	Before recommended	Mymensingh (N = 1)		Jamalpur (N = 0)		Tangail (N = 0)	
		-	-	-	-	-	-
	Recommended	1 (100)	1 (100)	-	-	-	-
	After recommended	-	-	-	-	-	-
BRRI dhan29	Before recommended	Mymensingh (N = 27)		Jamalpur (N = 14)		Tangail (N = 36)	
		-	7 (25.9)	-	2 (14.3)	-	-
	Recommended	22 (81.4)	14 (51.8)	13 (92.8)	12 (85.7)	26 (72.2)	26 (72.2)
	After recommended	5 (18.5)	6 (22.2)	1 (7.14)	--	10 (33.3)	10 (33.3)
Hybrid	Before recommended	Mymensingh (N = 0)		Jamalpur (N = 3)		Tangail (N = 0)	
		-	-	-	-	-	-
	Recommended	-	-	3 (100)	-	-	-
	After recommended	-	-	-	3 (100)	-	-

Note: N= Number of respondent farmers practiced different Boro varieties; BRRI dhan28: Recommended sowing time 15-29 November and harvesting time 03-18 April, BRRI dhan29: Recommended sowing time 1-30 November, Harvesting time 8-20 May, Hybrid: Recommended sowing time 15 November-14 December, Harvesting time 8-18 April (BRRI, 2015)

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Table 7: Existing mustard-based rice-rice cropping patterns followed in the surveyed areas

Sl. No.	Cropping pattern	Mymensingh (n = 30)		Jamalpur (n = 30)		Tangail (n = 30)		All the areas (n = 90)	
		Number of farmers (N)	Percentage	Number of farmers (N)	Percentage	Number of farmers (N)	Percentage	Number of farmers (N)	Percentage
01.	Fallow-BRRI dhan28-Hari dhan	4	13	1.0	3.0	--	--	5	6.0
02.	Fallow -BRRI dhan29-Hari dhan	4	13	9.0	30.0	--	--	13	14.4
03.	Fallow -Paijam -Hari dhan	01	3.3	--	--	--	--	01	1.1
04.	BARI Sarisha-14-BRRI dhan29-Hari dhan	--	--	02	7.0	--	--	02	2.2
05.	BARI Sarisha-14-BRRI dhan28-Hari dhan	--	--	02	7.0	--	--	02	2.2
06.	Tori-7-BRRI dhan28-Madhobi	02	7	--	--	--	--	02	2.2
07.	Fallow- BRRI dhan29-Madhobi	08	27	--	--	--	--	08	9.0
08.	Tori-7- BRRI dhan29-BRRI dhan49	--	--	--	--	03	10	03	3.3
10.	BARI Sarisha-14-BRRI dhan29-BRRI dhan49	05	17	--	--	14	47	19	21.0
11.	Fallow-BRRI dhan28-BRRI dhan49	09	30.0	13	43.3	--	--	22	24.4
12.	Fallow-BRRI dhan29-BRRI dhan49	--	--	--	--	10	33	10	11.0
13.	BARI Sarisha-14-BRRI dhan28-Pajam	02	7.0	01	3.3	--	--	03	3.3
14.	Fallow -BRRI dhan29-Pajam	02	7.0	03	10.0	--	--	05	5.5
15.	BARI Sarisha 15-BRRI dhan29- BRRI dhan34	02	7.0	--	--	--	--	02	2.2
16.	Fallow -BRRI dhan28-BRRI dhan34	02	7.0	--	--	--	--	02	2.2
17.	Fallow -BRRI dhan29-BRRI dhan34	02	7.0	--	--	--	--	2.0	2.2
18.	Fallow- BRRI dhan29-Gutishurna	04	13.0	--	--	--	--	04	4.4
19.	Fallow- BRRI dhan28-BRRI dhan30	01	3.0	--	--	--	--	01	1.1
20.	Fallow- BRRI dhan28-Kalijira	01	3.0	--	--	--	--	01	1.1
21.	Fallow- Hira-Kalijira	--	--	01	3.3	--	--	01	1.1
22.	Fallow -Hira-BR 10	--	--	01	3.3	--	--	01	1.1
23.	Fallow- BRRI dhan29-BR11	--	--	--	--	04	13	04	4.4
24.	BARISarisha14-BRRI dhan29-Binadhan-7	--	--	--	--	01	3.3	01	1.1
25.	Fallow-BRRI dhan29-Lal chamra	--	--	--	--	02	7.0	02	2.2
26.	Fallow -BRRI dhan29-Kartikzone	--	--	--	--	02	7.0	02	2.2

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h) Cost and return of T. Aman rice, Boro rice and Mustard crops under Mustard-Boro rice-T. Aman rice or Fallow-Boro rice-T. Aman rice cropping patterns

For determining of the relative profitability of different produces and cropping pattern, all cost items for each of the individual crops considered. Costs are the expenses involved in organizing and carrying the production process up to getting yield or output. For calculating the cost of cultivation of T. Aman, mustard, Boro rice crops under Fallow/Mustard-Boro rice-T. Aman rice cropping pattern, all variable costs like human labor, land preparation, seed, chemical fertilizer, insecticide, irrigation calculated per hectare basis. Under this calculation, fixed cost and family labor cost were not included. Labor wages considered on a local value basis. Gross return ($[4] ha-1) was calculated based on the local market price of the economic yield and by-product of those crops. The cost variation in *T. Aman* rice cultivation among the surveyed areas was mainly influenced by the variation of available labour number and their wages. The highest cost of cultivation for T. Aman rice was found $ 591.96, One dollar = Tk. 84.63 (Bangladeshi currency) as per on day value ha-1 in Tangail region followed by Jamalpur region $ 570.88 ha-1 due to the highest number of labor and wages. The lowest cost of cultivation was found in Mymensingh region $ 545.75 ha-1 due to lowest of labor. The highest gross margin in T. Aman rice was found $ 651.30 ha^{-1} from BRRI dhan49 in Jamalpur region followed by $ 577.6 ha-1 in Tangail region. The local variety Hari dhan contributed the gross margin $ 511.87 ha-1 in Jamalpur region. The local Lal Chamara and Kartikzone funded the lowest gross margin in Tangail region (Table 8). For mustard cultivation, the highest cost of cultivation was found in Mymensingh and Jamalpur regions $ 332.15 ha-1 and $ 377.10 ha-1 respectively while in Tangail region was found the lowest $ 317.97 ha-1. The highest gross margin $ 294.72 ha-1 was obtained by cultivating BARI Sarisha-15 in Mymensingh region followed by BARI Sarisha-14 in Mymensingh and Tangail regions. The local variety Tori-7 produced the lowest gross margin of $ 77.60 ha-1 (Table 9). In the case of Boro rice, the highest cost of cultivation $ 833.51 ha-1 was found in Tangail region followed by Mymensingh region $ 801.02 ha-1. Cost of cultivation for Boro rice was varied among the studied areas due to variation of irrigation cost. The lowest cost was found in Jamalpur region at $ 777.24 ha-1. Considering all locations, in case of Boro, BRRI dhan29 incurred the highest gross margin followed by BRRI dhan28 (Table 10).

i) Gross return analysis of the dominant cropping pattern

The gross return of farmers' under Fallow/Mustard-Boro rice-T. Aman rice was mainly influenced in the conjunctions of mustard between T. Aman and Boro rice. The highest profitability was found $ 1218.10 ha^{-1} from BARI Sarisha-14-BRRI dhan29-BRRI dhan49 cropping pattern in Tangail region followed by Mymensingh region $ 1114.53 ha-1. BARI Sarisha-14-BRRI dhan29-Hari Dhan cropping pattern also earned $ 1068.01 ha-1 profit in Jamalpur region (Table 11).

IV. Conclusion

The survey study revealed that over locations the dominant cropping pattern was found Fallow-BRRI dhan28 (Boro rice)-BRRI dhan49 (T. Aman rice) followed by BARI Sarisha-14-BRRI dhan29 (Boro rice)-BRRI dhan49 (T. Aman rice). Hence, there is enough scope of cultivation high yielding mustard crop in the Fallow-BRRI dhan28 (Boro rice)-BRRI dhan49 (T. Aman rice) cropping pattern by applying agronomic management practices by which 24.4% respondent of the survey areas may fetch a higher income of the farm families in the study area.

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Table 8: Yield, cost of cultivation, gross return and gross margin of cultivated T. Aman rice varieties under surveyed areas

Varieties	Mymensingh				Jamalpur				Tangail			
	Yield (t ha^{-1})	Cost of cultivation ($ ha^{-1})	Gross return[1] ($ ha^{-1})	Gross margin ($ ha^{-1})	Yield (t ha^{-1})	Cost of cultivation ($ ha^{-1})	Gross return ($ ha^{-1})	Gross margin ($ ha^{-1})	Yield (t ha^{-1})	Cost of cultivation ($ ha^{-1})	Gross return ($ ha^{-1})	Gross margin ($ ha^{-1})
Hari dhan	4.19	545.75	965.73	419.98	4.80	570.88	1082.76	511.87	-	-	-	-
Madhobi	3.60	545.75	1003.25	457.50	-	-	-	-	-	-	-	-
BRRI dhan49	4.19	545.75	1089.51	543.76	4.79	570.88	1222.20	651.31	4.50	591.95	1169.6	577.6
Pajam	3.10	545.75	992.17	446.41	3.30	570.88	1040.65	469.78	4.73	591.95	1014.33	422.4
BRRI dhan30	3.42	545.75	806.51	260.76	-	-	-	-	-	-	-	-
BRRI dhan34	-	-	-	-	2.20	570.88	651.72	105.96	-	-	-	-
Gutishurna	3.89	545.75	1018.61	472.86	-	-	-	-	-	-	-	-
Kalijira	1.64	545.75	922.90	377.15	-	-	-	-	-	-	-	-
Binadhan-7	3.12	545.75	751.28	159.33	-	-	-	-	-	-	-	-
Lal chamara	-	-	-	-	-		-	-	2.38	591.95	598.3	6.31
Kartikzone	-	-	-	-	-		-	-	3.00	591.95	726.5	134.51

Note: Selling price (Grain)-Aman rice: Hari dhan $ 0.21 kg^{-1}; Madhobi $ 0.25 kg^{-1}; BRRI dhan49 $ 0.24 kg^{-1}; Paijam $ 0.29 kg^{-1}, BRRI dhan30 $ 0.21 kg^{-1}; BRRI dhan34 $ 0.25 kg^{-1} & BR10 $ 0.21 kg^{-1}, Gutishurna $ 0.24 kg^{-1} and Kalijira $ 0.50 kg^{-1}, BR11 $ 0.19 kg^{-1}, Binadhan-7 $ 0.21 kg^{-1}, Lal chamara $ 0.21 kg^{-1} and Kartikzone $ 0.21 kg^{-1}

[1] Gross return (GR) was calculated by multiplying the total output (grain + straw) of an enterprise by the average market price in the harvesting period.

Table 9: Yield, cost of cultivation, gross return and gross margin of cultivated mustard varieties under surveyed areas

Varieties	Mymensingh				Jamalpur				Tangail			
	Yield (t ha^{-1})	Cost of cultivation ($ ha^{-1})	Gross return ($ ha^{-1})	Gross margin ($ ha^{-1})	Yield (t ha^{-1})	Cost of cultivation ($ ha^{-1})	Gross return ($ ha^{-1})	Gross margin ($ ha^{-1})	Yield (t ha^{-1})	Cost of cultivation ($ ha^{-1})	Gross return ($ ha^{-1})	Gross margin ($ ha^{-1})
Tori-7	0.75	332.15	409.76	77.6	-	-	-	-	-	-	-	-
BARI Sarisha-14	1.09	332.15	577.1	244.9	0.940	337.1	507.1	170.0	1.05	317.9	574.1	256.12
BARI Sarisha-15	1.20	332.15	626.8	294.7	-	-	-	-	-	-	-	-

Note: Selling price (Seed): Mustard-$ 0.47 kg^{-1}

Table 10: Yield, cost of cultivation, gross return and gross margin of cultivated Boro rice varieties under surveyed areas

Varieties	Mymensingh				Jamalpur				Tangail			
	Yield (t ha^{-1})	Cost of cultivation ($ ha^{-1})	Gross return ($ ha^{-1})	Gross margin ($ ha^{-1})	Yield (t ha^{-1})	Cost of cultivation ($ ha^{-1})	Gross return ($ ha^{-1})	Gross margin ($ ha^{-1})	Yield (t ha^{-1})	Cost of cultivation ($ ha^{-1})	Gross return ($ ha^{-1})	Gross margin ($ ha^{-1})
BRRI dhan28	4.37	801.0	1034.8	233.8	4.54	777.24	1074.4	297.1	-	-	-	-
BRRI dhan29	4.94	801.0	1126.8	325.8	5.10	777.24	1163.4	386.1	5.38	833.5	1225.7	392.2
Hira	-	-	-	-	4.48	777.24	1035.2	257.9	-	-	-	-

Note: Selling price (Grain)-Boro rice: BRRI dhan28= $ 0.21 kg^{-1}; BRRI dhan29= $ 0.20 kg^{-1}

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Table 11: Gross return study of the farmers under Mustard/Fallow-Boro rice-T. Aman rice cropping pattern in the surveyed areas

Sl. no.	Existing cropping pattern	Mymensingh ($ ha^{-1})	Jamalpur ($ ha^{-1})	Tangail ($ ha^{-1})
01.	Fallow- BRRI dhan28-Hari dhan	653.5	805.6	-
02.	Fallow- BRRI dhan29-Hari dhan	745.8	894.6	-
03.	BARI Sarisha-14- BRRI dhan29 -Hari dhan	-	1068.0	-
04.	BARI Sarisha-14- BRRI dhan28- Hari dhan	-	979.0	-
05.	Tori-7- BRRI dhan28- Madhobi	768.9	-	-
06.	Fallow- BRRI dhan29-Madhobi	783.3	-	-
07.	BARI Sarisha-14- BRRI dhan29-BRRI dhan49	1114.5	-	1218.10
08.	Fallow-BRRI dhan28-BRRI dhan49	777.5	948.5	-
09.	Fallow-BRRI dhan29-BRRI dhan49	-	-!	-
10.	BARI Sarisha-14- BRRI dhan28- Pajam	925.1	936.9	-
11.	Fallow- BRRI dhan29-Pajam	772.3	855.9	-
12.	BARI Sarisha-15- BRRI dhan29-BRRI dhan34	726.5	-	-
13.	Fallow- BRRI dhan28 BRRI dhan34	339.8	-	-
14.	Fallow- BRRI dhan29-BRRI dhan34	431.8	-	-
15.	Fallow- BRRI dhan29-Gutishurna	798.7	-	-
16.	Fallow -BRRI dhan28-BRRI dhan30	494.6	-	-
17.	Fallow -BRRI dhan28-Kalijira	610.9	-	-
18.	Fallow-Hira -BR 10	-	456.2	-
19.	Fallow-BRRI dhan29-BR11	-	-	814.8
20.	BARISarisha14-BRRI dhan29-Binadhan-7	-	-	807.6
21.	Fallow- BRRI dhan29-Chamra	-	-	398.5
22.	Fallow- BRRI dhan29-Kartikzone	-	-	526.7

References Références Referencias

1. Akter, M., Miah, M.A.M., Khurram, M.M.H., Rahman, M.S., Alam, Q.M. 2010. Economic feasibility of soybean production in some selected areas of Bangladesh. Bangladesh Journal of Agricultural Research, 35(4): 561-571.
2. Anwarul, M., Alam, Q.M., Baset, M.A. 2007. Technical efficiency of mustard production in Jamalpur district. Annual Research Report 2007-08, Oilseed Research Centre, BARI, Joydebpur, Gazipur.
3. BBS (Bangladesh Bureau of Statistics) 2011. Statistical Yearbook of Bangladesh. Bangladesh Bureau of Statistics, Ministry of Planning. Dhaka. Bangladesh. www.bbs.gov.bd
4. BRRI (2016). Bangladesh Rice Research Institute, Government of Bangladesh, ADHUNIK DHANER CHAS (In Bengali) (Modern rice cultivation), 19th edition, BRRI, Gazipur-1701, Bangladesh. pp. 7-10. www.bari.gov.bd
5. DAE. 2014. Department of Agriculture Extension, Ministry of Agriculture, Dhaka, Bangladesh, Bangladesh. www.dae.gov.bd
6. FSRDP.1987. A Research works on Monitored the Cropping Pattern in the FSRDP area at Kazirshimla of Mymensingh district, Annual Research Report, BARI, Gazipur.
7. Hasan, M.N.M., Hossain, S.M., Islam, R.M., Bari, M.A. 2013. Trends in the availability of agricultural land in Bangladesh Soil Resource Development Institute (SRDI), Ministry of Agriculture, Bangladesh, Dhaka.
8. Khan, M.A.H., Zaman, M.S., Hasan, M.K., Khan, A.S.M.M.R. 2017. Increasing cropping intensity and productivity through Mustard-*Boro* rice-*T. Aman* rice-*T. Aus* rice cropping pattern in Bangladesh. *SAARC Journal of Agriculture 15*(2) 103-112.
9. Miah, M.A.K, 2001. An Economic Analysis of Aromatic and Non-aromatic Rice Cultivation in Some Selected Areas of Dinajpur District. MS Thesis. Department of Agricultural Economics. BSMRAU, Salna, Gazipur.
10. Miah, M.A.M. and Alam, Q.M. 2008. Adoption and relative profitability of mustard production in Bangladesh. Annual Research Report 2007-08, Oilseed Research Centre, BARI, Joydebpur, Gazipur.
11. Miah, M.T.H. 1990. Economics of Commercial Poultry Farming in Bangladesh. Report No.21, Bureau of Socio-economic Research and Training. BAU, Mymensingh.
12. National Research Council, 1989. Diet and Health: Implications for Reducing Chronic Disease Risk. Washington, DC: The National Academies Press, 1989. doi:10.17226/1222
13. Paul, P.L.C., Rashid, M.A., Alam, M.M., Ghani, M.A., Hossain, M.B. 2016. Selection of profitable rice based cropping system under prevailing water

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environment in Satkhira district of Bangladesh. Academia Journal of Agricultural Research 4(9) 581-588.

14. Ray, S.K. 1998. A study on vegetable seed marketing in some selected area of Bangladesh, An Unpublished M.S. thesis Department of Cooperation and Marketing, Bangladesh Agricultural University, Mymensingh
15. Smith and Zope, 1970. Farm Machinary and Equipment, McGrow Hill Publication in the Agricultural science.
16. Yang, W.Y. 1962. Methods of farm management investigation for improving farm productivity. Food and Agricultural Organization of the United Nations, Rome, Italy.

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