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HYBRID RICE CULTIVATION AND ITS IMPACTS ON SOCIAL INEQUALITY IN TWO SELECTED AREAS OF BANGLADESH

F M M Rahman

F M M Rahman , M E Haque[1] and M G G Mortuza[2]

DPD, Establishment of KIB building project,
DAE, Khamarbari, Farmgate, Dhaka, Bangladesh.

Abstract

The present study was undertaken in Bogra and Gaibandha district for assessing the status of hybrid rice cultivation and comparing the social inequality that may prevail among the hybrid and in-bred rice growers. Sixty hybrid and sixty in-bred rice cultivating farmers were selected randomly from the 'treatment' (hybrid rice cultivation continuing) and 'control' (hybrid rice cultivation rejecting) village respectively. Data were collected from the sample farmers during April – July, 2010. Boro season of 2007-2008, 2008-2009 and 2009-2010 were subjected to analyze for both hybrid and in-bred rice cultivation. Hybrid rice adoption was found to increase sharply in 2008-2009 compared to 2007-2008 (considered as base year) but decreased in 2009-2010 compared to the base year both in the treatment and control village. The extent of decrease of hybrid rice adoption was much high in control village compared to the treatment village. Farmers' are adopting hybrid rice mostly because of its higher yield and lodging resistant but rejecting for high cost and non-availability of pure seed. Average yield of hybrid rice found significantly higher than HYV rice but BCR of them are more or less same. The small farmers in the treatment village were lagged behind in all the selected social inequality indicators (BCR, yield, and technical knowledge, contact with information sources, market price information and adoption of new technology) compared to the large farmers.

Key words: Hybrid and inbred rice, Yield, Adoption of new technology.

Introduction

Bangladesh with a population of 160 million in a land of 147570 Sq km is one of the most densely populated countries in the world (BBS 2015). Agriculture is the mainstay of Bangladesh economy and it employs nearly 52% of its labor force and contributes one fourth of its gross national product. The principal crop and the dominant staple food is rice, which occupies nearly 77% of its total cropped area in the country (BER 2005). During 2007-08 boro season, LVs, HYVs and Hybrid rice occupied 4%, 75% and 21% area respectively (BBS 2009). Rice contributes 76 percent of the calorie and 66 percent of the protein intake (BNNC 2000). The fluctuations in the productivity of rice influence the food security and to some extent affect political stability of the country.

However, Bangladesh needs to increase the rice yield further in order to meet the growing demand. The National Commission of Agriculture projected that in order to remain self-sufficient Bangladesh will need to produce 47 million tones of paddy (i.e., 31.6 million tons of clean rice) by the year 2020, which means a growth rate of production at 1.7 percent per year. An earlier Agricultural Research Strategy document prepared by the Bangladesh Agricultural Research Council (BARC) projected the required paddy production by 2020 at 52 million tons (34.7 million tons of rice), which would require a production growth of 2.2 percent per year. Bangladesh is a land scarce country and the potentiality of horizontal expansion of cropped area is absolutely impossible. So, the only way to achieve higher production is to obtain higher yield per unit area.

[1]Professor, Department of Agricultural Extension and Rural Development, BSMRAU, Gazipur, Bangladesh.
[2]Project Director, Expansion of Cotton Cultivation Project, Cotton Development Board, Khamarbari, Farmgate, Dhaka, Bangladesh.

Many progressive farmers are now cultivating hybrid rice in their fields in the Boro season. But the rice farming community, as a whole yet not much confident to grow hybrid rice as it is a very new innovation with which and they are not much familiar, especially its farm level performance. There are lot of confusions among the policy makers, researchers and extensionists' also. Many farmers who started cultivation hybrid rice discontinued the same within following one or two seasons for various socio-economic reasons. Besides, there exists very limited number assessment of farm-level performance and the farmers' perception about rice quality, reaction to disease and insects, seed production etc. Cultivation of hybrid rice requires higher production skill, knowledge and resources for obtaining higher yield much above the in-bred variety. Hybrid rice is very sensitive to various factors and only those rich farmers can avert the risk of crop failure. An in-depth study is essential to pinpoint its potentialities against yield, market and consumer's response as well as various social inequality parameters.

Therefore, the study has been planned with the objectives to assessing the farmers' perception, adoption/rejection, farmers' preference, yield, annual income, benefit-cost ratio of hybrid and HYV rice varieties, to assessing the impact of hybrid and HYV rice varieties on minimizing or enhancing social inequality (in areas, such as yield per unit area, benefit-cost ratio, use of agricultural information sources, and knowledge on agriculture).

Materials and Methods

To achieve the study objectives, the present research was designed to collect both qualitative and quantitative data. A chronological description of the methodology followed in conducting this research work has been presented in this chapter with the sections and sub-sections as follows.

Research Design

The study is an ex-post-facto survey type investigation. In this type of research, the researcher has no control over the variables; rather researcher only reports what has happened or what is happening. To collect relevant information from different sources (e.g. respondents, published and unpublished secondary sources), several methods (such as interview, focus group discussion, case study and systematic study of available records) were used.

To achieve the objectives, the study was conducted in different steps. First, the rate of adoption or rejection of hybrid rice varieties by the respondents as well as their perception regarding their hybrid rice cultivation was studied. Secondly, the impact of hybrid rice cultivation on level of prevailing social inequality was determined based on some selected indicators. The technology based social inequality indicators are as follows: BCR per unit area, yield per unit area, technical knowledge on agriculture, knowledge on market price information about agricultural products, contact with agricultural information sources and adoption of new technology (hybrid rice varieties).

Adoptions of hybrid and in-bred rice by the farmers' were calculated based on both head counts and areas cultivated for hybrid and HYV rice varieties. As 2007-08 Boro season was considered as a base year for assessing adoption, changes in adoption of hybrid rice were measured comparing the adoption figures of 2008 to 2010. In the experimental and control locations, percentage of farmers cultivating or not cultivating hybrid rice was estimated based on head counts and changes in areas under hybrid varieties were estimated through comparing with base year (2007-08) to (2009-10). Two sets of dependent variables i.e. reduction of hybrid adoption and increase/status quo of hybrid cultivation was subjected to regression analyses with different sets of independent variables responsible for decrease and increase (including status quo) of hybrid rice cultivation. Independent variables were identified through the discussions with the farmers and extension worker of the DAE.

Locale of the study

The study was conducted in the concentrated rice growing 'Kusharghop' village of 'Sonatola Upazila' under Bogra district and the 'Ulipur' village of Gobindagonj Upazila under Gaibandha district of Bangladesh.

Selection of treatment and control area

The 'Ulipur village' of Gobindagonj upazila was selected as a treatment area, where different categories of farmers (large, medium, small and marginal) were cultivating both hybrid and HYV rice varieties. On the other hand, the Kusharghop village of Sonatola upazila was considered as control area where the respondents once were largely cultivating hybrid varieties, but now the cultivation status is very low or only cultivating HYV rice varieties.

Sampling design

All the farmers of different categories who cultivate hybrid and HYV rice varieties in the treatment village constituted the 'treatment' population. On the other hand, the farmers of control village who previously cultivated hybrid rice but now discontinued/reduced the area and mostly cultivate HYV rice varieties constituted the 'control' population. A list of 200 (100+100) farmers from both the treatment and control population was made with the help of SAAOs and local leaders. From the target population of treatment area, 60 farmers were selected randomly as treatment respondents who were cultivating hybrid rice. Same numbers of respondents were also selected from the control village as control respondents (those who are cultivating HYV rice but previously also cultivated hybrid rice). Thus the total sample size was 120. The researcher also made a reserve list, which were used when any farmer of the original list was unavailable at the time of data collection.

Instrument for data collection

Data were collected through interviewing the household heads of the sample respondents from the selected areas. In order to collect relevant information from the respondents, pre-designed interview schedule was used. The interview schedule contained both open and closed form of questions. The questions were arranged systematically so that they could easily understand. Besides the above techniques, official records, reports, journals, proceedings and other related printed materials were also used as resource materials for the study.

Collection of data

Data were collected from the respondents and secondary sources during April – July 2010 by the researcher himself. Firstly interview schedule were used to collect data on personal traits of the respondents and their involvement in the hybrid and HYV rice cultivation. Desired rapport was established by the researcher with the respondents. However, if any respondent failed to understand any question, the researcher took necessary care to explain the matter.

Unit of analysis

The respondents, who cultivated the hybrid and HYV (HYV) rice varieties in the 'treatment' and 'control' villages, were treated as the unit of analysis for this study.

Measurement of variables

Adoption of hybrid rice in the present study was calculated based on both head counts and percent of area diverted for hybrid and HYV rice varieties. Boro season of 2008 considered as the base year for assessing adoption. Changes in adoption of hybrid rice were measured comparing the adoption figures of 2008 and 2010.

In order to measure the percent of adoption based on head counts, 100 respondents from both the treatment and control villages were selected randomly. From the above respondents (experimental and control locations), percentage of farmers cultivating or not cultivating hybrid rice was estimated based on head counts.

The following formula was used to measure extent of adoption of hybrid and HYV rice by the respondents:

Where,

$$\text{Adoption (Head counts)} = \frac{\text{Number of respondents cultivating particular rice variety}}{\text{Total number of respondents cultivating rice}} \times 100$$

$$\text{Adoption (area)} = \frac{\text{Area under particular rice variety}}{\text{Total area under rice cultivation}} \times 100$$

Technology based social inequality indicators

Yield per unit area, benefit-cost ratio (BCR), technical knowledge on agriculture (especially on rice cultivation), knowledge on market price information, adoption of new technology and contact with agricultural information sources were considered as technology based social inequality indicators.

Yield per unit area

Yield per unit area was measured in ton per hectare. Yield per unit area of hybrid and HYV rice varieties was counted for the year 2010.

BCR per unit area

Benefit-cost ratio of hybrid and HYV rice cultivation was estimated as a ratio of total return obtained and total cost of production.

Where,

$$\text{BCR} = \frac{\text{Gross return}}{\text{Total input cost}}$$

Total input cost

Per hectare total cultivation cost of hybrid and HYV rice were estimated as the sum total of cultural and intercultural operation cost, different input cost, post harvest operation and related costs.

Gross return

Gross return was defined by sum of the market price of paddy and the price of straw per hectare area in the considering year 2010.

Where,

Gross return = Total market price of paddy + Price of straw.

Net return

Per hectare net return was defined by subtracting the total cost of production from the gross return obtained from hybrid and HYV rice cultivation in the year of 2010.

Where,

Net return = Gross return – Total production cost.

Statistical measurements

Descriptive statistics, such as number, frequencies percentages, mean and standard deviation etc were used for presentation of data. These were presented in tables, figures and textual forms. To test hypotheses some inferential statistics such as correlation, paired t-test, ANOVA, multiple regression and stepwise regression analyses were used to measure technology based social inequality indicators. ANOVA was used for comparing mean values of more than two groups, and also 't-test' was conducted between two groups of respondents. Multiple regression models were used to identify the potentially significant independent variables and to determine the predictive power of the changes in the dependent variable in response to changes in independent variables (Hossain 2007).

Results and Discussion

Age of the farmer

Age of the respondents was found to range from 24 to 69 in case of control respondents and 22 to 65 in case of test respondents. The mean age was found 46.4 and 44.4 in case of control and test respondents respectively (Fig. 1). Considering their age, the respondents were classified into young (less than 30 years), middle aged (31 to 50 years) and old (above 50 years). This classification was in conformity with Ahmed (2003). The categories indicated that the highest percentage of control and test respondents (56.7, 55.0) belonged to middle age and lowest percentage of the control and test respondents (3.3, 16.7) belonged to young age; while 40.0 and 28.3 percent of the respondents belonged to old age category in case of control and test respondents respectively.

The findings revealed that percent of middle aged respondents of control (56.7) and test (55.0) respondents had little difference, percent of old aged respondents was higher in control (40.0) than test (28.3) respondents but percent of young aged respondents was higher in test (16.7) than control (3.3) respondents. The middle aged respondents were more dominating in numbers than old and young age in both the control and test cases. It was also observed that percent of young aged respondents were more in test than control respondents. But percent of old aged were more in control than test cases.

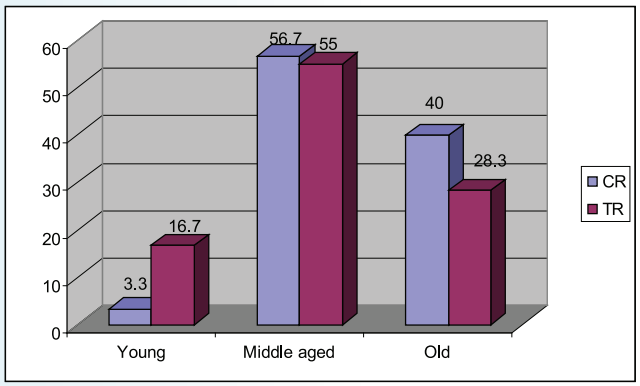

Fig. 1. Showing distribution of the respondents based on their age.

Education of the farmer

The education score of the respondents under the study ranged from 0 to 12 in case of control respondents and 0 to 14 in case of test respondents. Average scores were found 5.2 and 6.2 in case of control and test respondents respectively (Fig. 2). Considering their educational score, the respondents were classified into illiterate (0), primary (1 to 5), secondary (6 to 10) and above secondary education (11 and above). The education level of the respondents indicated that most of the control and test respondents belong to primary (41.7% and 45%) and secondary level (30% and 21.7%) of education compared to illiterate (15% and 6.7%) and above secondary (13.4% and 26.7%).

Percentage of control and test respondents at primary and secondary level of education were more or less same, but percentage of test respondents (26.7) were double than control (13.4) in above secondary level. On the other hand percentage of control respondents (15) was double than test respondents (6.7) in the illiterate category.

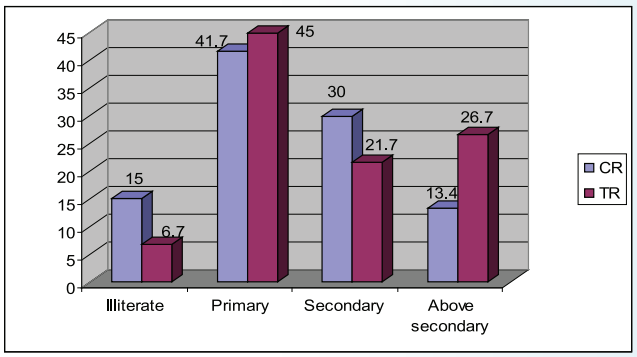

Fig. 2. Showing distribution of the respondents based on their level of education.

Farm size

Farm size is crucially important in determining socio-economic profile of the respondents. The farm size of the respondents ranged from 0.15 to 1.74 and 0.18 to 7.4 hectares in case of control and test respondents respectively. Average farm sizes of control and test respondents were 0.63 and 1.2 hectares respectively (Fig. 3). According to the size of the holdings the respondents were categorized into four groups such as marginal (0.02 - 0.20 hectare), small (0.21 – 1.00 hectare), medium (1.01 – 3.00 hectares) and large (above 3.00 hectares). This classification was conformity with national one (Anonymous 2007). It was found that the highest percentage of respondents belonged to small holding category in both the control (63.3) and test (53.3) cases followed by the percentages of

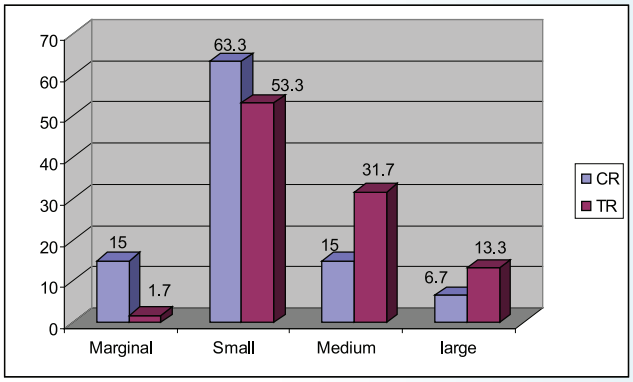

Fig. 3. Showing distribution of the respondents based on their farm size.

control and test respondents of marginal (15%, 1.7%), medium (15.0%, 31.7%) and large (6.7%, 13.3%) groups respectively. From these findings, it was also observed that there exists sharp difference between control and test respondents of the marginal, medium and large groups of respondents.

Family size

The family size scores ranged from 2 to 9 in case of control respondents and 2 to 10 in case of test respondents. Mean family size of control and test respondents were 4.5 and 5.2 respectively (Table 1). On the basis of family size score, the respondents were categorized into small (2 to 4), medium (5 to 7) and large (>7) groups. This classification was in conformity with Ahmed (2003). The average family sizes of the control and test respondents were 4.5 and 5.2 respectively. Highest percentage of the respondents belonged to small group (61.7, 48.3) in both the control and test cases followed by medium (35%, 35%) and large (3.3%, 16.7%) groups. The number of large category family size was higher in case of test area than control area. On the other hand, the number of small family size was higher in case of control than the test area.

Pressure on land

Pressure on land is helpful in understanding farmers' dependency on land. Data presented in the Table 1 showed that pressure on land of control and treatment respondents were ranged from .04 to .87 and .50 to 2.12 and the averages were found .15 and .26 respectively. Data indicated that control respondents were having more pressure on their land compared to the treatment respondents.

Occupation of the respondents

Data about the occupation indicated that all the respondents' major occupation was agriculture and most of them had more than one occupation in both control and test cases (Table 2). Data also indicated that the occupation of control and test respondents were more or less same in the study area.

Farming experience

The average farming experience scores of the control and test respondents were found 28.9 and 26.7 respectively. Based on the computed scores, the respondents were categorized into three groups as low (<16 years), medium (16 to 30 years) and high (>30 years) experienced (Table. 3).

This classification was in conformity with Gofran (2007). Highest percentage of control (43.3) and test (63.3) respondents belonged to medium experience category followed by low experience (15.0, 16.7) and high experience (41.7, 20.0) of control and test respondents respectively. It was also observed that most of the test respondents were in the medium experienced and there was a sharp difference between control and test respondents.

Table 1. Distribution of the respondents according to their family size and subsistence pressure

Attributes	Category	No.of respondents		Percentage of respondents		Mean	
		CR	TR	CR	TR	CR	TR
Family size	Small	37	29	61.7	48.3	4.5	5.2
	Medium	21	21	35.0	35.0		
	Large	2	10	3.3	16.7		
	Total	60	60	100	100		
Pressure on land	Over all	60	60	100	100	0.15	0.26

CR = Control Respondents TR = Test Respondents

Table 2. Distribution of the respondents according to their occupation

Occupation	Number of respondents		Percentage of respondents	
	CR	TR	CR	TR
Agriculture only	24	22	40	36.7
Agriculture + Business	8	19	13.3	31.7
Agriculture + Service	10	8	16.7	13.3
Agriculture + Others	18	11	30	18.3
Total	60	60	100	100

Table 3. Distribution of the respondents according to their farming experience.

Experience categories	Number of Respondents		Percentage of Respondents		Mean	
	CR	TR	CR	TR	CR	TR
Low experienced (less than16 years)	9	10	15	16.7	28.9	26.7
Medium experienced (16 to 30years)	26	38	43.3	63.3		
High experienced (above 30 years)	25	12	41.7	20		
Total	60	60	100	100		

CR = Control Respondents TR = Test Respondents

Annual income of the respondents

The annual income score of the respondents was found to range from 34.3 to 302.40 thousands taka and 37.0 to 437.30 thousands taka incase of control and test respondents respectively. The mean income of the control respondents had 100.7 thousands taka and test respondents had 169.6 thousands taka. According to annual income, respondents were categorized as low (up to taka 60 thousand), medium (taka 60 to 120 thousand) and high (above taka 120 thousand) income groups (Fig. 4).

The income category was in conformity with Harun (2009). Highest percentage of control and test respondents (58.3, 61.6) were in the medium income category followed by low (38.4, 16.7) and high (3.3, 21.7) income categories respectively. Most of the test respondents belonged to medium to high income categories. Data also showed that the percentage of high income group (21.7) of test respondents was so bigger than control respondents (3.3) and percentage of low income group of test respondents (16.7) were so smaller compared to control respondents (38.4). It may be concluded that the test respondents were more solvent than control respondents in respect of their annual income. Fig. 4 also depicts distribution of the respondents based on their annual income.

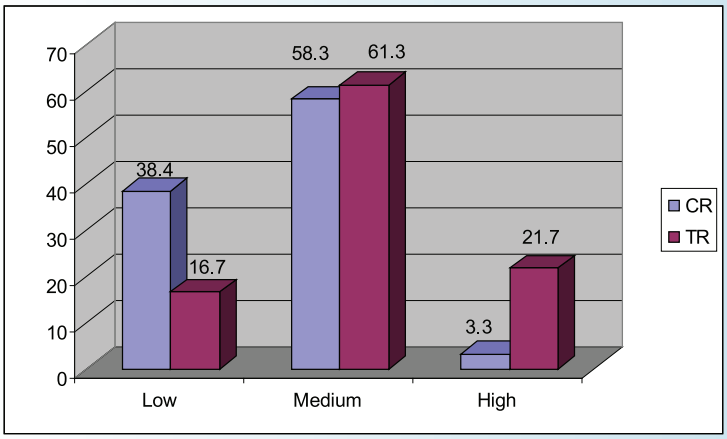

Fig. 4. Distribution of the respondents based on their annual income

Innovativeness

The innovativeness scores ranged from 5.0 to 15 and 8.0 to 17.0 as well as their averages were 9.93 and 12.15 incase of control and test respondents respectively. On the basis of their obtained innovativeness scores, respondents were classified into three groups, such as low (less than 7.84), medium (7.84 – 12.02) and high (>12.02) innovativeness (Table 4). This classification was in conformity with Forhad (2007). It was found that most of the control (78.3 %) and test (61.7%) respondents had medium innovativeness in comparison to low (10.0%, 0%) and high (11.7%, 38.3%) categories. It was also found that there was a large percentage (38.3) of test respondents' had high innovativeness. On the other hand there was no test respondents in low innovativeness category. It may be concluded that there exists a sharp difference in innovativeness between control and test respondents.

Table 4. Distribution of the respondents according to their innovativeness

Innovativeness categories	No. of respondents		Percentage		Mean	
	CR	TR	CR	TR	CR	TR
Low (< 7.84)	6	0	10.0	0	9.93	12.15
Medium (7.84 -12.02)	47	37	78.3	61.7		
High (>12.02)	7	23	11.7	38.3		
Total	60	60	100	100		

Organizational participation

The organizational participation scores of the control and test respondents were ranged from 0-9 and 0-10 with averages of 3.8 and 4.0 respectively (Table 5). On the basis of computed scores, the respondents were classified into three categories, such as low (< 1.37), moderate (1.37 to 6.13) and high (>6.13). This classification was conformity with Harun (2009). The data revealed that maximum of the control (68.3%) and test (63.3%) respondents had moderate organizational participation as compared to control and test respondents of low (15.0%, 17.4%) and high (16.7%, 19.3%) categories respectively (Table 5). Therefore, it is clearly evident that most of the control and test respondents had moderate to high organizational participation.

Table 5. Distribution of the respondents according to their organizational participation

Categories	No. of respondents		Percentage		Mean	
	CR	TR	CR	TR	CR	TR
Low (< 1.37)	9	10	15.0	17.4	3.8	4.0
Moderate (1.37 – 6.13)	41	38	68.3	63.3		
High (>6.13)	10	12	16.7	19.3		
Total	60	60	100	100		

CR = Control Respondents TR = Test Respondents

Cosmopoliteness of the respondents

The computed scores of cosmopoliteness of control and test respondents were ranged from 3.0-13.0 and 4.0-13.0 with averages of 7.2 and 8.2 respectively (Table 6). On the basis of calculated scores, the respondents were classified into three categories, such as low (<5.09), medium (5.09- 9.21) and high (>9.21). The data contained in Table 6 represent that majority of the control (66.7%) and test (76.7%) respondents had medium cosmopoliteness followed by control and test respondents of low (20%, 6.7%) and high (13.3%, 16.6%) categories respectively. It may be concluded that most of respondents were conscious, sincere and capable to make liaison with outside channel. The more cosmopolite individual will have greater contact with the outside world. This might have influenced the farmers to acquire the knowledge of new technology. Sound knowledge of the technologies naturally leads to higher adoption.

Table 6. Distribution of the respondents according to their Cosmopoliteness

Categories	No. of respondents		Percentage		Mean	
	CR	TR	CR	TR	CR	TR
Low (<5.09)	12	4	20.0	6.7	7.2	8.2
Medium (5.09-9.21)	40	46	66.7	76.7		
High (>9.21)	8	10	13.3	16.6		
Total	60	60	100	100		

CR = Control Respondents TR = Test Respondents

Contact with different agricultural information sources

The computed scores of contact with agricultural information sources of the control and test respondents ranged from 4-17 in both the cases and their averages were 8.7 and 9.8 respectively (Table 7). On the basis of computed scores, the respondents were classified into three categories, such as low (< 5.98), medium (5.98 -11.48) and high (>11.48) contact with agricultural information sources.

The data revealed that maximum of the control (80.0%) and test (71.7%) respondents had medium contact with information sources as compared to control and test respondents of low (8.3%,13.0%) and high (11.7%, 16.3%) categories respectively. Therefore, it is clearly evident that most of the respondents in both control and test groups had medium to high contact with agricultural information sources.

Table 7. Distribution of the respondents according to their contact with different agricultural information sources

Categories of respondents	No. of respondents		Percentage		Mean	
	CR	TR	CR	TR	CR	TR
Low informed (<5.98)	5	7	8.3	13.0	8.7	9.8
Medium informed (5.98 -11.48)	48	43	80.0	71.7		
High informed (>11.48)	7	10	11.7	16.3		
Total	60	60	100	100		

CR = Control Respondents TR = Test Respondents

Training received by the farmers

The training scores of the respondents ranged from 0- 4 in both the control and test cases as well as the mean of control and test cases were 1.52 and 1.97 respectively. The respondents were classified into four categories based on their obtained training score as shown in Table 8. This classification was in conformity with Gofran (2007).

Data presented in the Table 8 indicated that 68.3% and 61.7% of the control and test respondents had no to low training experience while 31.7% and 38.7% had moderate to high training experience respectively. It was also observed that control respondents were little more highly trained (31.7%) compared to treatment respondents (28.3%). It may be concluded that control and treatment respondents had more or less similar training background.

Table 8. Distribution of the respondents according to training received

Respondents' category	No. of respondents		Percentage	
	CR	TR	CR	TR
Non trained (0)	27	12	45.0	20.0
Low trained (1 to 2)	14	25	23.3	41.7
Moderately trained (> 2 -3)	0	6	0	10.0
Highly trained (>3)	19	17	31.7	28.3
Total	60	60	100	100

CR = Control Respondents TR = Test Respondents

Technical knowledge on agriculture

The obtained scores of technical knowledge on agriculture of the respondents ranged from 8.0 to 26 and 11.0 to 26 in cases of 'control' and 'test' respondents respectively. The average scores were 13.6 in case of control and 14.7 in case of test respondents (Table 9). Based on agricultural technical knowledge scores, the respondents were classified into three categories in conformity with Ahmed (2003). The categories were low (less than 11.48), medium (11.48 to 17.96) and high (> 17.96) knowledge.

Most of the control (66.7%) and test (75.0%) respondents had medium knowledge followed by low (25.0, 6.7) and high knowledge (8.3, 18.3) respectively. Data also showed that 93.3% of the treatment respondents possessed medium to high level of knowledge, on the other hand 91.7% control respondents possessed low to medium level of knowledge. It may be concluded that there was a sharp difference in knowledge level between control and treatment respondents.

Table 9. Distribution of the respondents on the basis of their technical knowledge on agriculture

Agril. knowledge Categories	No. of respondents		Percentage		Mean	
	CR	TR	CR	TR	CR	TR
Low (<11.48)	15	4	25.0	6.7	13.6	14.7
Medium (11.48 -17.96)	40	45	66.7	75.0		
High (> 17.96)	5	11	8.3	18.3		
Total	60	60	100	100		

CR = Control Respondents TR = Test Respondents

Market price information

The obtained scores of market price information of the respondents ranged from 2.0 to 11.0 and 6.0 to 12 in the cases of control and test respondents respectively. The average scores were 7.9 in case of control and 9.0 in case of test respondents (Table 10). Based on market price information knowledge scores, the respondents were classified into three categories such as low (less than 8.52), medium (8.52 to 10.62) and high (> 10.62) market price information knowledge categories.

Data showed that 66.7%of the control and 35 % of the test respondents had low market price information knowledge. It was also observed that percentage of medium category of control (26.7) and test (45) had a large gap. Data also revealed that most of the test respondents (65 %) lie between the medium to high informative categories. On the other hand, 93.4% control respondents belonged to either low to medium informative categories. It may be concluded that the treatment respondents were more market informative than control respondents.

Table 10. Distribution of the respondents on the based of market price information knowledge

Market information Categories	No. of respondents		Perc entage		Mean	
	CR	TR	CR	TR	CR	TR
Low (<8.52)	40	21	66.7	35	7.9	9.0
Medium (8.52-10.62)	16	27	26.7	45		
High (>10.62)	4	12	6.7	20		
Total	60	60	100	100		

CR = Control Respondents TR = Test Respondents

Hybrid rice cultivation related important factors

Farmers' perception about relative performance of hybrid and HYV rice

Farmers' over all perception about hybrid rice was evaluated through 15 indicators and their degree of perception in comparison to HYV varieties about each indicator was collected. The obtained perception scores on performance of control and test respondents ranged from 3.0 – 10.0 and 5.0 - 12.0 and their averages were 5.65 and 8.91 respectively (Table 11). Based on perception scores, the respondents were classified into three categories such as low (less than 3.84), medium (3.84 to 7.46) and high (>7.46) perception. Data showed that most (65%) of the control respondents had medium perception followed by low (11.7%) and high (23.3%) perception on performance. On the other hand, most (78.3%) of the test respondents had high perception followed by low (0%) and medium (21.7%) perception on performance of hybrid rice. It may be concluded that the test respondents had more positive perception on performance of hybrid rice than the control respondents.

Table 11. Distribution of the respondents based on their perception on relative performance of hybrid and HYV rice

Perception categories	Number of respondent		Percentage		Mean	
	CR	TR	CR	TR	CR	TR
Low (<3.84)	7	0	11.7	0	5.65	8.91
Medium (3.84 -7.46)	39	13	65.0	21.7		
High (>7.46)s	14	47	23.3	78.3		
Total	60	60	100	100		

CR = Control Respondents TR = Test Respondents

The perception on performance of hybrid rice also evaluated through individual indicator wise (Table 12). Data showed cent percent respondents opined that grain appearance is worsen than HYV, more susceptible to pest, seed price is extreme higher and seed was not available to them. Most of the farmers mentioned that grain yield of hybrid is higher but milling rate and suitability to consumption is not up to the mark. Most (65%) of the farmers thought that amount of straw is more in hybrid than HYV.

Ninety nine percent of the respondents expressed their positive opinion about lodging habit, i.e. hybrid rice is resistant to lodging and hail-storm damage. About 90% of the farmers mentioned that it has less demand and lower price in the local market but most of them reported it as a profitable crop while taking the total production price. About seventy percent opined that hybrid needs intensive care. Most of the respondents reported that unfilled grain and yield loss due to shattering is more or less same as of HYV varieties. Data in the Table 13 showed that hybrid rice varieties exhibited superior performance in yield, profitability, straw amount and non-lodging habit. Performance of hybrid rice is poor with respect to grain appearance, consumption suitability, market price, demand in local market, seed price, seed availability, milling rate and complexity in technology.

Amount of input used in hybrid and HYV rice

The considered inputs were seed, organic manure, chemical fertilizers, irrigation water, pesticides, labor, and other miscellaneous costs. Table 14 showed the average amount of input used into hybrid and HYV variety. Data showed that seed rate for HYV was higher than hybrid. Organic matter and chemical fertilizer used were higher than HYV in both the control and test cases. Pesticide use was higher than HYV in both the respondents categories. Number of irrigation used was more or less same except little bit more irrigation used in hybrid by the test respondents. Labor use was higher than HYV in both control and test cases. It may be concluded that hybrid rice needs more production inputs except seed than HYV rice.

Table 13. Farmers' perception on relative performance of HYV and hybrid rice

SL.	Indicators	Better than in HYV		Same as HYV		Worse than HYV	
		Frequency	Percent	Frequency	Percent	Frequency	Percent
1.	Yield	64	53.3	19	15.0	37	30.8
2.	Grain appearance	0	0	0	0	120	100
3.	Suitability to consumption	0	0	10	8.33	110	91.6
4.	Market price	0	0	4	3.3	116	97.0
5.	Demand in local market	1	0.8	2	1.7	117	97.5
6.	Profitability	57	47.5	14	11.7	49	40.8
7.	Susceptible to Pest	0	0	0	0	120	100
8.	Seed price	0	0	0	0	120	100
9.	Availability of quality seed	0	0	0	0	120	100
10.	Amount of straw	65	54.2	44	36.7	11	9.2
11.	Milling rate	3	2.5	14	11.7	104	85.8
12.	Lodging habit	119	99.0	1	1.0	0	0
13.	Grain loss after over maturing /shattering	1	.8	77	64.2	42	35
14.	Unfilled grain	20	16.7	54	45	46	38.3
15.	Technological complexity and yield management	2	1.7	32	26.7	86	71.7

Table 14. Different inputs used in hybrid and HYV rice cultivation in the boro season of 2010

Inputs	HYV			Hybrid		
	CR	TR	Average	CR	TR	Average
Seed (kg/ ha)	24.75	26.8	25.7	9.9	9.9	9.9
Organic manure (ton/ ha)	5.7	5.45	5.5	5.7	5.9	5.8
Urea (kg /ha)	271.3	236.5	253.9	270.0	255.0	262.5
TSP (kg / ha)	107.0	101.4	104.2	114.2	112.0	113.1
MOP(kg/ha)	80.6	75.0	78.0	81.3	82.5	81.9
Gypsum (kg/ ha)	46.0	43.5	44.8	46.8	47.3	47.1
Zinc (kg/ha)	0.0	1.25	.63	0.0	2.6	2.6
Pesticide (No of use)	.14	.12	.13	2.0	1.5	1.8
Irrigation (No. of irrigation)	33.7	34.2	34	34.5	37.4	3.6
Labour (day/ ha)	159.2	155.2	157.2	163.5	163.5	163..5

CR = Control Respondents TR = Test Respondents

Production cost per unit area (Tk./ha)

The surveyed data indicated that the total costs of production of hybrid was higher than HYV (BRRI dhan28 & 29). The cost of production per hectare for hybrid, BRRI dhan 28 and BRRI dhan 29 incase of test respondents were Taka 53806.23, 44889.73 and 50760.00 respectively. On the other hand the costs of production per hectare for hybrid, BRRI dhan 28 and BRRI dhan 29 in case of control respondents were Taka 54394.31, 49335.29 and 52299.14 respectively.

It was also observed that production cost both in hybrid and HYV varieties were higher in control respondents than test respondents. The largest difference in cost items between the hybrids and the HYV was on account of seeds. Other input cost was little bit higher than HYV.

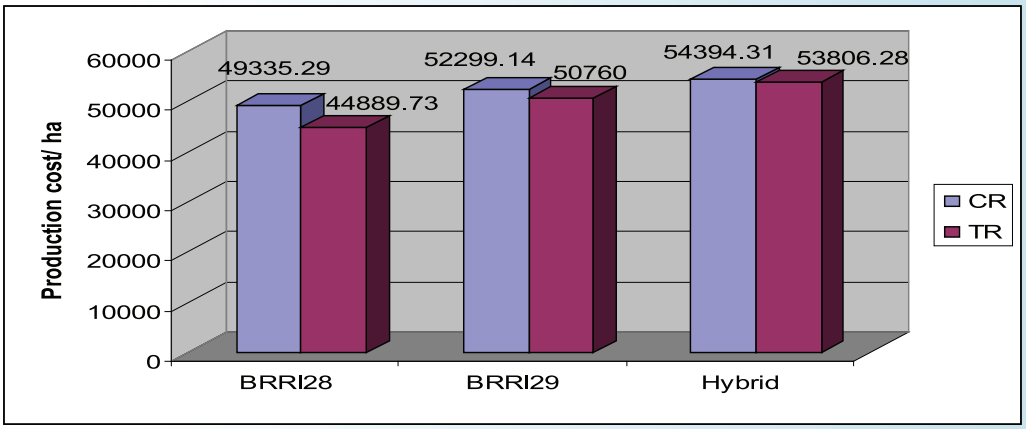

Fig. 5. Cost of production of Hybrid and HYV rice varieties

Yield performance of hybrid and HYV rice varieties in 2010

The relative yield performances of nine hybrid and two HYV varieties were presented in Table 15. Average yield of hybrid and HYV were found 7.38 t/ha and 5.85 t/ha in the boro season 2010 respectively. Data also showed that hybrid rice varieties Hira-5 (8.2 t/ha), Hira-2 (7.9 t/ha), Aloron (8.0 t/ha), Richor (7.5 t/ha), Jamuna (7.6 t/ha) and HB (7.3 t/ha) performed higher yield, but ACI-2, Sonarbangla and Tej performed lower yield compared to the average yield (7.38). Among all the hybrid varieties Hira-5 produced maximum yield (9.01 t/ha). In case of HYV varieties, BRRI dhan 29 performed better (6.52 t/ha), average being 5.85 t/ha.

Table 15. Comparison of yield performance of different hybrid and HYV rice varieties (t /ha)

Rice Varieties	No. of respondents	Yield (ton / ha)				
		Minimum	Maximum	Mean Yield	Average yield	Yield gained over HYV
Hybrid						
Hira-5	24	6.51	9.01	8.20		
Hira-2	18	6.60	8.41	7.90		
ACI-2	19	5.58	9.00	7.32		
Sonarbangla	4	6.00	6.61	6.30		
Richer	3	7.50	7.50	7.50	7.38	
Aloron	4	7.95	8.10	8.00		1.53
Jamuna	3	5.71	9.00	7.60		
Tej	3	6.31	6.30	6.30		
HB	3	6.60	8.10	7.30		
HYV						
BR28	110	4.80	5.72	5.45		
BR29	90	6.00	7.50	6.52	5.85	

The average yield gained from hybrid was 1.53 t/ha. It may be concluded that hybrid rice given better yield compared to HYV rice varieties. It was also observed (Fig. 6) that the range of yield gained from hybrid varieties by both control and test respondents which were 5.2 – 6.3 and 4.2 -9.0 and their averages were 5.64 and 6.19 respectively. On the basis of hybrid rice yield gained, the respondents were classified into low (<6.18 t/ha), medium (6.18–8.20 t/ha) and high (> 8.20 t/ha) yield gained categories. Data revealed that most (91.7%) of the control respondents are placed in low yield gained category followed by medium (8.3%) and high (0%) yield categories. On the other hand, most (66.7%) of the test respondents were in medium yield category followed by low (16.7%) and high (16.7%) yield categories. It may be concluded that the test respondents gained better yield from hybrid rice than the respondents of control village.

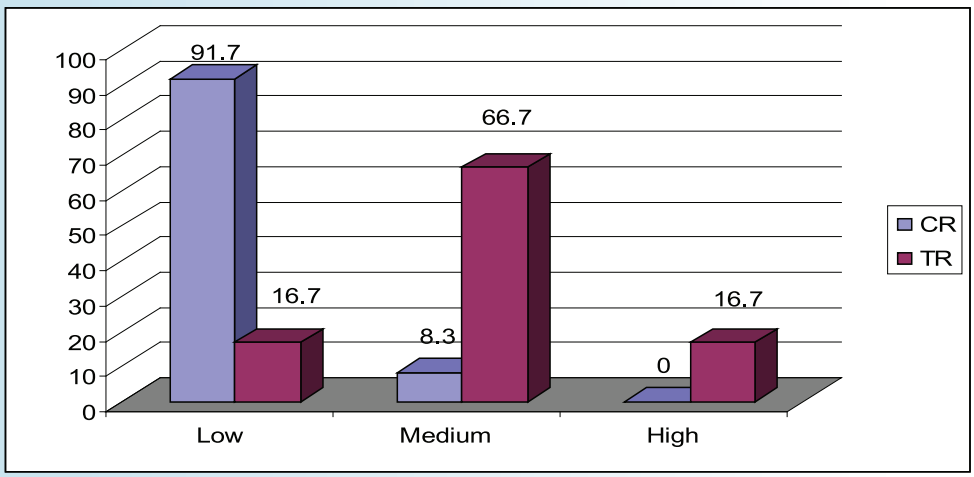

Fig. 6. Distribution of the respondents according to their per unit yield.

Extent of adoption of hybrid and HYV rice in Boro season

Extent of adoption of hybrid rice was determined with a view to know the difference of adoption of hybrid rice between the control and test respondents. Adoption of hybrid rice in boro seasons of the years of 2008, 2009 and 2010 were computed both in control and test respondents (Table 16). On the basis of computed adoption scores both the control and test respondents were classified into three categories, such as low, medium and high adoption. This classification was in conformity with Mahmud (2008). The extent of adoption in the base year 2007-08 was found to range from 0 to 50.0 and 0 to 89.2 percent with the average of 3.6 and 16.1 among control and test respondents respectively. It was observed in 2008 that most of the control and test respondents (92%, 68%) belonged to low adoption category followed by medium (8%, 22%) and high (0%, 10%) categories. The extent of adoption in the year 2008-09 was found to range from 0 to 100 and 0 to 91.7 percent with the averages of 48.1 and 41.7 both among the control and test respondents respectively. It was observed that most of the control (67%) and test (60%) respondents lies in the medium category followed by low (18%, 20%) and high (15%, 20%) categories. The extent of adoption in the year 2009-10 was found to range from 0 to 46.1 and 5.4 to 91.7 percent with the averages of 4.2 and 39.2 both among the control and test respondents respectively. It was observed that most (88%) of the control respondents belonged to low category followed by medium (12%) and high (0%) categories. On the other hand, most of the test respondents (72.0%) lies in medium category followed by low (13%) and high (17%) categories. From the above discussion, it may be concluded that the adoption of hybrid rice registered an increase in the year 2008-09 compared to the base year (i.e. 2007-08) among both the control and test respondents. But in the year 2009-10, the adoption rate was sharply decreased among the control respondents and also decreased slightly in case of test respondents compared to the adoption of 2008-09. Data revealed that most of the test respondents continued hybrid cultivation while most of the control respondents stopped cultivating hybrid rice after their initial practices.

Table 16. Distribution of the respondents based on their extent of adoption of hybrid rice in different years

Years	Adopters Categories	No. of respondents		Percentage of respondents		Mean	
		CR	TR	CR	TR	CR	TR
2007 -'08	Low (<33.0)	55	41	92	68	3.6	16.1
	Medium (33.0 – 65.0)	5	13	8	22		
	High (> 65.0)	0	6	0	10		
	Total	60	60	100	100		
2008 -'09	Low (< 33.0)	11	12	18	20	48.1	41.7
	Medium (33.0 – 65.0)	40	36	67	60		
	High (> 65.0)	9	12	15	20		
	Total	60	60	100	100		
2009 -'10	Low(< 33.0)	53	8	88	13	4.2	39.2
	Medium (33.0 – 65.0)	7	42	12	70.0		
	High (> 65.0)	0	10	0	17		
	Total	60	60	100	100		

CR = Control Respondents TR = Test Respondents

Computed adoption scores of hybrid rice in the control and treatment villages were shown in Fig. 7. Data revealed that the extent of adoption of hybrid rice in the control village in 2008, 2009 and 2010 were 3.6%, 48.1% and 4.2% respectively. On the other hand, the extent of adoption in the test village in 2008, 2009 and 2010 were 16.1%, 41.7% and 39.2% respectively. Data also showed that the adoption of hybrid rice was sharply increased in 2009 compared to 2008 boro season both in the control and treatment villages. But the extent of adoption in control village decreased sharply in 2010 compared to 2009 (from 48.1% to 4.2%), also found to decrease slightly (from 41.7% to 39.2%) in the treatment village. It was also observed that HYV rice cultivation in 2010 was increased again both in the control and treatment villages. It may be concluded that the cultivation of hybrid rice varieties decreased both in the control and treatment villages.

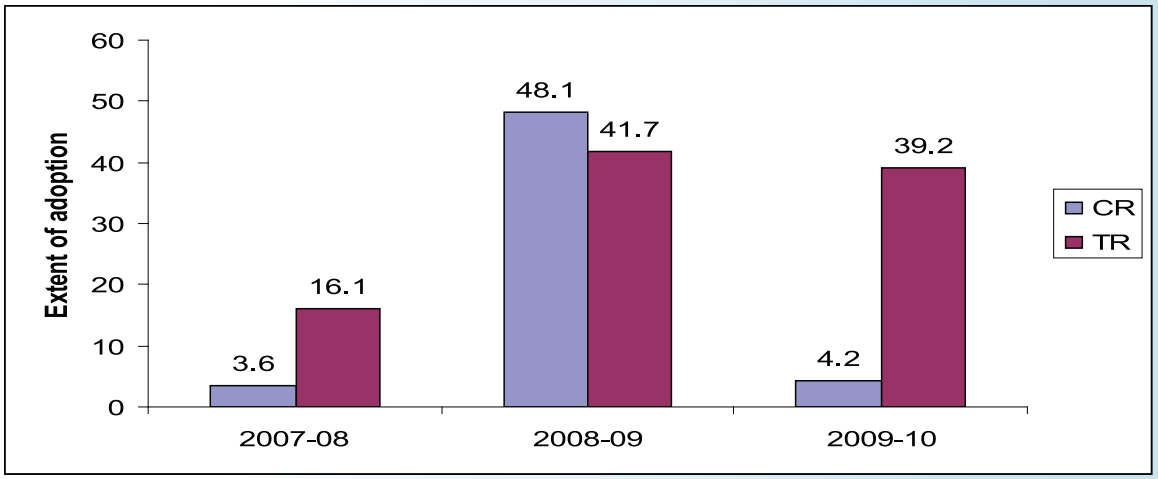

Fig. 7. Extent of adoption of hybrid rice based on area.

Extent of adoption of hybrid rice varieties based on headcounts in control and test villages were presented in Fig. 8. Data showed that 25 and 30 percent of the control and test respondents adopted hybrid rice in 2008; but in 2009 it was substantially increased up to 96% and 80% in the control and treatment villages respectively. In 2010, it was observed that percent of hybrid rice cultivating farmers were increased up to 85% in the treatment village while percent of hybrid cultivating farmers decreased in the control village. Only 15% of the respondents continued hybrid rice cultivation in the control village.

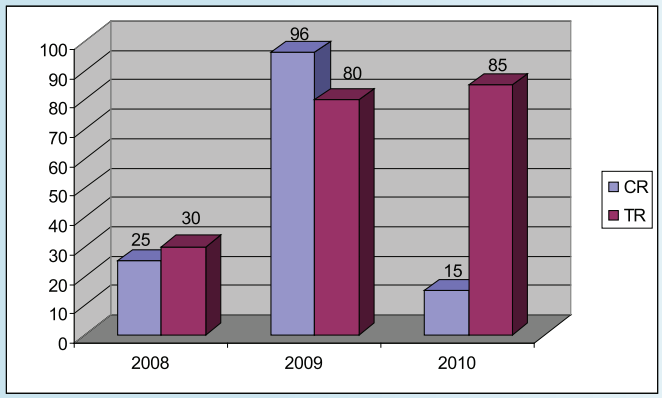

Fig. 8. Extent of adoption of hybrid rice based on head counts.

From the above discussion it may be concluded that the adoption of hybrid rice based on both area and headcounts sharply decreased in 2010 from 2008 and 2009 in case of control respondents. On the other hand, the rate of adoption and percent of adopters were increased from 2008 to 2010 in the treatment village. It was also observed that the percent of area under hybrid was slightly decreased (from 41.7% to 39.2%) but percent of adopters were increased in 2010 compared to 2009. This situation indicated that the numbers of adopter farmers though increased but the respondents have released some of their lands from hybrid rice to HYV rice. Trend of the overall findings of extent of adoption had conformity with BBS 2009-10.

Conclusion

Yield performance and net return of hybrid rice was found better as compared to HYV rice while the grain quality of hybrid rice varieties reported as inferior compared to in-bred rice. Hybrid rice needs more inputs and intensive management practices with respect to fertilizers, irrigation, pesticide, inter-cultural operations and also needs more technical knowledge.

Hybrid rice adoption was sharply increased from the base year (2008 Boro season) to 2009, but decreased in the year 2010 from the peak year (2009 boro season) both in control and treatment areas. The extent of decrease was very high in control village compared to slight decrease in the treatment village.

Extent of social inequality indicators were found significantly higher among the farmers of treatment village compared to control village. Significant positive differences were also found among the small, medium and large farmers of treatment village regarding social inequality indicators. Hence it may be concluded that hybrid rice creates social inequality among the farmers of Bangladesh.

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